SEN00235-05

Shop Manual

WHEEL LOADER GALEO

WA600-6

SERIAL NUMBERS 60001 and up

KOMATSU

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

00 Index and foreword

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Composition of shop manual

The contents of this shop manual are shown together with Form No. in a list.

Note 1: Always keep the latest version of this manual in accordance with this list and utilize accordingly.
The marks shown to the right of Form No. denote the following:
○: New issue (to be filed additionally) ●: Revision (to be replaced for each Form No.)

Note 2: This shop manual can be supplied for each Form No.

Note 3: To file this shop manual in the special binder for management, handle it as follows:
- Place a divider on the top of each section in the file after matching the Tub No. with No. indicated next to each Section Name shown in the table below:
- File overview and other materials in sections in the order shown below and utilize them accordingly.

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WA600-6 Wheel loader

Form No. SEN00398-05

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

00 Index and foreword

Foreword and general information

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Safety notice

(Rev. 2006/09)

Important safety notice

Proper service and repair are extremely important for safe machine operation. The service and repair techniques recommended by Komatsu and described in this manual are both effective and safe. Some of these techniques require the use of tools specially designed by Komatsu for the specific purpose.

To prevent injury to workers, the symbol ⚠ is used to mark safety precautions in this manual. The cautions accompanying these symbols should always be followed carefully. If any dangerous situation arises or may possibly arise, first consider safety, and take the necessary actions to deal with the situation.

1. General precautions

⚠ **Mistakes in operation are extremely dangerous. Read the Operation and Maintenance Manual carefully before operating the machine.**

1) Before carrying out any greasing or repairs, read all the safety plates stuck to the machine. For the locations of the safety plates and detailed explanation of precautions, see the Operation and Maintenance Manual.
2) Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt, water, or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.
3) When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
   - Always wear safety glasses when hitting parts with a hammer.
   - Always wear safety glasses when grinding parts with a grinder, etc.
4) When carrying out any operation with 2 or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR warning signs in the operator's compartment.
5) Only qualified workers must carry out work and operation which require license or qualification.
6) Keep all tools in good condition, learn the correct way to use them, and use the proper ones of them. Before starting work, thoroughly check the tools, machine, forklift, service car, etc.
7) If welding repairs are needed, always have a trained and experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, shielding goggles, cap and other clothes suited for welding work.
8) Before starting work, warm up your body thoroughly to start work under good condition.

Safety points

1	Good arrangement
2	Correct work clothes
3	Following work standard
4	Making and checking signs
5	Prohibition of operation and handling by unlicensed workers
6	Safety check before starting work
7	Wearing protective goggles (for cleaning or grinding work)
8	Wearing shielding goggles and protectors (for welding work)
9	Good physical condition and preparation
10	Precautions against work which you are not used to or you are used to too much

2. Preparations for work

1) Before adding oil or making any repairs, park the machine on hard and level ground, and apply the parking brake and block the wheels or tracks to prevent the machine from moving.
2) Before starting work, lower the work equipment (blade, ripper, bucket, etc.) to the ground. If this is not possible, insert the lock pin or use blocks to prevent the work equipment from falling. In addition, be sure to lock all the control levers and hang warning signs on them.

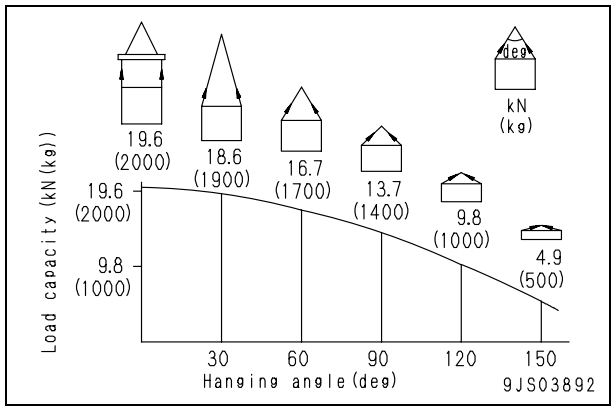
3) When disassembling or assembling, support the machine with blocks, jacks, or stands before starting work.
4) Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off the machine. If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

3. Precautions during work

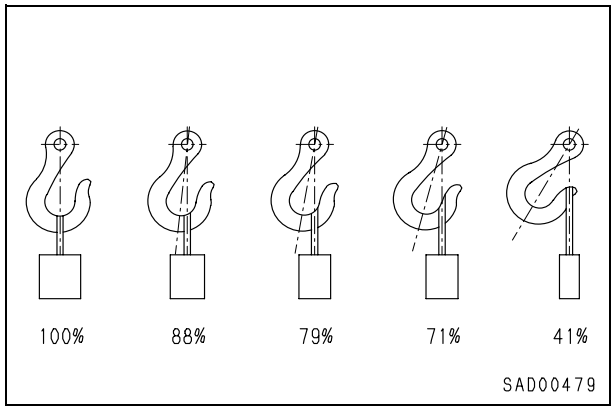
1) Before disconnecting or removing components of the oil, water, or air circuits, first release the pressure completely from the circuit. When removing the oil filler cap, a drain plug, or an oil pressure pickup plug, loosen it slowly to prevent the oil from spurting out.
2) The coolant and oil in the circuits are hot when the engine is stopped, so be careful not to get scalded. Wait for the oil and coolant to cool before carrying out any work on the oil or water circuits.
3) Before starting work, stop the engine. When working on or around a rotating part, in particular, stop the engine. When checking the machine without stopping the engine (measuring oil pressure, revolving speed, temperature, etc.), take extreme care not to get rolled or caught in rotating parts or moving parts.
4) Before starting work, remove the leads from the battery. Always remove the lead from the negative (–) terminal first.
5) When raising a heavy component (heavier than 25 kg), use a hoist or crane. Before starting work, check that the slings (wire ropes, chains, and hooks) are free from damage. Always use slings which have ample capacity and install them to proper places. Operate the hoist or crane slowly to prevent the component from hitting any other part. Do not work with any part still raised by the hoist or crane.
6) When removing a cover which is under internal pressure or under pressure from a spring, always leave 2 bolts in diagonal positions. Loosen those bolts gradually and alternately to release the pressure, and then remove the cover.
7) When removing components, be careful not to break or damage the electrical wiring. Damaged wiring may cause electrical fires.
8) When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips onto the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip and can even start fires.
9) As a general rule, do not use gasoline to wash parts. Do not use it to clean electrical parts, in particular.
10) Be sure to assemble all parts again in their original places. Replace any damaged parts and parts which must not be reused with new parts. When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is operated.
11) When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. In addition, check that connecting parts are correctly installed.
12) When assembling or installing parts, always tighten them to the specified torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.
13) When aligning 2 holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.
14) When measuring hydraulic pressure, check that the measuring tools are correctly assembled.
15) Take care when removing or installing the tracks of track-type machines. When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.
16) If the engine is operated for a long time in a place which is not ventilated well, you may suffer from gas poisoning. Accordingly, open the windows and doors to ventilate well.

4. Precautions for sling work and making signs

1) Only one appointed worker must make signs and co-workers must communicate with each other frequently. The appointed sign maker must make specified signs clearly at a place where he is seen well from the operator's seat and where he can see the working condition easily. The sign maker must always stand in front of the load and guide the operator safely.
   - Do not stand under the load.
   - Do not step on the load.
2) Check the slings before starting sling work.
3) Keep putting on gloves during sling work. (Put on leather gloves, if available.)
4) Measure the weight of the load by the eye and check its center of gravity.
5) Use proper sling according to the weight of the load and method of slinging. If too thick wire ropes are used to sling a light load, the load may slip and fall.
6) Do not sling a load with 1 wire rope alone. If it is slung so, it may rotate and may slip out of the rope. Install 2 or more wire ropes symmetrically.
   ⚠ Slinging with 1 rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.
7) Limit the hanging angle to 60°, as a rule. Do not sling a heavy load with ropes forming a wide hanging angle from the hook. When hoisting a load with 2 or more ropes, the force subjected to each rope will increase with the hanging angle. The table below shows the variation of allowable load in kN {kg} when hoisting is made with 2 ropes, each of which is allowed to sling up to 9.8 kN {1,000 kg} vertically, at various hanging angles. When the 2 ropes sling a load vertically, up to 19.6 kN {2,000 kg} of total weight can be suspended. This weight is reduced to 9.8 kN {1,000 kg} when the 2 ropes make a hanging angle of 120°. If the 2 ropes sling a 19.6 kN {2,000 kg} load at a lifting angle of 150°, each of them is subjected to a force as large as 39.2 kN {4,000 kg}.



8) When installing wire ropes to an angular load, apply pads to protect the wire ropes. If the load is slippery, apply proper material to prevent the wire rope from slipping.
9) Use the specified eyebolts and fix wire ropes, chains, etc. to them with shackles, etc.
10) Apply wire ropes to the middle portion of the hook.
    - Slinging near the tip of the hook may cause the rope to slip off the hook during hoisting. The hook has the maximum strength at the middle portion.



11) Do not use twisted or kinked wire ropes.
12) When lifting up a load, observe the following.
    - Wind in the crane slowly until wire ropes are stretched. When settling the wire ropes with the hand, do not grasp them but press them from above. If you grasp them, your fingers may be caught.
    - After the wire ropes are stretched, stop the crane and check the condition of the slung load, wire ropes, and pads.

- If the load is unstable or the wire rope or chains are twisted, lower the load and lift it up again.
- Do not lift up the load slantingly.

13) When lifting down a load, observe the following.
- When lifting down a load, stop it temporarily at 30 cm above the floor, and then lower it slowly.
- Check that the load is stable, and then remove the sling.
- Remove kinks and dirt from the wire ropes and chains used for the sling work, and put them in the specified place.

5. Precautions for using mobile crane

★ Read the Operation and Maintenance Manual of the crane carefully in advance and operate the crane safely.

6. Precautions for using overhead hoist crane

⚠ **When raising a heavy part (heavier than 25 kg), use a hoist, etc. In Disassembly and assembly, the weight of a part heavier than 25 kg is indicated after the mark of .**

1) Before starting work, inspect the wire ropes, brake, clutch, controller, rails, over wind stop device, electric shock prevention earth leakage breaker, crane collision prevention device, and power application warning lamp, and check safety.
2) Observe the signs for sling work.
3) Operate the hoist at a safe place.
4) Check the direction indicator plates (east, west, south, and north) and the directions of the control buttons without fail.
5) Do not sling a load slantingly. Do not move the crane while the slung load is swinging.
6) Do not raise or lower a load while the crane is moving longitudinally or laterally.
7) Do not drag a sling.
8) When lifting up a load, stop it just after it leaves the ground and check safety, and then lift it up.
9) Consider the travel route in advance and lift up a load to a safe height.
10) Place the control switch on a position where it will not be an obstacle to work and passage.
11) After operating the hoist, do not swing the control switch.
12) Remember the position of the main switch so that you can turn off the power immediately in an emergency.
13) If the hoist stops because of a power failure, turn the power switch OFF. When turning on a switch which was turned OFF by the electric shock prevention earth leakage breaker, check that the devices related to that switch are not in operation state.
14) If you find an obstacle around the hoist, stop the operation.
15) After finishing the work, stop the hoist at the specified position and raise the hook to at least 2 m above the floor. Do not leave the sling installed to the hook.

7. Selecting wire ropes

1) Select adequate ropes depending on the weight of parts to be hoisted, referring to the table below.

Wire ropes
(Standard “Z” twist ropes without galvanizing)
(JIS G3525, No. 6, Type 6X37-A)

Nominal diameter of rope	Allowable load	
mm	kN	ton
10	8.8	0.9
12	12.7	1.3
14	17.3	1.7
16	22.6	2.3
18	28.6	2.9
20	35.3	3.6
25	55.3	5.6
30	79.6	8.1
40	141.6	14.4
50	221.6	22.6
60	318.3	32.4

★ The allowable load is one-sixth of the breaking strength of the rope used (Safety coefficient: 6).

8. Precautions for disconnecting and connecting hoses and tubes in air conditioner circuit

1) Disconnection

⚠ **Collect the air conditioner refrigerant gas (R134a).**

⚠ **If the refrigerant gas (R134a) gets in your eyes, you may lose your sight. Accordingly, when collecting or adding it, you must be qualified for handling the refrigerant and put on protective goggles.**

2) Connection

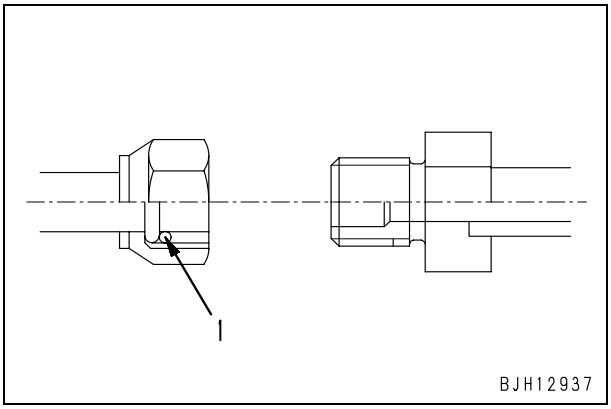
1] When installing the air conditioner circuit hoses and tubes, take care that dirt, dust, water, etc. will not enter them.

2] When connecting the air conditioner hoses and tubes, check that O-rings (1) are fitted to their joints.

3] Check that each O-ring is not damaged or deteriorated.

4] When connecting the refrigerant piping, apply compressor oil for refrigerant (R134a) **(DENSO: ND-OIL8, ZEXEL: ZXL100PG (equivalent to PAG46))** to its O-rings.

★ Example of O-ring (Fitted to every joint of hoses and tubes)



★ For tightening torque, see the precautions for installation in each section of "Disassembly and assembly".

How to read the shop manual

- Some attachments and optional parts in this shop manual may not be delivered to certain areas. If one of them is required, consult KOMATSU distributors.
- Materials and specifications are subject to change without notice.
- Shop manuals are divided into the “Chassis volume” and “Engine volume”. For the engine unit, see the engine volume of the engine model mounted on the machine.

1. Composition of shop manual

This shop manual contains the necessary technical information for services performed in a workshop. For ease of understanding, the manual is divided into the following sections.

00. Index and foreword

This section explains the shop manuals list, table of contents, safety, and basic information.

01. Specification

This section explains the specifications of the machine.

10. Structure, function and maintenance standard

This section explains the structure, function, and maintenance standard values of each component. The structure and function sub-section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting. The maintenance standard sub-section explains the criteria and remedies for disassembly and service.

20. Standard value table

This section explains the standard values for new machine and judgement criteria for testing, adjusting, and troubleshooting. This standard value table is used to check the standard values in testing and adjusting and to judge parts in troubleshooting.

30. Testing and adjusting

This section explains measuring instruments and measuring methods for testing and adjusting, and method of adjusting each part. The standard values and judgement criteria for testing and adjusting are explained in Testing and adjusting.

40. Troubleshooting

This section explains how to find out failed parts and how to repair them. The troubleshooting is divided by failure modes. The “S mode” of the troubleshooting related to the engine may be also explained in the Chassis volume and Engine volume. In this case, see the Chassis volume.

50. Disassembly and assembly

This section explains the special tools and procedures for removing, installing, disassembling, and assembling each component, as well as precautions for them. In addition, tightening torque and quantity and weight of coating material, oil, grease, and coolant necessary for the work are also explained.

90. Diagrams and drawings (chassis volume)/Repair and replacement of parts (engine volume)

- Chassis volume
  This section gives hydraulic circuit diagrams and electrical circuit diagrams.
- Engine volume
  This section explains the method of reproducing, repairing, and replacing parts.

2. Revision and distribution

Any additions, revisions, or other change of notices will be sent to KOMATSU distributors. Get the most up-to-date information before you start any work.

3. Filing method

File by the brochures in the correct order of the form number printed in the shop manual composition table.

- **Revised edition mark**
  When a manual is revised, the ones and tens digits of the form number of each brochure is increased by 1. (Example: 00, 01, 02 …)

- **Revisions**
  Revised brochures are shown in the shop manual composition table.

4. Symbols

Important safety and quality portions are marked with the following symbols so that the shop manual will be used practically.

Symbol	Item	Remarks
	Safety	Special safety precautions are necessary when performing work.
★	Caution	Special technical precautions or other precautions for preserving standards are necessary when performing work.
	Weight	Weight of parts of component or parts. Caution necessary when selecting hoisting wire, or when working posture is important, etc.
	Tightening torque	Places that require special attention for tightening torque during assembly.
	Coat	Places to be coated with adhesives, etc. during assembly.
	Oil, coolant	Places where oil, etc. must be added, and capacity.
	Drain	Places where oil, etc. must be drained, and quantity to be drained.

5. Units

In this shop manual, the units are indicated with International System of units (SI). For reference, conventionally used Gravitational System of units is indicated in parentheses { }.

Explanation of terms for maintenance standard

The maintenance standard values necessary for judgment of products and parts are described by the following terms.

1. Standard size and tolerance

- To be accurate, the finishing size of parts is a little different from one to another.
- To specify a finishing size of a part, a temporary standard size is set and an allowable difference from that size is indicated.
- The above size set temporarily is called the “standard size” and the range of difference from the standard size is called the “tolerance”.
- The tolerance with the symbols of + or – is indicated on the right side of the standard size.

Example:

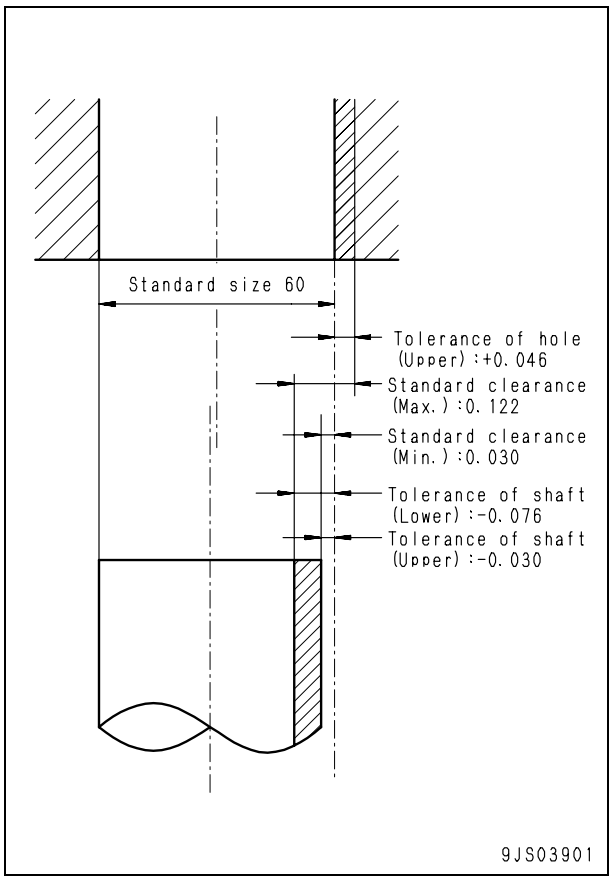
Standard size	Tolerance
120	–0.022 –0.126

★ The tolerance may be indicated in the text and a table as [standard size (upper limit of tolerance/lower limit of tolerance)].
Example) 120 (–0.022/–0.126)

- Usually, the size of a hole and the size of the shaft to be fitted to that hole are indicated by the same standard size and different tolerances of the hole and shaft. The tightness of fit is decided by the tolerance.
- Indication of size of rotating shaft and hole and relationship drawing of them

Example:

Standard size	Tolerance	
	Shaft	Hole
60	–0.030 –0.076	+0.046 0



2. Standard clearance and standard value

- The clearance made when new parts are assembled is called the “standard clearance“, which is indicated by the range from the minimum clearance to the maximum clearance.
- When some parts are repaired, the clearance is generally adjusted to the standard clearance.
- A value of performance and function of new products or equivalent is called the “standard value“, which is indicated by a range or a target value.
- When some parts are repaired, the value of performance/function is set to the standard value.

3. Standard interference

- When the diameter of a hole of a part shown in the given standard size and tolerance table is smaller than that of the mating shaft, the difference between those diameters is called the “interference”.
- The range (A – B) from the difference (A) between the minimum size of the shaft and the maximum size of the hole to the difference (B) between the maximum size of the shaft and the minimum size of the hole is the “standard interference”.
- After repairing or replacing some parts, measure the size of their hole and shaft and check that the interference is in the standard range.

4. Repair limit and allowable value

- The size of a part changes because of wear and deformation while it is used. The limit of changed size is called the “repair limit”.
- If a part is worn to the repair limit must be replaced or repaired.
- The performance and function of a product lowers while it is used. A value below which the product can be used without causing a problem is called the “allowable value”.
- If a product is worn to the allowable value, it must be checked or repaired. Since the permissible value is estimated from various tests or experiences in most cases, however, it must be judged after considering the operating condition and customer's requirement.

5. Clearance limit

- Parts can be used until the clearance between them is increased to a certain limit. The limit at which those parts cannot be used is called the “clearance limit”.
- If the clearance between the parts exceeds the clearance limit, they must be replaced or repaired.

6. Interference limit

- The allowable maximum interference between the hole of a part and the shaft of another part to be assembled is called the “interference limit”.
- The interference limit shows the repair limit of the part of smaller tolerance.
- If the interference between the parts exceeds the interference limit, they must be replaced or repaired.

Handling electric equipment and hydraulic component

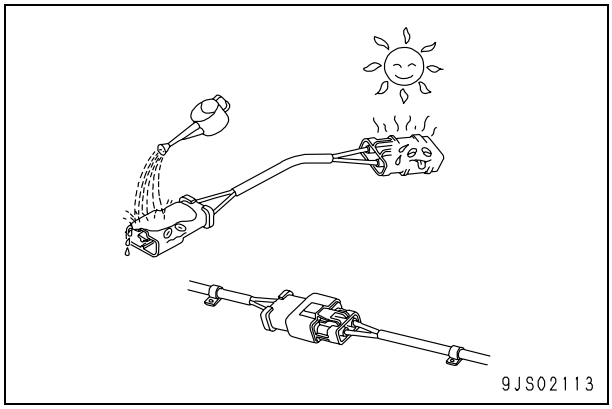
To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct “operation“, “maintenance and inspection“, “troubleshooting“, and “repairs” must be carried out. This section deals particularly with correct repair procedures for mechatronics and is aimed at improving the quality of repairs. For this purpose, it gives sections on “Handling electric equipment” and “Handling hydraulic equipment” (particularly gear oil and hydraulic oil).

Points to remember when handling electric equipment

1. Handling wiring harnesses and connectors

Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protectors or tubes used for protecting the wiring.

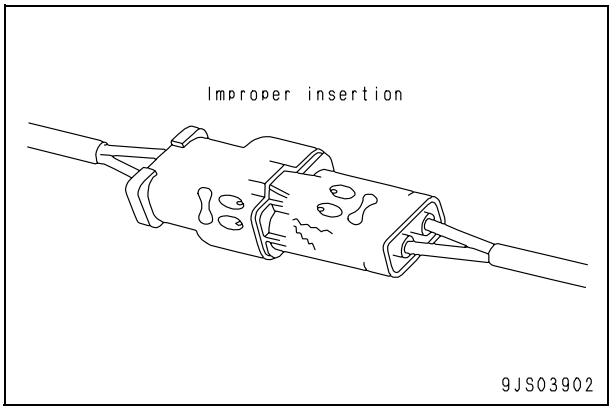
Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations, they are frequently removed and installed again, so they are likely to suffer deformation or damage. For this reason, it is necessary to be extremely careful when handling wiring harnesses.



2. Main failures occurring in wiring harness

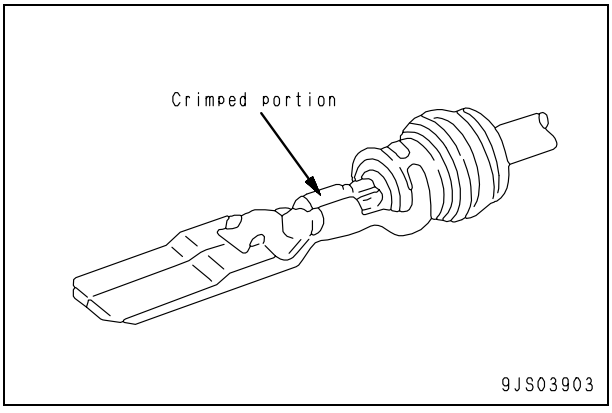
1) Defective contact of connectors (defective contact between male and female)

Problems with defective contact are likely to occur because the male connector is not properly inserted into the female connector, or because one or both of the connectors is deformed or the position is not correctly aligned, or because there is corrosion or oxidization of the contact surfaces. The corroded or oxidized contact surfaces may become shiny again (and contact may become normal) by connecting and disconnecting the connector about 10 times.

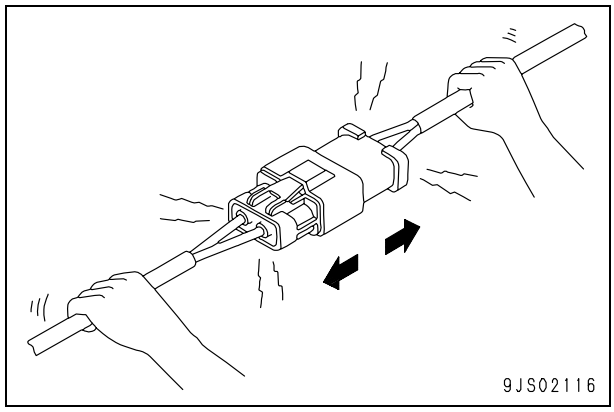


2) Defective crimping or soldering of connectors

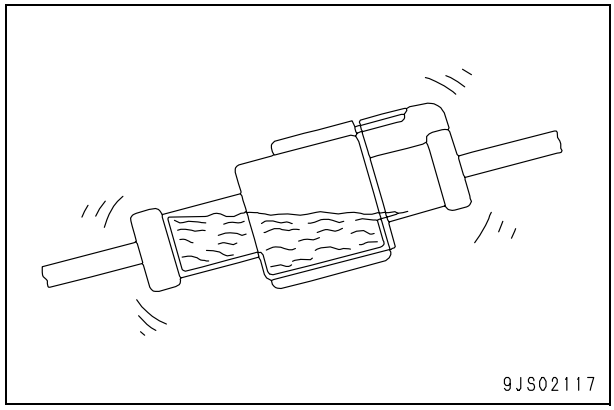
The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.



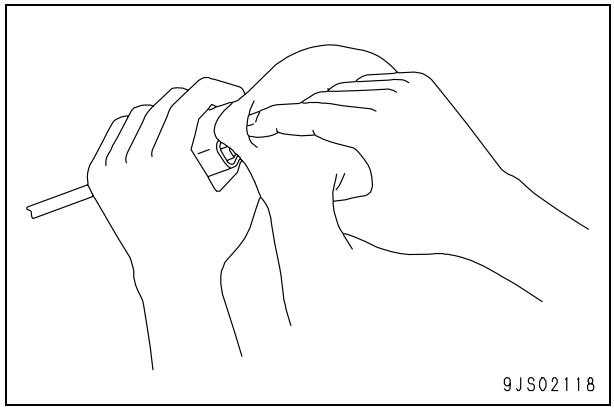
3) Disconnections in wiring
If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.



4) High-pressure water entering connector
The connector is designed to make it difficult for water to enter (drip-proof structure), but if high-pressure water is sprayed directly on the connector, water may enter the connector, depending on the direction of the water jet. Accordingly, take care not to splash water over the connector. The connector is designed to prevent water from entering, but at the same time, if water does enter, it is difficult for it to be drained. Therefore, if water should get into the connector, the pins will be short-circuited by the water, so if any water gets in, immediately dry the connector or take other appropriate action before passing electricity through it.



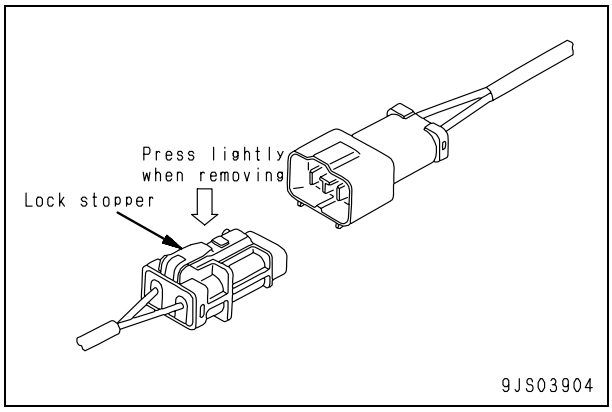
5) Oil or dirt stuck to connector
If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact. If there is oil or grease stuck to the connector, wipe it off with a dry cloth or blow it dry with compressed air and spray it with a contact restorer.
★ When wiping the mating portion of the connector, be careful not to use excessive force or deform the pins.
★ If there is oil or water in the compressed air, the contacts will become even dirtier, so remove the oil and water from the compressed air completely before cleaning with compressed air.



3. Removing, installing, and drying connectors and wiring harnesses

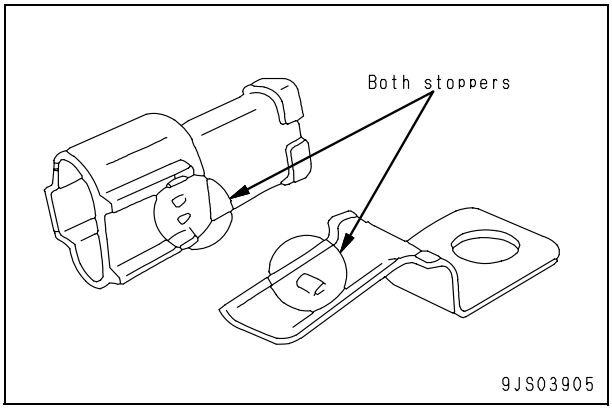
1) Disconnecting connectors

1] Hold the connectors when disconnecting.
When disconnecting the connectors, hold the connectors. For connectors held by a screw, loosen the screw fully, then hold the male and female connectors in each hand and pull apart. For connectors which have a lock stopper, press down the stopper with your thumb and pull the connectors apart.
★ Never pull with one hand.

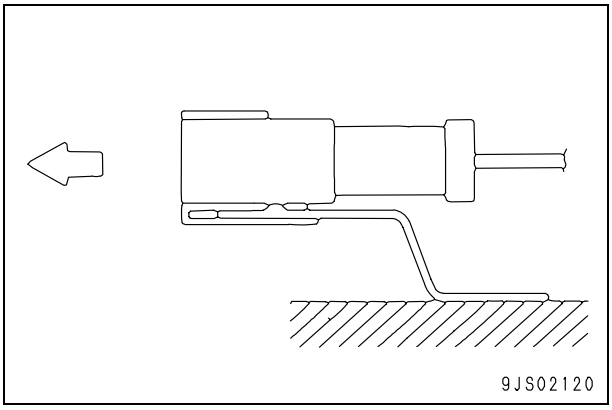


2] When removing from clips

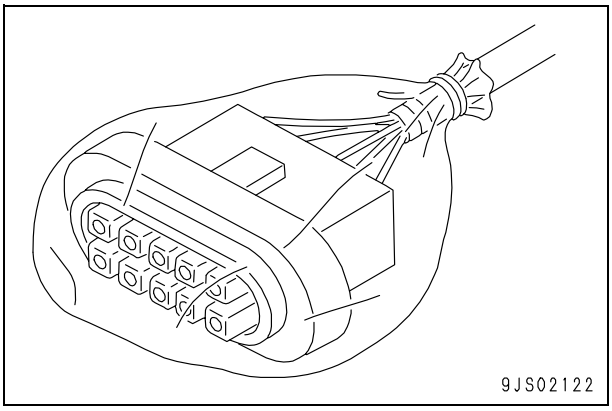
- Both of the connector and clip have stoppers, which are engaged with each other when the connector is installed.



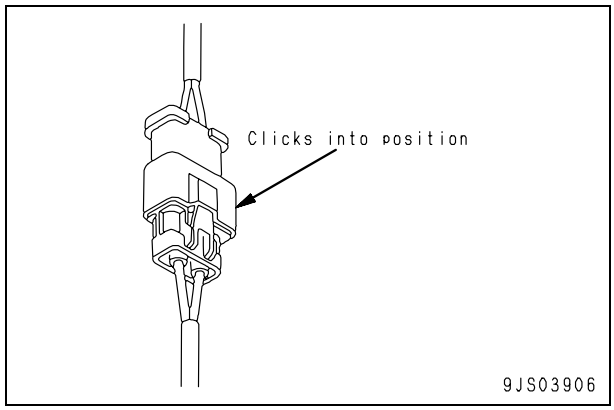
- When removing a connector from a clip, pull the connector in a parallel direction to the clip for removing stoppers.
★ If the connector is twisted up and down or to the left or right, the housing may break.

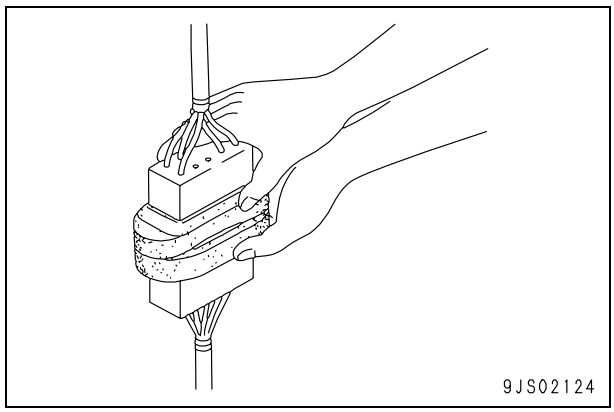


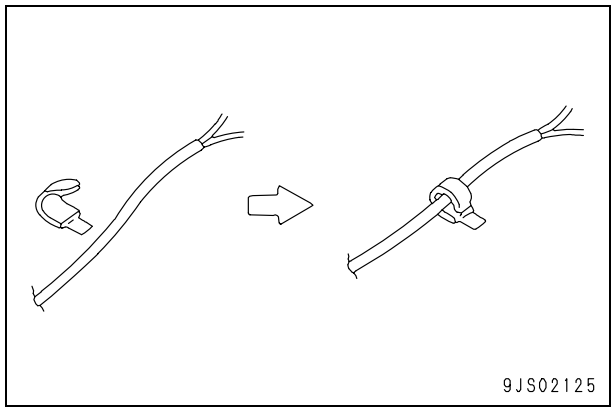
3] Action to take after removing connectors
After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.
★ If the machine is left disassembled for a long time, it is particularly easy for improper contact to occur, so always cover the connector.



2) Connecting connectors
   1] Check the connector visually.
   Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).
   Check that there is no deformation, defective contact, corrosion, or damage to the connector pins.
   Check that there is no damage or breakage to the outside of the connector.
   ★ If there is any oil, water, or dirt stuck to the connector, wipe it off with a dry cloth. If any water has got inside the connector, warm the inside of the wiring with a dryer, but be careful not to make it too hot as this will cause short circuits.
   ★ If there is any damage or breakage, replace the connector.
   2] Fix the connector securely.
   Align the position of the connector correctly, and then insert it securely. For connectors with the lock stopper, push in the connector until the stopper clicks into position.
   3] Correct any protrusion of the boot and any misalignment of the wiring harness.
   For connectors fitted with boots, correct any protrusion of the boot. In addition, if the wiring harness is misaligned, or the clamp is out of position, adjust it to its correct position.
   ★ If the connector cannot be corrected easily, remove the clamp and adjust the position.
   ● If the connector clamp has been removed, be sure to return it to its original position. Check also that there are no loose clamps.

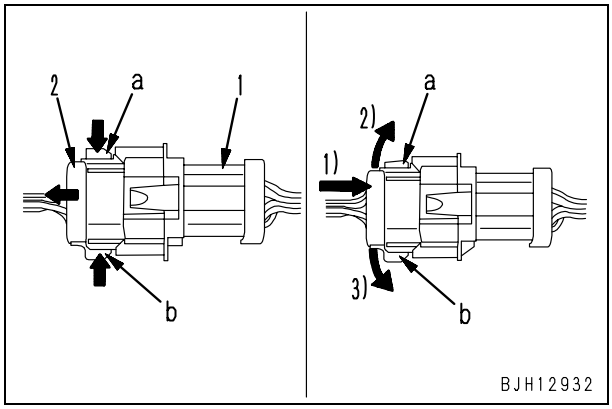




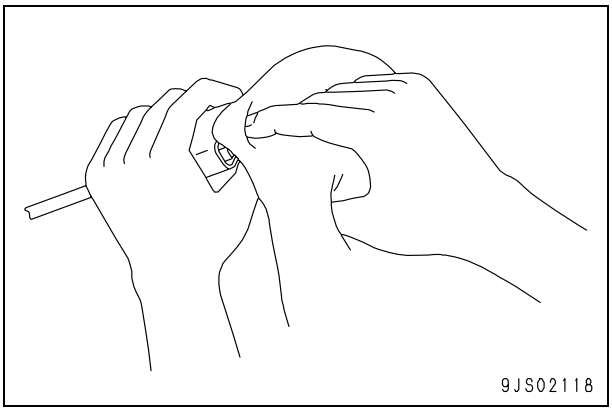


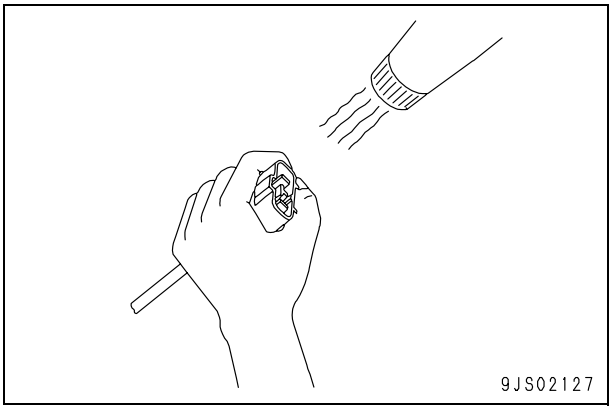
3) Heavy duty wire connector (DT 8-pole, 12-pole)
Disconnection (Left of figure)
While pressing both sides of locks (a) and (b), pull out female connector (2).
Connection (Right of figure)
1] Push in female connector (2) horizontally until the lock clicks.
Arrow: 1)
2] Since locks (a) and (b) may not be set completely, push in female connector (2) while moving it up and down until the locks are set normally.
Arrow: 1), 2), 3)
★ Right of figure: Lock (a) is pulled down (not set completely) and lock (b) is set completely.
(1): Male connector
(2): Female connector
(a), (b): Locks

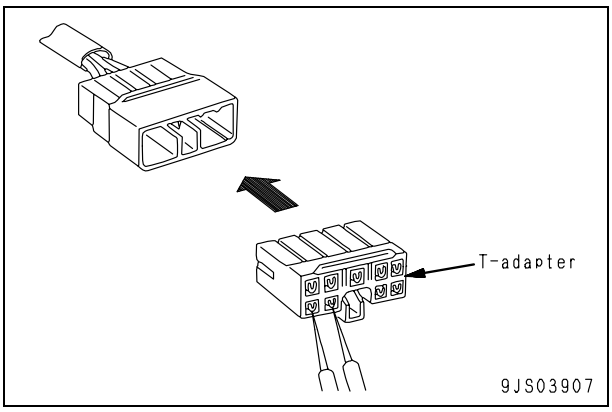
- Disconnection
- Connection (Example of incomplete setting of (a))



4) Drying wiring harness
If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high-pressure water or steam directly on the wiring harness. If water gets directly on the connector, do as follows.
   1] Disconnect the connector and wipe off the water with a dry cloth.
      ★ If the connector is blown dry with compressed air, there is the risk that oil in the air may cause defective contact, so remove all oil and water from the compressed air before blowing with air.
   2] Dry the inside of the connector with a dryer.
      If water gets inside the connector, use a dryer to dry the connector.
      ★ Hot air from the dryer can be used, but regulate the time that the hot air is used in order not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.
   3] Carry out a continuity test on the connector.
      After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits between pins caused by water.
      ★ After completely drying the connector, blow it with contact restorer and reassemble.

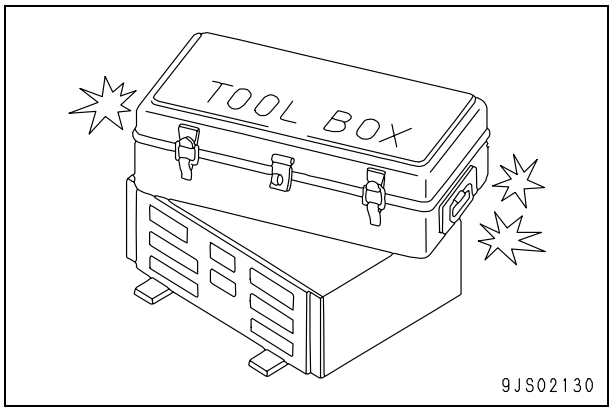


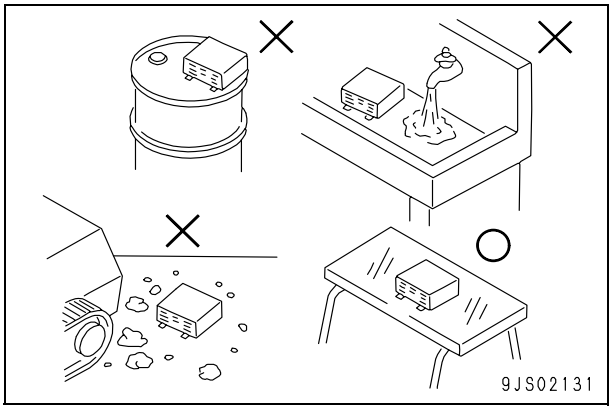




4. Handling controller

1) The controller contains a microcomputer and electronic control circuits. These control all of the electronic circuits on the machine, so be extremely careful when handling the controller.
2) Do not place objects on top of the controller.
3) Cover the control connectors with tape or a vinyl bag. Never touch the connector contacts with your hand.
4) During rainy weather, do not leave the controller in a place where it is exposed to rain.
5) Do not place the controller on oil, water, or soil, or in any hot place, even for a short time. (Place it on a suitable dry stand).
6) Precautions when carrying out arc welding
When carrying out arc welding on the body, disconnect all wiring harness connectors connected to the controller. Fit an arc welding ground close to the welding point.





5. Points to remember when troubleshooting electric circuits

1) Always turn the power OFF before disconnecting or connecting connectors.
2) Before carrying out troubleshooting, check that all the related connectors are properly inserted.
   ★ Disconnect and connect the related connectors several times to check.
3) Always connect any disconnected connectors before going on to the next step.
   ★ If the power is turned ON with the connectors still disconnected, unnecessary abnormality displays will be generated.
4) When carrying out troubleshooting of circuits (measuring the voltage, resistance, continuity, or current), move the related wiring and connectors several times and check that there is no change in the reading of the tester.
   ★ If there is any change, there is probably defective contact in that circuit.

Points to remember when handling hydraulic equipment

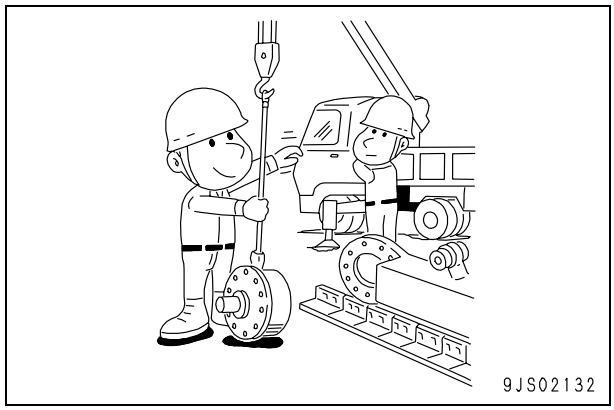
With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

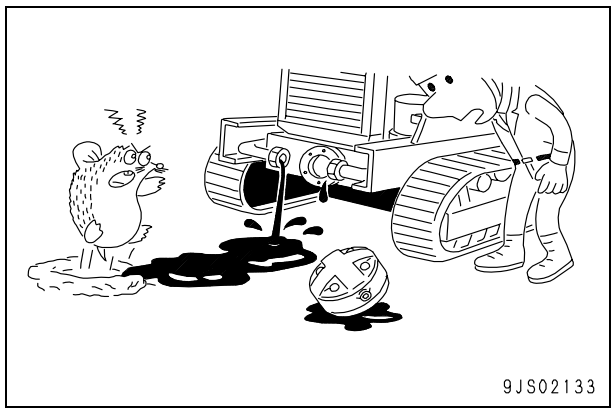
1. **Be careful of the operating environment.**
   Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

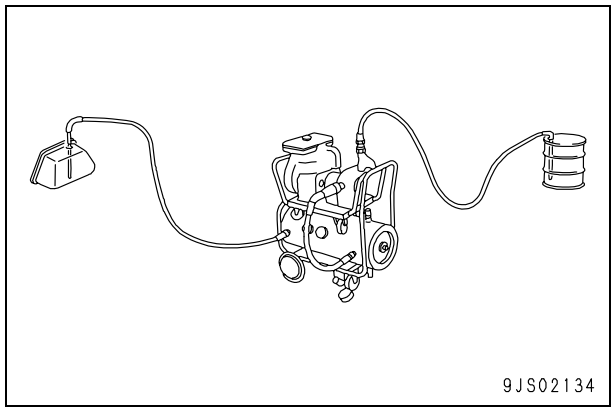
2. **Disassembly and maintenance work in the field**
   If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to check the performance after repairs, so it is desirable to use unit exchange. Disassembly and maintenance of hydraulic equipment should be carried out in a specially prepared dustproof workshop, and the performance should be checked with special test equipment.

3. **Sealing openings**
   After any piping or equipment is removed, the openings should be sealed with caps, tapes, or vinyl bags to prevent any dirt or dust from entering. If the opening is left open or is blocked with a rag, there is danger of dirt entering or of the surrounding area being made dirty by leaking oil so never do this. Do not simply drain oil out onto the ground, but collect it and ask the customer to dispose of it, or take it back with you for disposal.

4. **Do not let any dirt or dust get in during refilling operations**
   Be careful not to let any dirt or dust get in when refilling with hydraulic oil. Always keep the oil filler and the area around it clean, and also use clean pumps and oil containers. If an oil cleaning device is used, it is possible to filter out the dirt that has collected during storage, so this is an even more effective method.





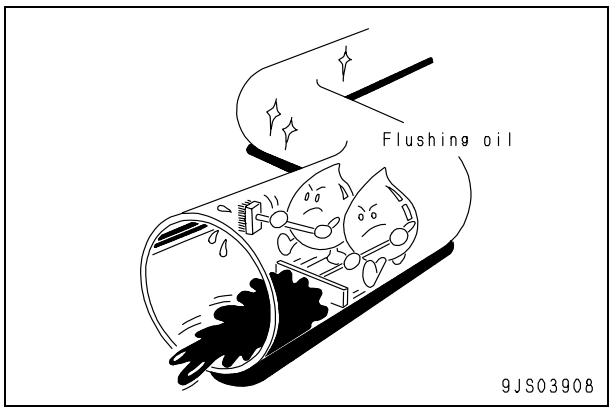


5. Change hydraulic oil when the temperature is high

When hydraulic oil or other oil is warm, it flows easily. In addition, the sludge can also be drained out easily from the circuit together with the oil, so it is best to change the oil when it is still warm. When changing the oil, as much as possible of the old hydraulic oil must be drained out. (Drain the oil from the hydraulic tank; also drain the oil from the filter and from the drain plug in the circuit.) If any old oil is left, the contaminants and sludge in it will mix with the new oil and will shorten the life of the hydraulic oil.

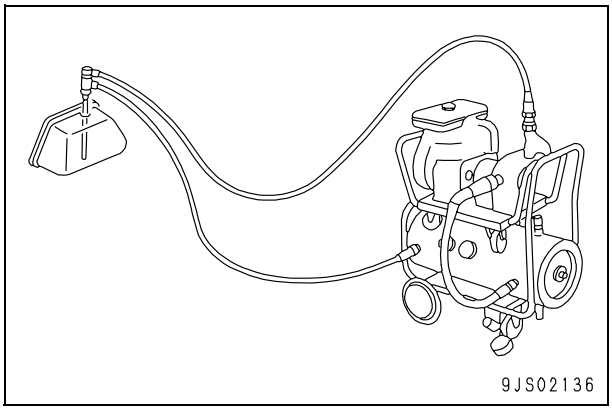
6. Flushing operations

After disassembling and assembling the equipment, or changing the oil, use flushing oil to remove the contaminants, sludge, and old oil from the hydraulic circuit. Normally, flushing is carried out twice: primary flushing is carried out with flushing oil, and secondary flushing is carried out with the specified hydraulic oil.



7. Cleaning operations

After repairing the hydraulic equipment (pump, control valve, etc.) or when running the machine, carry out oil cleaning to remove the sludge or contaminants in the hydraulic oil circuit. The oil cleaning equipment is used to remove the ultra fine (about 3 μ) particles that the filter built in the hydraulic equipment cannot remove, so it is an extremely effective device.



Connectors newly used for Tier 3 engines

1. Slide lock type (FRAMATOME-3, FRAMATOME-2)

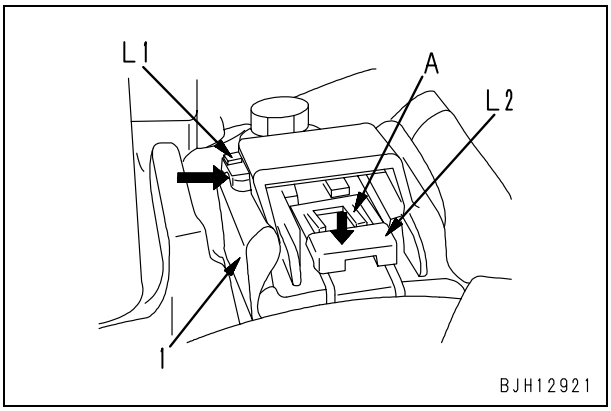
- 107 – 170, 12V140 engines
  - Various pressure sensors and NE speed sensor

  Examples)

  Intake air pressure in intake manifold: PIM (125, 170, 12V140 engines)
  Oil pressure sensor: POIL (125, 170, 12V140 engines)
  Oil pressure switch (107, 114 engines)
  Ne speed sensor of flywheel housing: NE (107 – 170, 12V140 engines)
  Ambient pressure sensor: PAMB (125, 170, 12V140 engines)

Disconnect connector (1) according to the following procedure.

1) Slide lock (L1) to the right.
2) While pressing lock (L2), pull out connector (1) toward you.
   - ★ Even if lock (L2) is pressed, connector (1) cannot be pulled out toward you, if part A does not float. In this case, float part A with a small screwdriver while press lock (L2), and then pull out connector (1) toward you.



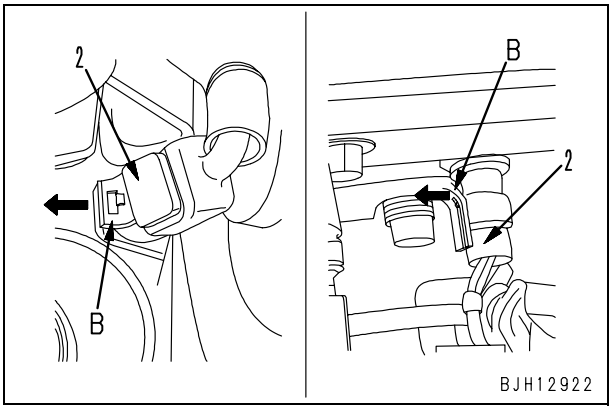
2. Pull lock type (PACKARD-2)

- 107 – 170, 12V140 engine
  - Various temperature sensors

Example)

Intake air temperature sensor in intake manifold: TIM
Fuel temperature sensor: TFUEL
Oil temperature sensor: TOIL
Coolant temperature sensor: TWTR, etc.

Disconnect the connector by pulling lock (B) (on the wiring harness side) of connector (2) outward.



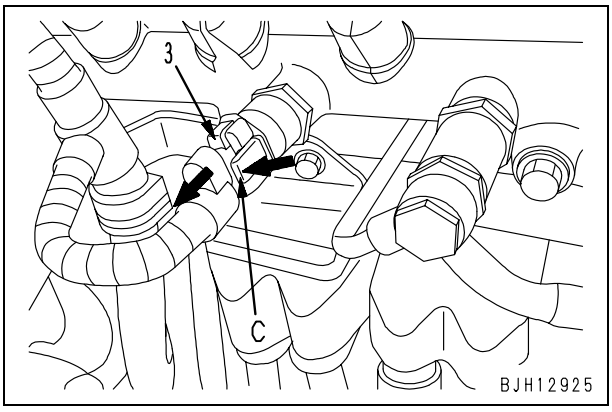
3. Push lock type

- 107, 114 engines
  Example)
  Fuel pressure sensor in common rail
  (**BOSCH-03**)

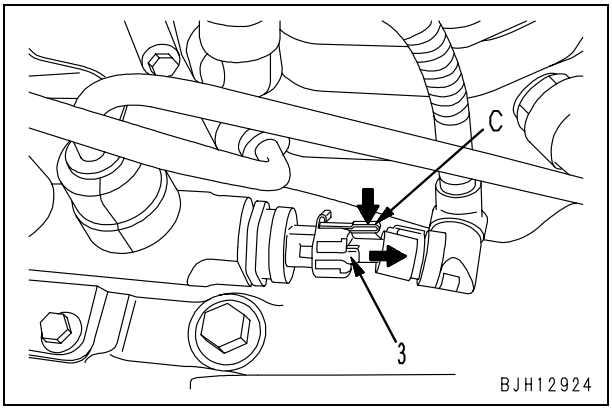
Disconnect connector (3) according to the following procedure.

1) While pressing lock (C), pull out connector (3) in the direction of the arrow.

- 114 engine

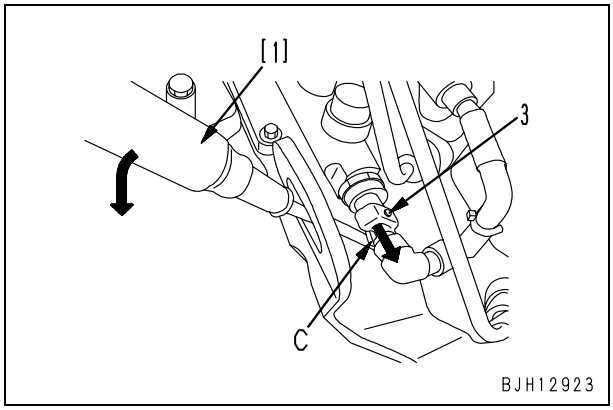


- 107 engine



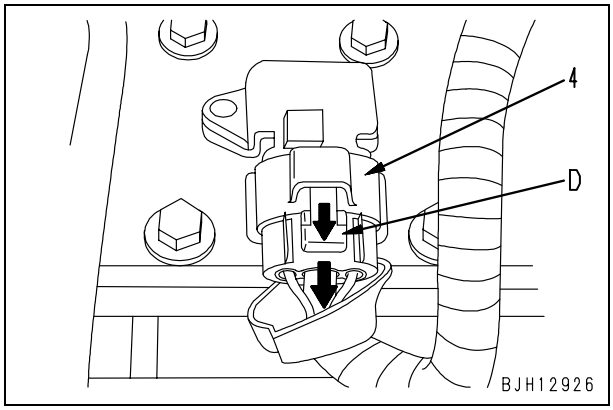
★ If the lock is on the underside, use flat-head screwdriver [1] since you cannot insert your fingers.

2) While pressing up lock (C) of the connector with flat-head screwdriver [1], pull out connector (3) in the direction of the arrow.



- 107, 114 engine
  Example)
  Intake air pressure/temperature sensor in intake manifold
  (**SUMITOMO-04**)

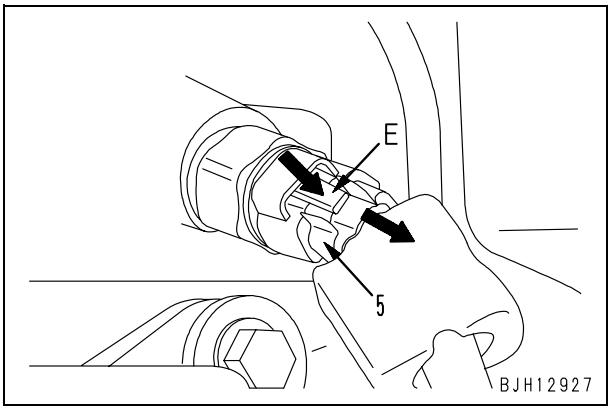
3) While pressing lock (D), pull out connector (4) in the direction of the arrow.



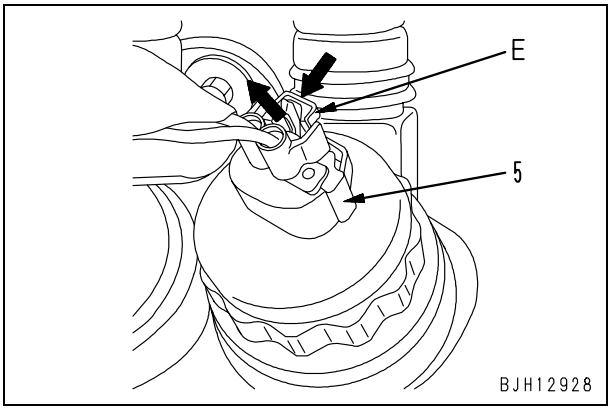
- 125 – 170, 12V140 engine

4) While pressing lock (E) of the connector, pullout connector (5) in the direction of the arrow.

Example)
Fuel pressure in common rail: PFUEL etc. (**AMP-3**)

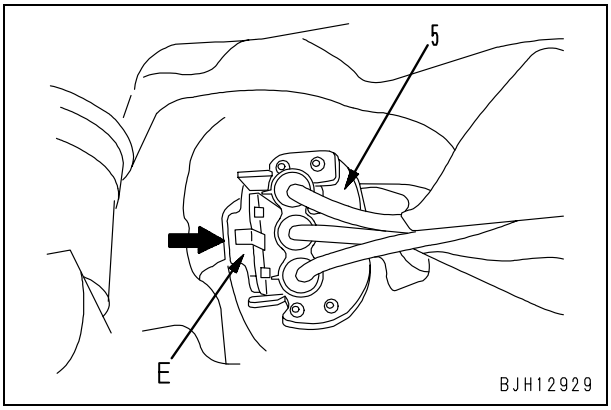


Example)
Injection pressure control valve of fuel supply pump: PCV (**SUMITOMO-2**)



Example)
Speed sensor of fuel supply pump: G (**SUMITOMO-3**)

★ Pull the connector straight up.



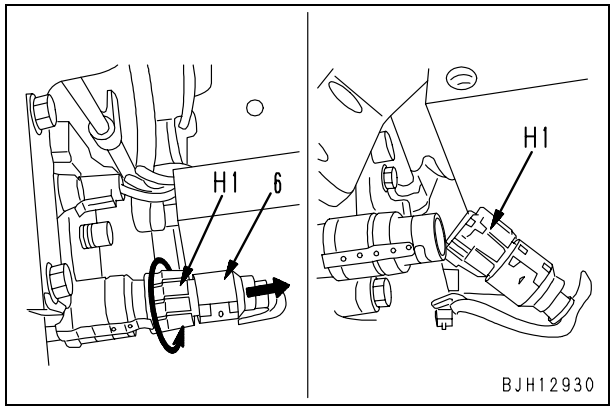
4. Turn-housing type (Round green connector)

- 140 engine

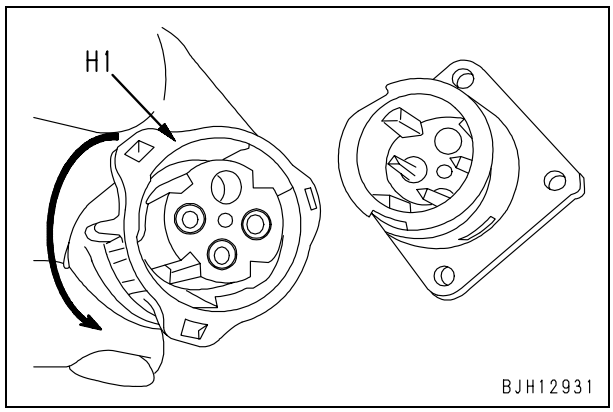
Example)
Intake air pressure sensor in intake manifold (CANNON-04): PIM etc.

1) Disconnect connector (6) according to the following procedure.
   1] Turn housing (H1) in the direction of the arrow.
      ★ When connector is unlocked, housing (H1) becomes heavy to turn.
   2] Pull out housing (H1) in the direction of the arrow.

   ★ Housing (H1) is left on the wiring harness side.



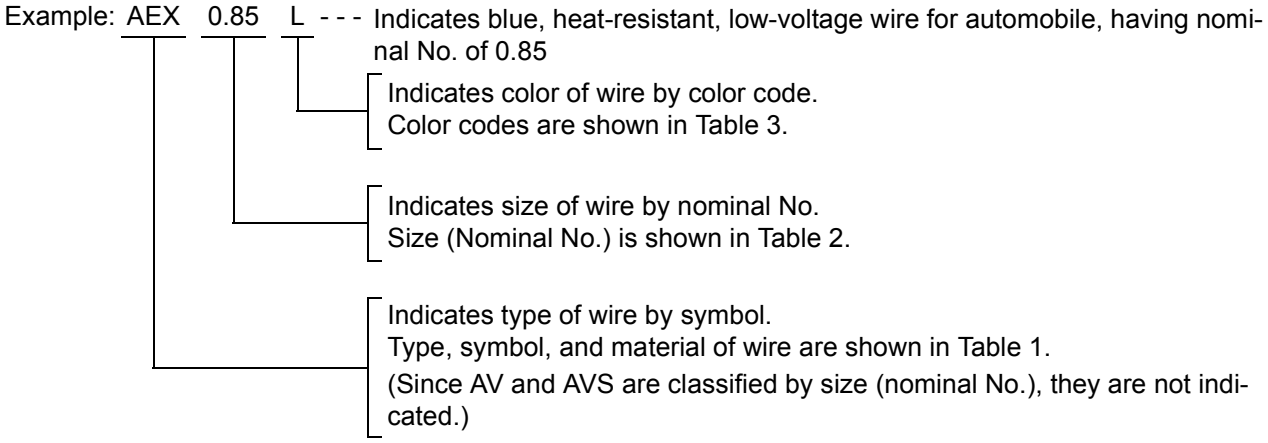
2) Connect the connector according to the following procedure.
   1] Insert the connector to the end, while setting its groove.
   2] Turn housing (H1) in the direction of the arrow until it “clicks”.



How to read electric wire code

★ The information about the wires unique to each machine model is described in Troubleshooting section, Relational information of troubleshooting.

In the electric circuit diagram, the material, thickness, and color of each electric wire are indicated by symbols. The electric wire code is helpful in understanding the electric circuit diagram.



1. Type, symbol, and material

AV and AVS are different in only thickness and outside diameter of the cover. AEX is similar to AV in thickness and outside diameter of AEX and different from AV and AVS in material of the cover.

(Table 1)

Type	Symbol	Material		Using temperature range (°C)	Example of use
Low-voltage wire for automobile	AV	Conductor	Annealed copper for electric appliance	–30 to +60	General wiring (Nominal No. 5 and above)
		Insulator	Soft polyvinyl chloride		
Thin-cover low-voltage wire for automobile	AVS	Conductor	Annealed copper for electric appliance		General wiring (Nominal No. 3 and below)
		Insulator	Soft polyvinyl chloride		
Heat-resistant low-voltage wire for automobile	AEX	Conductor	Annealed copper for electric appliance	–50 to +110	General wiring in extremely cold district, wiring at high-temperature place
		Insulator	Heat-resistant crosslinked polyethylene		

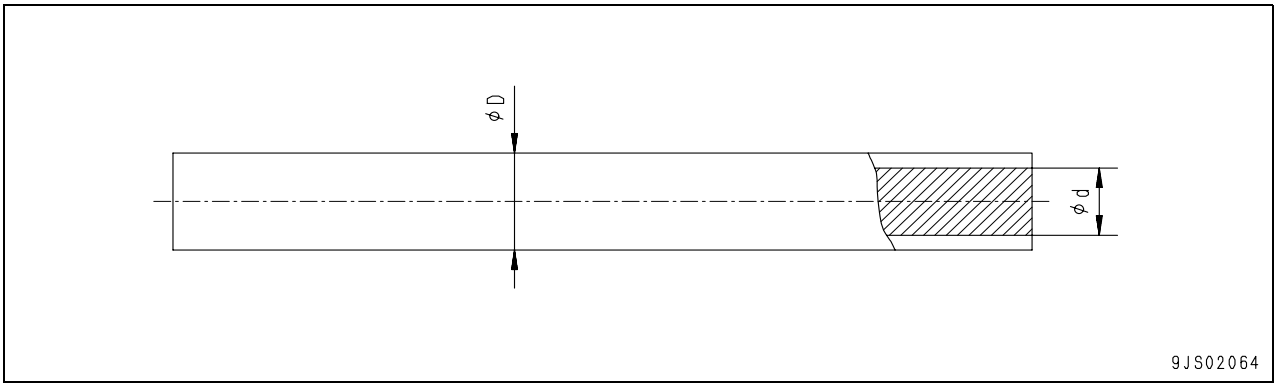
2. Dimensions

(Table 2)

Nominal No.			0.5f	(0.5)	0.75f	(0.85)	1.25f	(1.25)	2f	2	3f	3	5
Conductor		Number of strands/Diameter of strand	20/0.18	7/0.32	30/0.18	11/0.32	50/0.18	16/0.32	37/0.26	26/0.32	58/0.26	41/0.32	65/0.32
		Sectional area (mm^2)	0.51	0.56	0.76	0.88	1.27	1.29	1.96	2.09	3.08	3.30	5.23
		d (approx.)	1.0		1.2		1.5		1.9	1.9	2.3	2.4	3.0
Cover D	AVS	Standard	2.0		2.2		2.5		2.9	2.9	3.5	3.6	–
	AV	Standard	–		–		–		–	–	–	–	4.6
	AEX	Standard	2.0		2.2		2.7		3.0	3.1	–	3.8	4.6

Nominal No.			8	15	20	30	40	50	60	85	100
Conductor		Number of strands/Diameter of strand	50/0.45	84/0.45	41/0.80	70/0.80	85/0.80	108/0.80	127/0.80	169/0.80	217/0.80
		Sectional area (mm^2)	7.95	13.36	20.61	35.19	42.73	54.29	63.84	84.96	109.1
		d (approx.)	3.7	4.8	6.0	8.0	8.6	9.8	10.4	12.0	13.6
Cover D	AVS	Standard	–	–	–	–	–	–	–	–	–
	AV	Standard	5.5	7.0	8.2	10.8	11.4	13.0	13.6	16.0	17.6
	AEX	Standard	5.3	7.0	8.2	10.8	11.4	13.0	13.6	16.0	17.6

"f" of nominal No. denotes flexible".



3. Color codes table

(Table 3)

Color Code	Color of wire
B	Black
Br	Brown
BrB	Brown & Black
BrR	Brown & Red
BrW	Brown & White
BrY	Brown & Yellow
Ch	Charcoal
Dg	Dark green
G	Green
GB	Green & Black
GL	Green & Blue
Gr	Gray
GR	Green & Red
GW	Green & White
GY	Green & Yellow
L	Blue
LB	Blue & Black
Lg	Light green
LgB	Light green & Black
LgR	Light green & Red

Color Code	Color of wire
LgW	Light green & White
LgY	Light green & Yellow
LR	Blue & Red
LW	Blue & White
LY	Blue & Yellow
O	Orange
P	Pink
R	Red
RB	Red & Black
RG	Red & Green
RL	Red & Blue
RW	Red & White
RY	Red & Yellow
Sb	Sky Blue
Y	Yellow
YB	Yellow & Black
YG	Yellow &Green
YL	Yellow & Blue
YR	Yellow & Red
YW	Yellow & White

Remarks: In a color code consisting of 2 colors, the first color is the color of the background and the second color is the color of the marking.
Example: “GW” means that the background is Green and marking is White.

4. Types of circuits and color codes

(Table 4)

Type of wire		AVS or AV						AEX	
Type of circuit	Charge	R	WG	–	–	–	–	R	–
	Ground	B	–	–	–	–	–	B	–
	Start	R	–	–	–	–	–	R	–
	Light	RW	RB	RY	RG	RL	–	D	–
	Instrument	Y	YR	YB	YG	YL	YW	Y	Gr
	Signal	G	GW	GR	GY	GB	GL	G	Br
	Others	L	LW	LR	LY	LB	–	L	–
		Br	BrW	BrR	BrY	BrB	–	–	–
		Lg	LgR	LgY	LgB	LgW	–	–	–
		O	–	–	–	–	–	–	–
		Gr	–	–	–	–	–	–	–
		P	–	–	–	–	–	–	–
		Sb	–	–	–	–	–	–	–
		Dg	–	–	–	–	–	–	–
		Ch	–	–	–	–	–	–	–

Precautions when carrying out operation

[When carrying out removal or installation (disassembly or assembly) of units, be sure to follow the general precautions given below when carrying out the operation.]

1. Precautions when carrying out removal work

- If the coolant contains antifreeze, dispose of it correctly.
- After disconnecting hoses or tubes, cover them or fit plugs to prevent dirt or dust from entering.
- When draining oil, prepare a container of adequate size to catch the oil.
- Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
- To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors. Do not pull the wires.
- Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.
- Check the number and thickness of the shims, and keep in a safe place.
- When raising components, be sure to use lifting equipment of ample strength.
- When using forcing screws to remove any components, tighten the forcing screws uniformly in turn.
- Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.

★ Precautions when handling piping during disassembly
Fit the following plugs into the piping after disconnecting it during disassembly operations.

1) Face seal type hoses and tubes

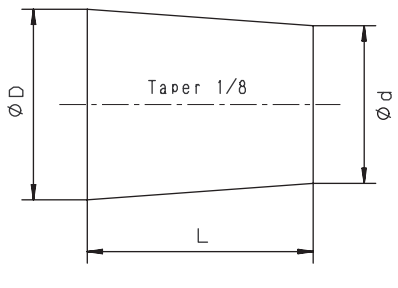
Nominal number	Plug (nut end)	Sleeve nut (elbow end)
02	07376-70210	02789-20210
03	07376-70315	02789-20315
04	07376-70422	02789-20422
05	07376-70522	02789-20522
06	07376-70628	02789-20628
10	07376-71034	07221-21034
12	07376-71234	07221-21234

2) Split flange type hoses and tubes

Nominal number	Flange (hose end)	Sleeve head (tube end)	Split flange
04	07379-00400	07378-10400	07371-30400
05	07379-00500	07378-10500	07371-30500

3) If the part is not under hydraulic pressure, the following corks can be used.

Nominal number	Part Number	Dimensions		
		D	d	L
06	07049-00608	6	5	8
08	07049-00811	8	6.5	11
10	07049-01012	10	8.5	12
12	07049-01215	12	10	15
14	07049-01418	14	11.5	18
16	07049-01620	16	13.5	20
18	07049-01822	18	15	22
20	07049-02025	20	17	25
22	07049-02228	22	18.5	28
24	07049-02430	24	20	30
27	07049-02734	27	22.5	34



DEW00401

2. Precautions when carrying out installation work

- Tighten all bolts and nuts (sleeve nuts) to the specified (KES) torque.
- Install the hoses without twisting or interference and fix them with intermediate clamps, if there are any.
- Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
- Bend the cotter pins and lock plates securely.
- When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2 – 3 drops of adhesive.
- When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
- Clean all parts, and correct any damage, dents, burrs, or rust.
- Coat rotating parts and sliding parts with engine oil.
- When press fitting parts, coat the surface with anti-friction compound (LM-P).
- After fitting snap rings, check that the snap ring is fitted securely in the ring groove.
- When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
- When using eyebolts, check that there is no deformation or deterioration, screw them in fully, and align the direction of the hook.
- When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.

★ When operating the hydraulic cylinders for the first time after reassembling cylinders, pumps and other hydraulic equipment removed for repair, always bleed the air as follows:
  1) Start the engine and run at low idle.
  2) Operate the work equipment control lever to operate the hydraulic cylinder 4 – 5 times, stopping the cylinder 100 mm from the end of its stroke.
  3) Next, operate the hydraulic cylinder 3 – 4 times to the end of its stroke.
  4) After doing this, run the engine at normal speed.

★ When using the machine for the first time after repair or long storage, follow the same procedure.

3. Precautions when completing the operation

1) Refilling with coolant, oil and grease
   - If the coolant has been drained, tighten the drain valve, and add coolant to the specified level. Run the engine to circulate the coolant through the system. Then check the coolant level again.
   - If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
   - If the piping or hydraulic equipment have been removed, always bleed the air from the system after reassembling the parts.
     ★ For details, see Testing and adjusting, “Bleeding air”.
   - Add the specified amount of grease (molybdenum disulphide grease) to the work equipment parts.
2) Checking cylinder head and manifolds for looseness
   Check the cylinder head and intake and exhaust manifold for looseness.
   If any part is loosened, retighten it.
   - For the tightening torque, see “Disassembly and assembly”.
3) Checking engine piping for damage and looseness
   Intake and exhaust system
   Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for air suction and exhaust gas leakage.
   If any part is loosened or damaged, retighten or repair it.
   Cooling system
   Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for coolant leakage.
   If any part is loosened or damaged, retighten or repair it.
   Fuel system
   Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for fuel leakage.
   If any part is loosened or damaged, retighten or repair it.

4) Checking muffler and exhaust pipe for damage and looseness
   1] Visually check the muffler, exhaust pipe and their mounting parts for a crack and damage.
      If any part is damaged, replace it.
   2] Check the mounting bolts and nuts of the muffler, exhaust pipe and their mounting parts for looseness.
      If any bolt or nut is loosened, retighten it.
5) Checking muffler function
   Check the muffler for abnormal sound and sound different from that of a new muffler.
   If any abnormal sound is heard, repair the muffler, referring to “Troubleshooting” and “Disassembly and assembly”.

Method of disassembling and connecting push-pull type coupler

⚠ **Before carrying out the following work, loosen the oil filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**

⚠ **Even if the residual pressure is released from the hydraulic tank, some hydraulic oil flows out when the hose is disconnected. Accordingly, prepare an oil receiving container.**

Type 1

1. Disconnection

1) Hold adapter (1) and push hose joint (2) into mating adapter (3). (Fig. 1)
   - ★ The adapter can be pushed in about 3.5 mm.
   - ★ Do not hold rubber cap portion (4).
2) After hose joint (2) is pushed into adapter (3), press rubber cap portion (4) against adapter (3) until it clicks. (Fig. 2)
3) Hold hose adapter (1) or hose (5) and pull it out. (Fig. 3)
   - ★ Since some hydraulic oil flows out, prepare an oil receiving container.

Fig. 1

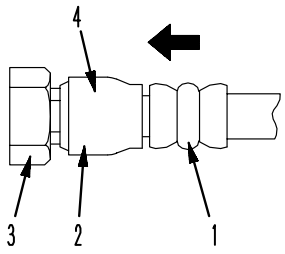


Fig. 2

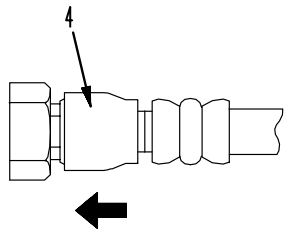
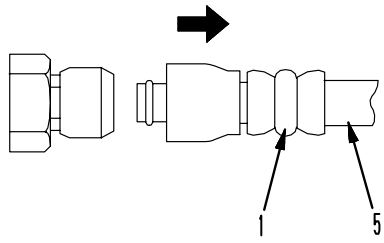


Fig. 3



9JS02109

2. Connection

1) Hold hose adapter (1) or hose (5) and insert it in mating adapter (3), aligning them with each other. (Fig. 4)
   - ★ Do not hold rubber cap portion (4).
2) After inserting the hose in the mating adapter perfectly, pull it back to check its connecting condition. (Fig. 5)
   - ★ When the hose is pulled back, the rubber cap portion moves toward the hose about 3.5 mm. This does not indicate abnormality, however.

Fig. 4

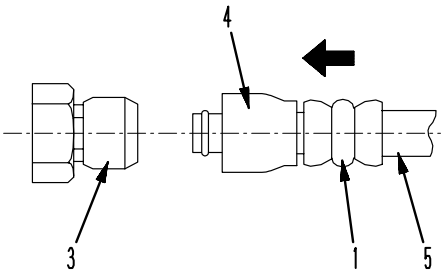
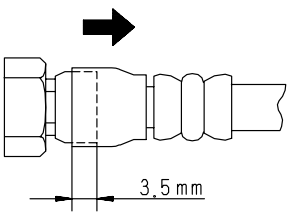


Fig. 5

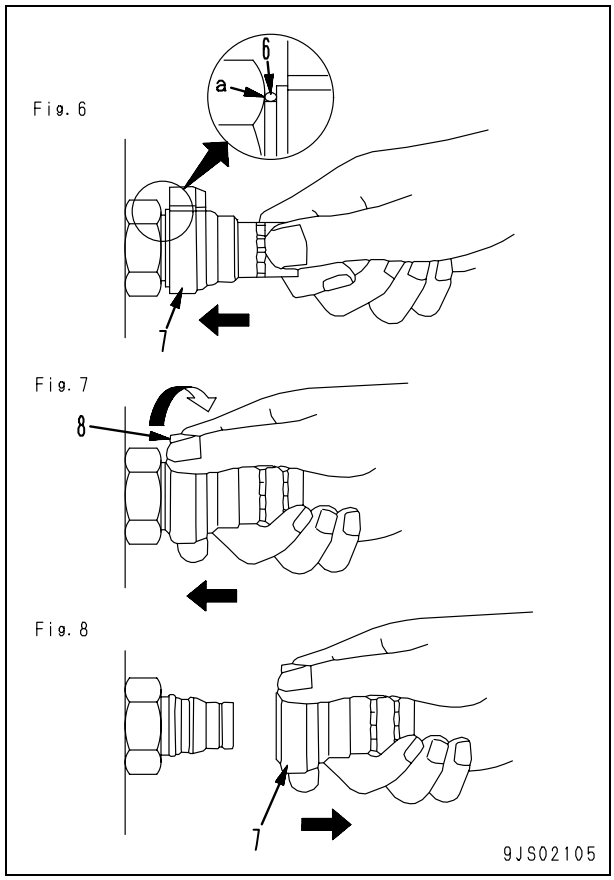


9JS02110

Type 2

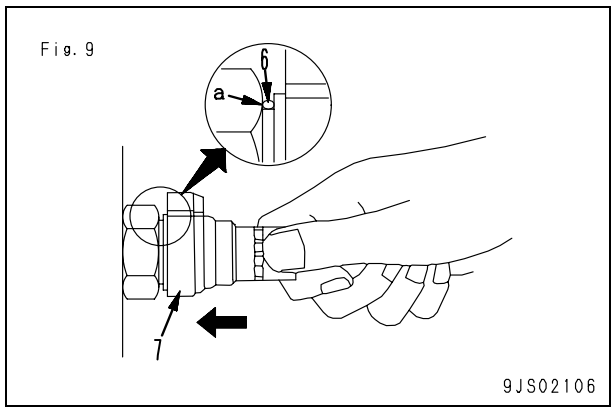
1. Disconnection

1) Hold the tightening portion and push body (7) straight until sliding prevention ring (6) contacts contact surface (a) of the hexagonal portion at the male end. (Fig. 6)
2) While holding the condition of Step 1), turn lever (8) to the right (clockwise). (Fig. 7)
3) While holding the condition of Steps 1) and 2), pull out whole body (7) to disconnect it. (Fig. 8)



2. Connection

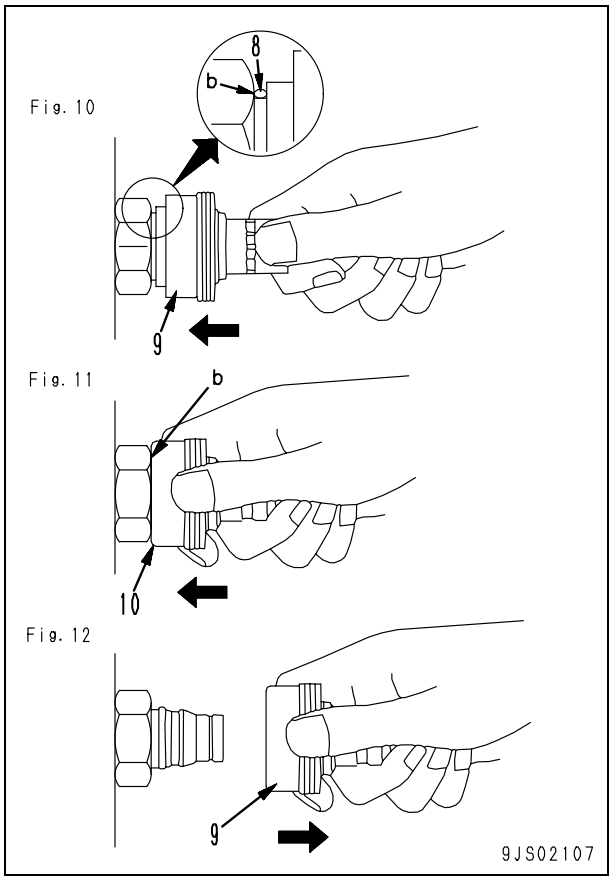
- Hold the tightening portion and push body (7) straight until sliding prevention ring (6) contacts contact surface (a) of the hexagonal portion at the male end. (Fig. 9)



Type 3

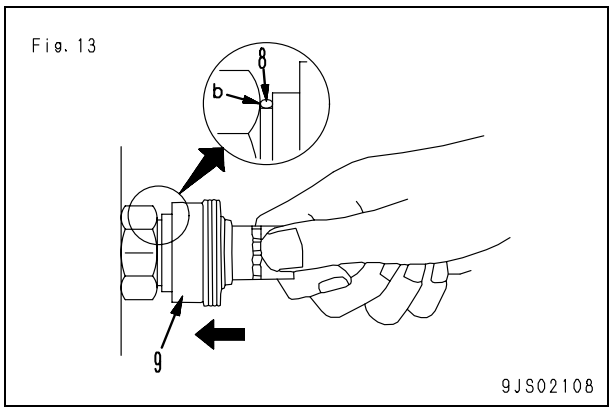
1. Disconnection

1) Hold the tightening portion and push body (9) straight until sliding prevention ring (8) contacts contact surface (b) of the hexagonal portion at the male end. (Fig. 10)
2) While holding the condition of Step 1), push cover (10) straight until it contacts contact surface (b) of the hexagonal portion at the male end. (Fig. 11)
3) While holding the condition of Steps 1) and 2), pull out whole body (9) to disconnect it. (Fig. 12)



2. Connection

- Hold the tightening portion and push body (9) straight until the sliding prevention ring contacts contact surface (b) of the hexagonal portion at the male end. (Fig. 13)



Standard tightening torque table

1. Table of tightening torques for bolts and nuts
   ★ Unless there are special instructions, tighten metric nuts and bolts to the torque below. (When using torque wrench)

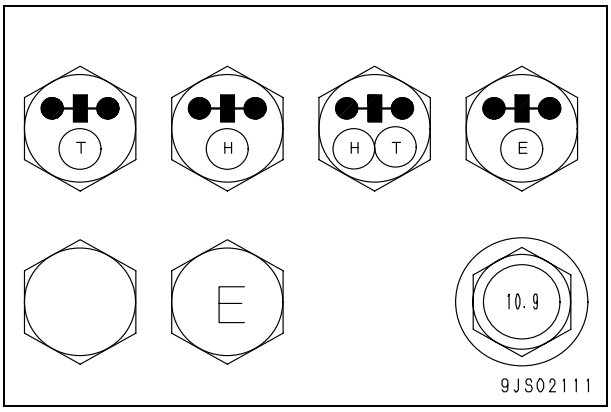
   ★ The following table corresponds to the bolts in Fig. A.

Thread diameter of bolt	Width across flats	Tightening torque	
mm	mm	Nm	kgm
6	10	11.8 – 14.7	1.2 – 1.5
8	13	27 – 34	2.8 – 3.5
10	17	59 – 74	6.0 – 7.5
12	19	98 – 123	10.0 – 12.5
14	22	153 – 190	15.5 – 19.5
16	24	235 – 285	23.5 – 29.5
18	27	320 – 400	33.0 – 41.0
20	30	455 – 565	46.5 – 58.0
22	32	610 – 765	62.5 – 78.0
24	36	785 – 980	80.0 – 100.0
27	41	1,150 – 1,440	118 – 147
30	46	1,520 – 1,910	155 – 195
33	50	1,960 – 2,450	200 – 250
36	55	2,450 – 3,040	250 – 310
39	60	2,890 – 3,630	295 – 370

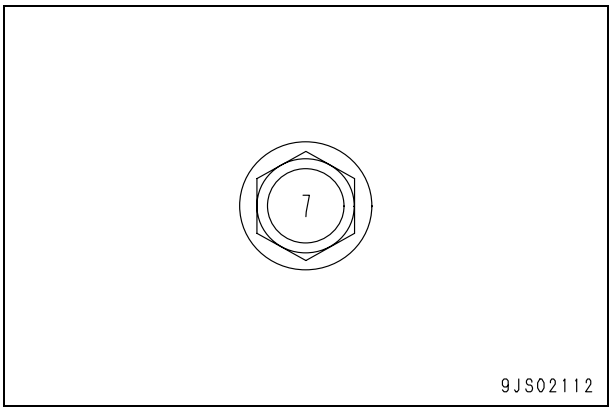
   ★ The following table corresponds to the bolts in Fig. B.

Thread diameter of bolt	Width across flats	Tightening torque	
mm	mm	Nm	kgm
6	10	5.9 – 9.8	0.6 – 1.0
8	13	13.7 – 23.5	1.4 – 2.4
10	14	34.3 – 46.1	3.5 – 4.7
12	27	74.5 – 90.2	7.6 – 9.2

★ Fig. A



★ Fig. B



2. Table of tightening torques for split flange bolts

★ Unless there are special instructions, tighten split flange bolts to the torque below.

Thread diameter of bolt	Width across flats	Tightening torque	
mm	mm	Nm	kgm
10	14	59 – 74	6.0 – 7.5
12	17	98 – 123	10.0 – 12.5
16	22	235 – 285	23.5 – 29.5

3. Table of tightening torques for O-ring boss piping joints

★ Unless there are special instructions, tighten O-ring boss piping joints to the torque below.

Nominal No.	Thread diameter	Width across flats	Tightening torque Nm {kgm}	
	mm	mm	Range	Target
02	14	Varies depending on type of connector.	35 – 63 { 3.5 – 6.5}	44 { 4.5}
03,04	20		84 – 132 { 8.5 – 13.5}	103 {10.5}
05,06	24		128 – 186 {13.0 – 19.0}	157 {16.0}
10,12	33		363 – 480 {37.0 – 49.0}	422 {43.0}
14	42		746 – 1,010 {76.0 – 103}	883 {90.0}

4. Table of tightening torques for O-ring boss plugs

★ Unless there are special instructions, tighten O-ring boss plugs to the torque below.

Nominal No.	Thread diameter	Width across flats	Tightening torque Nm {kgm}	
	mm	mm	Range	Target
08	8	14	5.88 – 8.82 {0.6 – 0.9}	7.35 {0.75}
10	10	17	9.81 – 12.74 {1.0 – 1.3}	11.27 {1.15}
12	12	19	14.7 – 19.6 {1.5 – 2.0}	17.64 {1.8}
14	14	22	19.6 – 24.5 {2.0 – 2.5}	22.54 {2.3}
16	16	24	24.5 – 34.3 {2.5 – 3.5}	29.4 {3.0}
18	18	27	34.3 – 44.1 {3.5 – 4.5}	39.2 {4.0}
20	20	30	44.1 – 53.9 {4.5 – 5.5}	49.0 {5.0}
24	24	32	58.8 – 78.4 {6.0 – 8.0}	68.6 {7.0}
30	30	32	93.1 – 122.5 { 9.5 – 12.5}	107.8 {11.0}
33	33	–	107.8 – 147.0 {11.0 – 15.0}	127.4 {13.0}
36	36	36	127.4 – 176.4 {13.0 – 18.0}	151.9 {15.5}
42	42	–	181.3 – 240.1 {18.5 – 24.5}	210.7 {21.5}
52	52	–	274.4 – 367.5 {28.0 – 37.5}	323.4 {33.0}

5. Table of tightening torques for hoses (taper seal type and face seal type)

★ Unless there are special instructions, tighten the hoses (taper seal type and face seal type) to the torque below.

★ Apply the following torque when the threads are coated (wet) with engine oil.

Nominal No. of hose	Width across flats	Tightening torque Nm {kgm}		Taper seal	Face seal	
		Range	Target	Thread size (mm)	Nominal No. - Number of threads, type of thread	Thread diameter (mm) (Reference)
02	19	34 – 54 { 3.5 – 5.5}	44 { 4.5}	–	9/16-18UN	14.3
		34 – 63 { 3.5 – 6.5}		14	–	–
03	22	54 – 93 { 5.5 – 9.5}	74 { 7.5}	–	11/16-16UN	17.5
	24	59 – 98 { 6.0 – 10.0}	78 { 8.0}	18	–	–
04	27	84 – 132 { 8.5 – 13.5}	103 {10.5}	22	13/16-16UN	20.6
05	32	128 – 186 {13.0 – 19.0}	157 {16.0}	24	1-14UNS	25.4
06	36	177 – 245 {18.0 – 25.0}	216 {22.0}	30	1-3/16-12UN	30.2
(10)	41	177 – 245 {18.0 – 25.0}	216 {22.0}	33	–	–
(12)	46	197 – 294 {20.0 – 30.0}	245 {25.0}	36	–	–
(14)	55	246 – 343 {25.0 – 35.0}	294 {30.0}	42	–	–

6. Table of tightening torques for 102, 107 and 114 engine series (Bolts and nuts)

★ Unless there are special instructions, tighten the metric bolts and nuts of the 102, 107 and 114 engine series to the torque below.

Thread size	Tightening torque	
	Bolts and nuts	
mm	Nm	kgm
6	10 ± 2	1.02 ± 0.20
8	24 ± 4	2.45 ± 0.41
10	43 ± 6	4.38 ± 0.61
12	77 ± 12	7.85 ± 1.22
14	—	—

7. Table of tightening torques for 102, 107 and 114 engine series (Eye joints)

★ Unless there are special instructions, tighten the metric eye joints of the 102, 107 and 114 engine series to the torque below.

Thread size	Tightening torque	
mm	Nm	kgm
6	8 ± 2	0.81 ± 0.20
8	10 ± 2	1.02 ± 0.20
10	12 ± 2	1.22 ± 0.20
12	24 ± 4	2.45 ± 0.41
14	36 ± 5	3.67 ± 0.51

8. Table of tightening torques for 102, 107 and 114 engine series (Taper screws)

★ Unless there are special instructions, tighten the taper screws (unit: inch) of the 102, 107 and 114 engine series to the torque below.

Thread size	Tightening torque	
inch	Nm	kgm
1/16	3 ± 1	0.31 ± 0.10
1/8	8 ± 2	0.81 ± 0.20
1/4	12 ± 2	1.22 ± 0.20
3/8	15 ± 2	1.53 ± 0.20
1/2	24 ± 4	2.45 ± 0.41
3/4	36 ± 5	3.67 ± 0.51
1	60 ± 9	6.12 ± 0.92

Conversion table

Method of using the conversion table

The conversion table in this section is provided to enable simple conversion of figures. For details of the method of using the conversion table, see the example given below.

Example: Method of using the conversion table to convert from millimeters to inches

1. Convert 55 mm into inches.

1) Locate the number 50 in the vertical column at the left side, take this as (A), and then draw a horizontal line from (A).
2) Locate the number 5 in the row across the top, take this as (B), then draw a perpendicular line down from (B).
3) Take the point where the 2 lines cross as (C). This point (C) gives the value when converting from millimeters to inches. Therefore, 55 mm = 2.165 inches.

2. Convert 550 mm into inches.

1) The number 550 does not appear in the table, so divide it by 10 (move the decimal point one place to the left) to convert it to 55 mm.
2) Carry out the same procedure as above to convert 55 mm to 2.165 inches.
3) The original value (550 mm) was divided by 10, so multiply 2.165 inches by 10 (move the decimal point one place to the right) to return to the original value. This gives 550 mm = 21.65 inches.

Millimeters to inches

(B)

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
						(C)				
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

(A)

Millimeters to inches

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to pound

1 kg = 2.2046 lb

	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Liters to U.S. Gallons

1 ℓ = 0.2642 U.S.Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.361	25.625	25.889	26.153

Liters to U.K. Gallons

1 ℓ = 0.21997 U.K.Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379
30	6.599	6.819	7.039	7.259	7.479	7.699	7.919	8.139	8.359	8.579
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.778
50	10.998	11.281	11.438	11.658	11.878	12.098	12.318	12.528	12.758	12.978
60	13.198	13.418	13.638	13.858	14.078	14.298	14.518	14.738	14.958	15.178
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378
80	17.598	17.818	18.037	18.257	18.477	18.697	18.917	19.137	19.357	19.577
90	19.797	20.017	20.237	20.457	20.677	20.897	21.117	21.337	21.557	21.777

kgm to ft.lb

1 kgm = 7.233 ft.lb

	0	1	2	3	4	5	6	7	8	9
0	0	7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	296.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.7	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	976.5	983.7	990.9	998.2	1005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.6	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

kg/cm^2 to lb/in^2

1 kg/cm^2 = 14.2233 lb/in^2

	0	1	2	3	4	5	6	7	8	9
0	0	14.2	28.4	42.7	56.9	71.1	85.3	99.6	113.8	128.0
10	142.2	156.5	170.7	184.9	199.1	213.4	227.6	241.8	256.0	270.2
20	284.5	298.7	312.9	327.1	341.4	355.6	369.8	384.0	398.3	412.5
30	426.7	440.9	455.1	469.4	483.6	497.8	512.0	526.3	540.5	554.7
40	568.9	583.2	597.4	611.6	625.8	640.1	654.3	668.5	682.7	696.9
50	711.2	725.4	739.6	753.8	768.1	782.3	796.5	810.7	825.0	839.2
60	853.4	867.6	881.8	896.1	910.3	924.5	938.7	953.0	967.2	981.4
70	995.6	1,010	1,024	1,038	1,053	1,067	1,081	1,095	1,109	1,124
80	1,138	1,152	1,166	1,181	1,195	1,209	1,223	1,237	1,252	1,266
90	1,280	1,294	1,309	1,323	1,337	1,351	1,365	1,380	1,394	1,408
100	1,422	1,437	1,451	1,465	1,479	1,493	1,508	1,522	1,536	1,550
110	1,565	1,579	1,593	1,607	1,621	1,636	1,650	1,664	1,678	1,693
120	1,707	1,721	1,735	1,749	1,764	1,778	1,792	1,806	1,821	1,835
130	1,849	1,863	1,877	1,892	1,906	1,920	1,934	1,949	1,963	1,977
140	1,991	2,005	2,020	2,034	2,048	2,062	2,077	2,091	2,105	2,119
150	2,134	2,148	2,162	2,176	2,190	2,205	2,219	2,233	2,247	2,262
160	2,276	2,290	2,304	2,318	2,333	2,347	2,361	2,375	2,389	2,404
170	2,418	2,432	2,446	2,460	2,475	2,489	2,503	2,518	2,532	2,546
180	2,560	2,574	2,589	2,603	2,617	2,631	2,646	2,660	2,674	2,688
190	2,702	2,717	2,731	2,745	2,759	2,773	2,788	2,802	2,816	2,830
200	2,845	2,859	2,873	2,887	2,901	2,916	2,930	2,944	2,958	2,973
210	2,987	3,001	3,015	3,030	3,044	3,058	3,072	3,086	3,101	3,115
220	3,129	3,143	3,158	3,172	3,186	3,200	3,214	3,229	3,243	3,257
230	3,271	3,286	3,300	3,314	3,328	3,343	3,357	3,371	3,385	3,399
240	3,414	3,428	3,442	3,456	3,470	3,485	3,499	3,513	3,527	3,542

Temperature

Fahrenheit-Centigrade conversion: A simple way to convert a Fahrenheit temperature reading into a Centigrade temperature reading or vice versa is to enter the accompanying table in the center (boldface column) of figures. These figures refer to the temperature in either Fahrenheit or Centigrade degrees.
When convert from Fahrenheit to Centigrade degrees, consider the center column to be a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.
When convert from Centigrade to Fahrenheit degrees, consider the center column to be a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

1°C = 33.8°F

°C		°F	°C		°F	°C		°F	°C		°F
–40.4	**–40**	–40.0	–11.7	**11**	51.8	7.8	**46**	114.8	27.2	**81**	177.8
–37.2	**–35**	–31.0	–11.1	**12**	53.6	8.3	**47**	116.6	27.8	**82**	179.6
–34.4	**–30**	–22.0	–10.6	**13**	55.4	8.9	**48**	118.4	28.3	**83**	181.4
–31.7	**–25**	–13.0	–10.0	**14**	57.2	9.4	**49**	120.2	28.9	**84**	183.2
–28.9	**–20**	–4.0	–9.4	**15**	59.0	10.0	**50**	122.0	29.4	**85**	185.0
–28.3	**–19**	–2.2	–8.9	**16**	60.8	10.6	**51**	123.8	30.0	**86**	186.8
–27.8	**–18**	–0.4	–8.3	**17**	62.6	11.1	**52**	125.6	30.6	**87**	188.6
–27.2	**–17**	1.4	–7.8	**18**	64.4	11.7	**53**	127.4	31.1	**88**	190.4
–26.7	**–16**	3.2	–7.2	**19**	66.2	12.2	**54**	129.2	31.7	**89**	192.2
–26.1	**–15**	5.0	–6.7	**20**	68.0	12.8	**55**	131.0	32.2	**90**	194.0
–25.6	**–14**	6.8	–6.1	**21**	69.8	13.3	**56**	132.8	32.8	**91**	195.8
–25.0	**–13**	8.6	–5.6	**22**	71.6	13.9	**57**	134.6	33.3	**92**	197.6
–24.4	**–12**	10.4	–5.0	**23**	73.4	14.4	**58**	136.4	33.9	**93**	199.4
–23.9	**–11**	12.2	–4.4	**24**	75.2	15.0	**59**	138.2	34.4	**94**	201.2
–23.3	**–10**	14.0	–3.9	**25**	77.0	15.6	**60**	140.0	35.0	**95**	203.0
–22.8	**–9**	15.8	–3.3	**26**	78.8	16.1	**61**	141.8	35.6	**96**	204.8
–22.2	**–8**	17.6	–2.8	**27**	80.6	16.7	**62**	143.6	36.1	**97**	206.6
–21.7	**–7**	19.4	–2.2	**28**	82.4	17.2	**63**	145.4	36.7	**98**	208.4
–21.1	**–6**	21.2	–1.7	**29**	84.2	17.8	**64**	147.2	37.2	**99**	210.2
–20.6	**–5**	23.0	–1.1	**30**	86.0	18.3	**65**	149.0	37.8	**100**	212.0
–20.0	**–4**	24.8	–0.6	**31**	87.8	18.9	**66**	150.8	40.6	**105**	221.0
–19.4	**–3**	26.6	0	**32**	89.6	19.4	**67**	152.6	43.3	**110**	230.0
–18.9	**–2**	28.4	0.6	**33**	91.4	20.0	**68**	154.4	46.1	**115**	239.0
–18.3	**–1**	30.2	1.1	**34**	93.2	20.6	**69**	156.2	48.9	**120**	248.0
–17.8	**0**	32.0	1.7	**35**	95.0	21.1	**70**	158.0	51.7	**125**	257.0
–17.2	**1**	33.8	2.2	**36**	96.8	21.7	**71**	159.8	54.4	**130**	266.0
–16.7	**2**	35.6	2.8	**37**	98.6	22.2	**72**	161.6	57.2	**135**	275.0
–16.1	**3**	37.4	3.3	**38**	100.4	22.8	**73**	163.4	60.0	**140**	284.0
–15.6	**4**	39.2	3.9	**39**	102.2	23.3	**74**	165.2	62.7	**145**	293.0
–15.0	**5**	41.0	4.4	**40**	104.0	23.9	**75**	167.0	65.6	**150**	302.0
–14.4	**6**	42.8	5.0	**41**	105.8	24.4	**76**	168.8	68.3	**155**	311.0
–13.9	**7**	44.6	5.6	**42**	107.6	25.0	**77**	170.6	71.1	**160**	320.0
–13.3	**8**	46.4	6.1	**43**	109.4	25.6	**78**	172.4	73.9	**165**	329.0
–12.8	**9**	48.2	6.7	**44**	111.2	26.1	**79**	174.2	76.7	**170**	338.0
–12.2	**10**	50.0	7.2	**45**	113.0	26.7	**80**	176.0	79.4	**175**	347.0

WA600-6 Wheel loader

Form No. SEN00415-01

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Printed in Japan 10-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

01 Specification

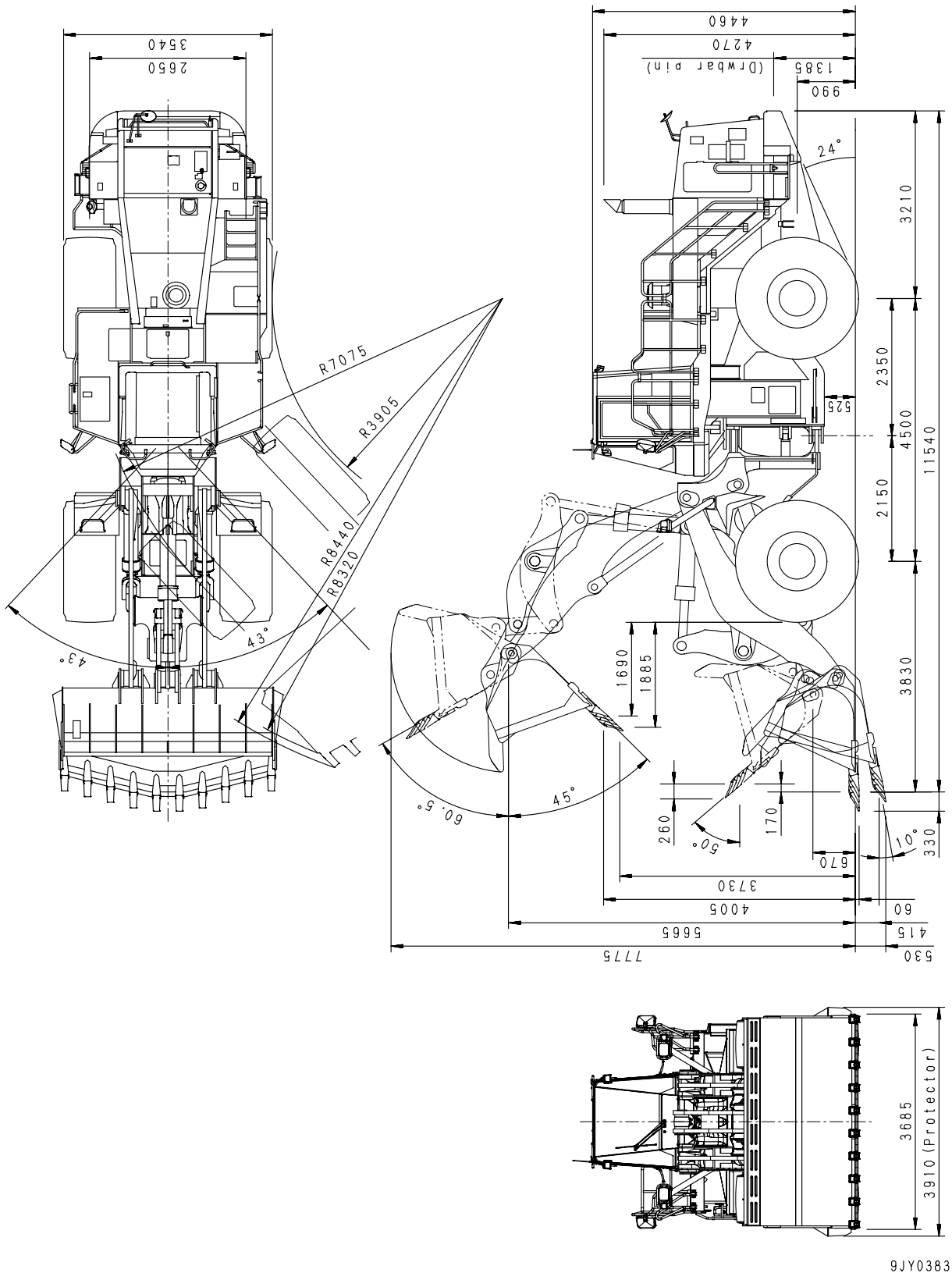
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Specification and technical data

Specification dimension drawing

3,850 mm with lift arm



Specifications

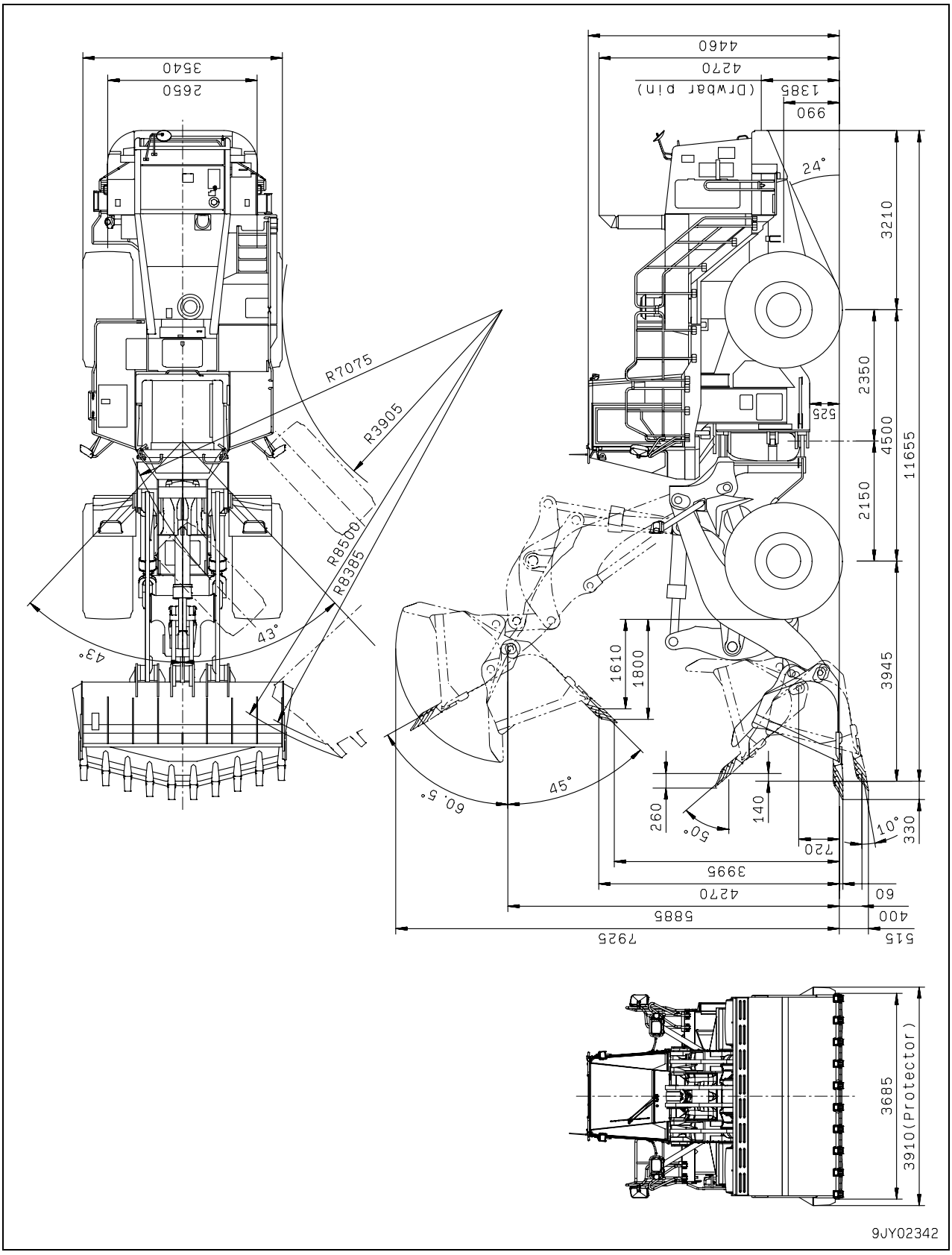
3,850 mm with lift arm

Machine model name			WA600-6			
Serial number			60001 and up		60001 and up	
			Standard		For EU	
Weight	Operating weight	kg	52,900		53,130	
	Distribution					
	Front wheel	kg	26,485		26,550	
	Rear wheel	kg	26,335		26,500	
Performance	Bucket capacity (Heaped)	m^3	7.0		7.0	
	Rated load	kN{kg}	123.56 {12,600}		123.56 {12,600}	
	Data inside the parentheses represents a value when locked up		P-mode	E-mode	P-mode	E-mode
	Travel speed F1	km/h	6.7	6.6	6.7	6.6
	Travel speed F2	km/h	11.7 (12.4)	11.5 (12.1)	11.7 (12.4)	11.5 (12.1)
	Travel speed F3	km/h	20.3 (21.7)	19.4 (20.9)	20.3 (21.7)	19.4 (20.9)
	Travel speed F4	km/h	33.8 (37.7)	31.5 (35.5)	33.8 (37.7)	31.5 (35.5)
	Travel speed R1	km/h	7.3	7.3	7.3	7.3
	Travel speed R2	km/h	12.8 (13.5)	12.5 (12.8)	12.8 (13.5)	12.5 (12.8)
	Travel speed R3	km/h	22.0 (23.7)	21.1 (22.5)	22.0 (23.7)	21.1 (22.5)
	Travel speed R4	km/h	37.0 (41.0)	34.0 (38.4)	37.0 (41.0)	34.0 (38.4)
	Max. drawbar pull, forward	kN{kg}	429.53{43,800}	357.94{36,500}	429.53{43,800}	357.94{36,500}
	Max. drawbar pull, reverse	kN{kg}	387.36{39,500}	354.02{36,100}	387.36{39,500}	354.02{36,100}
	Gradeability	deg.	25		25	
	Min. turning radius					
	Center of outside tire	mm	7,075		7,075	
	Outside of chassis (with teeth)	mm	8,440		8,440	
Dimensions	Overall length (with teeth)	mm	11,870		11,870	
	Overall width (chassis)	mm	3,540		3,540	
	Bucket width (outside width of protector)	mm	3,910		3,910	
	Overall height (ROPS cab top)	mm	4,460		4,460	
	Overall height with bucket lifted up to maximum height	mm	7,775		7,775	
	Wheelbase	mm	4,500		4,500	
	Tread	mm	2,650		2,650	
	Minimum ground clearance	mm	525		525	
	Max. hinge pin height of bucket	mm	5,665		5,665	
	Dumping clearance (Teeth end/Edge tip)	mm	3,730 / 4,005		3,730 / 4,005	
	Dumping reach (Teeth end/Edge tip)	mm	1,885 / 1,690		1,885 / 1,690	
	Bucket tilt-forward angle	deg.	45		45	
	Bucket tilt-back angle (Operating posture)	deg.	50		50	
	Digging depth, 10° (Teeth end/Edge tip)	mm	530 / 415		530 / 415	

Machine model name			WA600-6		WA600-6	
Serial number			60001 and up		60001 and up	
			Standard		for EU	
Engine	Name		SAA6D170E-5			
	Type		4-cycle, water-cooled, direct injection type with turbocharger, aftercooler and water-cooled EGR			
	Number of cylinders – Bore × Stroke	mm	6 – 170 x 170			
	Total piston displacement	ℓ {cc}	23.15 {23,150}			
	Flywheel horsepower	kW/rpm {HP/rpm}	P-mode: 393 {527}/1,800	E-mode: 382 {513}/1,700	P-mode: 393 {527}/1,800	E-mode: 382 {513}/1,700
	Max. torque	Nm/rpm {kgm/rpm}	2,594/1,000 {264.5/1,000}			
	Rated fuel consumption	g/kWh {g/HPh}	227 {169} (In P-mode only)			
	High idle speed	rpm	2,000			
	Low idle speed	rpm	800			
	Starting motor		24 V, 11 kW × 2			
	Alternator		24 V, 90 A			
	Battery		12 V, 200 Ah × 2 pcs			
Power train	Torque converter		3-element, 1-stage, 2-phase (with lockup clutch)			
	Transmission		Planetary type, multiple disc type, and forward-reverse 4 stages			
	Reduction gear unit		Spiral bevel gear type and splash lubrication type			
	Differential system		Straight bevel gear type			
	Final drive		Single-stage planetary gear and splash lubrication type			
Wheel and axle	Drive method		Front and rear wheel drive			
	Front axle		Fixed frame, full floating type			
	Rear axle		Center pin supporting, full floating type			
	Tire		36/65-33-36PR(L-4)			
	Wheel rim		28.00 x 33WTB			
	Tire inflation pressure	kPa {kg/cm^2}	Front wheel: 525 {5.4} and rear wheel: 525 {5.4}			
Brake	Foot brake		Independent front and rear wheel brake system of closed multiple wet disc type			
			Fully hydraulic type			
	Parking brake		Drive shaft braking system of wet disc type			
			Hydraulically released spring-driven brake			

Machine model name				WA600-6	
Serial number				60001 and up	60001 and up
Steering system	Steering system			Standard	for EU
	Type			Articulated steering	
	Structure			Fully hydraulic power steering	
Hydraulic system	Hydraulic pump delivery	Work equipment pump	ℓ/min	478 (Variable displacement type piston pump HPV125+125)	
		Steering pump	ℓ/min	163 (Variable displacement type piston pump HPV125)	
		Fan pump	ℓ/min	57 (Variable displacement type piston pump LPV45)	
		Torque converter and transmission pump	ℓ/min	294 (Gear pump SAL(4)160)	
		Cooling pump	ℓ/min	182 (Gear pump SAL(3)100)	
		EPC and brake pump	ℓ/min	58 (Gear pump SAL(2)32)	
	Control valve	Set pressure for work equipment	MPa {kg/cm^2}	3-spool type (with HI valve) 34.3 {350}	
		Set pressure for steering system	MPa {kg/cm^2}	Spool valve type 34.3 {350}	
	Cylinder	Number of lift arm cylinders – Bore x Stroke	mm	Double-acting piston type, 2 – 200 x 1,067	
		Number of bucket cylinders – Bore x Stroke	mm	Double-acting piston type, 1 – 225 x 776	
		Number of steering cylinders – Bore x Stroke	mm	Double-acting piston type, 2 – 115 x 510	
	Motor				
	Fan motor			Fixed displacement piston type LMF55	
Work equipment	Work equipment				
	Type of link			Single link	
	Shape of bucket cutting edge			Spade nose with teeth	

3,990 mm with lift arm



3,990 mm with lift arm

Machine model name			WA600-6			
Serial number			60001 and up		60001 and up	
			Standard		For EU	
Weight	Operating weight	kg	52,700		52,930	
	Distribution					
	Front wheel	kg	26,640		26,705	
	Rear wheel	kg	25,980		26,145	
Performance	Bucket capacity (Heaped)	m^3	6.4		6.4	
	Rated load	kN{kg}	114.54 {11,680}		114.54 {11,680}	
	Data inside the parentheses represents a value when locked up		P-mode	E-mode	P-mode	E-mode
	Travel speed F1	km/h	6.7	6.6	6.7	6.6
	Travel speed F2	km/h	11.7 (12.4)	11.5 (12.1)	11.7 (12.4)	11.5 (12.1)
	Travel speed F3	km/h	20.3 (21.7)	19.4 (20.9)	20.3 (21.7)	19.4 (20.9)
	Travel speed F4	km/h	33.8 (37.7)	31.5 (35.5)	33.8 (37.7)	31.5 (35.5)
	Travel speed R1	km/h	7.3	7.3	7.3	7.3
	Travel speed R2	km/h	12.8 (13.5)	12.5 (12.8)	12.8 (13.5)	12.5 (12.8)
	Travel speed R3	km/h	22.0 (23.7)	21.1 (22.5)	22.0 (23.7)	21.1 (22.5)
	Travel speed R4	km/h	37.0 (41.0)	34.0 (38.4)	37.0 (41.0)	34.0 (38.4)
	Max. drawbar pull, forward	kN{kg}	429.53{43,800}	357.94{36,500}	429.53{43,800}	357.94{36,500}
	Max. drawbar pull, reverse	kN{kg}	387.36{39,500}	354.02{36,100}	387.36{39,500}	354.02{36,100}
	Gradeability	deg.	25		25	
	Min. turning radius					
	Center of outside tire	mm	7,075		7,075	
	Outside of chassis (with teeth)	mm	8,500		8,500	
Dimensions	Overall length (with teeth)	mm	11,985		11,985	
	Overall width (chassis)	mm	3,540		3,540	
	Bucket width (outside width of protector)	mm	3,910		3,910	
	Overall height (ROPS cab top)	mm	4,460		4,460	
	Overall height with bucket lifted up to maximum height	mm	7,925		7,925	
	Wheelbase	mm	4,500		4,500	
	Tread	mm	2,650		2,650	
	Minimum ground clearance	mm	525		525	
	Max. hinge pin height of bucket	mm	5,885		5,885	
	Dumping clearance (Teeth end/Edge tip)	mm	3,995 / 4,270		3,995 / 4,270	
	Dumping reach (Teeth end/Edge tip)	mm	1,800 / 1,610		1,800 / 1,610	
	Bucket tilt-forward angle	deg.	45		45	
	Bucket tilt-back angle (Operating posture)	deg.	50		50	
	Digging depth, 10° (Teeth end/Edge tip)	mm	515 / 400		515 / 400	

Machine model name			WA600-6		WA600-6	
Serial number			60001 and up		60001 and up	
			Standard		for EU	
Engine	Name		SAA6D170E-5			
	Type		4-cycle, water-cooled, direct injection type with turbocharger, aftercooler and water-cooled EGR			
	Number of cylinders – Bore × Stroke	mm	6 – 170 x 170			
	Total piston displacement	ℓ {cc}	23.15 {23,150}			
	Flywheel horsepower	kW/rpm {HP/rpm}	P-mode: 393 {527}/1,800	E-mode: 382 {513}/1,700	P-mode: 393 {527}/1,800	E-mode: 382 {513}/1,700
	Max. torque	Nm/rpm {kgm/rpm}	2,594/1,000 {264.5/1,000}			
	Rated fuel consumption	g/kWh {g/HPh}	227 {169} (In P-mode only)			
	High idle speed	rpm	2,000			
	Low idle speed	rpm	800			
	Starting motor		24 V, 11 kW × 2			
	Alternator		24 V, 90 A			
	Battery		12 V, 200 Ah × 2 pcs			
Power train	Torque converter		3-element, 1-stage, 2-phase (with lockup clutch)			
	Transmission		Planetary type, multiple disc type, and forward-reverse 4 stages			
	Reduction gear unit		Spiral bevel gear type and splash lubrication type			
	Differential system		Straight bevel gear type			
	Final drive		Single-stage planetary gear and splash lubrication type			
Wheel and axle	Drive method		Front and rear wheel drive			
	Front axle		Fixed frame, full floating type			
	Rear axle		Center pin supporting, full floating type			
	Tire		36/65-33-36PR(L-4)			
	Wheel rim		28.00 x 33WTB			
	Tire inflation pressure	kPa {kg/cm^2}	Front wheel: 525 {5.4} and rear wheel: 525 {5.4}			
Brake	Foot brake		Independent front and rear wheel brake system of closed multiple wet disc type			
			Fully hydraulic type			
	Parking brake		Drive shaft braking system of wet disc type			
			Hydraulically released spring-driven brake			

Machine model name				WA600-6	
Serial number				60001 and up	60001 and up
Steering system	Steering system			Standard	for EU
	Type			Articulated steering	
	Structure			Fully hydraulic power steering	
Hydraulic system	Hydraulic pump delivery	Work equipment pump	ℓ/min	478 (Variable displacement type piston pump HPV125+125)	
		Steering pump	ℓ/min	163 (Variable displacement type piston pump HPV125)	
		Fan pump	ℓ/min	57 (Variable displacement type piston pump LPV45)	
		Torque converter and transmission pump	ℓ/min	294 (Gear pump SAL(4)160)	
		Cooling pump	ℓ/min	182 (Gear pump SAL(3)100)	
		EPC and brake pump	ℓ/min	58 (Gear pump SAL(2)32)	
	Control valve	Set pressure for work equipment	MPa {kg/cm^2}	3-spool type (with HI valve) 34.3 {350}	
		Set pressure for steering system	MPa {kg/cm^2}	Spool valve type 34.3 {350}	
	Cylinder	Number of lift arm cylinders – Bore x Stroke	mm	Double-acting piston type, 2 – 200 x 1,067	
		Number of bucket cylinders – Bore x Stroke	mm	Double-acting piston type, 1 – 225 x 776	
		Number of steering cylinders – Bore x Stroke	mm	Double-acting piston type, 2 – 115 x 510	
	Motor				
	Fan motor			Fixed displacement piston type LMF55	
Work equipment	Work equipment				
	Type of link			Single link	
	Shape of bucket cutting edge			Spade nose with teeth	

Weight table

⚠ **This weight table is prepared for your reference when handling or transporting the components.**

Unit: kg

Machine model name	WA600-6
Serial number	60001 and up
Engine (Dry weight)	3,098
Radiator (Dry weight)	433
Torque converter (Dry weight)	486
Transmission (Dry weight)	1,290
Upper drive shaft	29.6
Center drive shaft	60.5
Front drive shaft	65
Rear drive shaft	62.8
Center support	46.4
Front axle	3,635
Rear axle	3,532
Front differential	551
Rear differential	586
Planetary carrier assembly (1 unit)	191
Wheel hub (1 piece)	182.5
Axle pivot (Front)	136.2
Axle pivot (Rear)	190
Wheel (1 piece)	409
Tire (Standard: 35/65-33-36PR L-4) (1 piece)	1,085
Steering valve	66
Steering cylinder (1 unit)	97.8
Hydraulic tank (Dry weight)	492
Work equipment pump	180
Steering pump	103
Fan pump	25
Torque converter, transmission + Cooling + Brake, EPC	48.3
Oil cooler	59.5
Torque converter oil cooler	75
Fan motor	25
Fan	62

Unit: kg

Machine model name	WA600-6
Serial number	60001 and up
Work equipment valve	120
Lift cylinder (1 piece)	517
Bucket cylinder	515
Engine hood (top hood, front/rear)	33.4 / 42.4
Engine hood (a side hood)	50.5
Radiator guard	354
Front frame	4,310
Rear frame	4,333
Bucket link (including bushing)	298
Bell crank (including bushing)	1,275
3,850 mm lift arm (including bushing)	3,754
3,990 mm lift arm (including bushing)	3,905
Bucket (with teeth)	5,115
Counterweight	2,780
Fuel tank	426
Battery (1 piece)	64
Cab	1,095
Air conditioner unit	9.8
Operator's seat	50.2
Floor frame	116.3

Table of fuel, coolant and lubricants

★ For details of the notes (e.g.,Note. 1, Note. 2 …) in the table, see the Operation and Maintenance Manual.

Reservoir	Fluid Type	Ambient Temperature, degrees Celsius -22 -4 14 32 50 68 86 104 122 °F -30 -20 -10 0 10 20 30 40 50 °C	Recommended Komatsu Fluids
Engine oil pan	Engine oil	(Note.1)	Komatsu EOS0W30
		(Note.1)	Komatsu EOS5W40
			Komatsu EO10W30-DH
			Komatsu EO15W40-DH
			Komatsu EO30-DH
Transmission case	Power train oil (Note.2)		TO30 TO10
Hydraulic system	Power train oil		TO10
	Hydraulic oil		HO46-HM HO-MVK
	Engine oil		Komatsu EO10W30-DH
			Komatsu EO15W40-DH
Axle	Axle oil (Note.3)		AXO80
	Power train oil (Note.4)		TO50
Pin/Bushing Grease fitting (Note.5)	Hyper grease (Note.6)		G2-T, G2-TE
	Lithium EP grease		G2-LI
Work equipment pin (Note.7)	Gear oil		GO80W90
Cooling system	Supercoolant AF-NAC (Note.8)		AF-NAC
Fuel tank	Diesel fuel		ASTM Grade No.1-D S15 ASTM Grade No.1-D S500
			ASTM Grade No.2-D S15 ASTM Grade No.2-D S500

Capacity \ Refill points		Engine oil pan	Transmission case	Hydraulic oil system	Front axle	Rear axle	Pins	Fuel tank	Cooling system
Specified capacity	ℓ	97	120	592	155	155	—	718	182
Refill capacity	ℓ	86	83	443	155	155	—	—	147

WA600-6 Wheel loader

Form No. SEN00400-02

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

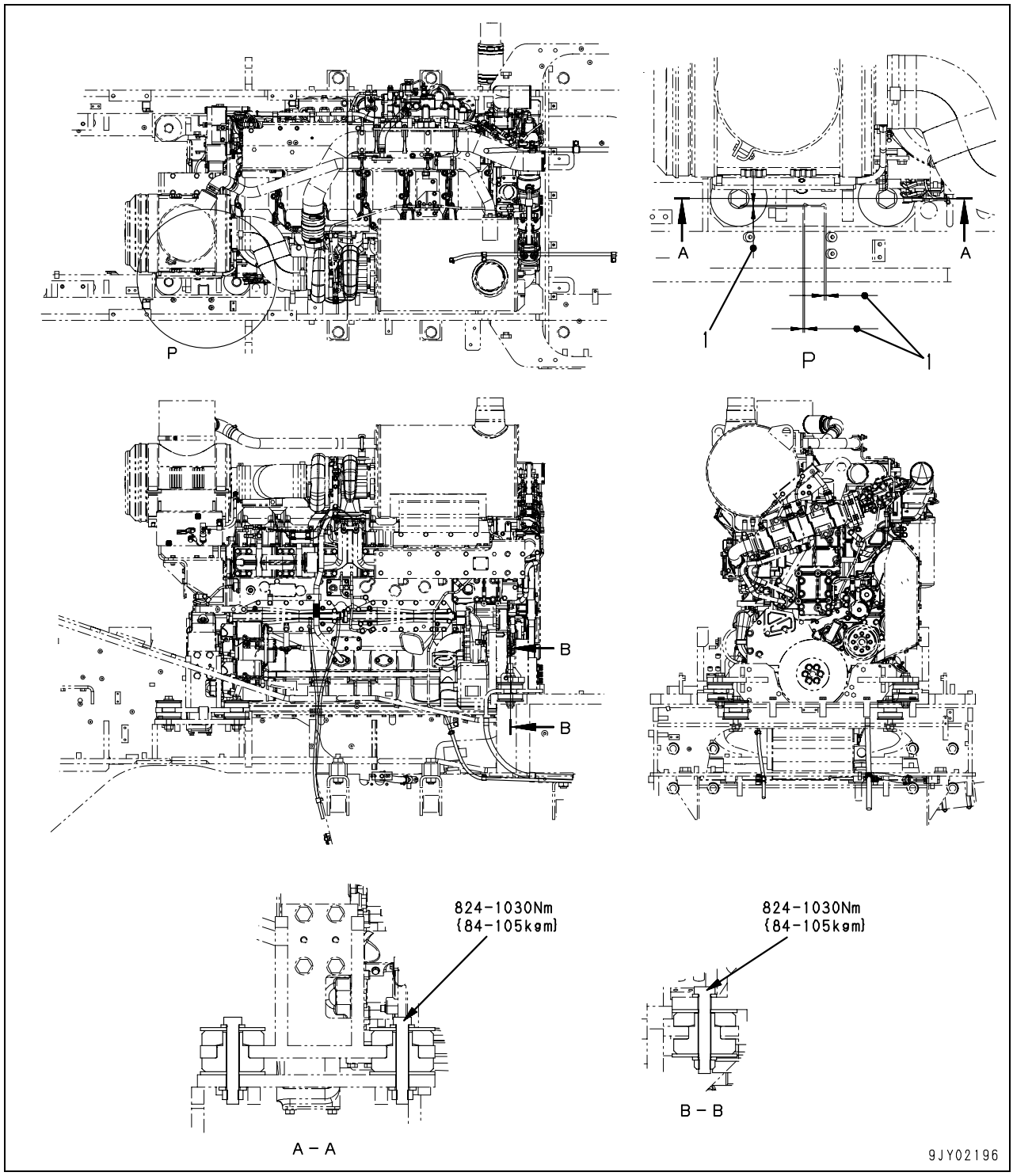
10 Structure, function and maintenance standard

Engine and cooling system

Engine and cooling system 2
Engine mount and transmission mount 2
Damper 4
Cooling system 6
Cooling fan pump 10
Cooling fan motor 18

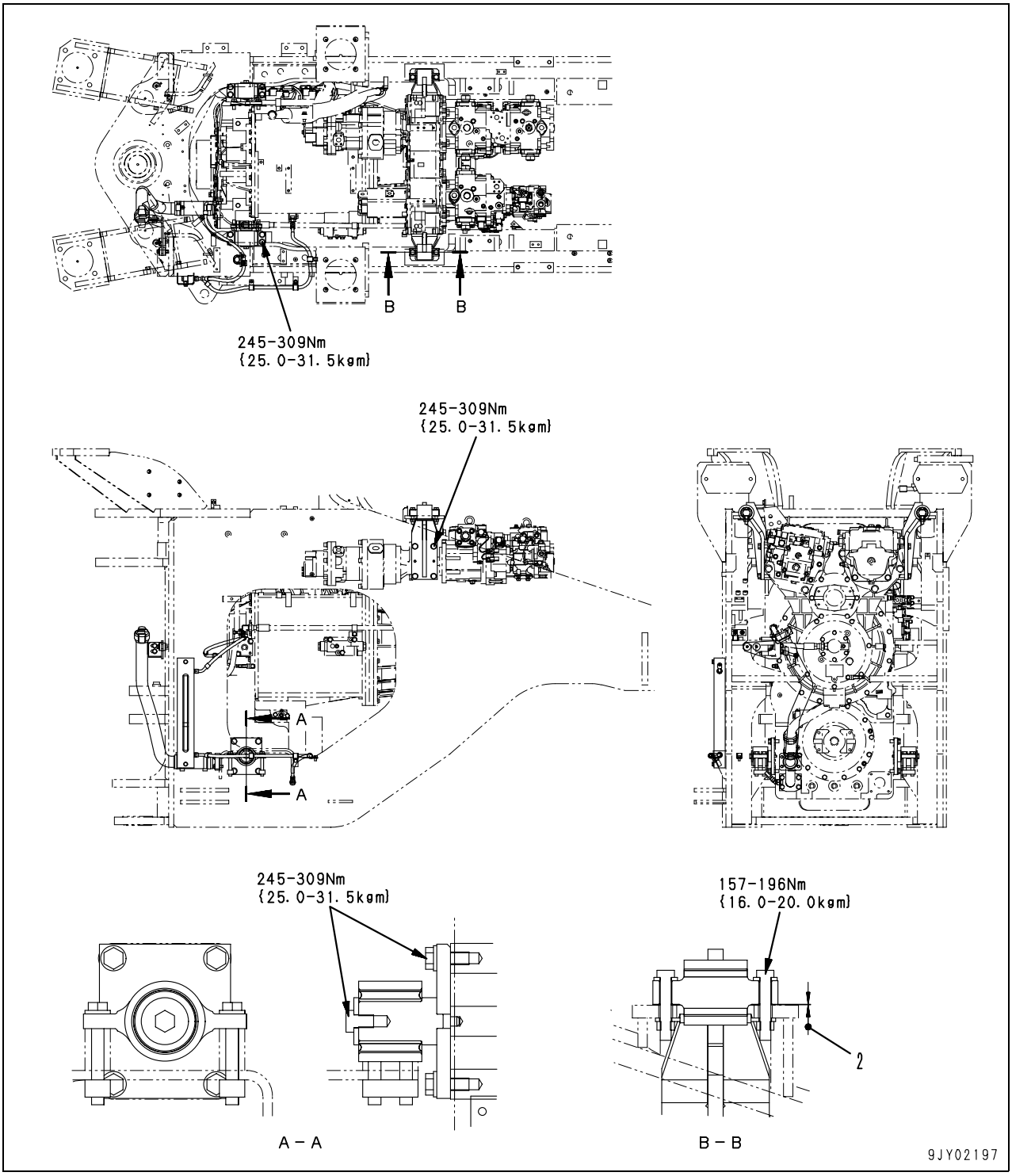
Engine and cooling system

Engine mount and transmission mount



Unit: mm

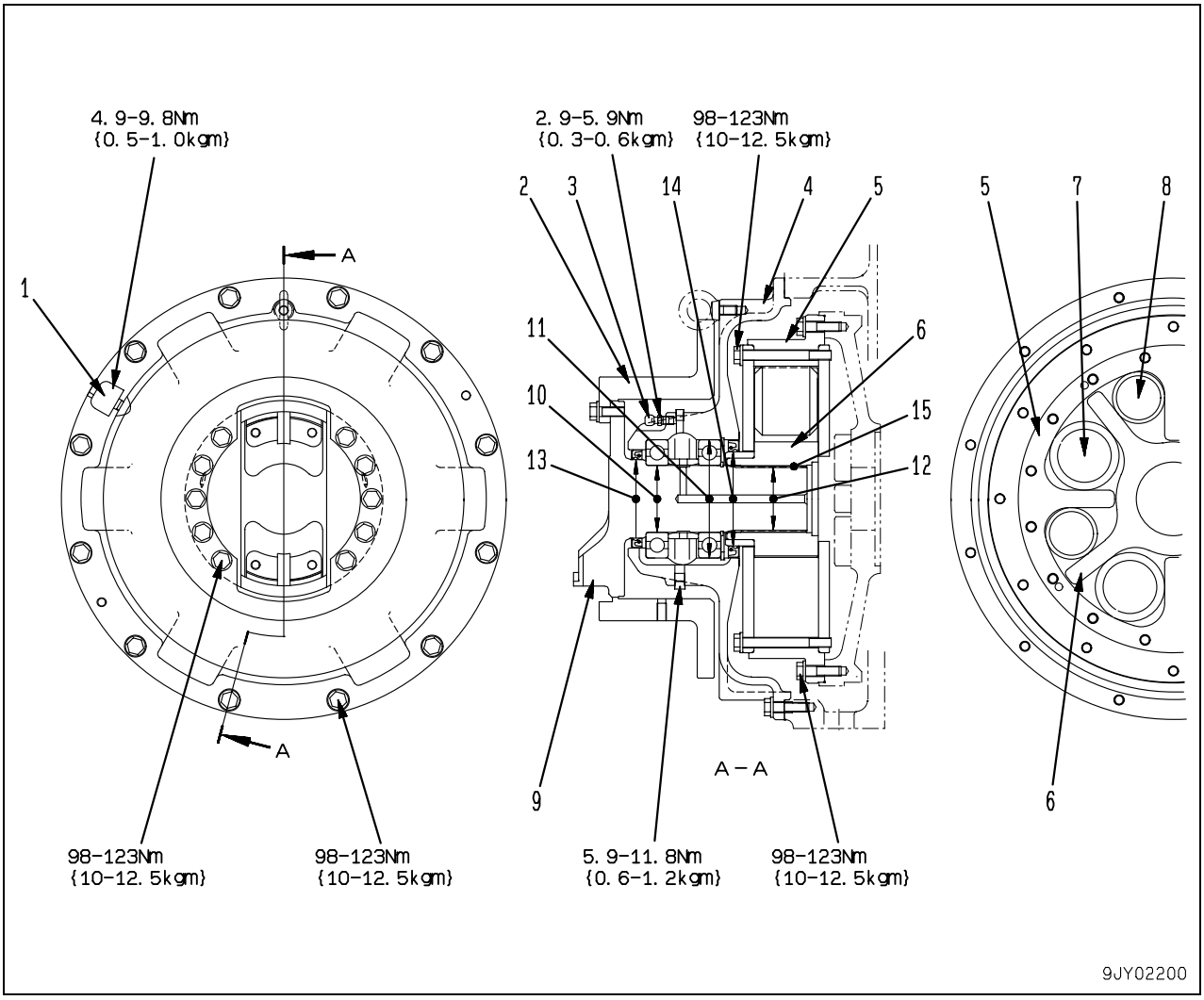
No.	Check item	Criteria	Remedy
1	Clearance between stopper and support	Min. 1	Adjust



Unit: mm

No.	Check item	Criteria	Remedy
2	Standard shim thickness of mount	1.2 (Parallelism of center support coupling and transmission coupling is 0.1 mm)	Adjust

Damper



1. Breather
2. Flywheel (shaft side)
3. Breather
4. Cover
5. Outer body
6. Inner body
7. Rubber cushion (large)
8. Rubber cushion (small)
9. Shaft

Function

- The damper reduces torsional vibration due to torque fluctuation and protects vibration in the drive system after the engine from torsional vibration.

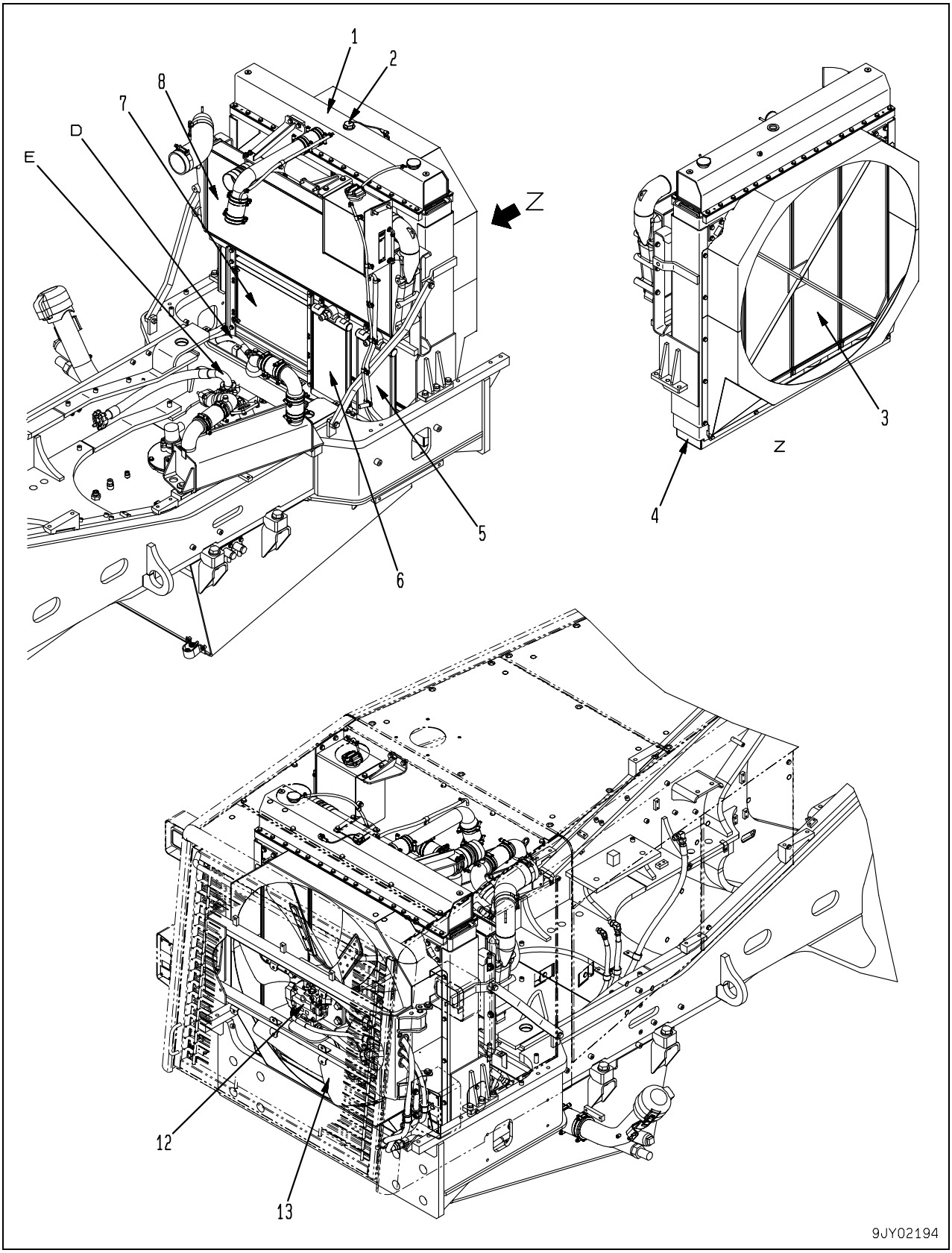
Operation

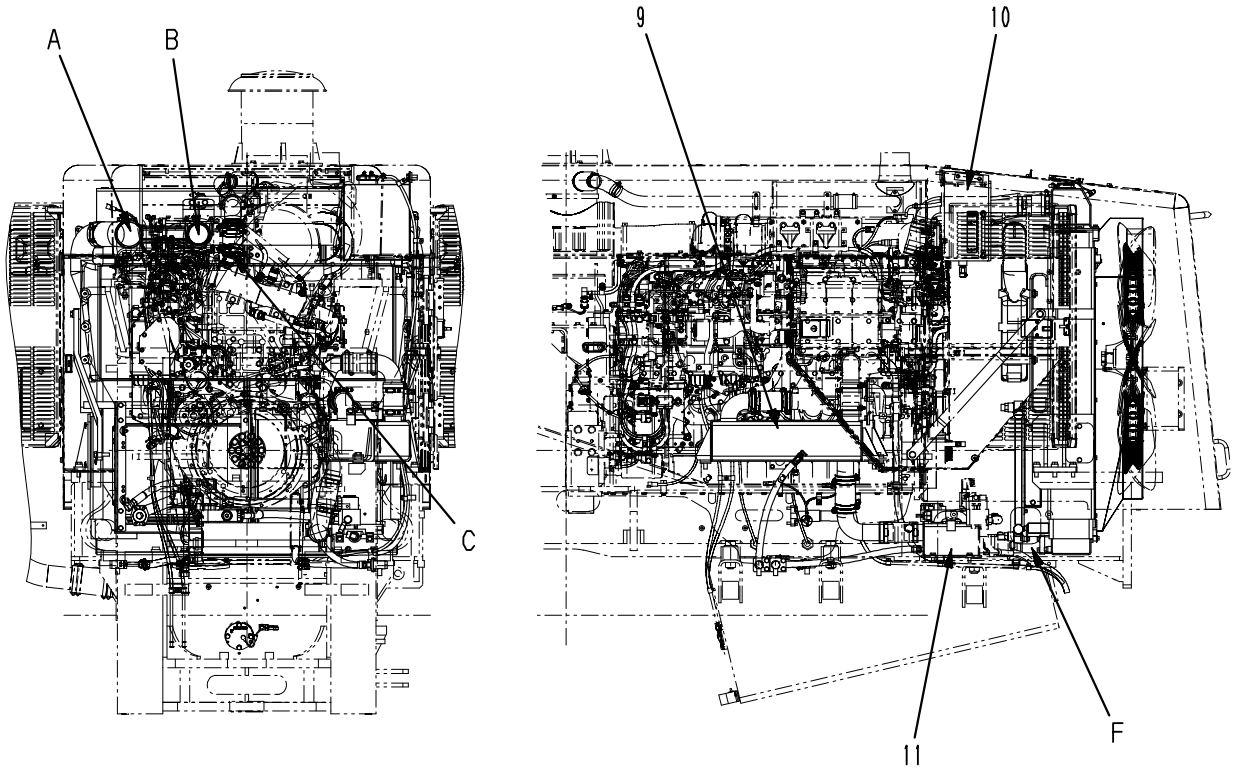
- Power from the engine is transmitted to outer body (5) via the flywheel. Rubber cushions (7) and (8) absorb torsional vibration of the engine, and the power is transmitted to the upper drive shaft between the torque converter through shaft (9) via inner body (6).

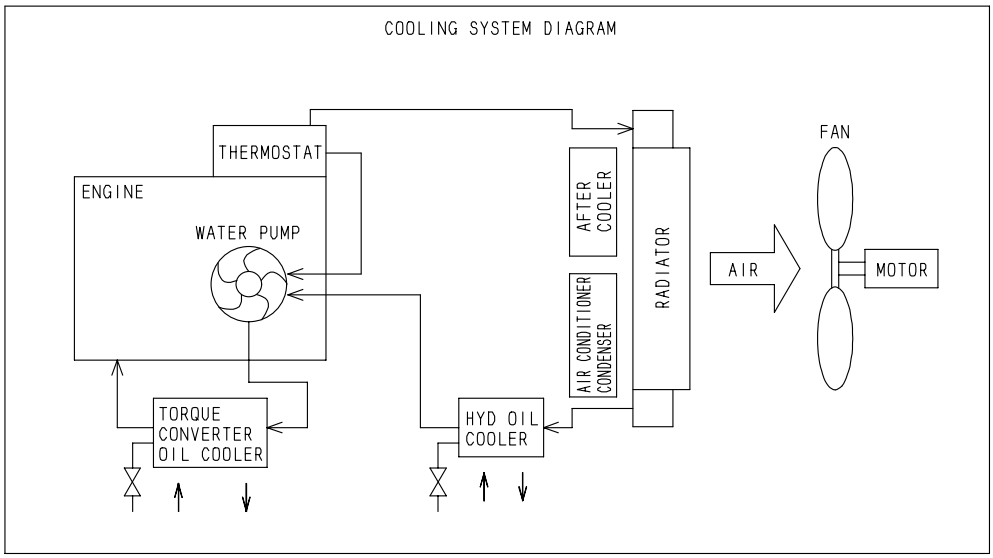
Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="3">10</td><td rowspan="3">Clearance between bearing and shaft</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="4">Replace</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>85</td><td>+0.015
+0.003</td><td>0
–0.020</td><td>–0.035 –
–0.003</td><td>0.005</td></tr>
<tr><td>11</td><td>Clearance between bearing and housing</td><td>150</td><td>0
–0.018</td><td>–0.008
–0.033</td><td>–0.033 –
–0.010</td><td>0.018</td></tr>
<tr><td>12</td><td>Clearance between inner body and shaft</td><td>85</td><td>–0.012
–0.034</td><td>+0.110
+0.030</td><td>0.042 –
0.144</td><td></td></tr>
<tr><td rowspan="2">13</td><td rowspan="2">Wear of oil seal contact surface of shaft</td><td colspan="2">Standard size</td><td colspan="2">Tolerance</td><td colspan="2">Repair limit</td><td rowspan="3">Finish with grinder or replace after chrome-plating repair</td></tr>
<tr><td colspan="2">100</td><td colspan="2">0
–0.087</td><td colspan="2">–0.18</td></tr>
<tr><td>14</td><td>Wear of oil seal contact surface of sleeve</td><td colspan="2">120</td><td colspan="2">0
–0.087</td><td colspan="2">–0.18</td></tr>
<tr><td>15</td><td>Backlash at spline section</td><td colspan="6">0.068 – 0.262</td><td>Replace</td></tr>
</table>

Cooling system




A
B
C
9
10
11
F


COOLING SYSTEM DIAGRAM
THERMOSTAT
ENGINE
WATER PUMP
AFTER COOLER
AIR CONDITIONER CONDENSER
RADIATOR
FAN
AIR
MOTOR
TORQUE CONVERTER OIL COOLER
HYD OIL COOLER

9JY02195

1. Radiator upper tank
2. Coolant level sensor
3. Radiator core
4. Radiator lower tank
5. Brake oil cooler (if equipped)
6. Brake oil cooler (if equipped)
7. Air conditioner condenser
8. Aftercooler
9. Torque converter oil cooler
10. Coolant sub-tank
11. Hydraulic oil cooler
12. Cooling fan motor
13. Cooling fan

A: Aftercooler outlet port
B: Aftercooler inlet port
C: Coolant inlet port
D: Hydraulic oil cooler inlet port
E: Hydraulic oil cooler outlet port
F: Coolant port

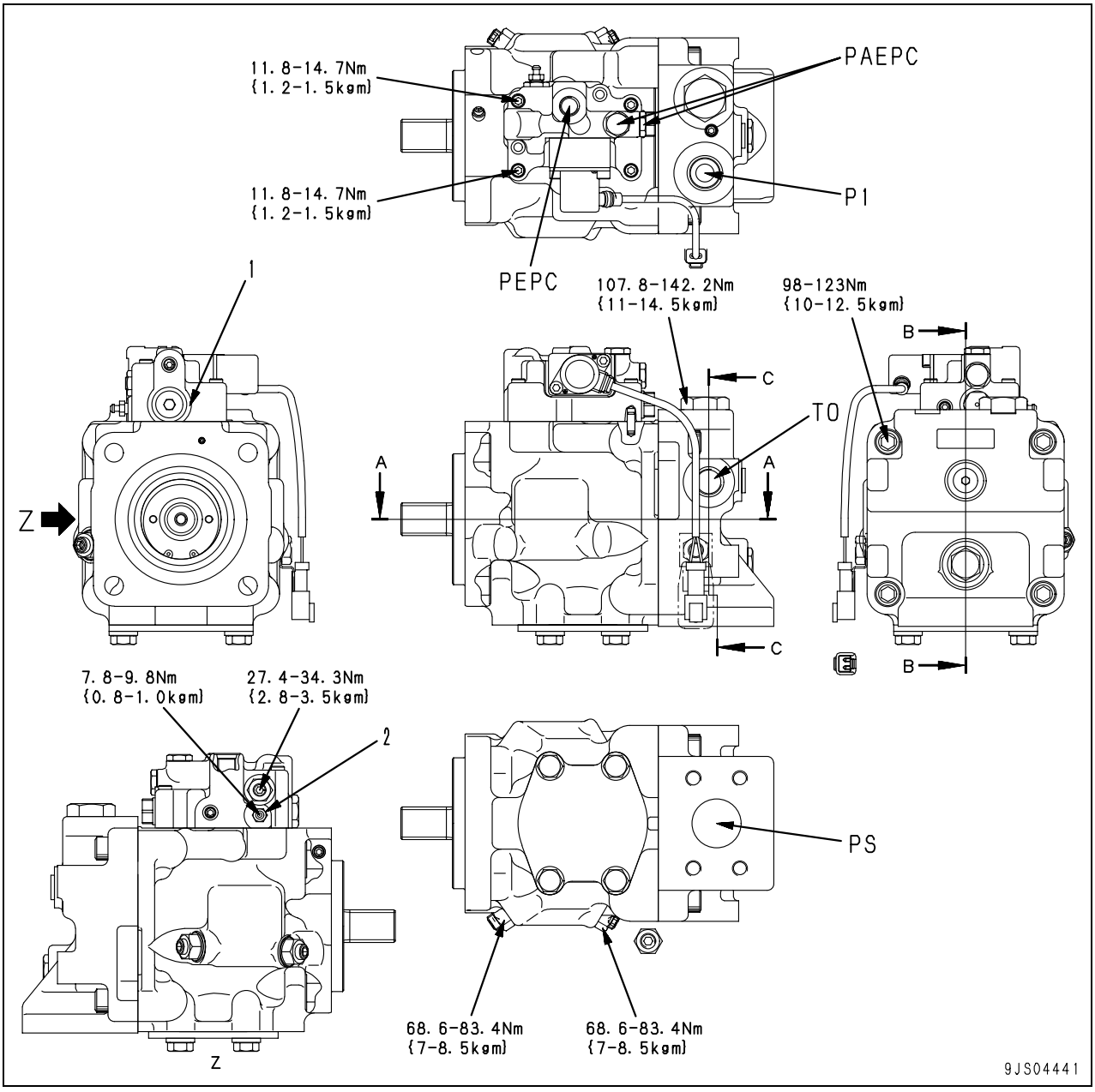
Specifications

	Radiator	Oil cooler	Aftercooler	Torque converter oil cooler	Brake oil cooler (if equipped)
Type of core	GF68-5	PTO-OL	Triangle and straight, 15-hole pipe type	PTO-LS	CF40-1
Fin pitch (mm)	4.0/2P	*1) 100 × 558 × 20 stages	4.0/2P	150 × 620 × 25 stages	4.0/2P
Total heat dissipation surface (m^2)	59.04	2.1512	53.64	4.065	2.90
Cross sectional area of flow (m^2)	156.96	—	—	—	—
Pressure valve cracking pressure (kPa{kg/cm^2})	70 ± 15 {0.7 ± 0.15}	—	—	—	—
Vacuum valve cracking pressure (kPa{kg/cm^2})	0 – 5 {0 – 0.05}	—	—	—	—

*1): Size of element

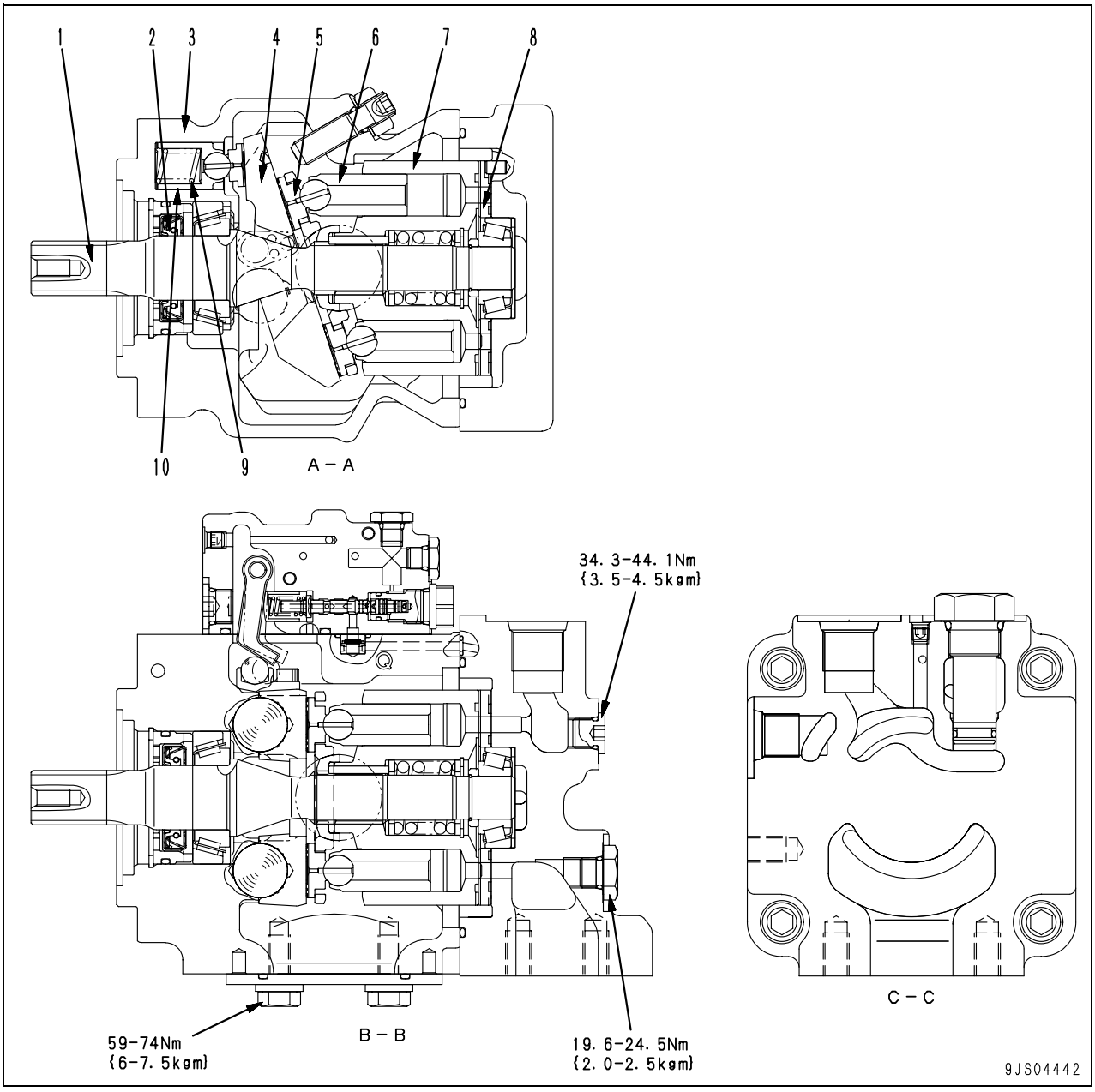
Cooling fan pump

Type: LPV45

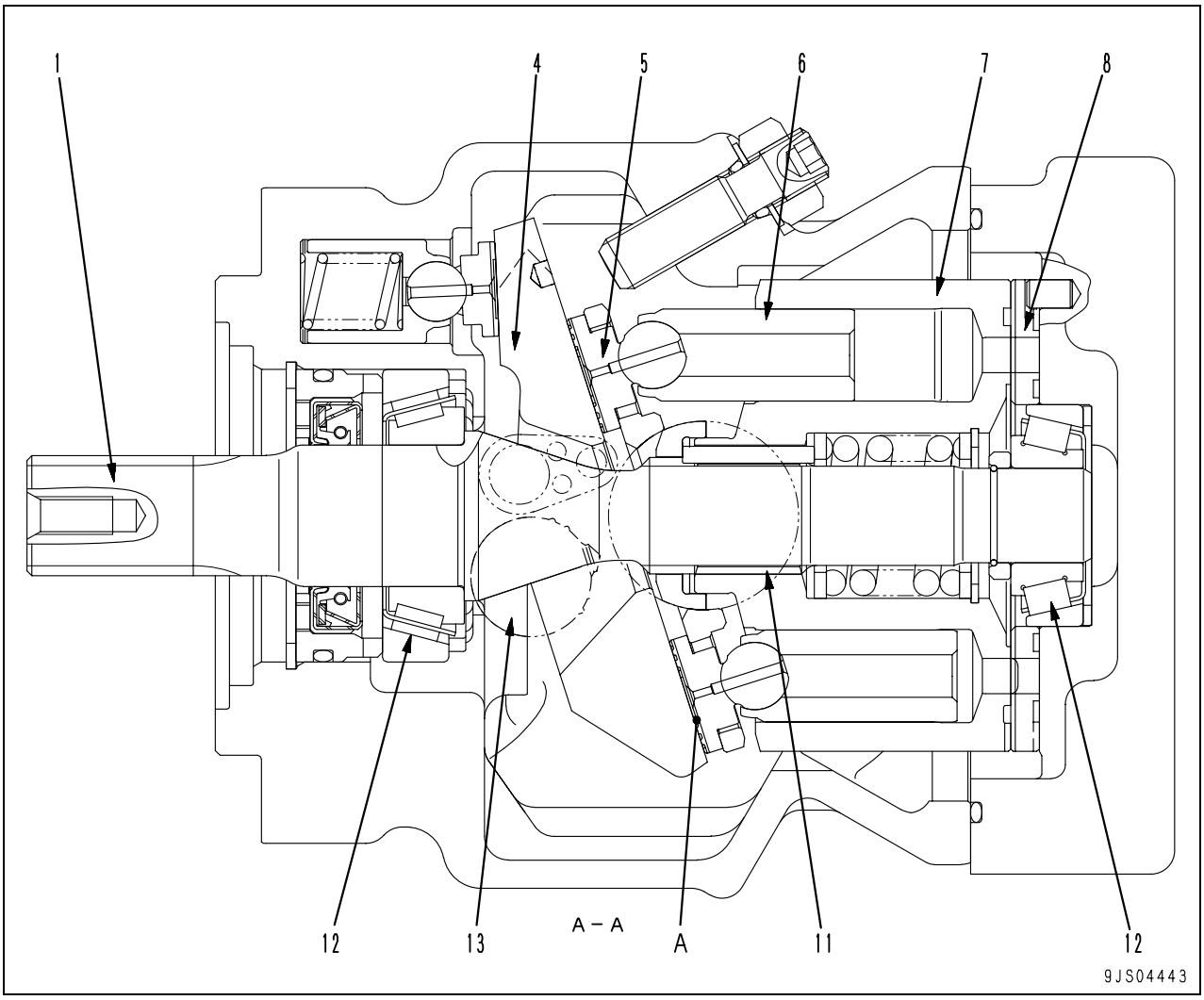


P1 : Pump discharge port
PAEPC : EPC output pressure pickup plug
PEPC : EPC valve basic pressure input port
PS : Pump suction port
TO : Drain port

1. Servo valve
2. Air bleeder



1. Shaft
2. Oil seal
3. Case
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. Spring
10. Servo piston



Function

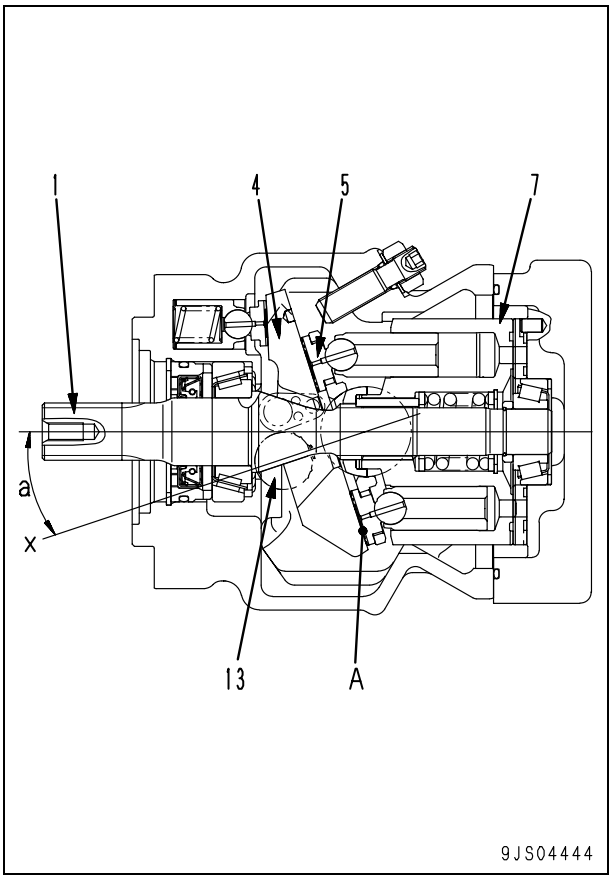
- The pump converts the engine rotation transmitted to its shaft to oil pressure and delivers pressurized oil corresponding to the load.
- It is possible to change the discharge amount by changing the swash plate angle.

Structure

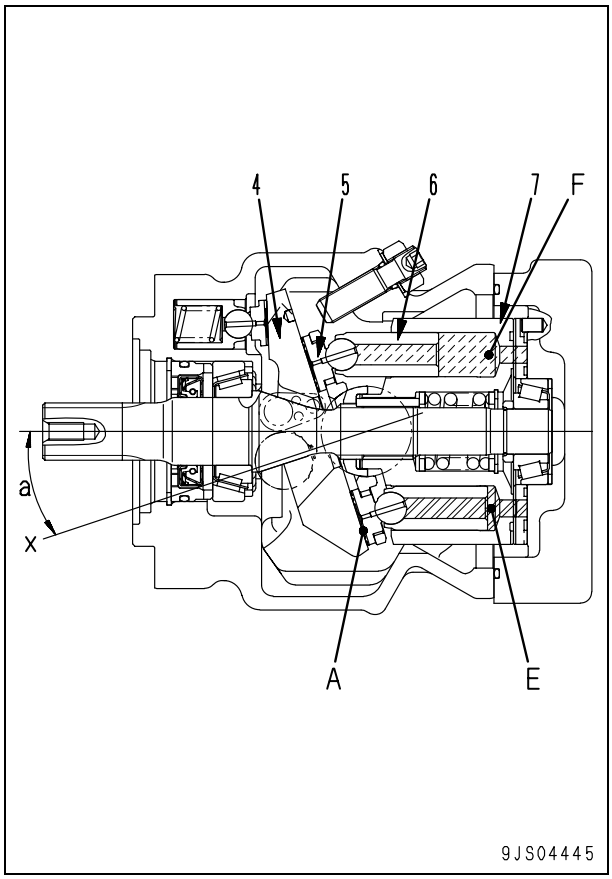
- Cylinder block (7) is supported to shaft by spline (11).
- Shaft (1) is supported with front and rear bearings (12).
- The end of piston (6) has a spherical hollow and is combined with shoe (5).
- Piston (6) and shoe (5) form a spherical bearing.
- Shoe (5) is kept pressed against plane (A) of rocker cam (4) and slid circularly.
- Rocker cam (4) slides around ball (13).
- Piston (6) carries out relative movement in the axial direction inside each cylinder chamber of cylinder block (7).
- Cylinder block (7) seals the pressurized oil to valve plate (8) and carries out relative rotation.
- This surface is designed so that the oil pressure balance is maintained at a suitable level.
- The oil inside each cylinder chamber of cylinder block (7) is suctioned and discharged through valve plate (8).

Operation of pump

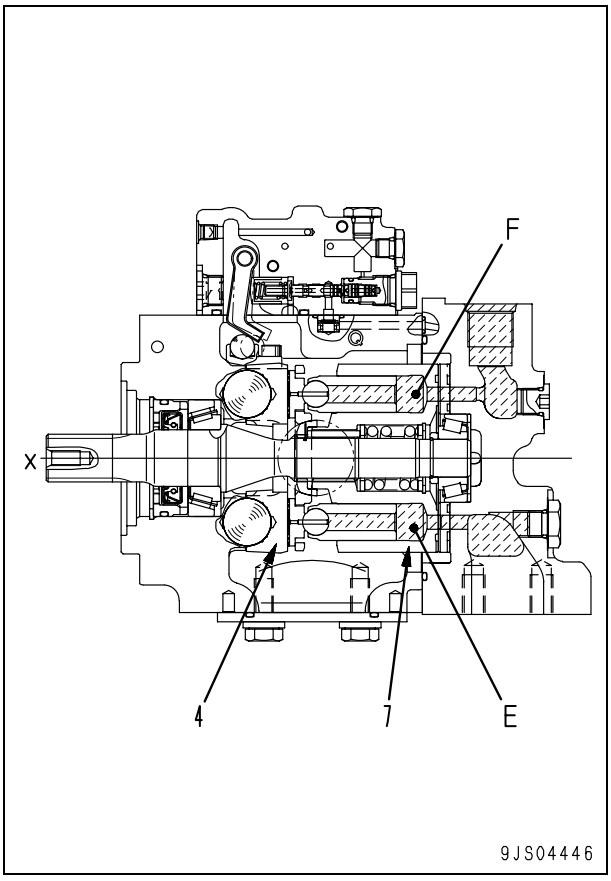
- Cylinder block (7) rotates together with shaft (1), and shoe (5) slides on flat surface (A).
- At this time, rocker cam (4) slants around ball (13). As a result, angle (a) between center line (X) of rocker cam (4) and the axis of cylinder block (7) changes.
- Angle (a) is called the swash plate angle.



- With the condition of center line (X) of rocker cam (4) has swash plate angle (a) to axial direction of cylinder block (7), flat surface (A) functions as cam against shoe (5).
- In this way, piston (6) slides on the inside of cylinder block (7), so a difference between volumes (E) and (F) is created inside cylinder block (7).
- A single piston (6) sucks and discharges the oil by the amount (F) – (E).
- As cylinder block (7) rotates and the volume of chamber (E) becomes smaller, the pressurized oil is discharged.
- On the other hand, the volume of chamber (F) grows larger and, in this process, the oil is suctioned.



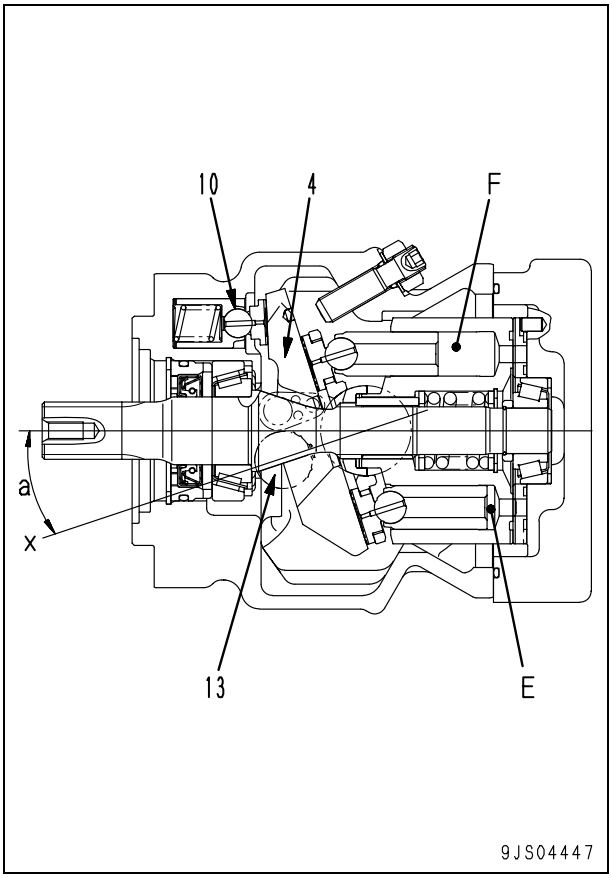
- As center line (X) of rocker cam (4) matches the axial direction of cylinder block (7) (swash plate angle (a) = 0), the difference between volumes (E) and (F) inside cylinder block (7) becomes 0.
- Suction and discharge of pressurized oil is not carried out in this state. Namely pumping action is not performed. (Actually, however, the swash plate angle is not set to 0)



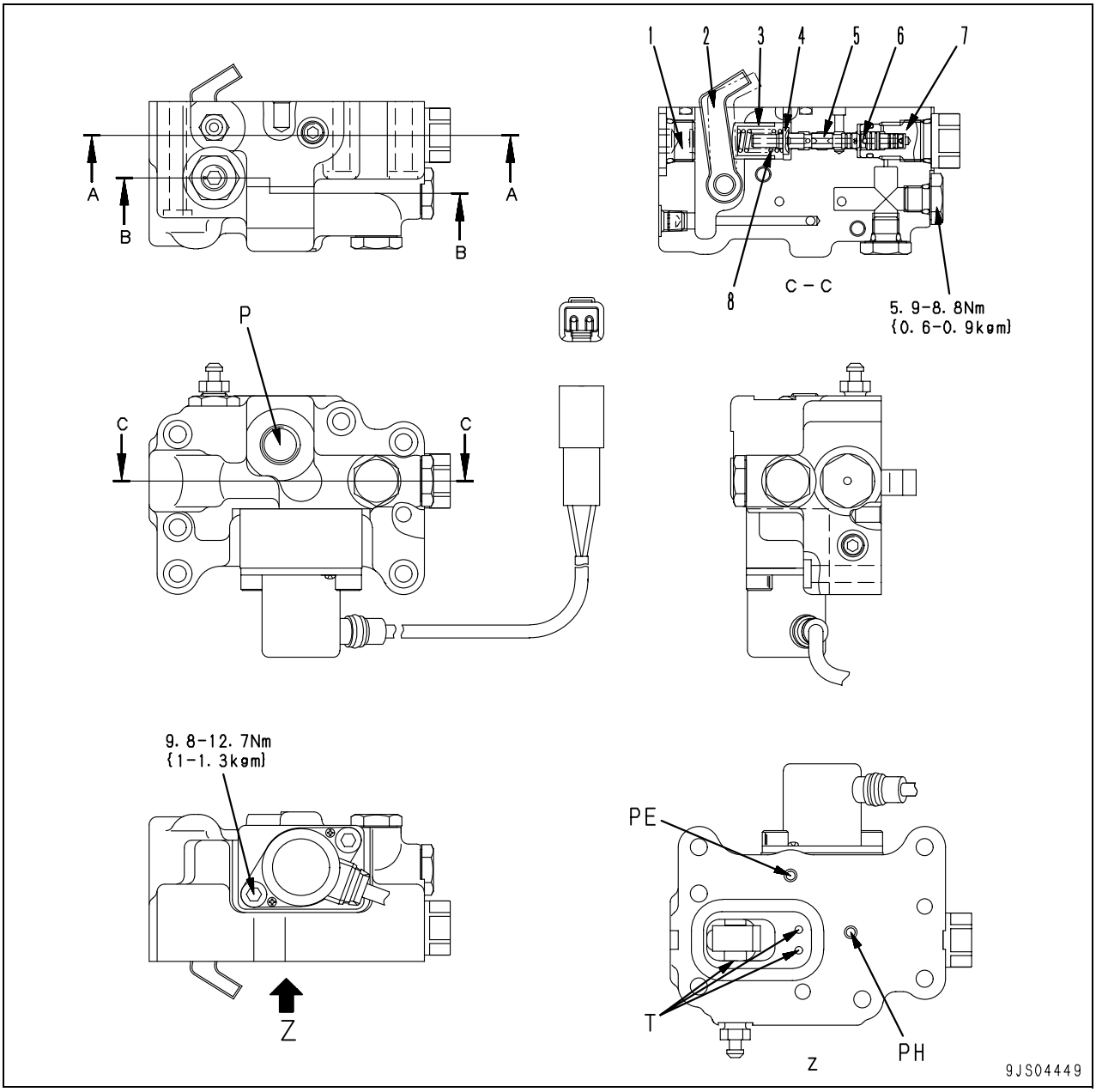
- Swash plate angle (a) is in proportion to the pump delivery.

Control of delivery

- If the swash plate angle (a) becomes larger, the difference between volumes (E) and (F) becomes larger and pump delivery (Q) increases.
- Swash plate angle (a) is changed with servo piston (10).
- Servo piston (10) reciprocates straight according to the signal pressure of the servo valve.
- This straight motion is transmitted to rocker cam (4).
- Rocker cam (4) supported with ball (13) slides around ball (13).

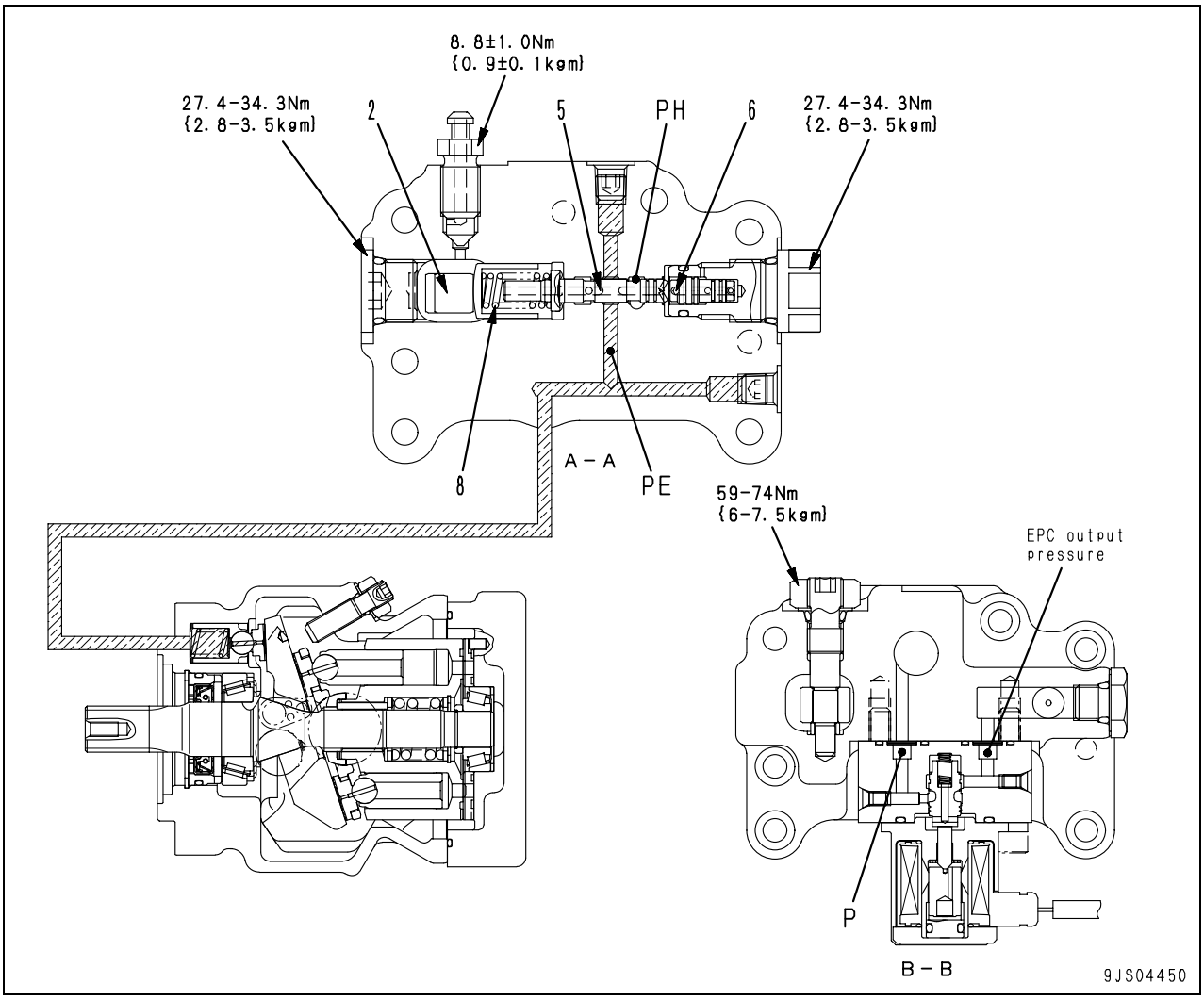


Servo valve



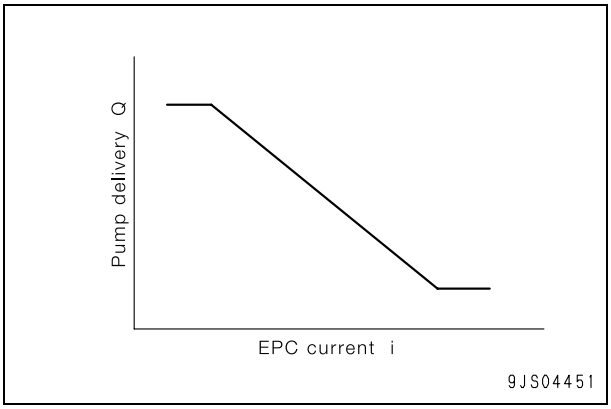
P : EPC valve basic pressure
PE : Control piston pressure
PH : Pump discharge pressure
T : Drain port

1. Plug
2. Lever
3. Retainer
4. Seat
5. Spool
6. Piston
7. Sleeve
8. Spring



Function

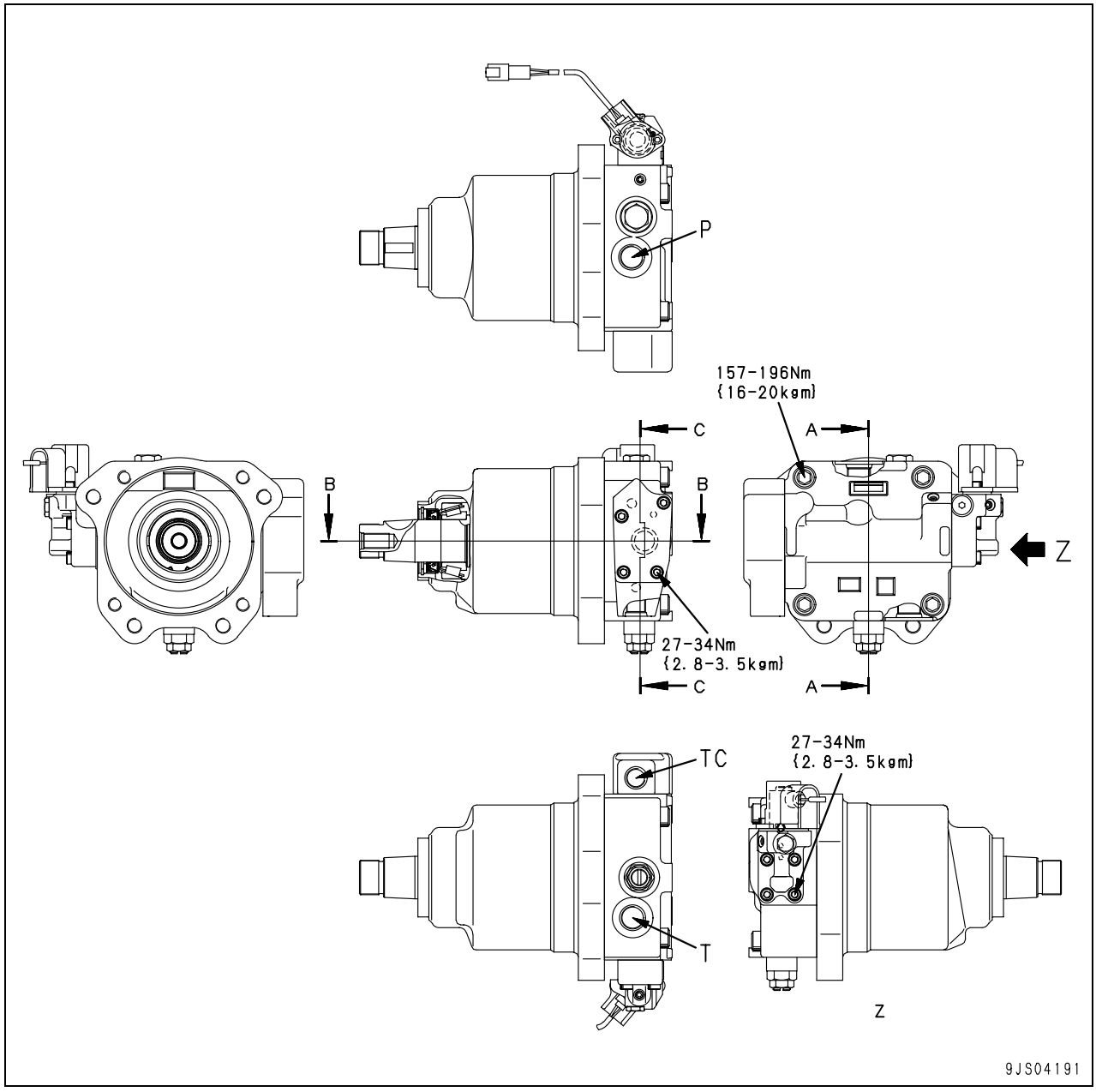
- The servo valve controls the current input to the EPC valve and pump delivery (Q) so that they will be related as shown in the diagram.



- The output pressure of the EPC valve flows in the piston chamber to push piston (6).
- Piston (6) pushes spool (5) until it is balanced with the spring.
- Then, the land of the servo piston pressure passage is connected to the pump discharge passage by the notch of spool (5) and the discharge pressure is led to the servo piston.
- When the rocker cam is pushed up by the servo piston, a position feedback is applied and lever (2) moves to compress spring (8).
- When spool (5) is pushed back, the pump discharge circuit and the servo piston circuit are cut off.
- Pressure in the servo piston chamber drops and the rocker cam returns in the direction of a maximum swash plate angle.
- These processes are repeated until the swash plate is fixed to a position where the EPC output pressure is balanced with spring (8) force.
- The greater the EPC output pressure, the smaller the swash plate angle. Conversely, the smaller the EPC output pressure, the greater the swash plate angle.

Cooling fan motor

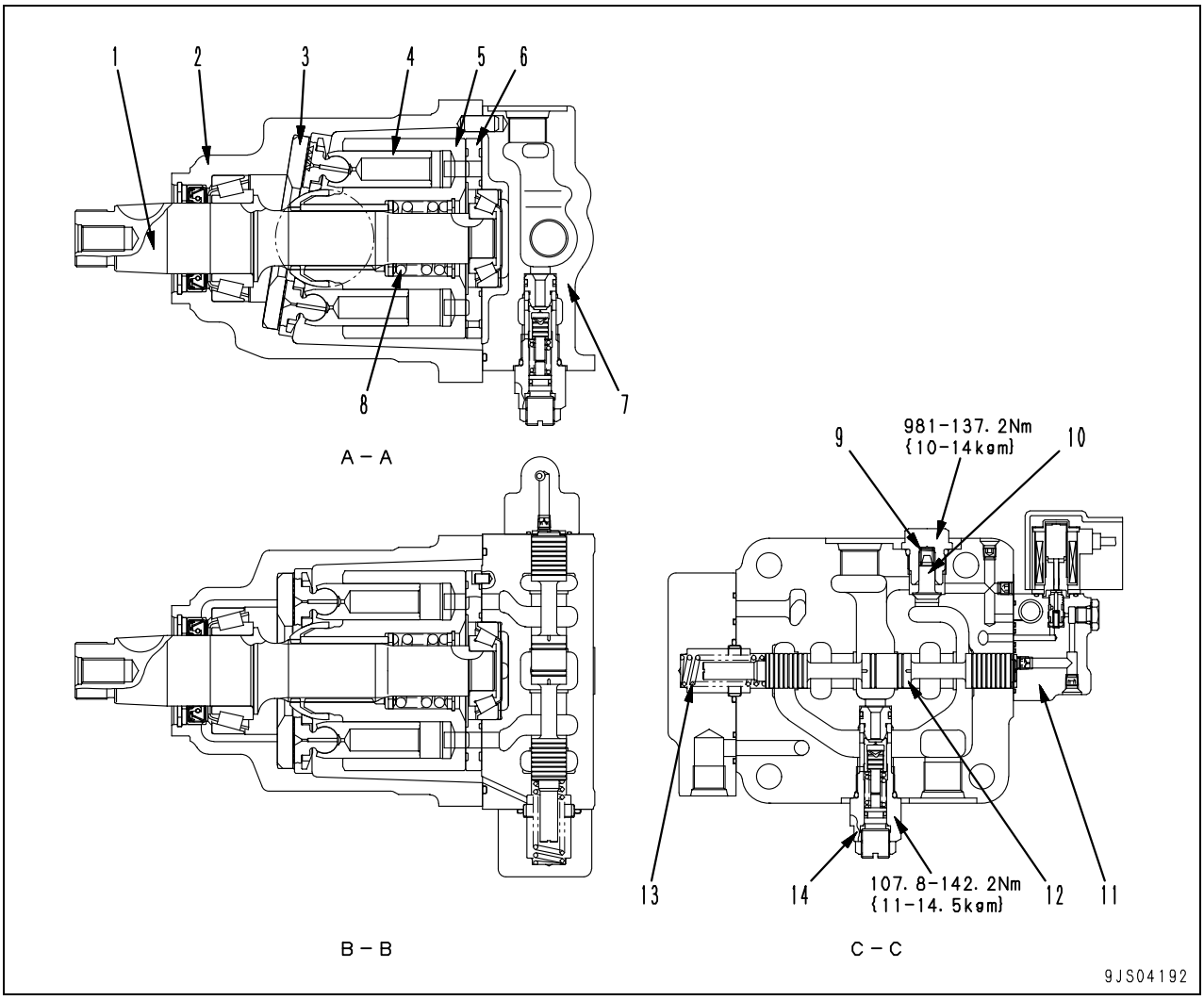
Type: LMF55



P : From fan pump
T : From cooler to tank
TC : To tank

Specifications

Type : LMF55
Capacity : 55.0 cc/rev
Rated speed : 980 rpm
Rated flow : 53.9 ℓ/min
Check valve cracking pressure : 78.5 kPa {0.8 kg/cm^2}



1. Output shaft
2. Case
3. Thrust plate
4. Piston assembly
5. Cylinder block
6. Valve plate
7. End cover
8. Center spring
9. Check valve spring
10. Check valve
11. Pilot valve
12. Spool for reversible valve
13. Spring for reversible valve
14. Safety valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
9	Check valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		16.4 x 8.9	11.5	13.7 N {1.4 kg}	—	11.0 N {1.12 kg}	

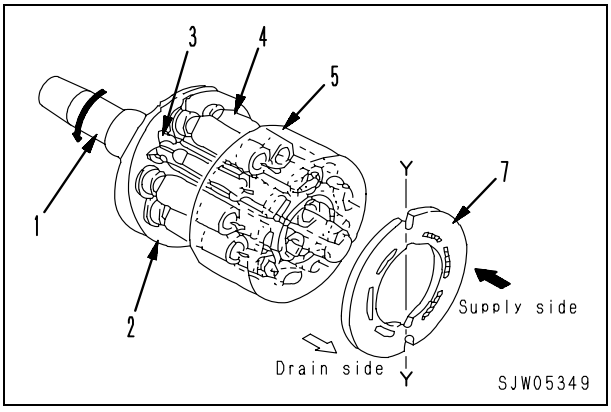
1. Hydraulic motor unit

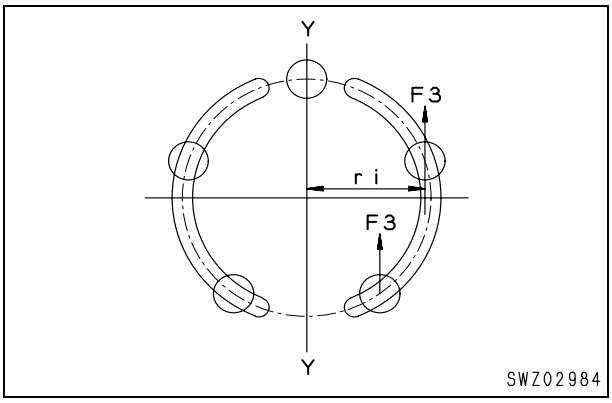
Function

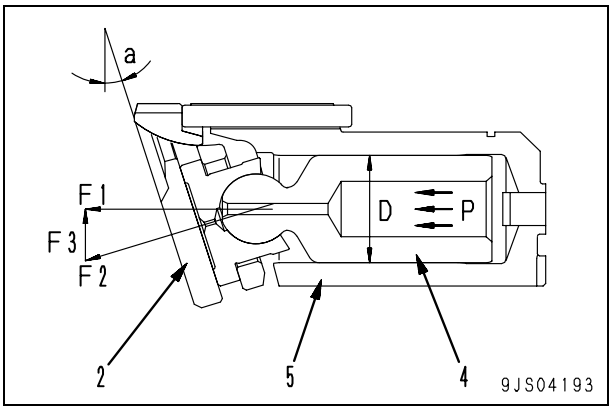
- This hydraulic motor is called a swash plate-type axial piston motor. It converts the energy of the pressurized oil sent from the hydraulic pump into rotary motion.

Principle of operation

- The oil sent from the hydraulic pump flows through valve plate (7) into cylinder block (5).
- This oil can flow on only one side of the (Y-Y) line connecting the top dead center and bottom dead center of the stroke of piston (4).
- The oil sent to one side of cylinder block (5) presses pistons (4) (2 or 3 pieces) and generates force (F1).
- Force F1 (F1 kg = P kg/cm^2 x πD^2/4 cm^2)
- This force is applied to thrust plate (2).
- Since thrust plate (2) is fixed to a certain angle ("a" degrees) to output shaft (1), the force is divided into components (F2) and (F3).
- Radial component (F3) generates torque [T = F3 x ri] against the (Y - Y) line connecting the top dead center and bottom dead center.
- The result of this torque [T = ∑(F3 x ri)] rotates cylinder block (5) through the piston.
- This cylinder block (5) is coupled to output shaft (1) with the spline.
- Output shaft (1) rotates and torque is transmitted.







2. Suction valve

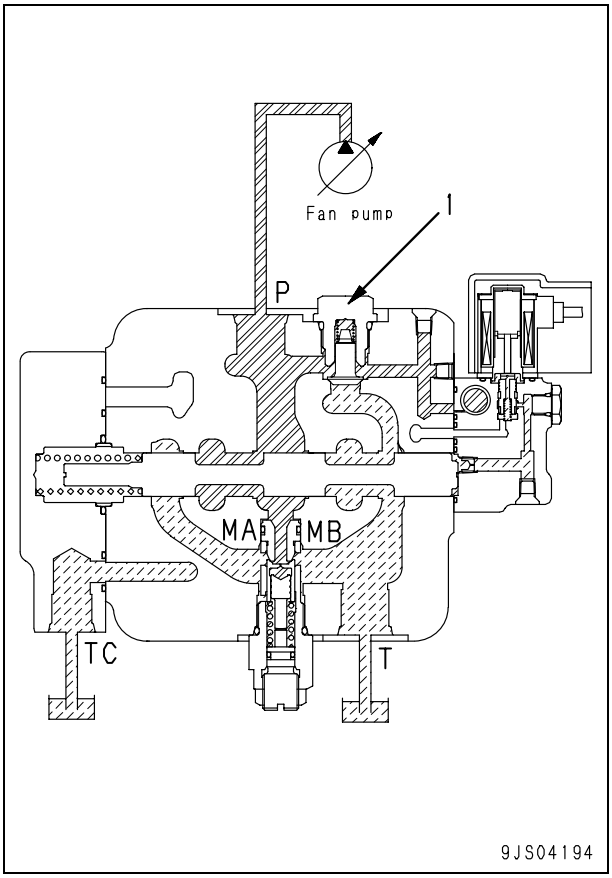
Function

- When the fan pump stops rotating, hydraulic oil does not flow into the motor.
- Since the motor is revolved by the force of inertia, the pressure rises on the outlet side of the motor.
- When the oil stops flowing in from inlet port (P), suction valve (1) sucks in the oil on the outlet side and supplies it to port (MA) where there is not sufficient oil.
- Cavitation is prevented from being generated accordingly.

Operation

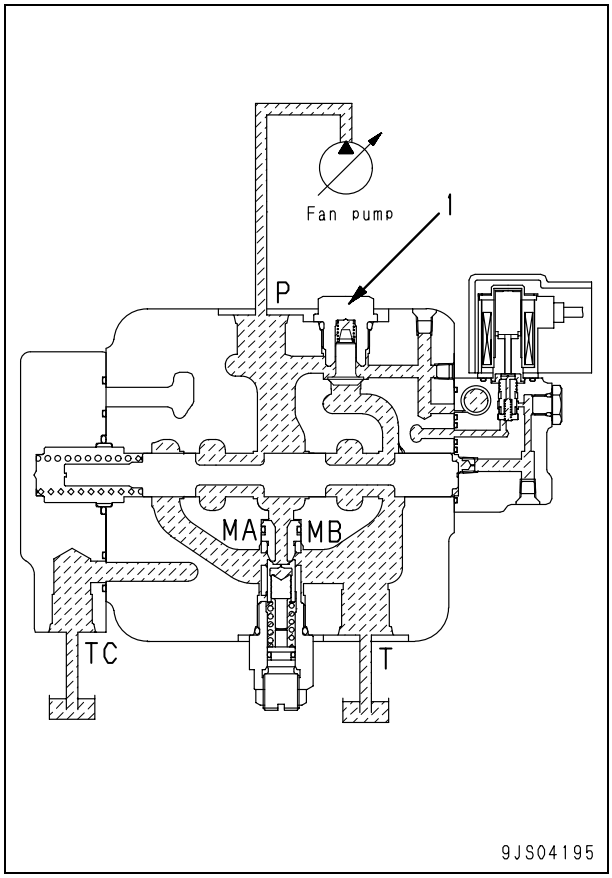
(1) When starting

- When the hydraulic oil from the pump is supplied to port (P) and the pressure on (MA) side rises.
- When starting torque is generated in the motor, the motor starts revolution.
- The oil on outlet (MB) side of the motor returns through port (T) to the tank.



(2) When stopping

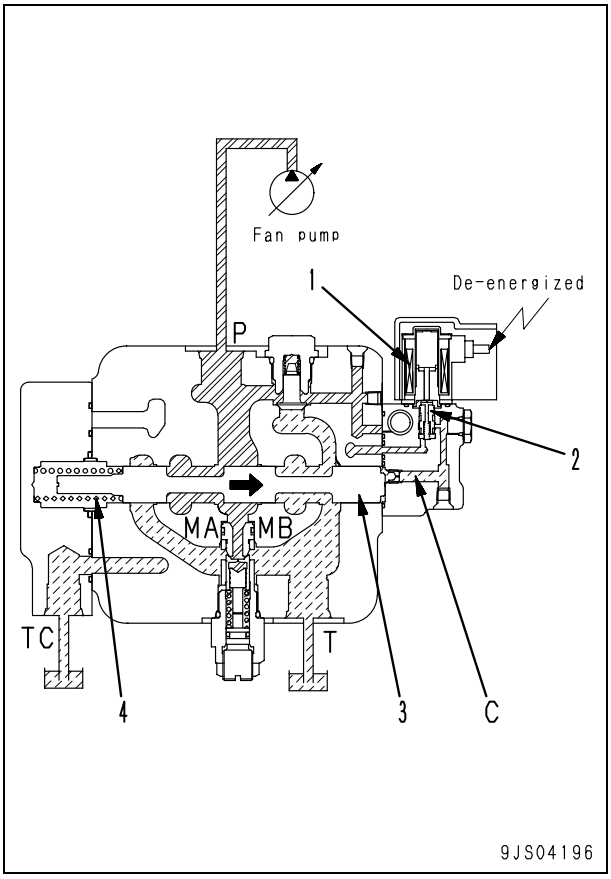
- When the engine stops, the fan pump input revolution becomes 0 rpm.
- Hydraulic oil from the pump is not supplied to port (P).
- As the hydraulic oil does not flow to (MA) side of the motor, the motor speed decreases gradually to stop.
- If the motor shaft is revolved by the force of inertia while the oil flow to port (P) decreases, the oil in port (T) on the outlet side is sent by suction valve (1) to (MA) side.
- Cavitation is prevented from being generated accordingly.



3. Operation of reversible valve

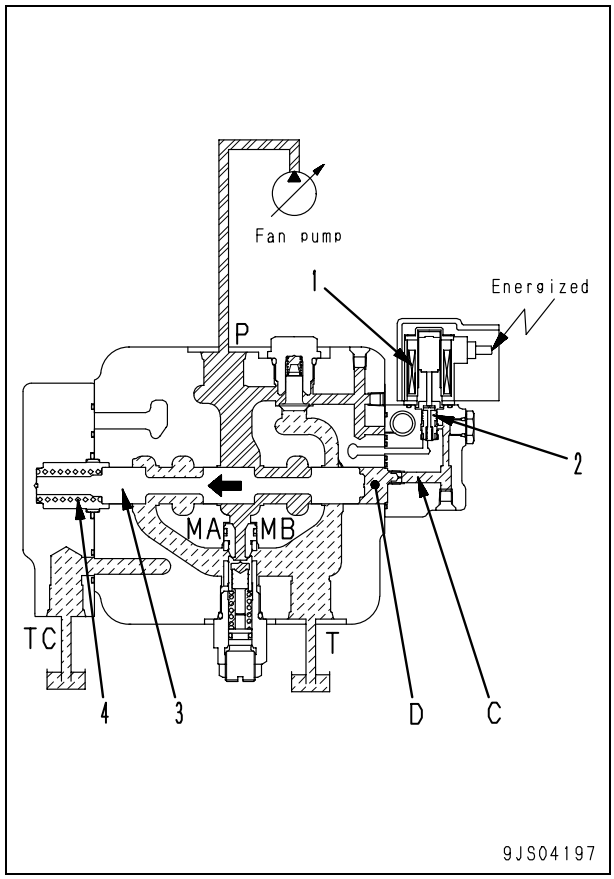
(1) When solenoid valve is de-energized

- When solenoid valve (1) is “de-energized”, hydraulic oil from the pump is cut off by selector valve (2).
- Port (C) is connected to the tank circuit.
- Accordingly, spool (3) is pressed by spring (4) to the right.
- As a result, motor port (MA) opens and the hydraulic oil flows into the motor to revolve it in normal direction (clockwise).



(2) When solenoid valve is energized

- When solenoid valve (1) is “energized”, selector valve (2) switches.
- Hydraulic oil from the pump flows through port (C) into spool chamber (D).
- Hydraulic oil in chamber (D) compresses spring (4).
- Spool (3) moves to the left.
- As a result, motor port (MB) opens and the hydraulic oil flows into the motor to revolve it in reverse (counterclockwise).



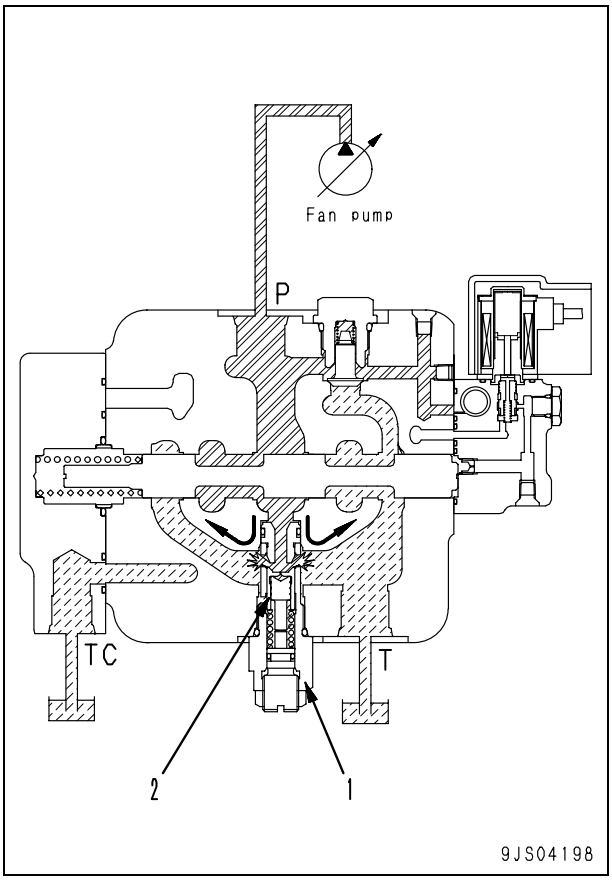
4. Safety valve

Function

- When the engine is started, the pressure in port (P) of the fan motor is heightened in some cases.
- Safety valve (1) is installed to protect the fan system circuit.

Operation

- If the pressure in port (P) rises above the cracking pressure of safety valve (1), valve (2) of safety valve (1) opens to release the pressurized oil into port (T).
- Accordingly, abnormally high pressure is prevented from being generated in port (P).



WA600-6 Wheel loader

Form No. SEN00402-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

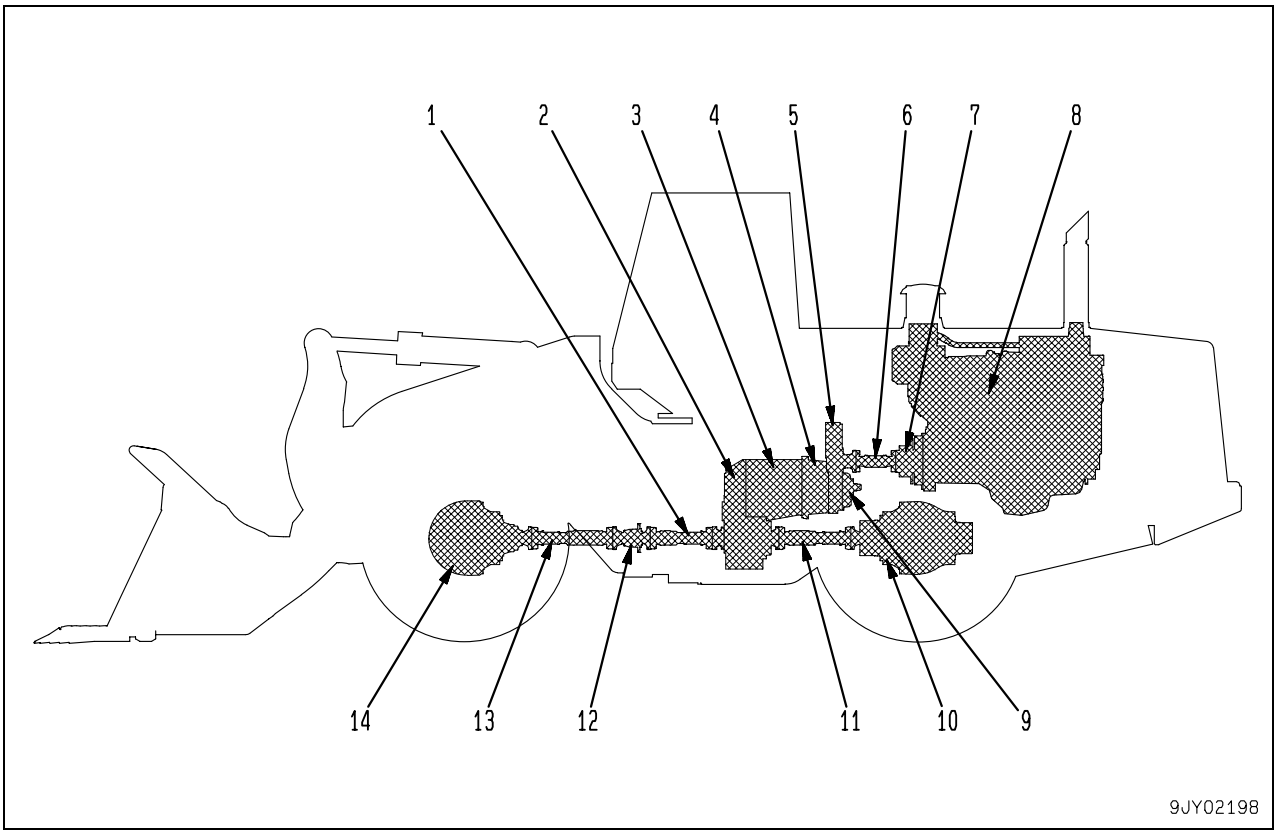
10 Structure, function and maintenance standard

Power train, Part 1

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Power train system diagram 3
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Torque converter 6
Modulation clutch 15
Torque converter regulator valve 16
Transmission 18
Transfer 38
Transmission control valve 40
ECMV 43
Main relief valve and torque converter relief valve 50
Lubrication relief valve 52

Power train, Part 1

Power train

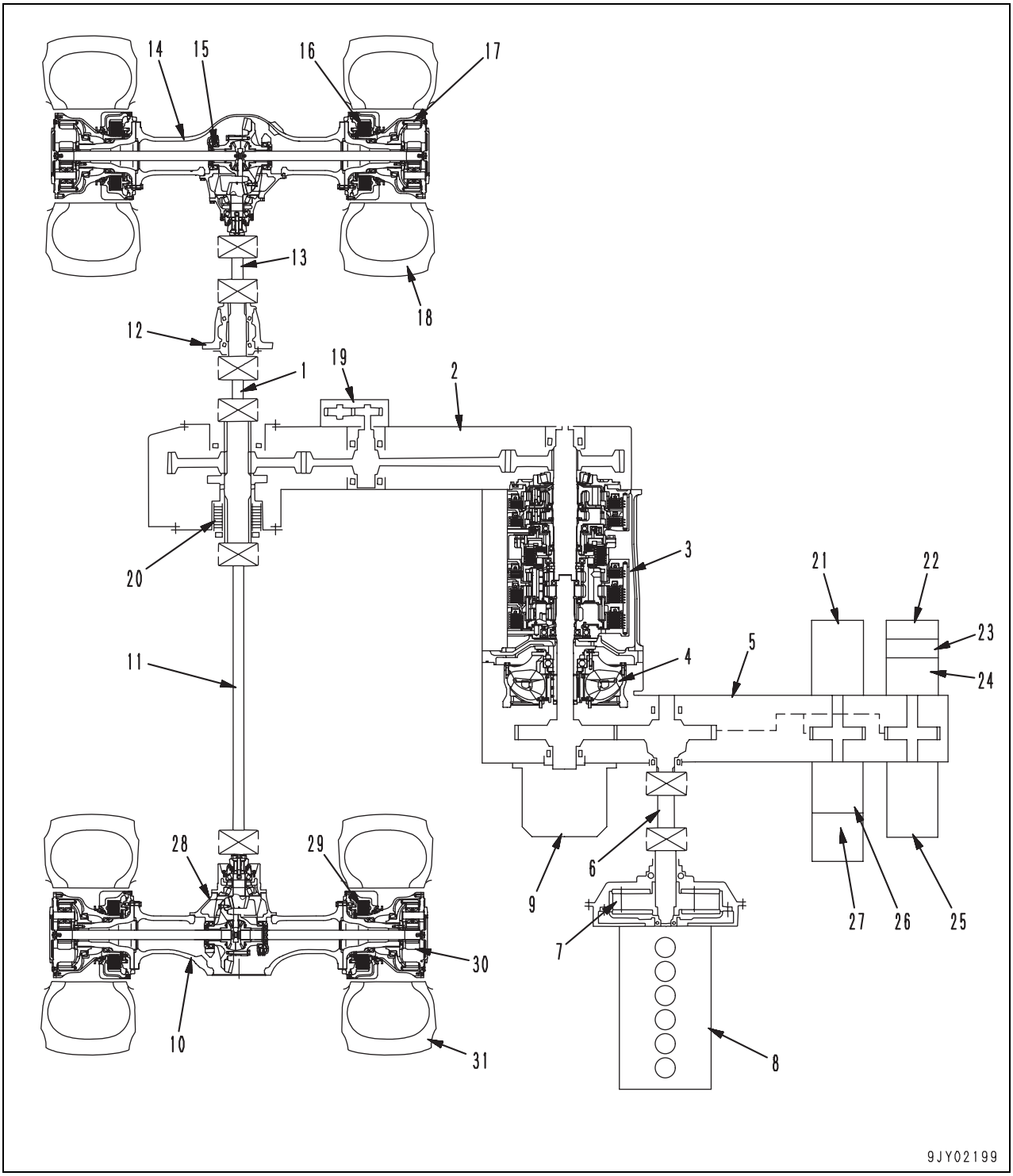


1. Center drive shaft
2. Transfer (output)
3. Transmission
4. Torque converter
5. Transfer (input)
6. Upper drive shaft
7. Damper
8. Engine
9. Modulation clutch
10. Rear axle
11. Rear drive shaft
12. Center support
13. Front drive shaft
14. Front axle

Outline

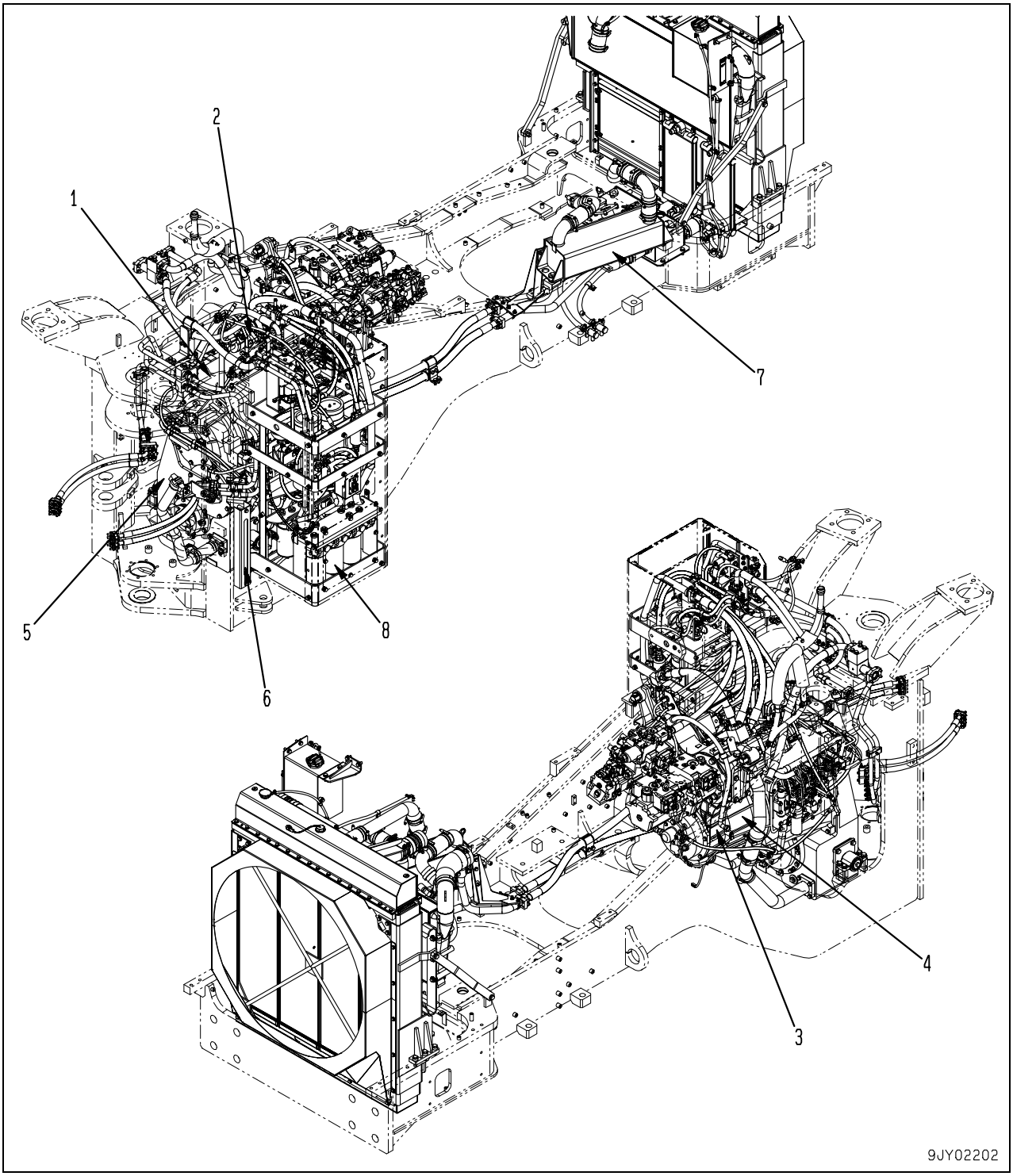
- Power from engine (8) is transmitted through the flywheel of engine to damper (7). The damper output shaft is connected to modulation clutch (9) via upper drive shaft (6). The output of the modulation clutch is connected to pump of torque converter (4). The turbine of the torque converter is connected to input shaft of transmission (3).
- The transmission has 6 hydraulic clutches to set itself to 4 forward gear speeds and 4 reverse gear speeds, which is operated through selection of one of them using an electrically controlled switch.
- The output shaft of the transmission is connected to gear of transfer (2) and the power is transmitted to the output shaft. The power from the transfer output shaft is transmitted through center drive shaft (1), center support (12), front drive shaft (13) and rear drive shaft (11) to front axle (14) and rear axle (10), and then transmitted through the wheels to the tires.

Power train system diagram



15. Front differential
16. Front brake
17. Front final drive
18. Front tire
19. Emergency steering pump (Only machine with emergency steering system)
20. Parking brake
21. Brake cooling pump (if equipped)
22. Brake and EPC pump
23. Hydraulic cooling pump
24. Power train pump
25. Work equipment pump
26. Steering pump
27. Fan pump
28. Rear differential
29. Rear brake
30. Rear final drive
31. Rear tire

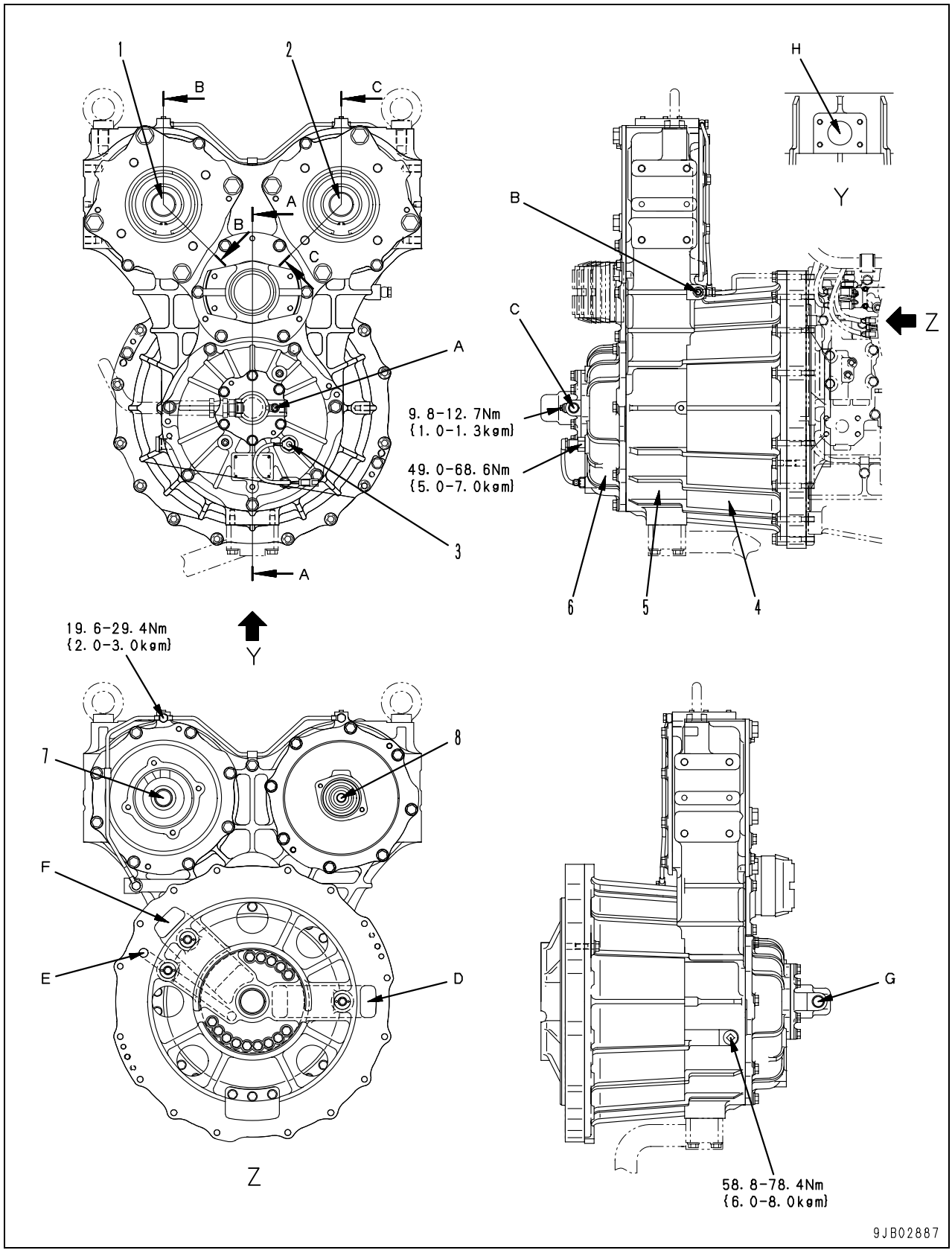
Torque converter and transmission piping diagram



1. Transmission
2. Power train, hydraulic cooling, brake and EPC pump
3. Transfer (input)
4. Torque converter
5. Transfer (output)
6. Transmission oil level gauge
7. Torque converter oil cooler
8. Torque converter oil filter

Torque converter

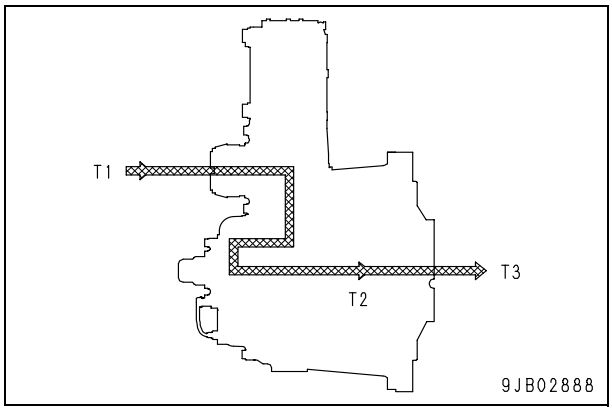
(Input transfer, PTO, modulation clutch, and torque converter)



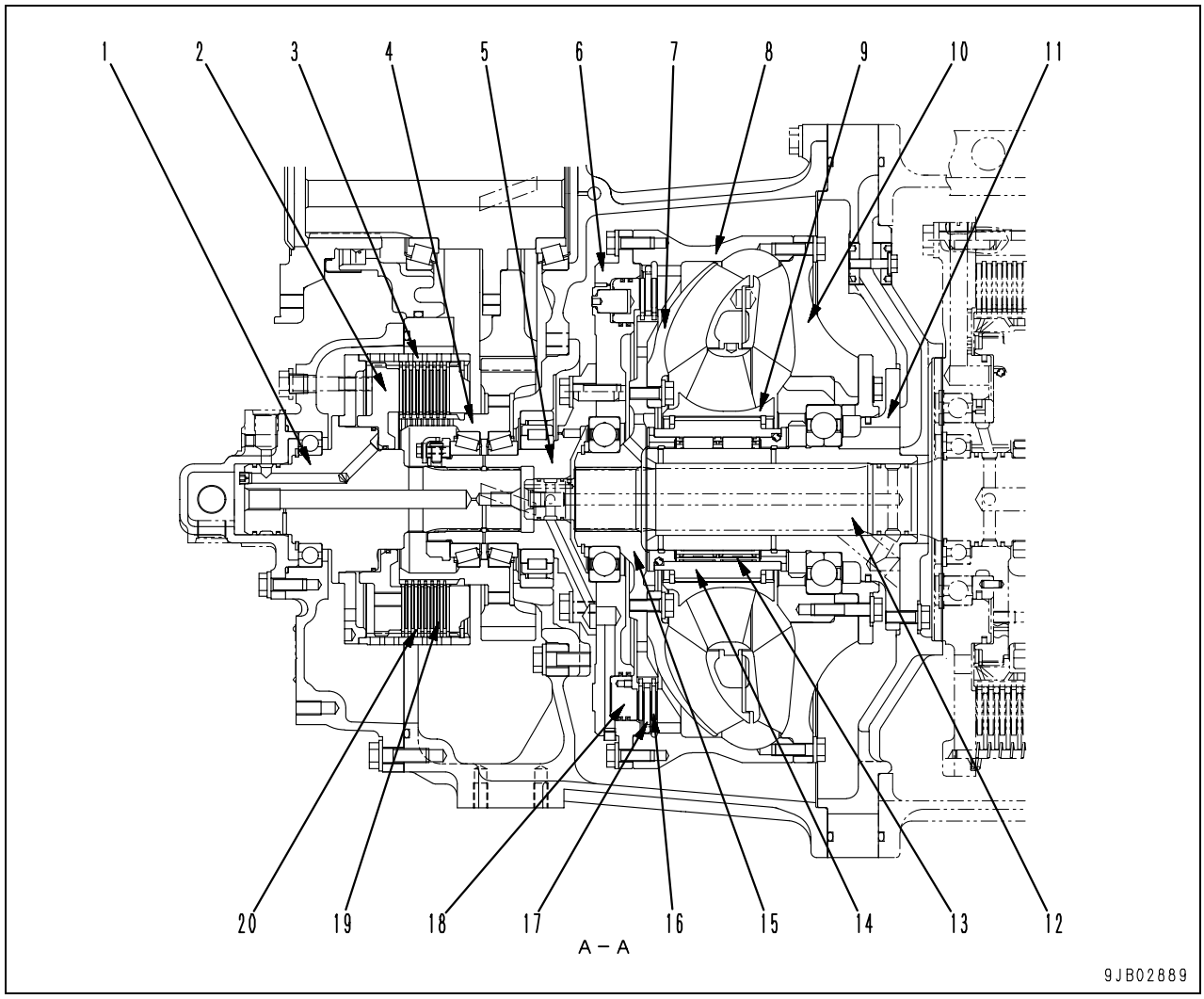
A: Modulation clutch oil pressure pickup port
B: From transmission control valve
C: From brake valve (Left)
D: To torque converter regulator valve
E: From lockup clutch ECMV
F: From main relief valve
G: From oil cooler
H: To transfer case

1. Steering, cooling fan pump mounting port
2. Work equipment pump mounting port
3. Modulation clutch output shaft speed sensor
4. Torque converter
5. Input transfer and PTO
6. Modulation clutch
7. Power train, hydraulic oil cooling, brake and EPC pump mounting port
8. Brake cooling pump (If equipped) mounting port

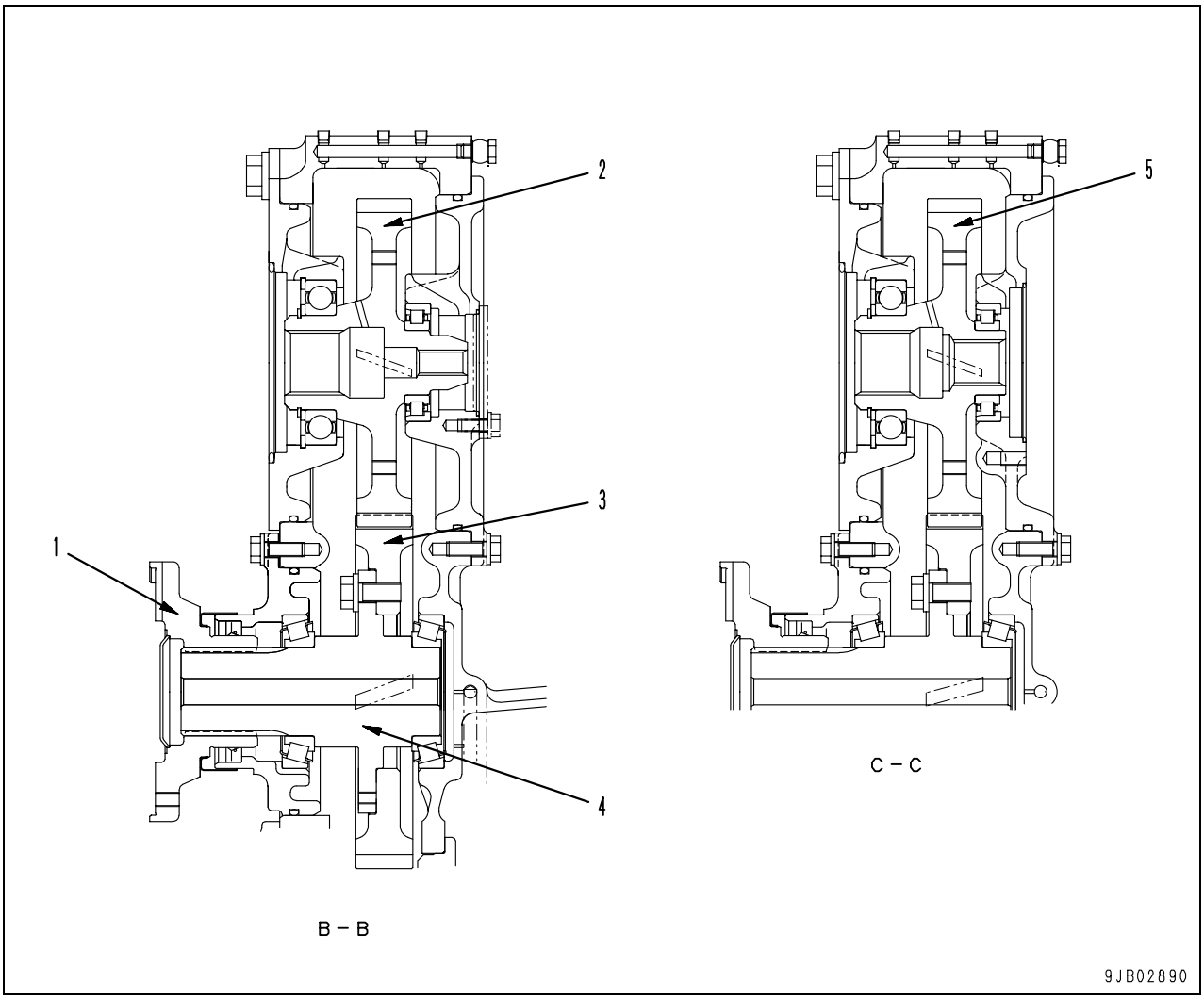
Specifications



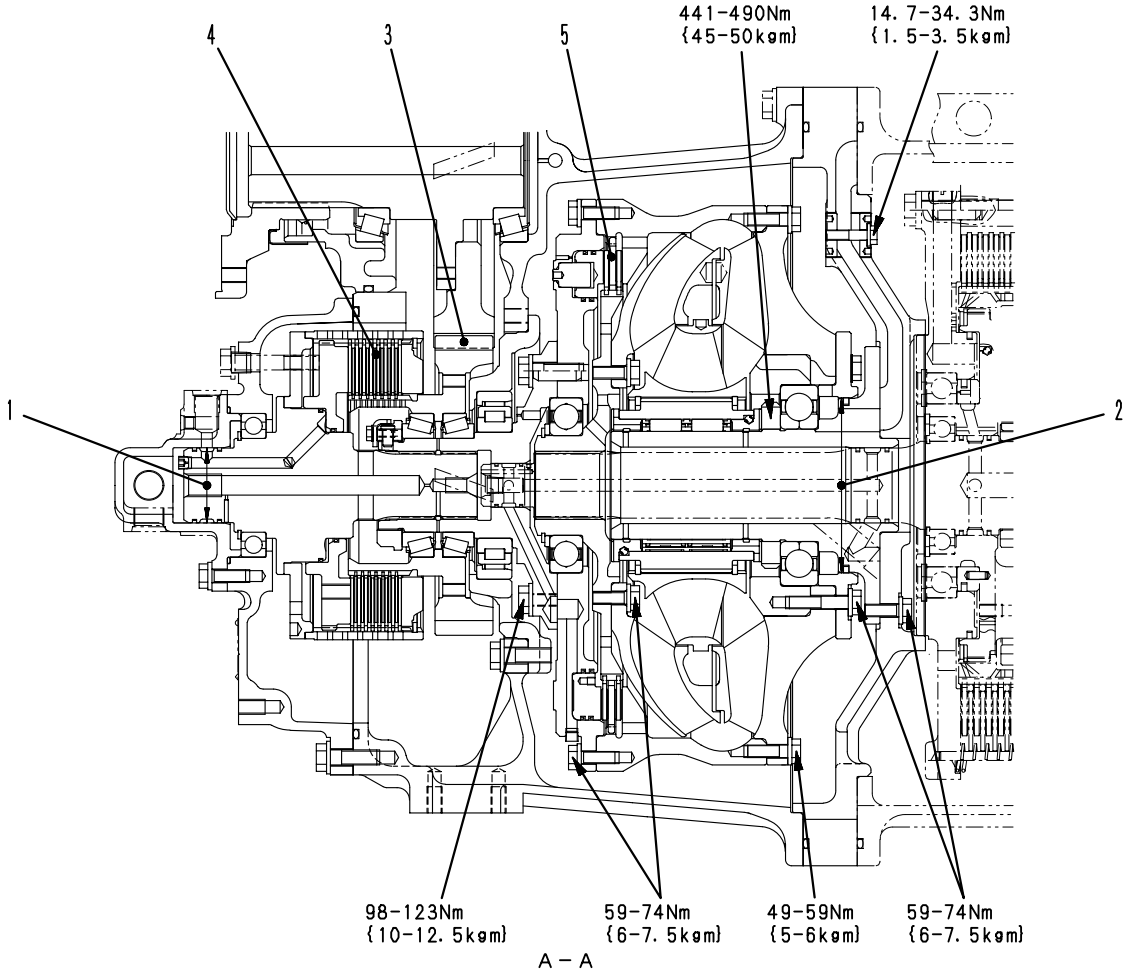
Type	3-element, 1-stage, 2-phase
Stall torque ratio	2.113 (T3/T1) 2.654 (T3/T2)



1. Modulation clutch output shaft
2. Modulation clutch piston
3. Modulation clutch outer drum
4. Modulation clutch gear (Number of teeth: 43)
5. Torque converter input shaft
6. Lockup clutch housing
7. Turbine
8. Drive case
9. Stator
10. Pump
11. Stator shaft
12. Transmission input shaft
13. Free wheel
14. Race
15. Boss
16. Lockup clutch disc
17. Lockup clutch plate
18. Lockup clutch piston
19. Modulation clutch disc
20. Modulation clutch plate

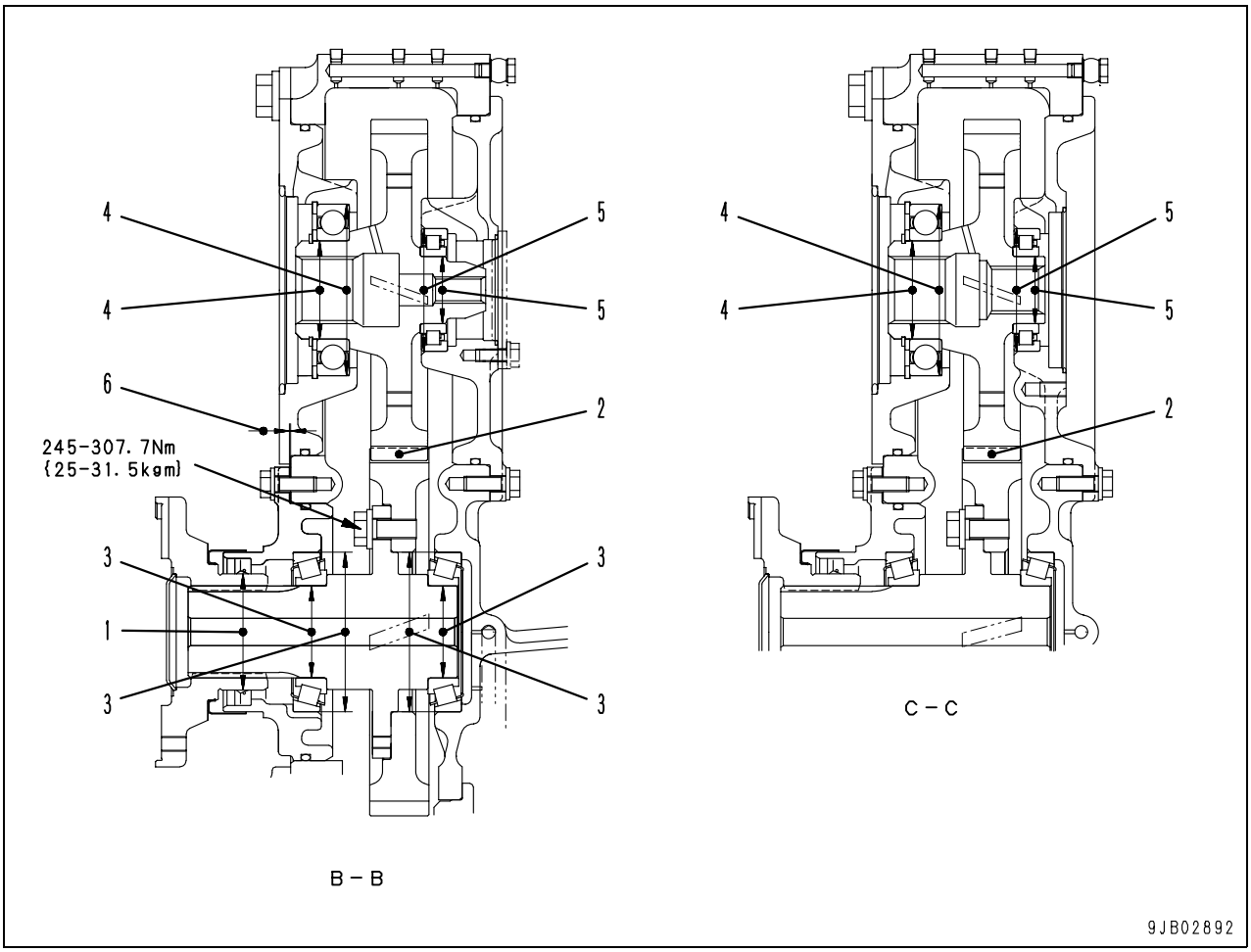


1. Coupling
2. PTO gear (Number of teeth: 51)
3. Drive gear (Number of teeth: 54)
4. Input shaft
5. PTO gear (Number of teeth: 51)



Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Inside diameter of cover seal ring contact surface	60	+0.050 0	60.5	Repair by hard chromium-plating or replace
2	Inside diameter of retainer seal ring contact surface	140	+0.040 0	140.5	
3	Backlash between drive gear and modulation clutch inner drum	0.198 – 0.506			Replace
4	Thickness of modulation clutch disc	2.8	±0.08	2.3	
	Thickness of modulation clutch plate	2.6	±0.05	2.3	
	Total assembly thickness of modulation clutch	40.4	±0.25	37.1	
5	Thickness of lockup clutch disc	5.0	±0.1	4.5	
	Thickness of lockup clutch plate	5.0	±0.1	4.5	
	Total assembly thickness of lockup clutch	15.0	±0.17	13.9	

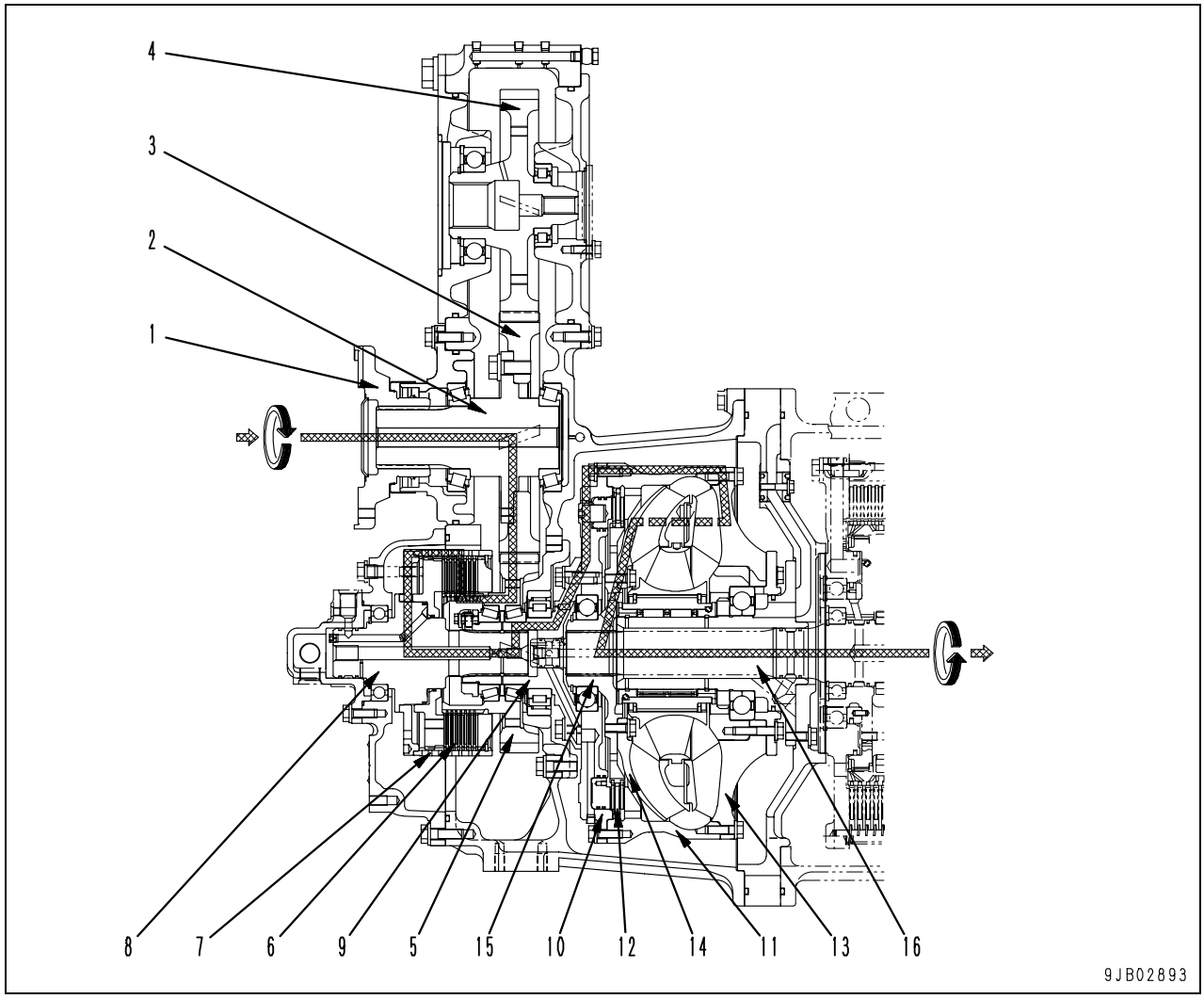


Unit: mm

No.	Check item		Criteria			Remedy
1	Outside diameter of coupling oil seal contact surface		Standard size	Tolerance	Repair limit	Repair by hard chromium-plating or replace
			95	0 –0.087	94.8	
2	Backlash between drive gear and PTO gear		0.198 – 0.506			Replace
3	Tolerance for fitness of input shaft bearing		Standard size	Tolerance		
				Shaft	Hole	
		Outside diameter	130	0 –0.020	–0.012 –0.052	
		Inside diameter	75	+0.039 +0.020	0 –0.015	
4	Tolerance for fitness of PTO gear bearing (rear)	Outside diameter	140	0 –0.018	+0.026 –0.014	
		Inside diameter	80	+0.030 +0.011	0 –0.015	
5	Tolerance for fitness of PTO gear bearing (front)	Outside diameter	100	0 –0.015	–0.010 –0.045	
		Inside diameter	55	+0.030 +0.011	0 –0.015	
6	Clearance between cage and case		Standard clearance		Clearance limit	
			1.05 – 1.70 (Standard shim thickness: 1.2)		—	

Power transmitting route

When lockup clutch is “disengaged”



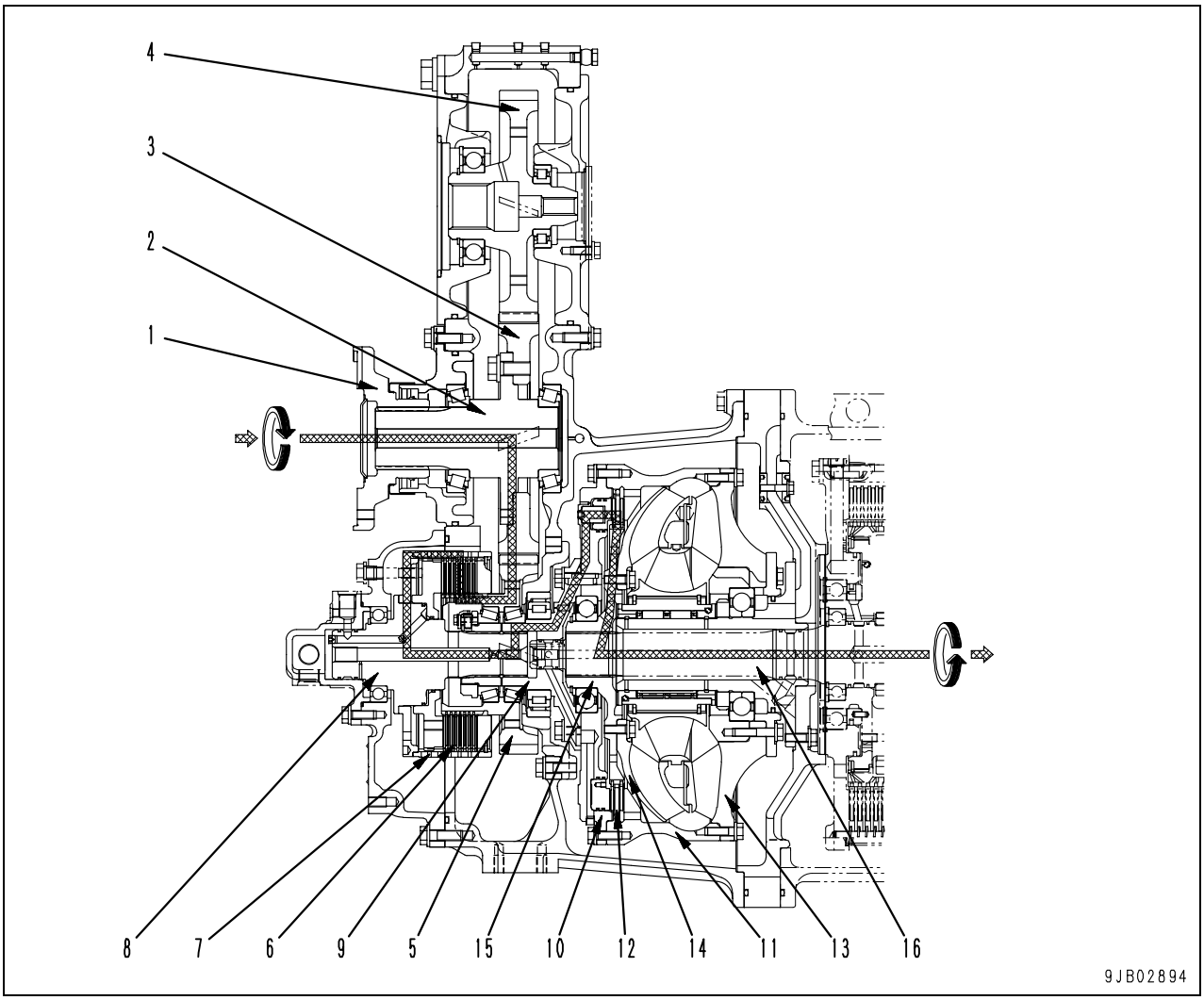
Drive case (11) is disconnected from boss (15) and turbine (14) and lockup torque converter works as an ordinary torque converter.

The power from engine
↓
Damper
↓
Universal joint
↓
Coupling (1)
↓
Input shaft (2)
↓
Drive gear (3)
↓
Clutch gear (5)
↓
Modulation clutch (6)
↓
(To right top) →

→ (from left bottom)
↓
Outer drum (7)
↓
Output shaft (8)
↓
Input shaft (9)
↓
Clutch housing (10), drive case (11) and pump (13) rotate together
↓
Oil is used as medium
↓
Turbine (14) and boss (15)
↓
Transmission input shaft (16)

- The power being transmitted to coupling (1) is then transmitted through input shaft (2), drive gear (3) and PTO gear (4) and then used as the pump driving power.

When lockup clutch is “engaged”



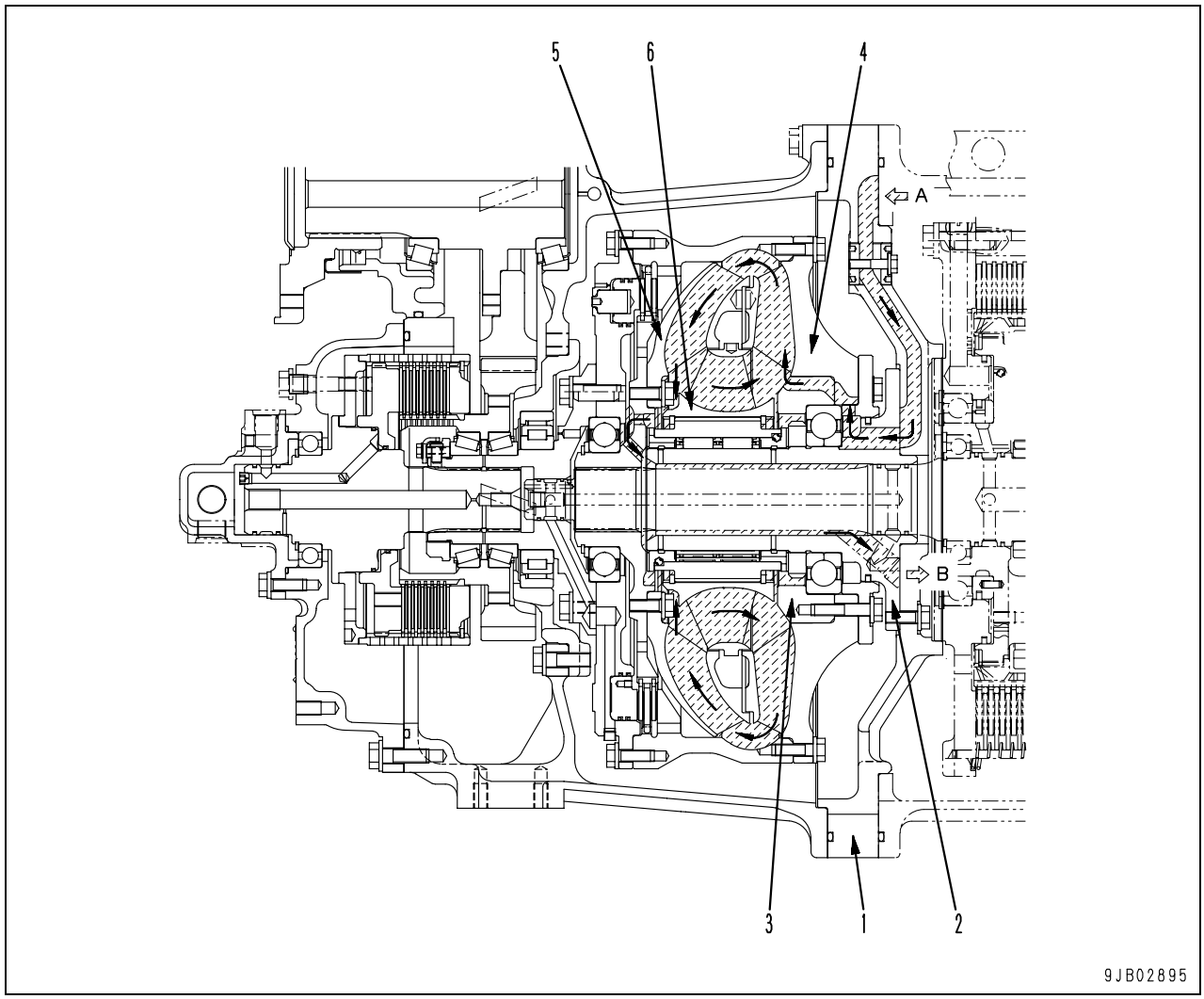
Drive case (11) is connected to boss (15) and turbine (14) and lockup torque converter is locked up.

The power from engine
↓
Damper
↓
Universal joint
↓
Coupling (1)
↓
Input shaft (2)
↓
Drive gear (3)
↓
Clutch gear (5)
↓
Modulation clutch (6)
↓
(To right top) →

→ (from left bottom)
↓
Outer drum (7)
↓
Output shaft (8)
↓
Input shaft (9)
↓
Clutch housing (10), drive case (11) and pump (13) rotate together
↓
Lockup clutch (12)
↓
Boss (15)
↓
Transmission input shaft (16)

- The power being transmitted to coupling (1) is then transmitted through input shaft (2), drive gear (3) and PTO gear (4) and then used as the pump driving power.

Oil flow



- The oil flows through the main relief valve and its pressure is regulated by the torque converter relief valve, and then it flows to the pump (4) through inlet port (A) and the oil passage of housing (1), stator shaft (2) and guide (3).
- The oil is given a centrifugal force by pump (4), and then it enters turbine (5) to transmit its energy to turbine (5).
- The oil from turbine (5) is sent to stator (6), and then returned to pump (4). Part of this oil is sent to the oil cooler through stator (6), oil passage of stator shaft (2) and outlet port (B).

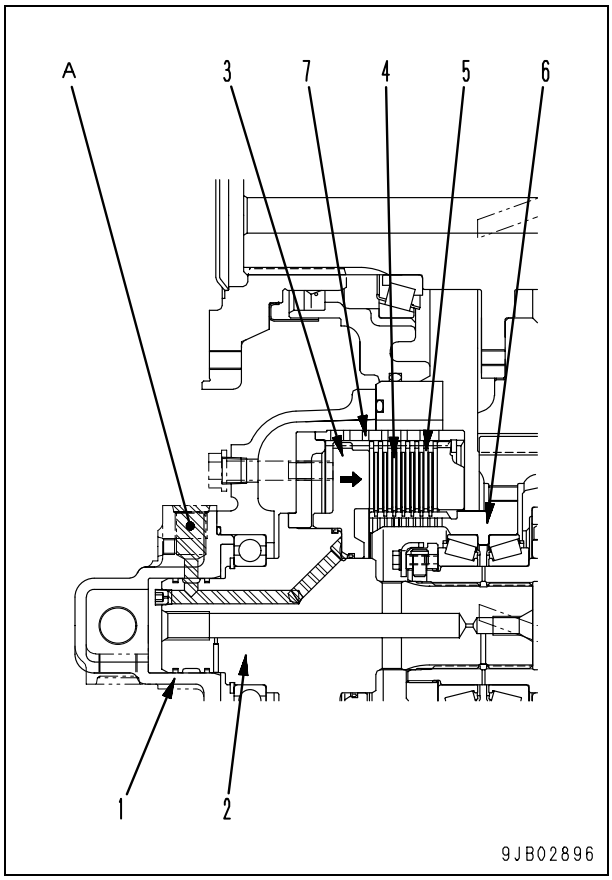
Modulation clutch

Outline

- The modulation clutch is installed between the input transfer and torque converter.
- Regulating the clutch oil pressure by use of ECMV allows adjusting the clutch connection.
- Sliding the clutch allows reducing the power to be transmitted to the torque converter.

When clutch is “engaged” (fixed)

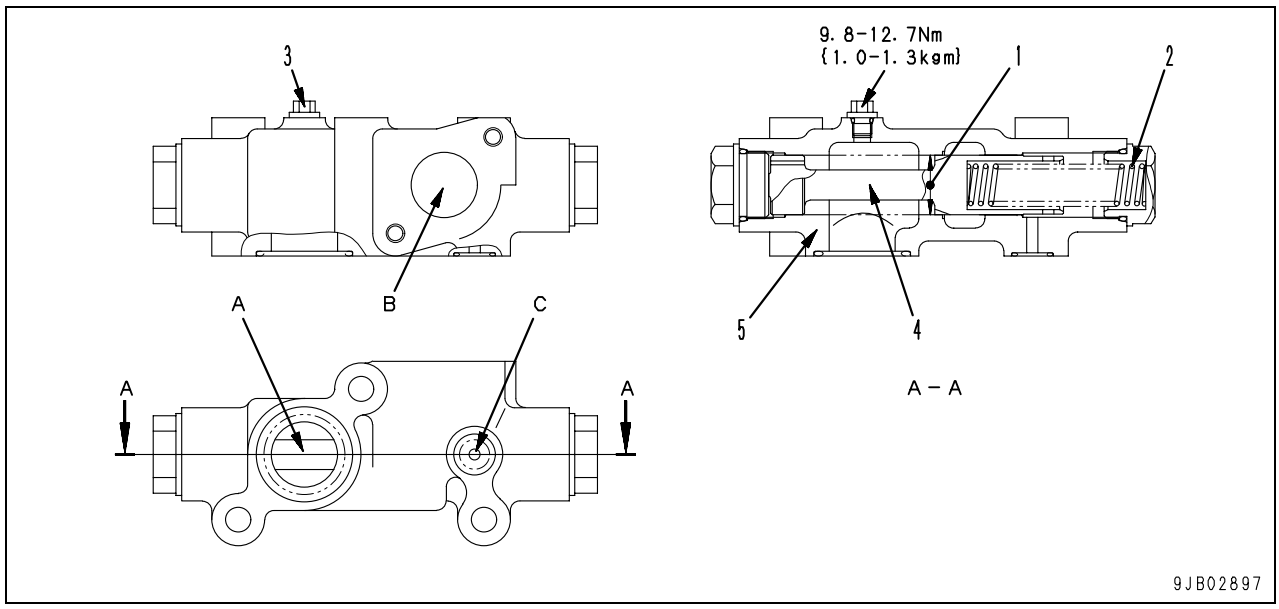
- The oil sent from the modulation clutch ECMV flows to piston (3) through port (A) of cover (1) and oil passage of output shaft (2). The oil reached there works as back pressure to drive piston (3) in the right direction.
- Rise in the clutch oil pressure increases pressing force of piston (3), closely contacting disc (4) and plate (5) each other and as the result uniting clutch gear (6) and outer drum (7) to transmit the power.
  In this case, the power from clutch gear (6) is directly transmitted to outer drum (7).



Clutch is in “slip” (partially disengaged)

- As the low clutch oil pressure signal from the controller is received, the modulation clutch ECMV reduces the clutch oil pressure.
- As the clutch oil pressure goes low, pressing force of piston (3) is weakened, causing slippage of disc (4) and plate (5). As the result, speed of outer drum (7) becomes slower than clutch gear (6).
  Thus, the power to be transmitted to outer drum (7) is reduced.
- Magnitude of the power to be transmitted is determined by the ratio between the clutch slip ratio and torque converter's speed.
  Slip ratio (%) = (1 – Output shaft speed/Input shaft speed) x 100

Torque converter regulator valve



Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between spool and valve body	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		32	–0.050 –0.066	+0.025 0	0.050 – 0.091	0.111	
2	Valve spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		126.6	94.5	328 N {33.5 kg}	122.8	312 N {31.8 kg}	

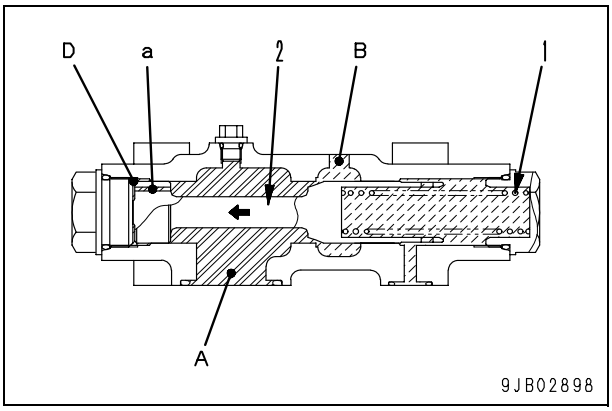
3. Torque converter outlet port oil pressure pickup port
4. Spool
5. Valve body

A: From torque converter
B: To oil cooler
C: Drain

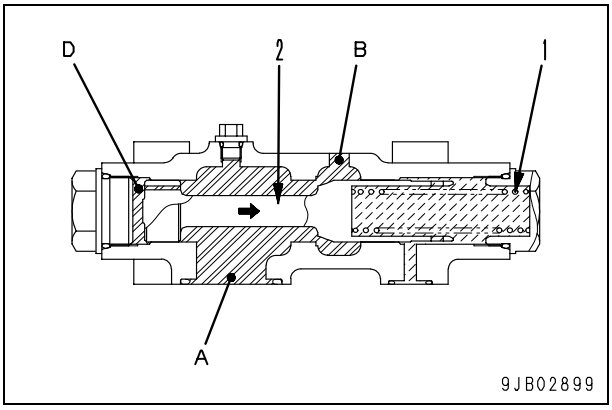
Outline

- This valve is provided at the torque converter outlet circuit in order to secure an optimum performance of the torque converter by adjusting its set oil pressure.
  Set pressure:
  0.57 ± 0.05 MPa {5.8 ± 0.5 kg/cm^2}

Operation



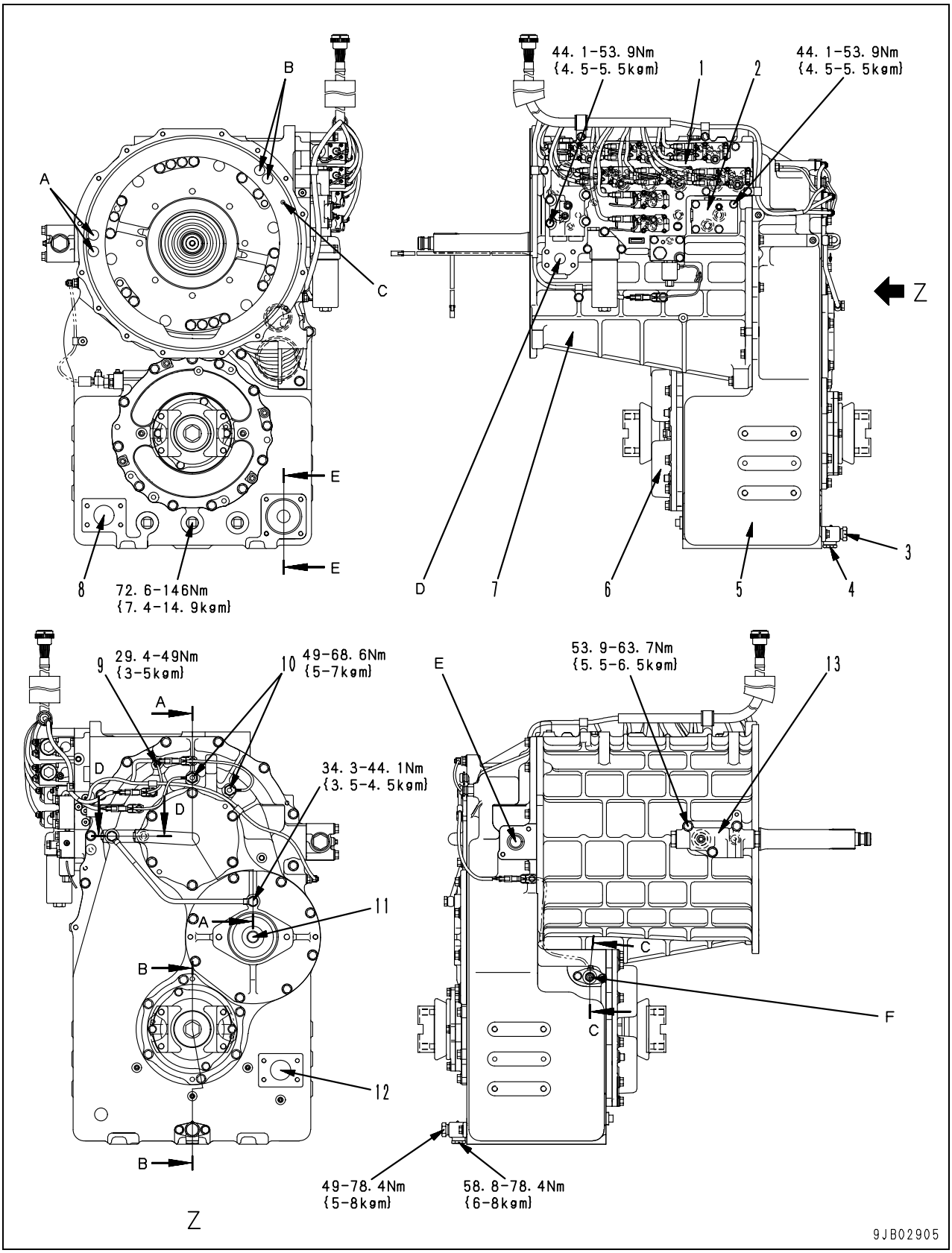
- The oil from the torque converter is conducted to chamber (D) through port (A) and orifice (a).
- When the oil pressure force generated in chamber (D) is smaller than the tension of spring (1), spool (2) is pressed leftward, closing port (A) and port (B).

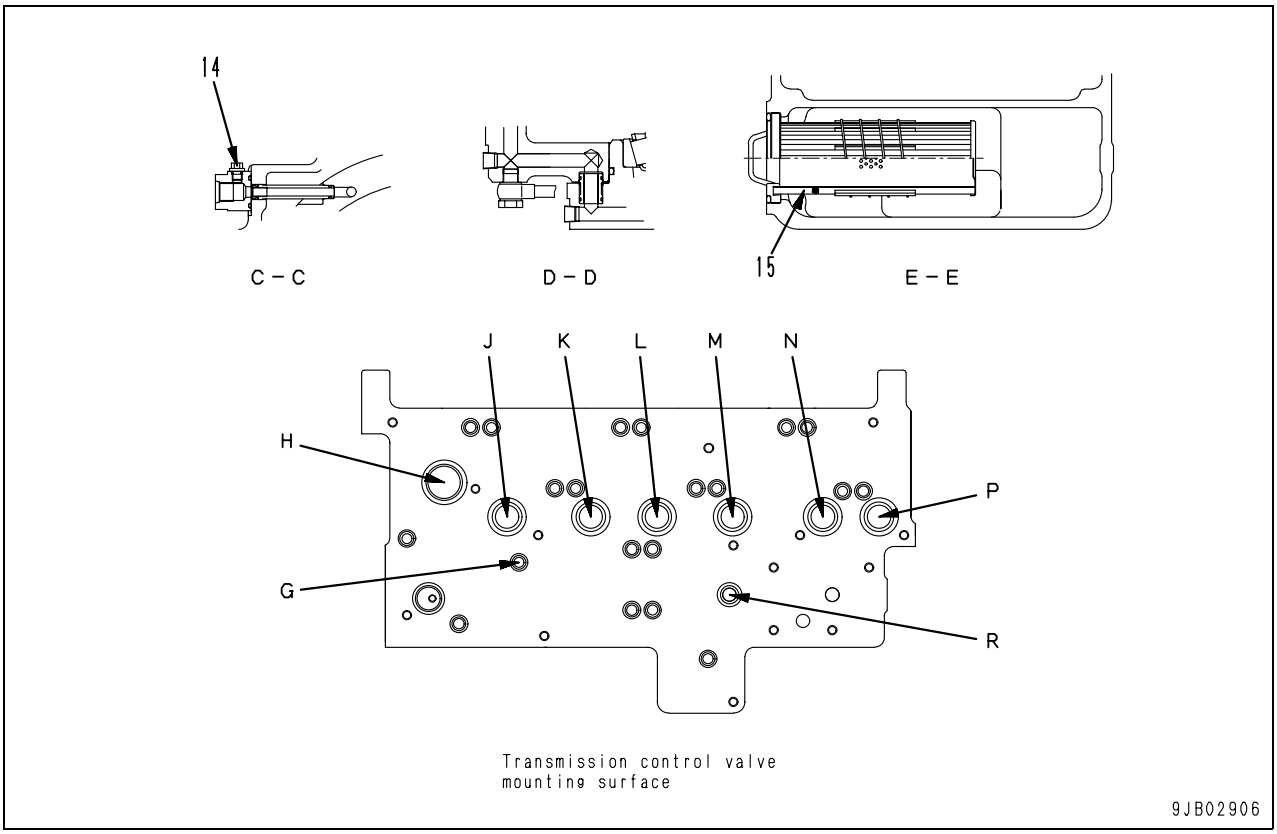


- If the oil pressure force generated in chamber (D) becomes larger than the tension of spring (1), spool (2) is pressed rightward, opening port (A) and port (B).

Transmission

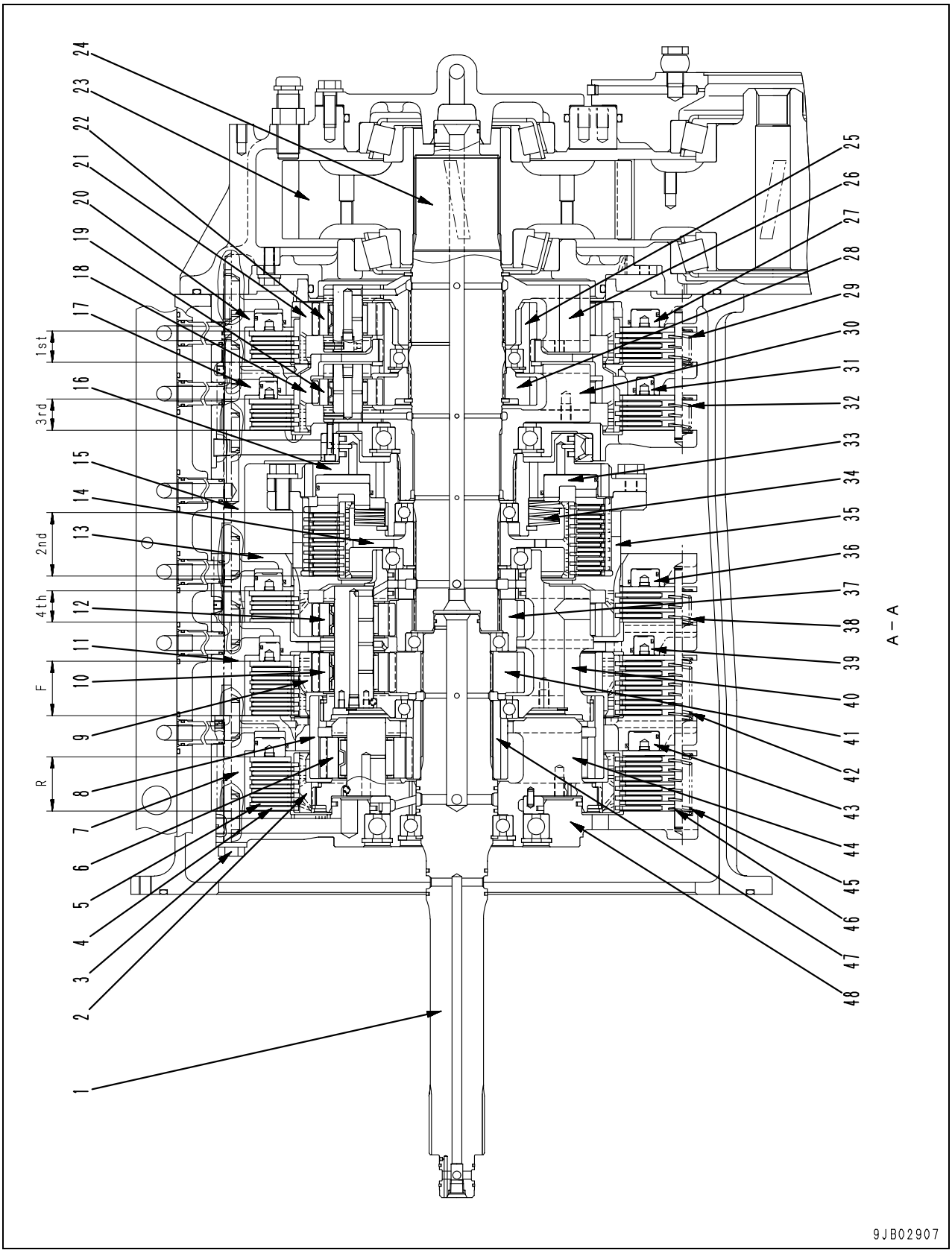
(Transmission, transfer and parking brake)





A: From torque converter
B: To torque converter
C: To lockup clutch
D: From power train pump
E: From oil cooler
F: From parking brake emergency release valve
G: From lockup clutch ECMV
H: From main relief valve
J: From R clutch ECMV
K: From F clutch ECMV
L: From 4th clutch ECMV
M: From 2nd clutch ECMV
N: From 3rd clutch ECMV
P: From 1st clutch ECMV
R: From torque converter relief valve

1. Transmission control valve
2. Lubrication relief valve
3. Drain valve
4. Drain plug
5. Transfer
6. Parking brake
7. Transmission
8. Torque converter drain tube mounting port
9. Transmission lubrication temperature sensor
10. Speed sensor
11. Emergency steering pump mounting port
12. Oil filler tube mounting port
13. Torque converter regulator valve
14. Parking brake oil pressure pickup port
15. Strainer


1st
3rd
2nd
4th
F
R
A – A
9JB02907

1. Transmission input shaft
2. R ring gear (Hub)
3. Tie bolt
4. Clutch disc
5. Clutch plate
6. R planetary pinion (Number of teeth: 28)
7. R clutch housing
8. R ring gear (Number of inside teeth: 86)
9. F ring gear (Number of inside teeth: 90)
10. F planetary pinion (Number of teeth: 24)
11. F clutch housing
12. 4th planetary pinion (Number of teeth: 24)
13. 4th clutch housing
14. 2nd hub
15. 2nd clutch housing
16. 2nd clutch piston housing
17. 3rd clutch housing
18. 3rd ring gear (Number of inside teeth: 90)
19. 3rd planetary pinion (Number of teeth: 20)
20. 1st clutch housing
21. 1st ring gear (Number of inside teeth: 90)
22. 1st planetary pinion (Number of teeth: 20)
23. Transfer input gear (Number of teeth: 46)
24. Transmission output shaft
25. 1st sun gear (Number of teeth: 50)
26. 1st carrier
27. 1st clutch piston
28. 3rd sun gear (Number of teeth: 50)
29. 1st piston return spring
30. 3rd carrier
31. 3rd clutch piston
32. 3rd piston return spring
33. 2nd clutch piston
34. 2nd piston return spring
35. 4th ring gear (Number of inside teeth: 90)
36. 4th clutch piston
37. 4th sun gear (Number of teeth: 42)
38. 4th piston return spring
39. F clutch piston
40. F and 4th carrier
41. F sun gear (Number of teeth: 42)
42. F piston return spring
43. R clutch piston
44. R carrier
45. R piston return spring
46. Washer spring
47. R sun gear (Number of teeth: 30)
48. Housing

Outline

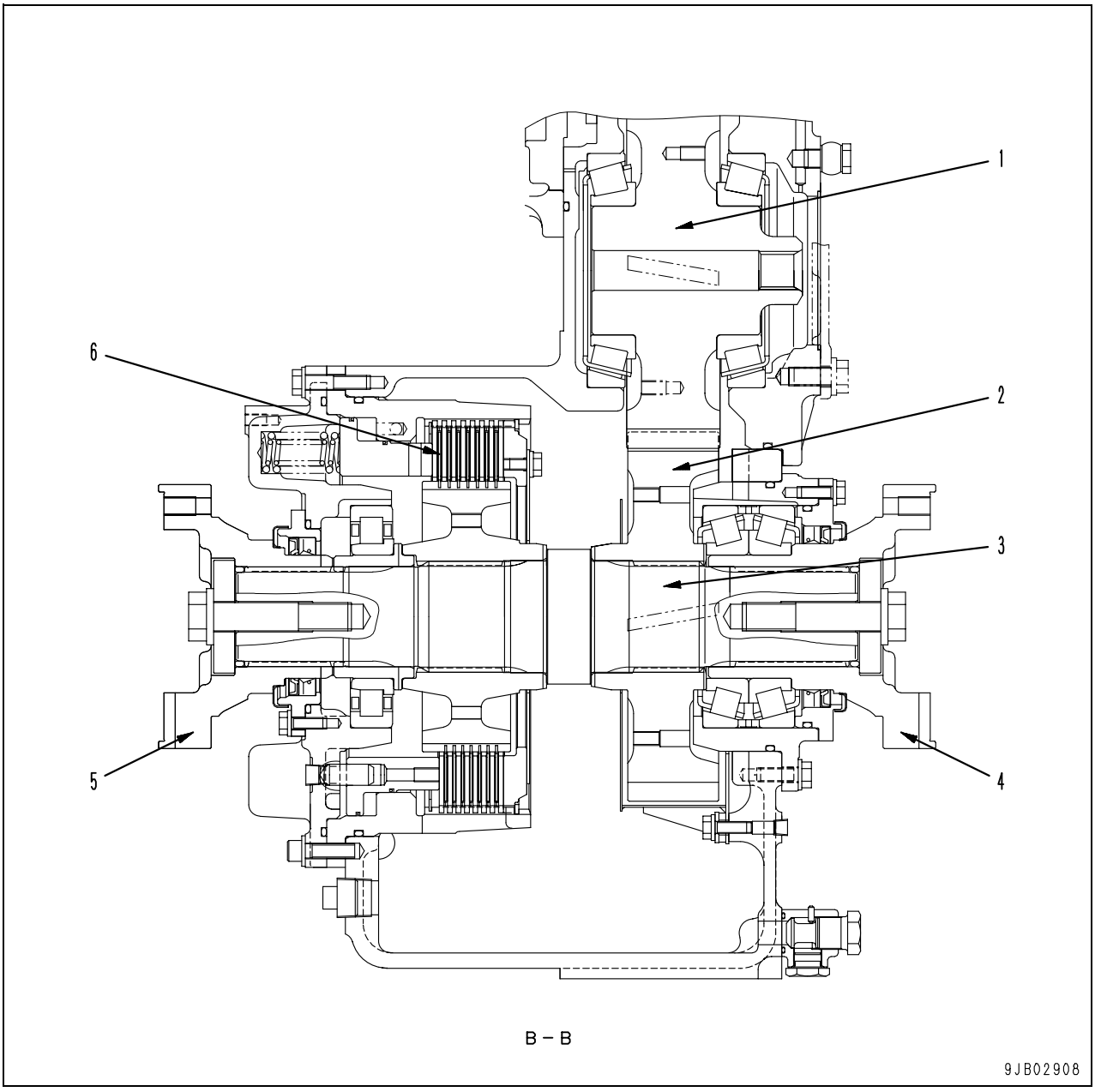
- The transmission employed consists of the united planetary gear mechanism and disc clutch that provides “4 forward gear speeds and 4 reverse gear speeds”.
- The transmission selects a single rotating direction and a single speed by fixing the planetary gear mechanism and 2 of 6 disc clutches by use of ECMV.
- The transmission transmits the power being transmitted to the transmission input shaft to the output shaft after selecting a single speed from the 1st to 4th speeds both in the forward and reverse travel. In this case, the gear speed change is done by F and R clutches plus combinations of 4 speed clutches.

Number of plates and discs used

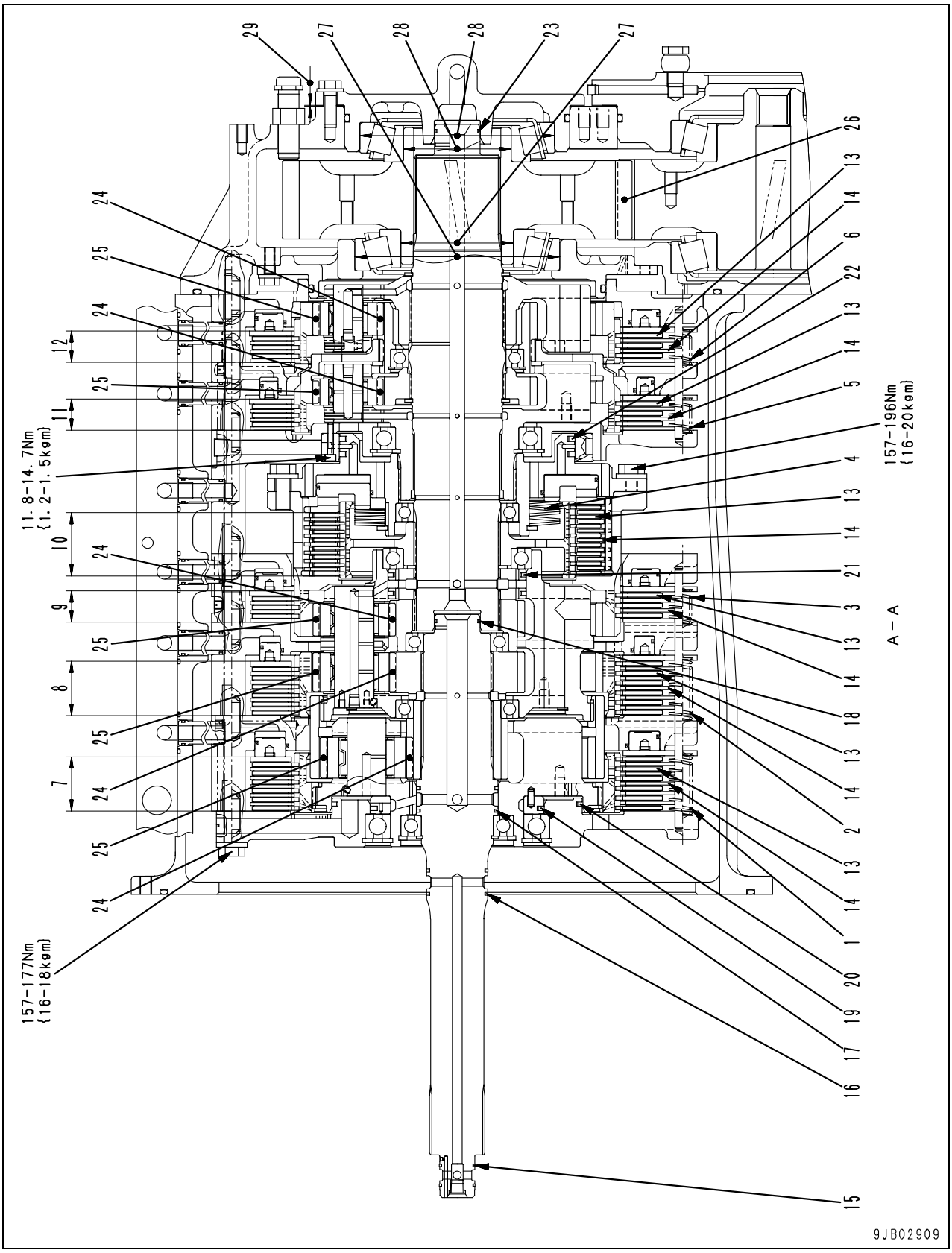
Clutch No.	Number of plates	Number of discs
R clutch	5 + 1	6
F clutch	5 + 1	6
4th clutch	3 + 1	3
2nd clutch	7	8
3rd clutch	3 + 1	3
1st clutch	3 + 1	3

Combinations of clutches at respective gear speeds and reduction ratio

Gear speed	Clutch used	Reduction ratio
Forward 1st	F x 1st	5.622
Forward 2nd	F x 2nd	3.143
Forward 3rd	F x 3rd	1.765
Forward 4th	F x 4th	1.000
Neutral	—	—
Reverse 1st	R x 1st	5.128
Reverse 2nd	R x 2nd	2.866
Reverse 3rd	R x 3rd	1.610
Reverse 4th	R x 4th	0.912



1. Transfer idler gear (Number of teeth: 41)
2. Transfer output gear (Number of teeth: 42)
3. Output shaft
4. Front coupling
5. Rear coupling
6. Parking brake

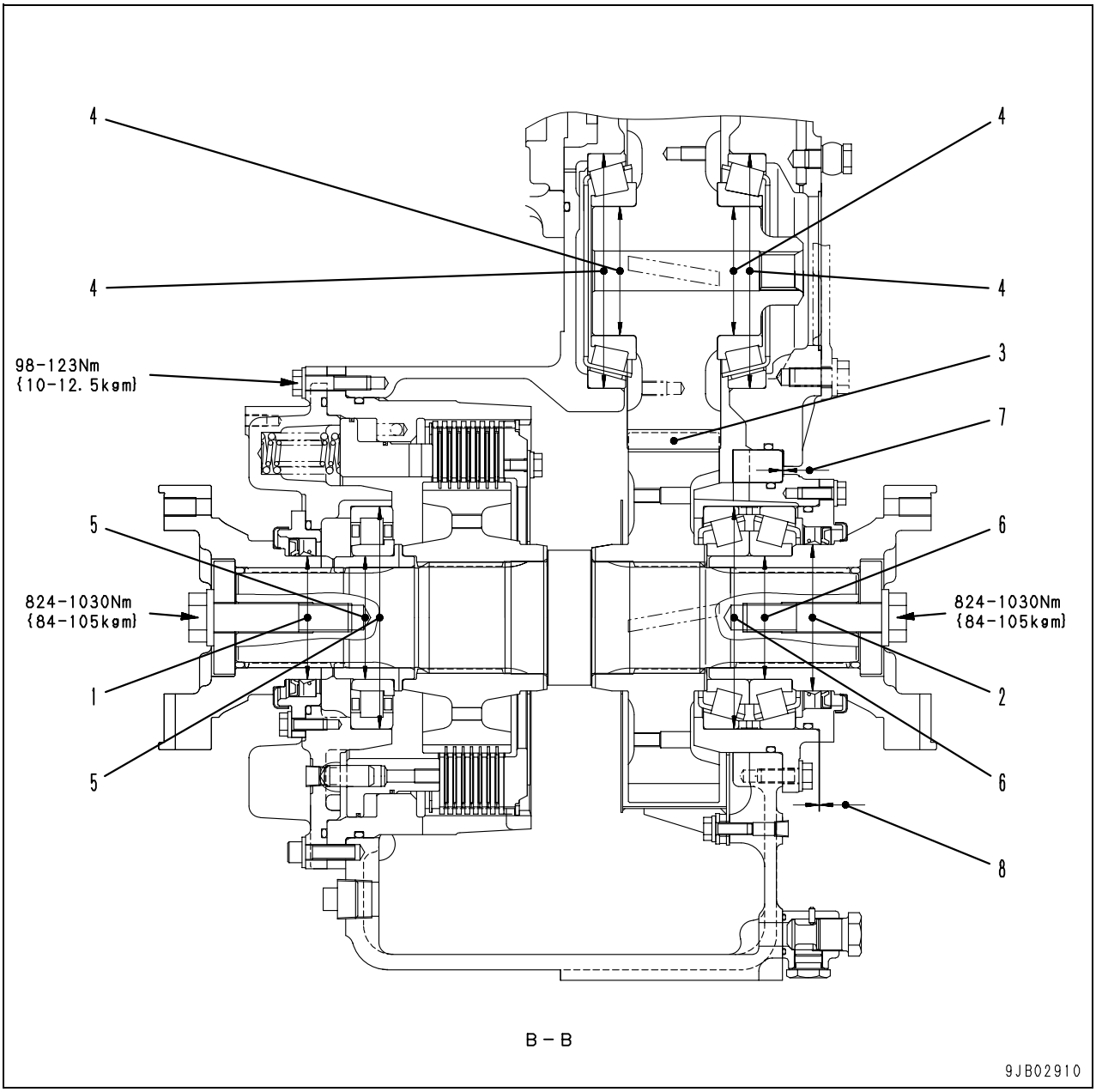

157-196Nm
{16-20kgm}
11.8-14.7Nm
{1.2-1.5kgm}
157-177Nm
{16-18kgm}
A-A
9JB02909

Unit: mm

No.	Check item		Criteria					Remedy
1	R clutch spring (12 springs)		Standard size			Repair limit		Replace
			Free length	Installed length	Installed load	Free length	Installed load	
			68	61.0	78.5 N {8.0 kg}	63.9	66.7 N {6.8 kg}	
2	F clutch spring (12 springs)		68	61.5	72.9 N {7.4 kg}	63.9	61.8 N {6.3 kg}	
3	4th clutch spring (12 springs)		41	34.7	85.3 N {8.7 kg}	38.5	72.6 N {7.4 kg}	
4	2nd clutch spring (5 springs)		6	4.9	1,627 N {166 kg}	5.64	1,380 N {141 kg}	
5	3rd clutch spring (12 springs)		41	34.7	85.3 N {8.7 kg}	38.5	72.6 N {7.4 kg}	
6	1st clutch spring (12 springs)		41	34.7	85.3 N {8.7 kg}	38.5	72.6 N {7.4 kg}	
7	Total assembled thickness of 6 discs and 6 plates for R clutch		Standard size		Tolerance	Repair limit		
			53.4		±0.35	50.2		
8	Total assembled thickness of 6 discs and 6 plates for F clutch		53.4		±0.35	50.2		
9	Total assembled thickness of 3 discs and 4 plates for 4th clutch		30.8		±0.26	28.4		
10	Total assembled thickness of 8 discs and 7 plates for 2nd clutch		62.4		±0.39	58.1		
11	Total assembled thickness of 3 discs and 4 plates for 3rd clutch		30.8		±0.26	28.4		
12	Total assembled thickness of 3 discs and 4 plates for 1st clutch		30.8		±0.26	28.4		
13	Thickness of clutch disc	F, R	5.4		±0.1	4.9		
		4th, 3rd, 1st	5.4		±0.1	4.6		
		2nd	5.0		±0.1	4.5		
14	Thickness of clutch plate	F, R, 4th, 3rd, 1st	3.2		±0.1	2.9		
			5.0		±0.1	4.5		
		2nd	3.2		±0.1	2.9		
15	Wear of input shaft seal ring	Width	2.56		–0.01 –0.03	2.30		
		Thickness	1.7		±0.1	1.55		
16	Wear of input shaft seal ring	Width	3.0		–0.01 –0.03	2.70		
		Thickness	2.5		±0.1	2.35		
17	Wear of input shaft seal ring	Width	3.0		–0.01 –0.03	2.70		
		Thickness	3.3		±0.1	3.15		
18	Wear of input shaft seal ring	Width	3.0		–0.01 –0.03	2.70		
		Thickness	1.9		±0.1	1.75		

Unit: mm

No.	Check item		Criteria			Remedy
			Standard size	Tolerance	Repair limit	
19	Wear of R spacer seal ring	Width	4.5	–0.01 –0.03	4.05	
		Thickness	6.0	±0.15	5.85	
20	Wear of housing seal ring	Width	4.0	–0.01 –0.04	3.60	
		Thickness	5.0	±0.15	4.85	
21	Wear of 4th spacer housing seal ring	Width	4.0	–0.01 –0.03	3.60	
21	Wear of seal ring of 4th spacer housing	Thickness	5.1	±0.12	4.95	
22	Wear of 2nd clutch piston housing seal ring	Width	5.0	–0.01 –0.03	4.50	
		Thickness	6.0	±0.15	5.85	
23	Wear of output shaft seal ring	Width	3.0	–0.01 –0.03	2.70	
		Thickness	1.9	±0.1	1.75	
24	Backlash between sun gear and planetary pinion	R	0.13 – 0.31			Replace
		F, 4th, 3rd, 1st	0.14 – 0.35			
25	Backlash between planetary pinion and ring gear	R	0.15 – 0.38			
		F, 4th, 3rd, 1st	0.15 – 0.39			
26	Backlash between input gear and idler gear		0.190 – 0.486			
27	Tolerance for fitness of input gear bearing (Rear)		Standard size	Tolerance		
				Shaft	Hole	
		Outside diameter	200	0 –0.030	–0.014 –0.060	
		Inside diameter	110	+0.045 +0.023	0 –0.020	
28	Tolerance for fitness of input gear bearing (Front)	Outside diameter	190	0 –0.030	–0.022 –0.051	
		Inside diameter	105	+0.045 +0.023	0 –0.020	
29	Clearance between cage and case		Standard clearance		Clearance limit	
			0.85 – 1.70 (Standard shim thickness: 1.1)		—	

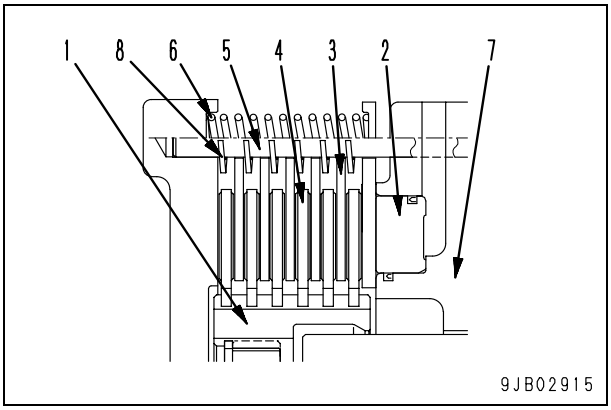

4
4
4
4
98-123Nm
{10-12.5kgm}
3
7
5
6
824-1030Nm
{84-105kgm}
824-1030Nm
{84-105kgm}
1
2
5
6
8
B – B
9JB02910

Unit: mm

<table>
<tr><th>No.</th><th colspan="2">Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2" colspan="2">Outside diameter of coupling oil seal contact surface (Rear)</td><td>Standard size</td><td>Tolerance</td><td colspan="2">Repair limit</td><td rowspan="3">Repair by hard chromium-plating or replace</td></tr>
<tr><td>105</td><td>0
–0.087</td><td colspan="2">104.8</td></tr>
<tr><td>2</td><td colspan="2">Outside diameter of coupling oil seal contact surface (Front)</td><td>125</td><td>0
–0.087</td><td colspan="2">124.8</td></tr>
<tr><td>3</td><td colspan="2">Backlash between idler gear and output gear</td><td colspan="4">0.190 – 0.486</td><td rowspan="9">Replace</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Tolerance for fitness of idler gear bearing</td><td rowspan="2">Standard size</td><td colspan="3">Tolerance</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>Outside diameter</td><td>200</td><td>0
–0.030</td><td>–0.014
–0.060</td></tr>
<tr><td></td><td>Inside diameter</td><td>110</td><td>+0.045
+0.023</td><td>0
–0.020</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">Tolerance for fitness of output shaft bearing (Rear)</td><td>Outside diameter</td><td>190</td><td>0
–0.030</td><td>–0.014
–0.060</td></tr>
<tr><td>Inside diameter</td><td>105</td><td>+0.059
+0.037</td><td>0
–0.020</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Tolerance for fitness of output gear bearing (Front)</td><td>Outside diameter</td><td>190</td><td>0
–0.030</td><td>–0.022
–0.051</td></tr>
<tr><td>Inside diameter</td><td>105</td><td>+0.059
+0.037</td><td>0
–0.015</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2" colspan="2">Clearance between cage and case</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td></tr>
<tr><td colspan="2">0.63 – 1.37
(Standard shim thickness: 1.0)</td><td colspan="2">—</td></tr>
<tr><td>8</td><td colspan="2">Clearance between cover and cage</td><td colspan="2">0.38 – 1.23
(Standard shim thickness: 0.5)</td><td colspan="2">—</td></tr>
</table>

Disc clutch

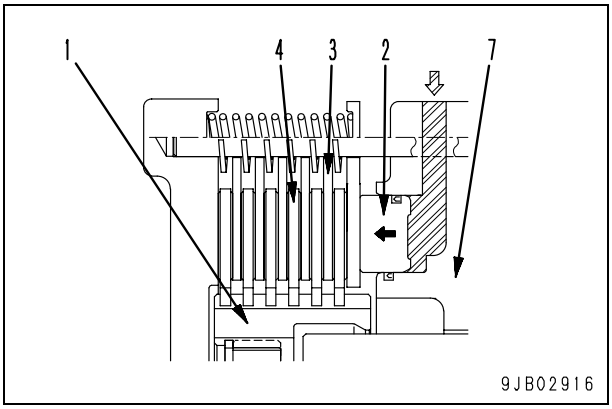
Structure



- Disc clutch is used for fixing ring gear (1). It consists of piston (2), plate (3), disc (4), pin (5), return spring (6) and washer spring (8).
- Inside teeth of disc (4) are engaged with outside teeth of ring gear (1).
- Plate (3) is assembled to clutch housing (7) with pin (5).

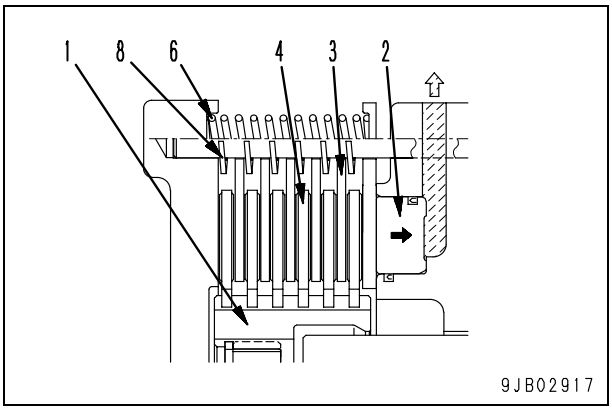
Operation

When clutch is “engaged” (fixed)



- The oil from ECMV is sent with pressure to the rear side of piston (2) through oil the passage of housing (7) and pushes piston (2) leftward.
- Piston (2) contacts plate (3) closely against disc (4) to stop rotation of disc (4) by use of the friction force generated between them.
- Since inside teeth of disc (4) are engaged with outside teeth of ring gear (1), move of ring gear (1) is stopped.

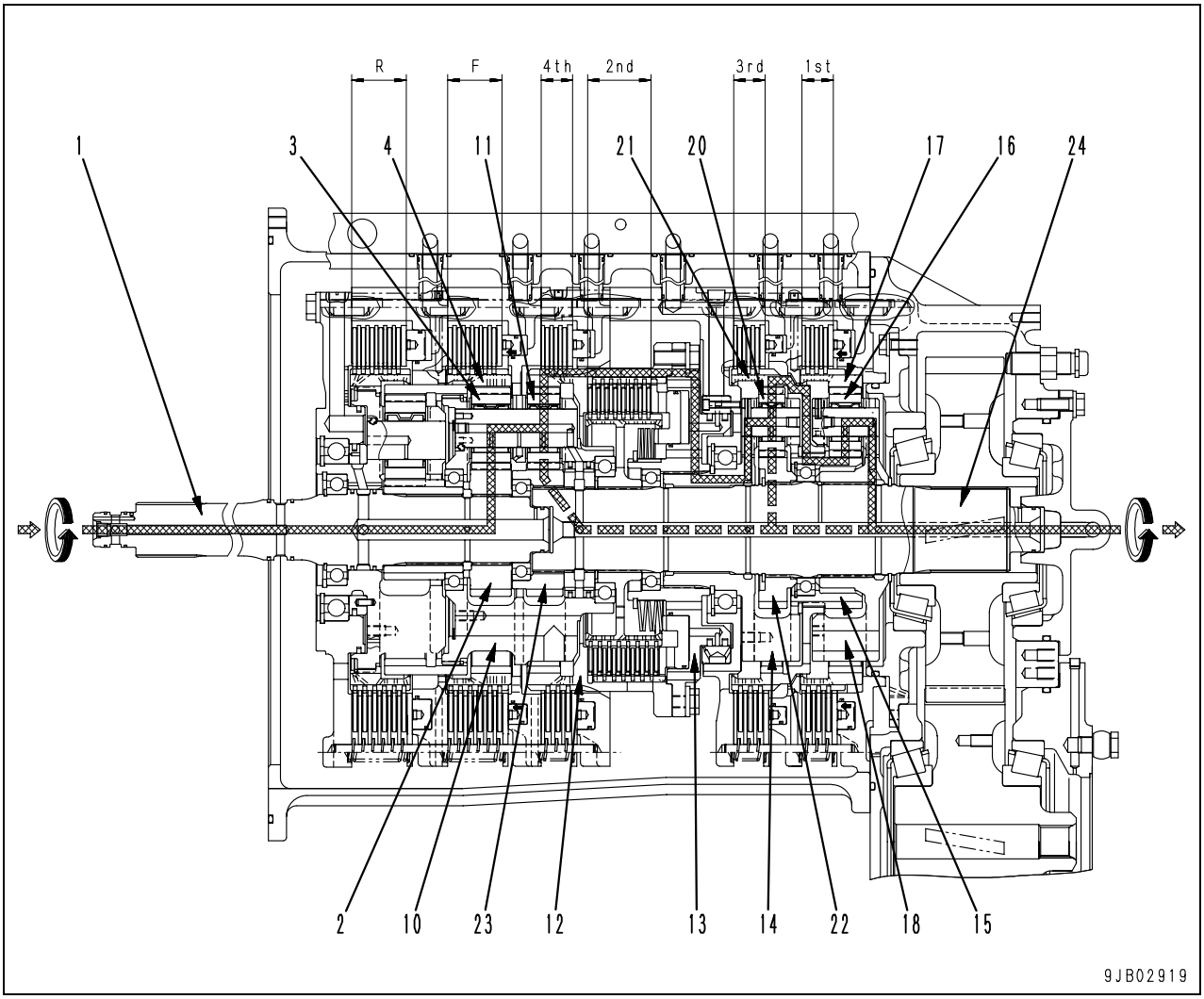
When clutch is “disengaged” (released)



- As the oil from ECMV is stopped, piston (2) is pushed back rightward by return spring (6).
- Plate (3) and disc (4) are released from the frictional force and ring gear (1), as the result, is also released.
- Washer spring (8) is installed between plate (3). This spring quickens return of piston (2) as the clutch is disengaged by providing smooth separation of plate (3) and disc (4). At the same time, it is used for preventing the dragging.

Power transmitting route

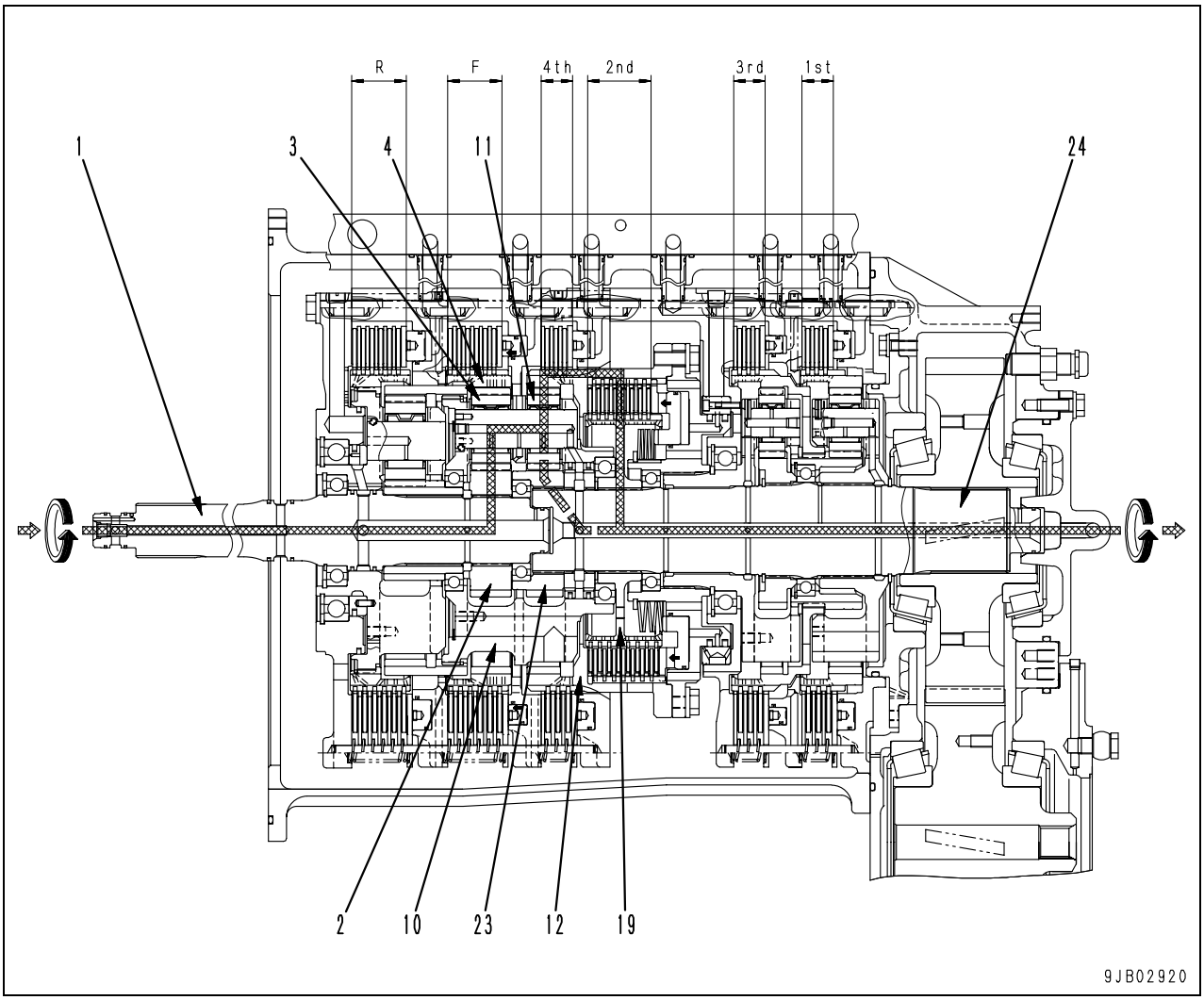
Forward 1st gear speed



F ring gear (4) of F clutch and 1st ring gear (17) of 1st clutch are fixed hydraulically.

The power from torque converter
↓
Input shaft (1)
↓
F sun gear (2)
↓
F planetary pinion (3)
↓
F and 4th carrier (10)
↓
4th planetary pinion (11) → 4th sun gear (23)
↓
4th ring gear (12)
↓
2nd clutch piston housing (13)
↓
3rd carrier (14)
↓
3rd planetary pinion (20) → 3rd sun gear (22)
↓
3rd ring gear (21)
↓
1st sun gear (15)
↓
1st planetary pinion (16)
↓
1st carrier (18)
↓
Output shaft (24)

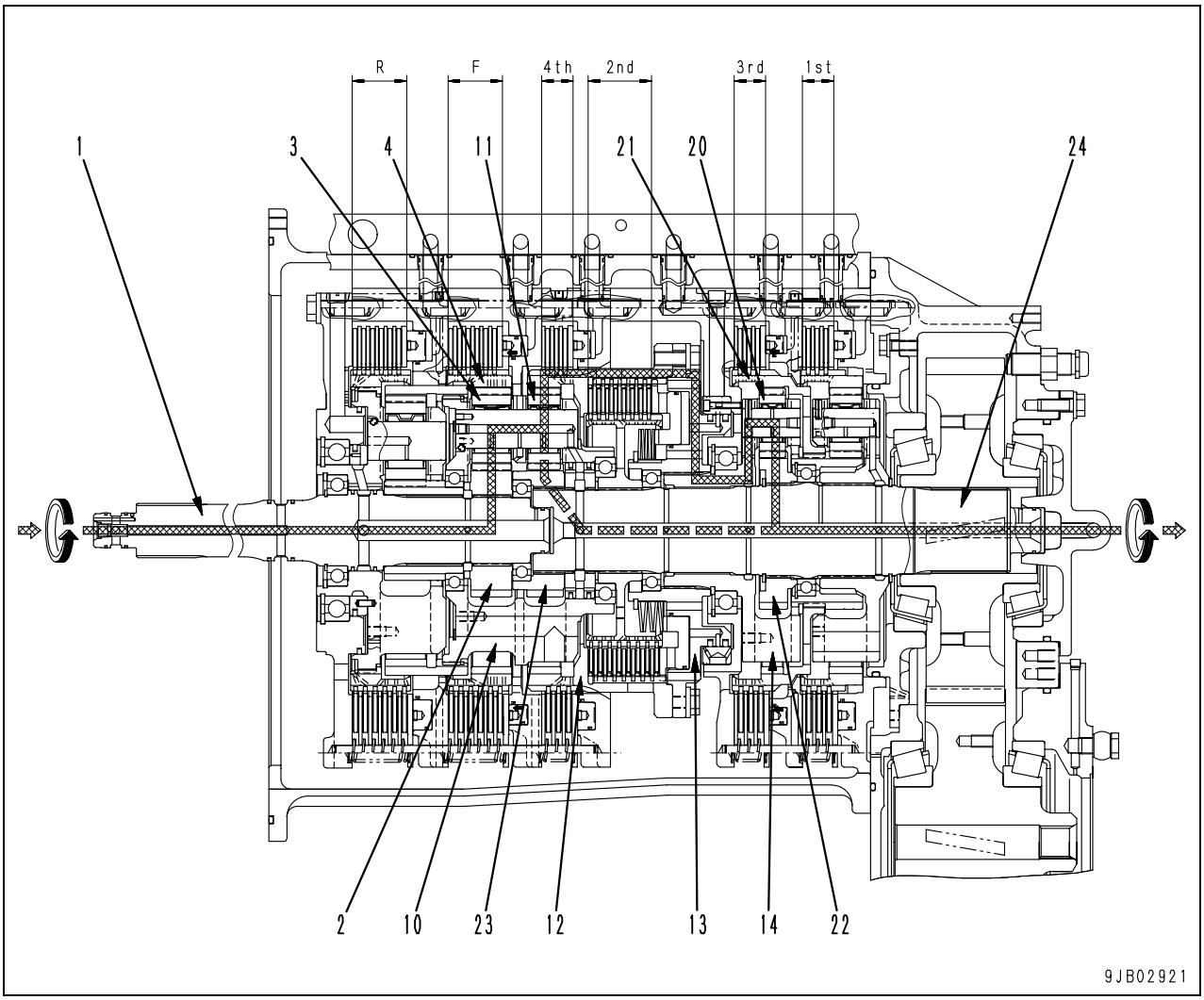
Forward 2nd gear speed



F ring gear (4) of F clutch and 2nd hub (19) of 2nd clutch are fixed hydraulically.

The power from torque converter
↓
Input shaft (1)
↓
F sun gear (2)
↓
F planetary pinion (3)
↓
F and 4th carrier (10)
↓
4th planetary pinion (11) → 4th sun gear (23)
↓
4th ring gear (12)
↓
2nd hub (19)
↓
Output shaft (24)

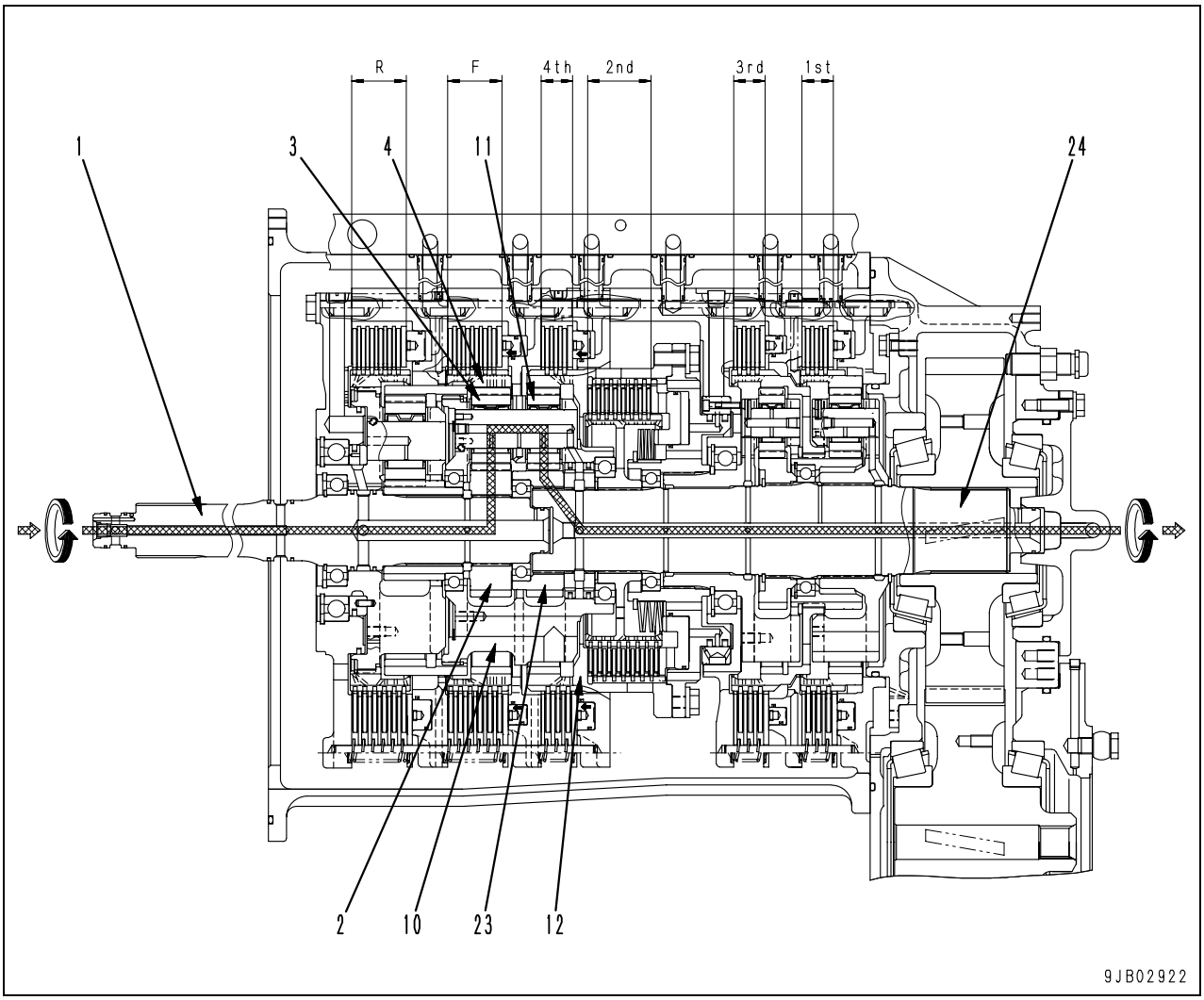
Forward 3rd gear speed



F ring gear (4) of F clutch and 3rd ring gear (21) of 3rd clutch are fixed hydraulically.

The power from torque converter
↓
Input shaft (1)
↓
F sun gear (2)
↓
F planetary pinion (3)
↓
F and 4th carrier (10)
↓
4th planetary pinion (11) → 4th sun gear (23)
↓
4th ring gear (12)
↓
2nd clutch piston housing (13)
↓
3rd carrier (14)
↓
3rd planetary pinion (20)
↓
3rd sun gear (22)
↓
Output shaft (24)

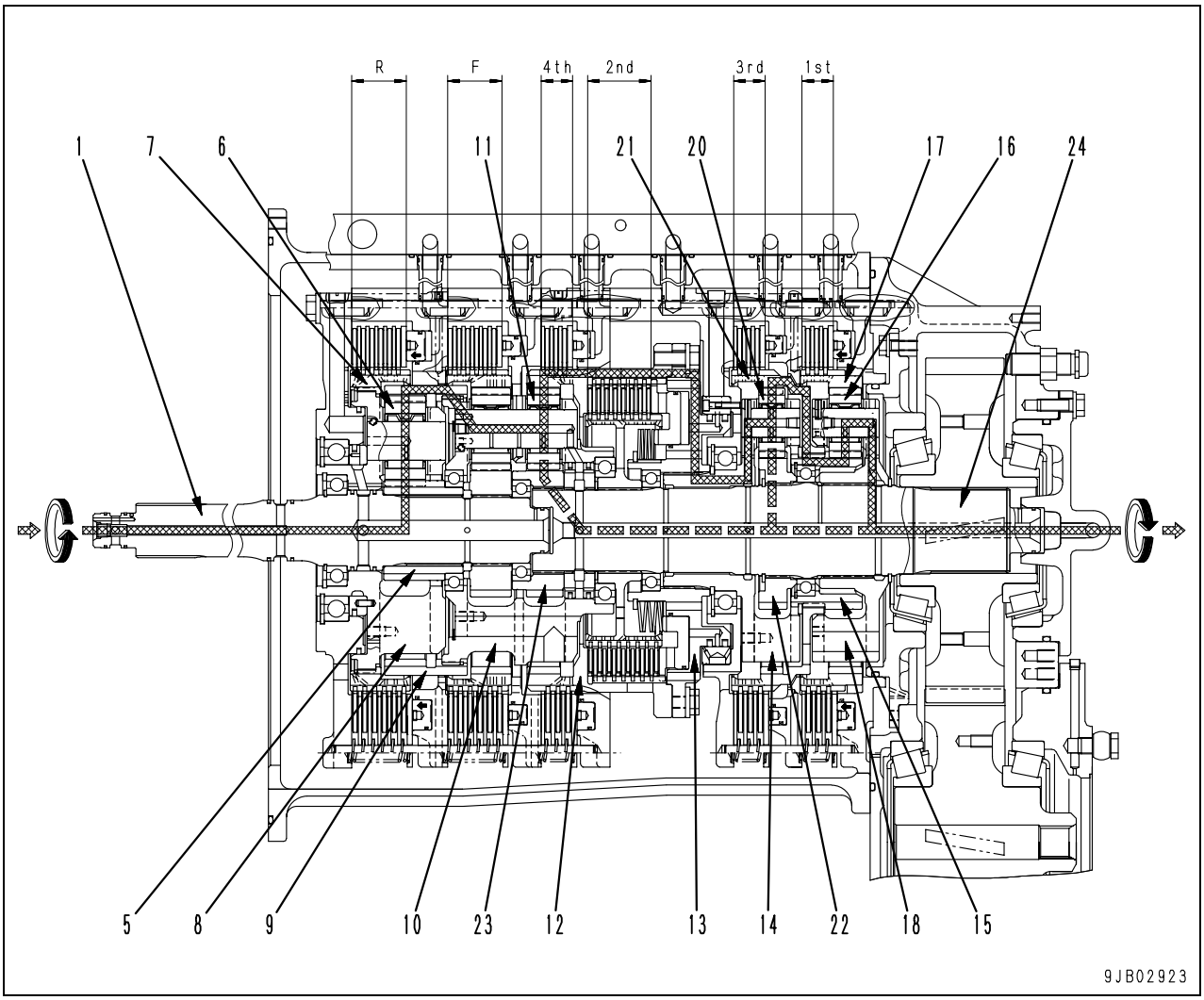
Forward 4th gear speed



F ring gear (4) of F clutch and 4th ring gear (12) of 4th clutch are fixed hydraulically.

The power from torque converter
↓
Input shaft (1)
↓
F sun gear (2)
↓
F planetary pinion (3)
↓
F and 4th carrier (10)
↓
4th planetary pinion (11)
↓
4th sun gear (23)
↓
Output shaft (24)

Reverse 1st gear speed



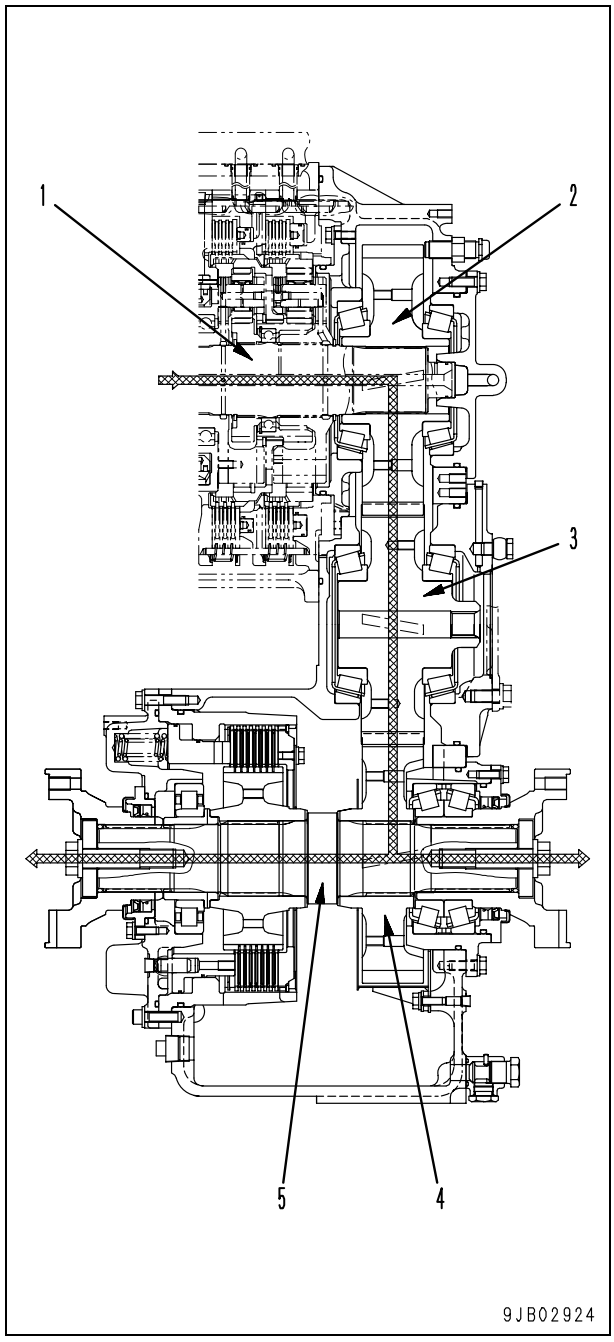
R ring gear (7) of R clutch and 1st ring gear (17) of 1st clutch are fixed hydraulically.

The power from torque converter
↓
Input shaft (1)
↓
R sun gear (5)
↓
R planetary pinion (6)
↓
R ring gear (9)
(R carrier (8) is fixed with R ring gear (7) =
R ring gear (9) rotation direction is opposite to
input shaft (1))
↓
F and 4th carrier (10)
↓
4th planetary pinion (11) → → → 4th sun gear (23)
↓ ↓
4th ring gear (12) ↓
↓ ↓
2nd clutch piston housing (13) ↓
↓ ↓
3rd carrier (14) ↓
↓ ↓
3rd planetary pinion (20) → 3rd sun gear (22)
↓ ↓
3rd ring gear (21) ↓
↓ ↓
1st sun gear (15) ↓
↓ ↓
1st planetary pinion (16) ↓
↓ ↓
1st carrier (18) ↓
↓ ↓
Output shaft (24) ← ← ← ←

Transfer

Outline

- The transfer is installed in the output side of the transmission and fixed to the transmission case with the bolt.



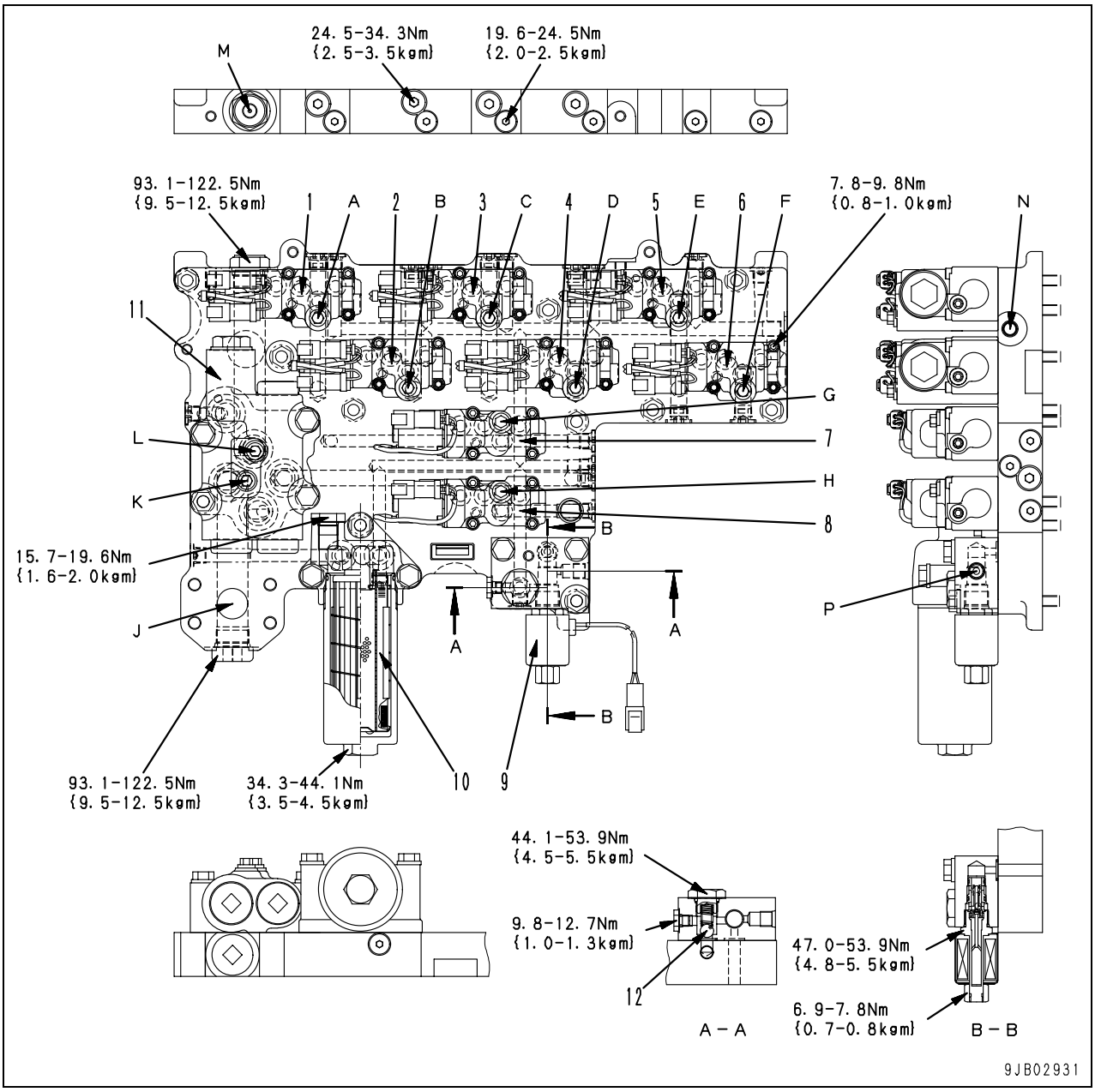
Operation

Power transmitting route

Transmission output shaft (1)
↓
Transfer input gear (2)
↓
Transfer idler gear (3)
↓
Transfer output gear (4)
↓
Output shaft (5) → Rear drive shaft
↓
Center drive shaft
↓
Front drive shaft → Rear axle
↓
Front axle

Transmission control valve

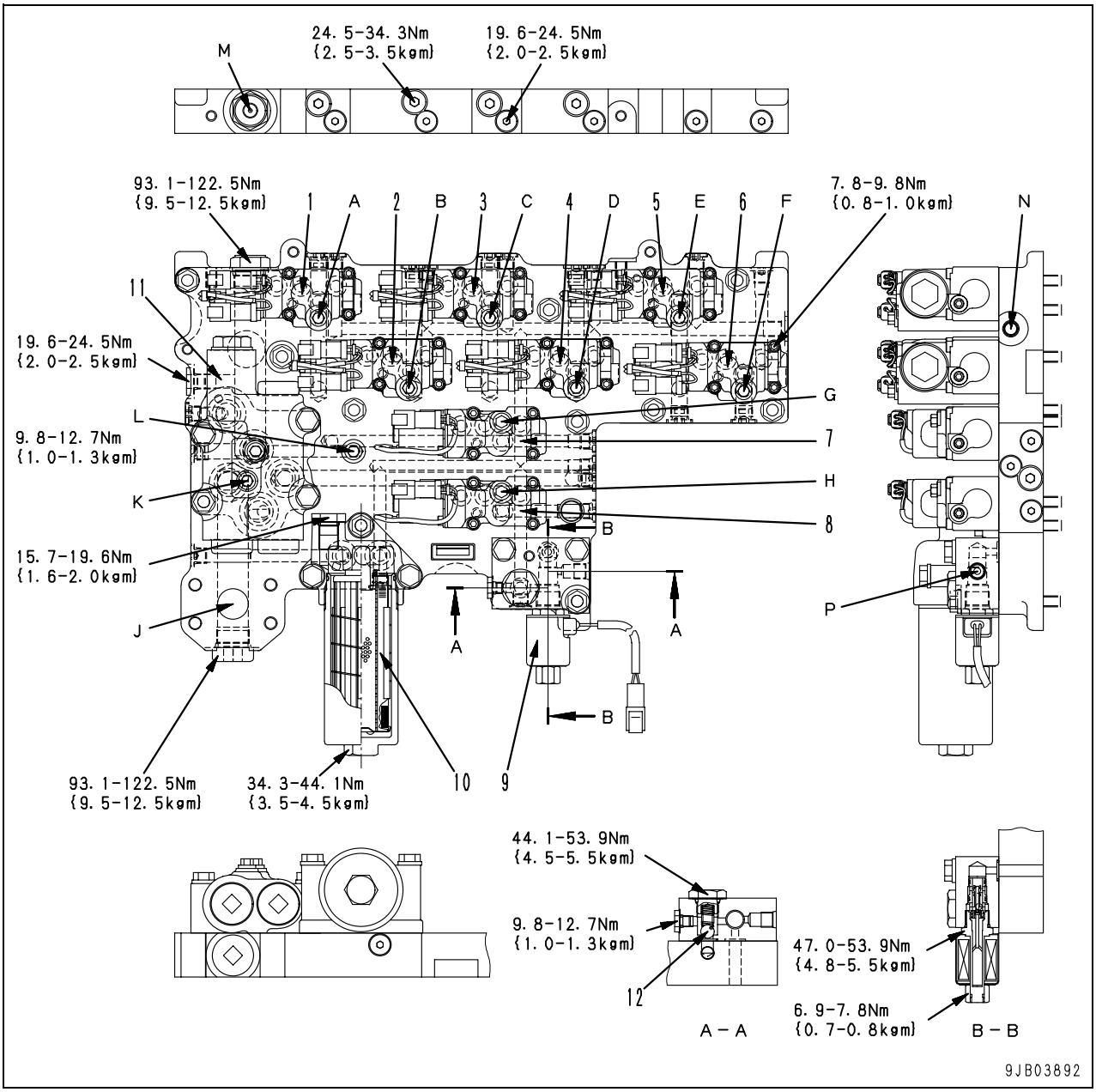
Serial No.: 60001 – (Transmission No. 100090)



A: R clutch oil pressure pickup port
B: F clutch oil pressure pickup port
C: 4th clutch oil pressure pickup port
D: 2nd clutch oil pressure pickup port
E: 3rd clutch oil pressure pickup port
F: 1st clutch oil pressure pickup port
G: Lockup clutch oil pressure pickup port
H: Modulation clutch oil pressure pickup port
J: From power train pump
K: Main relief oil pressure pickup port
L: Torque converter relief pressure pickup port
M: To input transfer lubrication
N: To parking brake emergency release valve (Pilot pressure)
P: To parking brake emergency release valve (To parking brake piston)

1. R clutch ECMV
2. F clutch ECMV
3. 4th clutch ECMV
4. 2nd clutch ECMV
5. 3rd clutch ECMV
6. 1st clutch ECMV
7. Lockup clutch ECMV
8. Modulation clutch ECMV
9. Parking brake solenoid valve
10. Last chance filter
11. Main relief valve and torque converter relief valve
12. Check valve

Serial No.: (Transmission No. 100091) and up



A: R clutch oil pressure pickup port
B: F clutch oil pressure pickup port
C: 4th clutch oil pressure pickup port
D: 2nd clutch oil pressure pickup port
E: 3rd clutch oil pressure pickup port
F: 1st clutch oil pressure pickup port
G: Lockup clutch oil pressure pickup port
H: Modulation clutch oil pressure pickup port
J: From power train pump
K: Main relief oil pressure pickup port
L: Torque converter relief pressure pickup port
M: To input transfer lubrication
N: To parking brake emergency release valve (Pilot pressure)
P: To parking brake emergency release valve (To parking brake piston)

1. R clutch ECMV
2. F clutch ECMV
3. 4th clutch ECMV
4. 2nd clutch ECMV
5. 3rd clutch ECMV
6. 1st clutch ECMV
7. Lockup clutch ECMV
8. Modulation clutch ECMV
9. Parking brake solenoid valve
10. Last chance filter
11. Main relief valve and torque converter relief valve
12. Check valve

Operation table of ECMV

ECMV / Gear speed	F	R	1st	2nd	3rd	4th	L/U	M/C
F1	○		○					○
F2	○			○			○	○
F3	○				○		○	○
F4	○					○	○	○
R1		○	○					○
R2		○		○			○	○
R3		○			○		○	○
R4		○				○	○	○

L/U: lockup clutch ECMV
M/C: modulation clutch ECMV

Outline

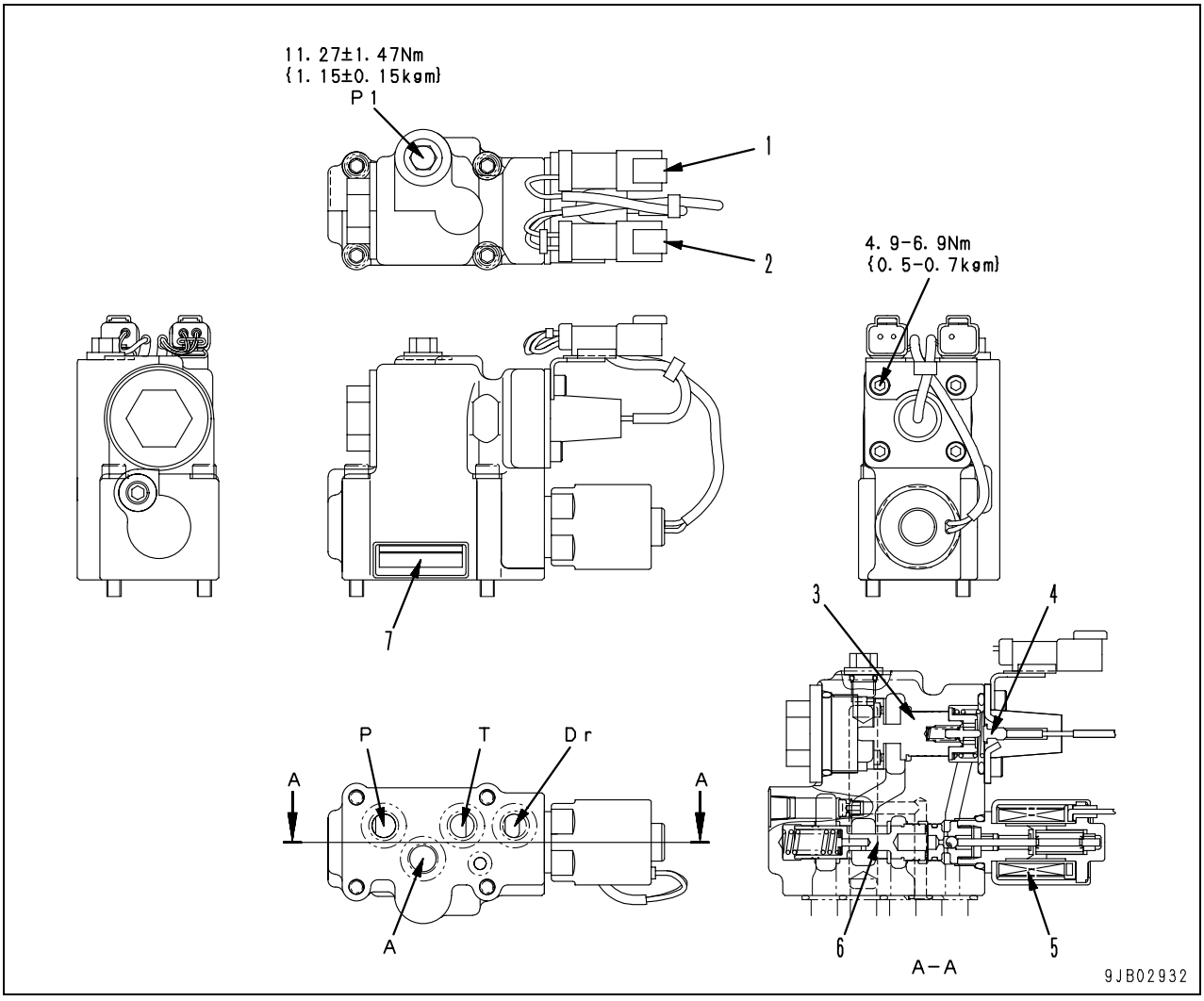
- The oil from the pump flows to the transmission control valve via the oil filter and then oil flow is divided into the main relief circuit and clutch actuation circuit.
- The pressure of the oil sent to the clutch actuation circuit is regulated by the main relief valve, and then used to actuate the clutch and parking brake through the last chance filter. The oil relieved from the main relief valve is supplied to the torque converter.
- When the transmission gear is shifted, the ECMV increases the clutch oil pressure smoothly according to the command current from the transmission controller to reduce the gear shifting shocks. The ECMV also keeps the clutch pressure constant during travel.
- If the F, R, or 1st to 4th ECMV is selected, the regulated oil pressure is supplied to the selected clutch to set the transmission in the desired gear speed.
- In the 2nd, 3rd and 4th speed travel, the lockup clutch ECMV operates at a speed higher than the speed being specified from the transmission controller.
- The modulation clutch ECMV operates at every gear speed.

ECMV

★ ECMV: Abbreviation for Electronic Control Modulation Valve

For F, R, 1st, 2nd, 3rd, and 4th clutch

★ Don't try to disassemble it since adjustment for maintaining the performance will be needed.



A: To clutch
P: From pump
T: Drain
Dr: Drain
P1: Clutch oil pressure pickup port

1. Fill switch connector
2. Proportional solenoid connector
3. Flow rate pickup valve
4. Fill switch
5. Proportional solenoid
6. Pressure control valve
7. Nameplate (*1)

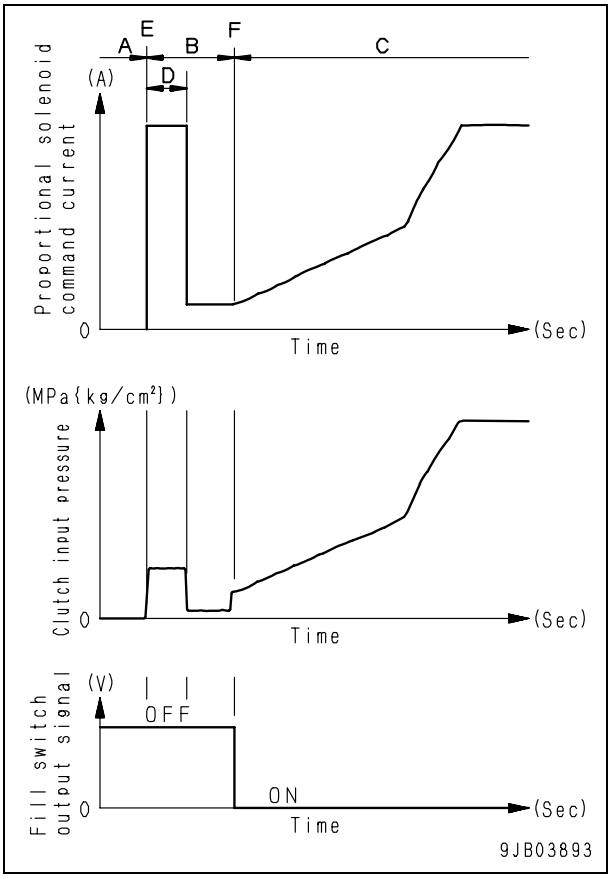
*1:

Clutch used	Printing on name plate
F, R, 1st, 2nd, 3rd, 4th	D*******

Outline of ECMV

- The ECMV consists of 1 pressure control valve and 1 fill switch.
- **Pressure control valve**
  This valve receives the current sent from the transmission controller with a proportional solenoid, and then converts it into oil pressure.
- **Fill switch**
  This switch detects that the clutch is filled with oil and has the following functions.

1. Outputs a signal (a fill signal) to the controller to notify that filling is completed when the clutch is filled with oil.
2. Keeps outputting signals (fill signals) to the controller to notify whether oil pressure is applied or not while oil pressure is applied to the clutch.



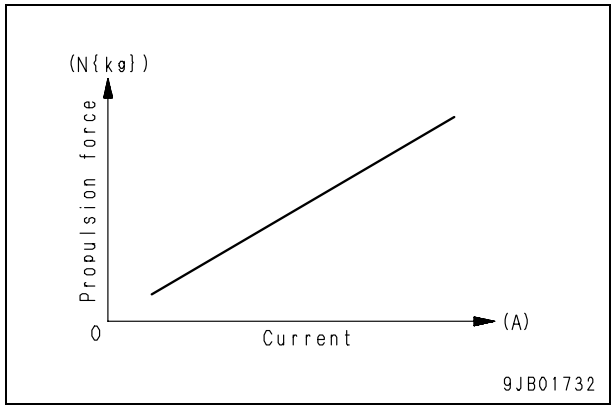
Range A: Before shifting gear (When draining)
Range B: During filling
Range C: Pressure regulation
Range D: During filling (During triggering)
Point E: Start of filling
Point F: Finish of filling

★ The logic is so made that the controller will not recognize completion of filling even if the fill switch is turned “ON” during triggering (Range D).

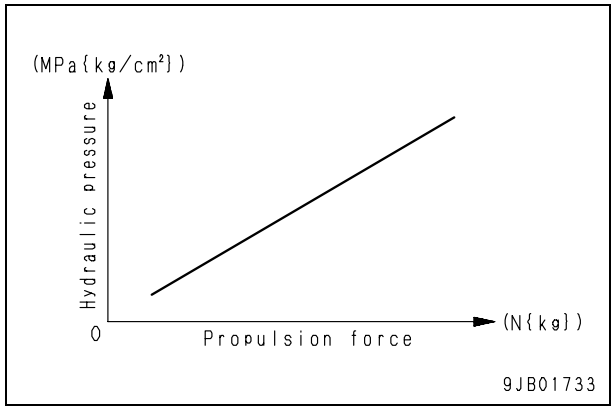
ECMV and proportional solenoid

- For each ECMV, 1 proportional solenoid is installed.
  The proportional solenoid generates thrust shown below according to the command current from the controller.
  The thrust generated by the proportional solenoid is applied to the pressure control valve spool to generate oil pressure as shown in the figure below. Accordingly, the thrust is changed by controlling the command current to operate the pressure control valve to control the flow and pressure of the oil.

Current – Propulsion force characteristics of proportional solenoid



Propulsion force – Hydraulic pressure characteristics of proportional solenoid

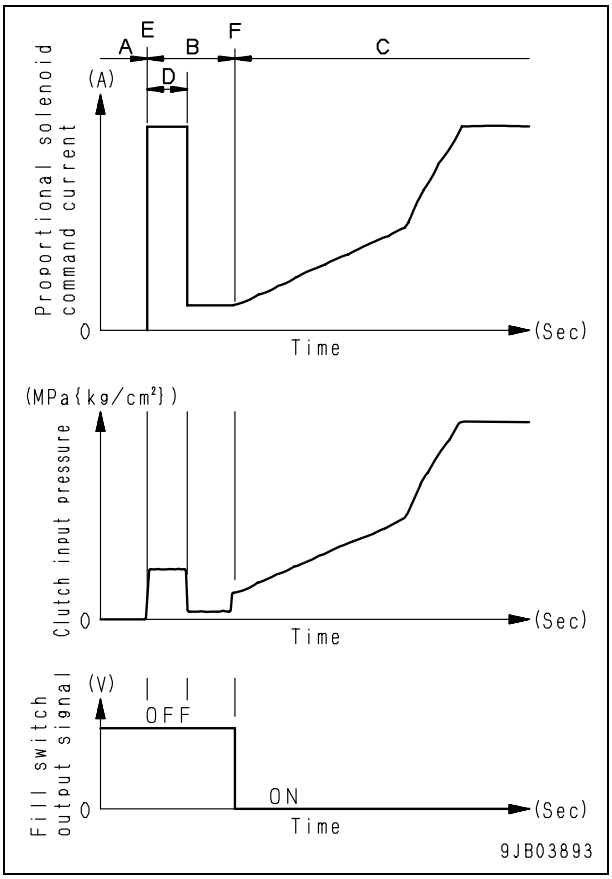


ECMV and fill switch

- For each ECMV, 1 fill switch is installed.
  If the clutch is filled with oil, the fill switch is turned “ON” by the pressure of the clutch. The oil pressure is built up according to this signal.

Operation of ECMV

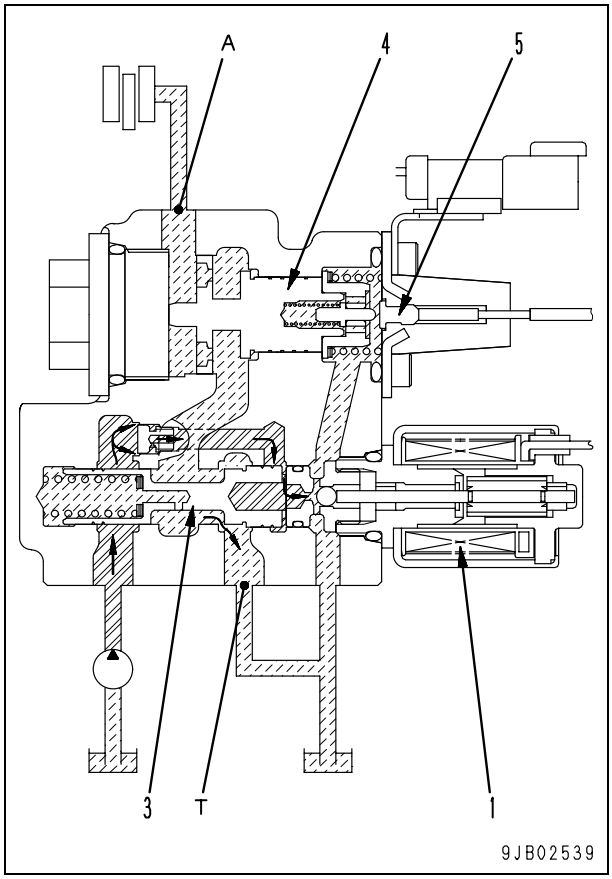
- ECMV is controlled with the command current sent from the controller to the proportional solenoid and the fill switch output signal.
  The relationship between the proportional solenoid command current of ECMV, clutch input pressure, and fill switch output signal is shown below.



Range A: Before shifting gear (When draining)
Range B: During filling
Range C: Pressure regulation
Range D: During filling (During triggering)
Point E: Start of filling
Point F: Finish of filling

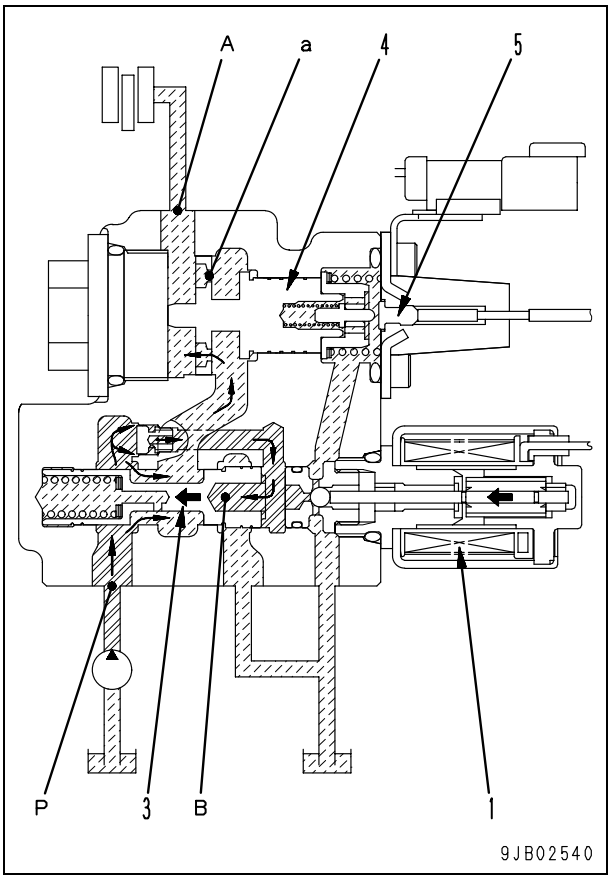
★ The logic is so made that the controller will not recognize completion of filling even if the fill switch is turned “ON” during triggering (Range D).

Before shifting gear (when draining) (Range A in chart)



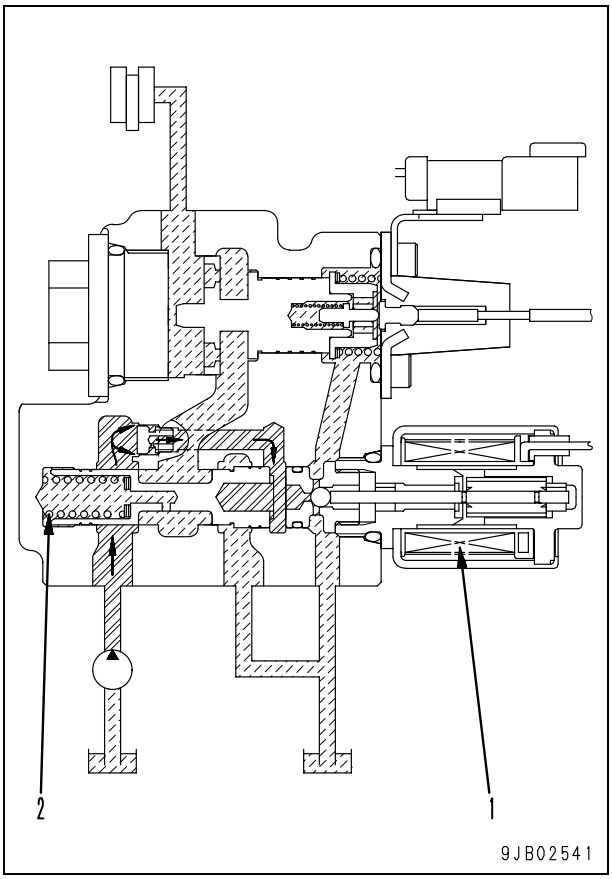
- While no current is flowing in proportional solenoid (1), pressure control valve (3) drains the oil from clutch port (A) through drain port (T).
  At this time, since no oil pressure is applied to flow rate pickup valve (4), fill switch (5) is turned “OFF”.

During filling (Range B in chart)



- If a current is given to proportional solenoid (1) while there is no oil in the clutch, a hydraulic force balanced with the solenoid force is applied to chamber (B) and it pushes pressure control valve (3) to the left. This conducts oil through pump port (P) and orifice (a) of flow rate pickup valve (4) to start filling the oil to the clutch chamber. At this time, differential pressure is generated between the upper stream and down stream of orifice (a) of flow rate pickup valve (4). This differential pressure pushes flow rate pickup valve (4) leftward.
  As the clutch chamber is filled up with oil and oil flow from pump port (P) to clutch port (A) is stopped, differential pressure before and after orifice (a) of flow rate pickup valve (4) disappears. As the result, flow rate pickup valve (4) is pushed rightward, turning “ON” fill switch (5).

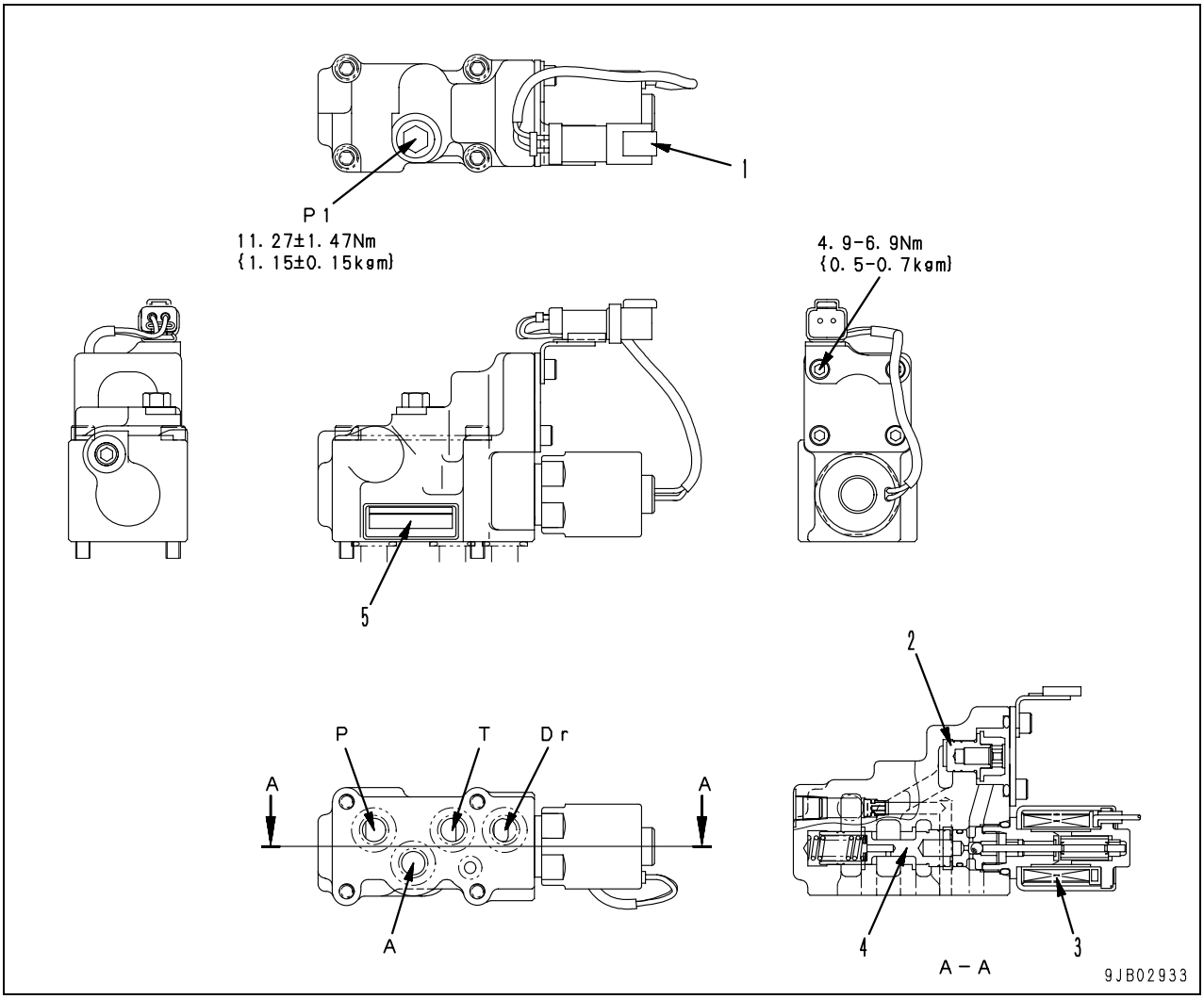
Pressure regulation (Range C in chart)



- If a current flows in proportional solenoid (1), the solenoid generates thrust in proportion to the current. This thrust of the solenoid is balanced with the sum of the thrust generated by the oil pressure in clutch port and the tension of pressure control valve spring (2), and then the pressure is settled.

ECMV for lockup and modulation clutch

★ Don't try to disassemble it since adjustment for maintaining the performance will be needed.



A: To clutch
P: From pump
T: Drain
Dr: Drain
P1: Clutch oil pressure pickup port

1. Proportional solenoid connector
2. Sleeve
3. Proportional solenoid
4. Pressure control valve
5. Nameplate (*1)

*1:

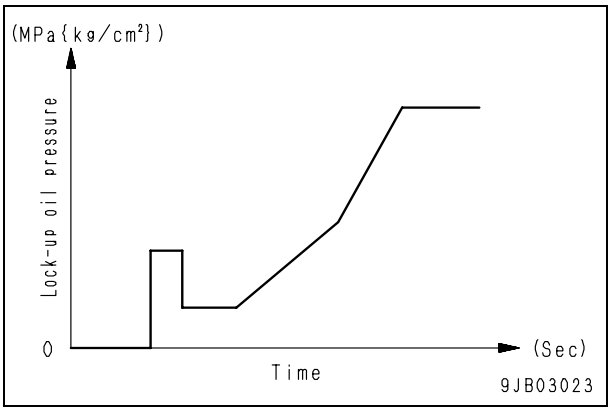
Clutch used	Printing on name plate
Lockup, modulation	K*******

Outline

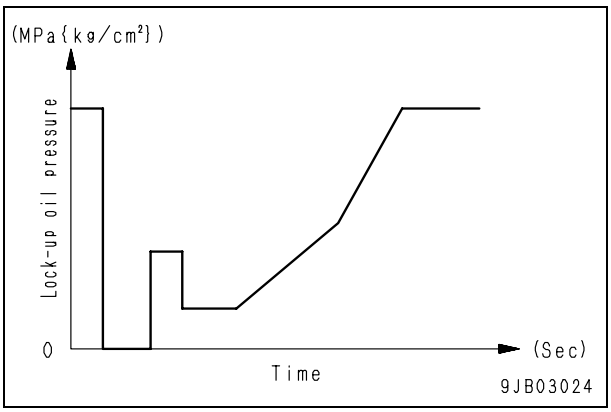
ECMV for lockup clutch

- This valve is used to switch the clutch in order to regulate the clutch oil pressure to the set pressure.
  Since the modulation waveform is used for the pressure application characteristics to the clutch, ECMV is capable of connecting the lockup clutch smoothly, thereby reducing shocks resulting from gear shift. Above also prevents generation of peak torque in the power train. These arrangements make the machine comfortable to operator and enhance durability of the power train.

When changing from torque converter travel to direct travel



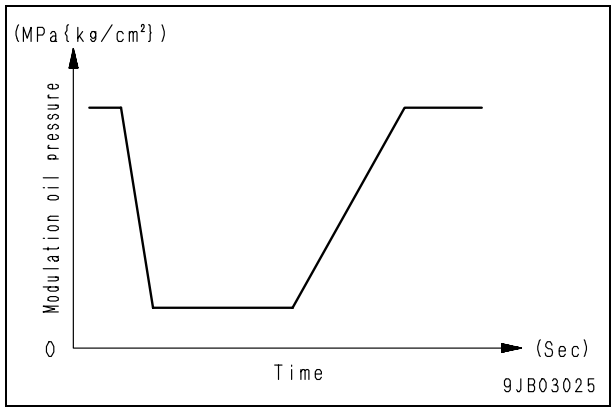
At gear shift (in direct travel)



ECMV for modulation clutch

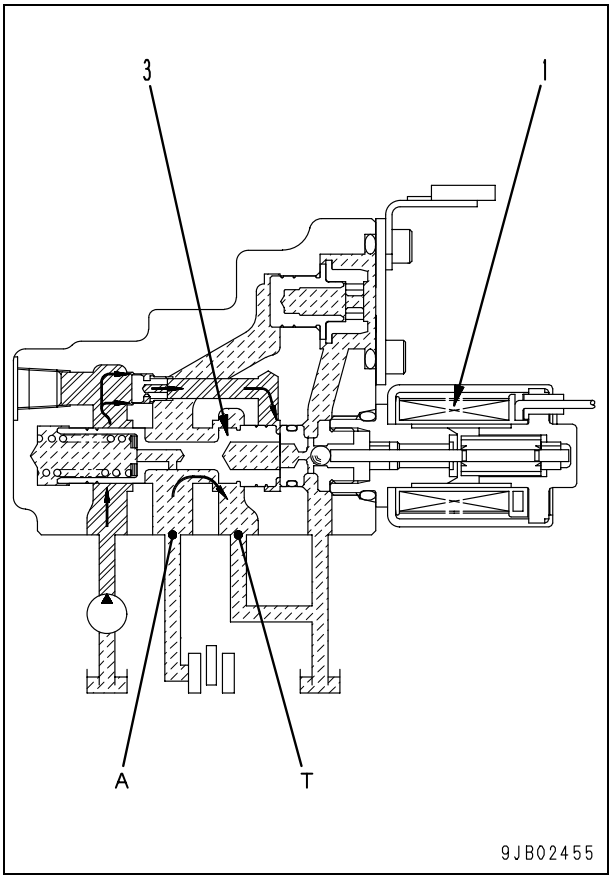
- This valve is used for regulating the clutch oil pressure to the set pressure.
  It controls oil pressure by employing the proportional solenoid for adjusting slip ratio of the clutch.
  Responding to the command current from the controller, the valve controls oil pressure by applying the thrust generated on the proportional solenoid to the pressure control valve spool.
  In order to control the oil pressure, this valve changes levels of the thrust applied to the pressure control valve by controlling the command current.

Oil pressure control of modulation clutch



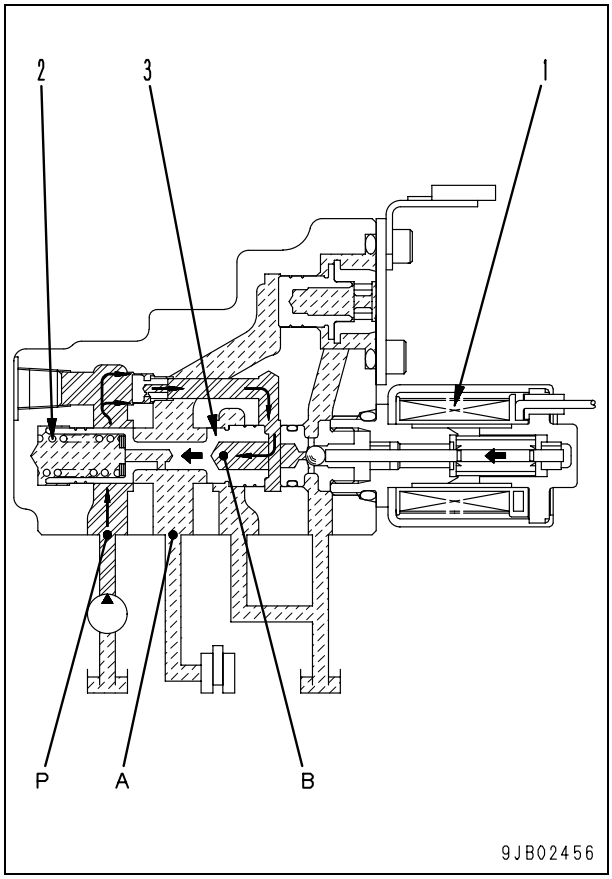
Operation

When clutch is “disengaged” (released)



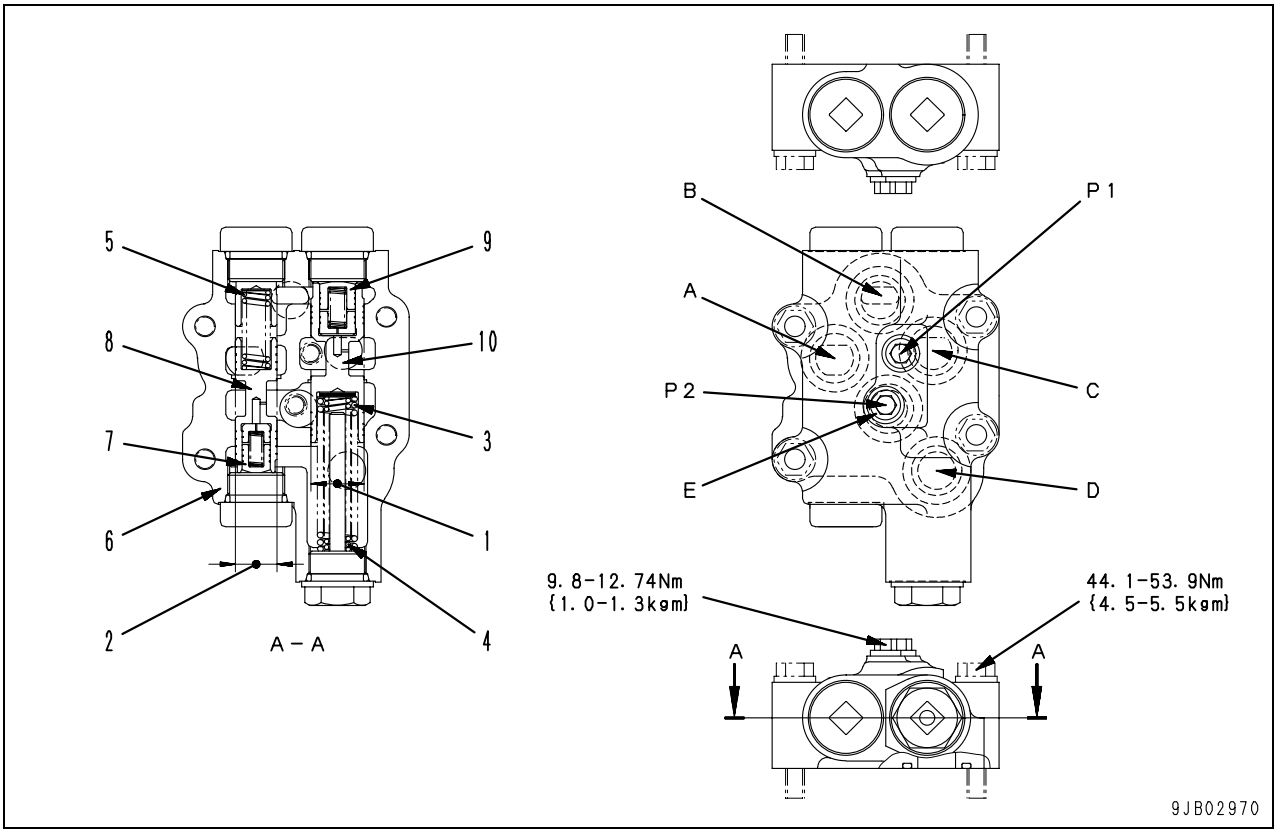
- While no current is flowing in to proportional solenoid (1), pressure control valve (3) drains the oil from clutch port (A) through drain port (T).

When clutch is “engaged” (fixed)



- As current is conducted to proportional solenoid (1), the oil pressure being balanced with the solenoid force is applied to chamber (B), pushing pressure control valve (3) leftward. Above opens pump port (P) and clutch port (A) to start filling oil to the clutch.
- As the clutch is filled with oil, the solenoid thrust is balanced with the sum of the thrust generated from oil pressure of the clutch port and the tension of the pressure control valve spring (2), and then the pressure is settled.

Main relief valve and torque converter relief valve



Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between main relief valve and valve body	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		28	–0.035 –0.045	+0.013 0	0.035 – 0.058	0.078	
2	Clearance between torque converter relief valve and valve body	22	–0.035 –0.045	+0.013 0	0.035 – 0.058	0.078	
3	Main relief valve spring (Outside)	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		128	78.3	479.1 N {48.9 kg}	124.2	456 N {46.5 kg}	
4	Main relief valve spring (Inside)	108	78.3	365.5 N {37.3 kg}	104.8	347 N {35.4 kg}	
5	Torque converter relief valve spring	50	41.5	162.5 N {16.5 kg}	48.5	154 N {15.7 kg}	

6. Body
7. Piston
8. Torque converter relief valve
9. Piston
10. Main relief valve

A: Drain (Torque converter relief)
B: Drain
C: From pump
D: Drain
E: To torque converter
P1: Main relief oil pressure pickup port
P2: Torque converter relief pressure pickup port
(Serial No.: 60001 – (Transmission No. 100090))

Outline

Torque converter relief valve

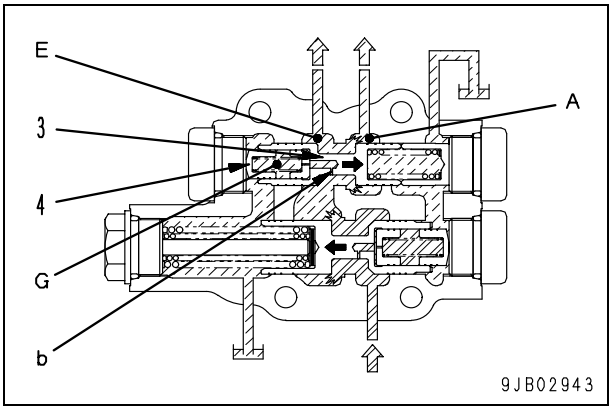
- The torque converter relief valve constantly regulates the torque converter inlet circuit pressure below the set pressure to protect the torque converter from abnormally high pressure.
  Set pressure: 1.02 MPa {10.4 kg/cm^2}
  (Cracking pressure)

Main relief valve

- The main relief valve regulates the pressure in the transmission and parking brake hydraulic circuits to the set pressure.
  Set pressure: 3.58 MPa {36.5 kg/cm^2}
  (At rated engine speed)

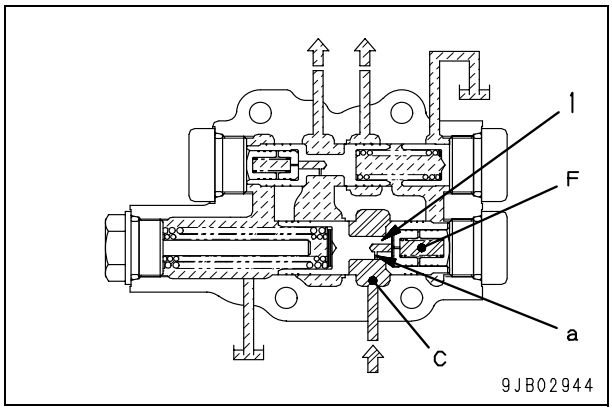
Operation

Operation of torque converter relief valve

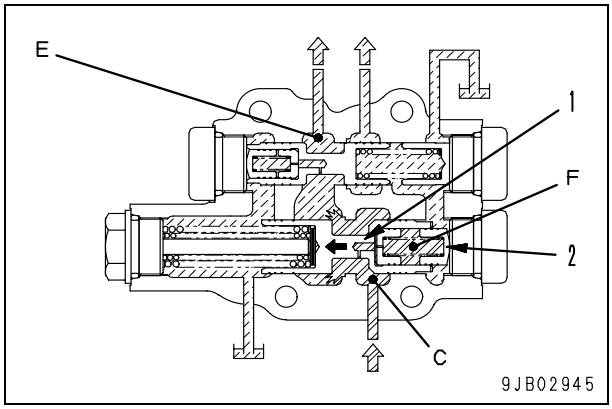


- The oil relieved through the main relief valve flows through port (E) into the torque converter. It also flows through orifice (b) of torque converter relief valve (3) into chamber (G).
- As the oil pressure to the torque converter rises beyond the set pressure, the oil conducted to chamber (G) pushes piston (4) and the resulting reaction force pushes torque converter relief valve (3) rightward, opening ports (E) and (A).
  As the result, the oil in port (E) is drained to the oil tank through port (A).

Operation of main relief valve

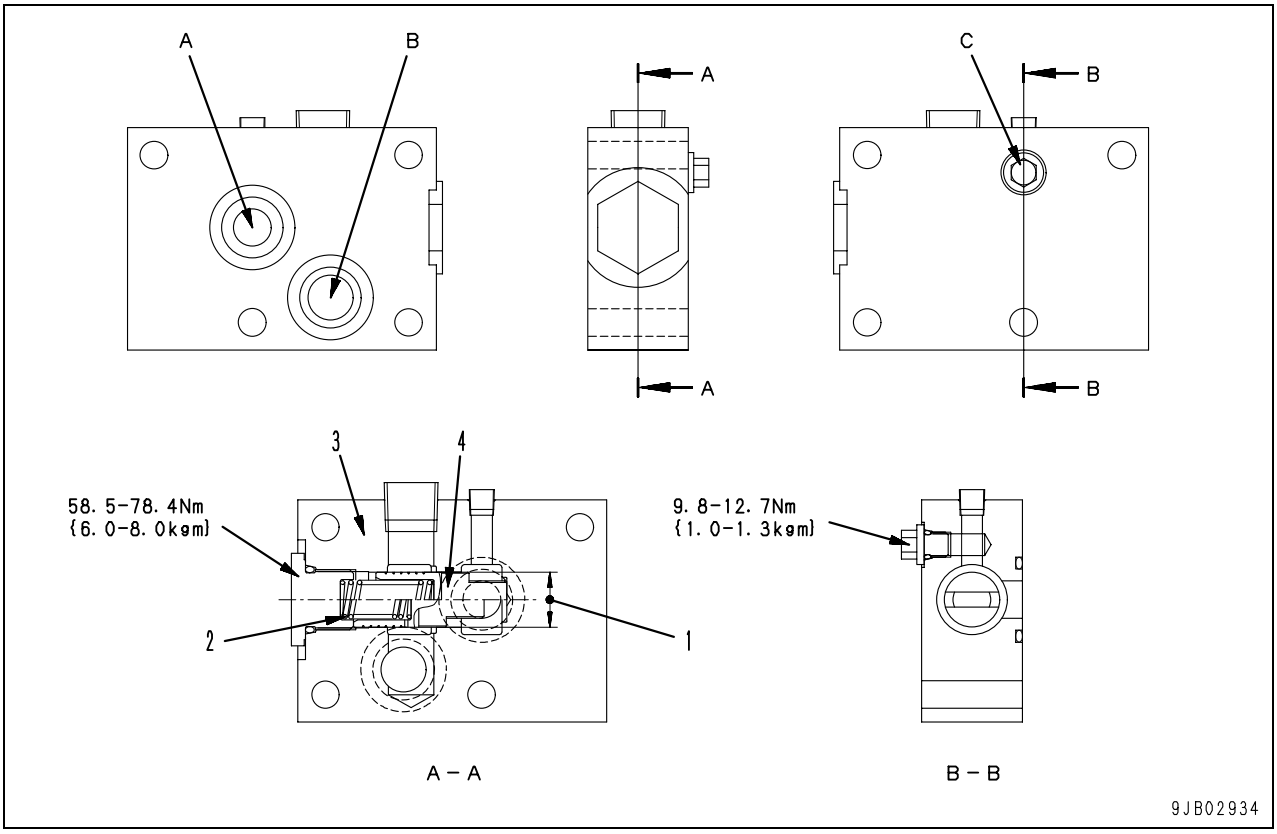


- The oil from the hydraulic pump flows to chamber (F) through the filter, port (C) of the relief valve and orifice (a) of main relief valve (1).



- As the oil pressure in the circuit goes beyond the set pressure, the oil conducted to chamber (F) pushes piston (2) and the resulting reaction force pushes main relief valve (1) leftward, opening ports (C) and (E).
  Above operation conducts the oil from port (E) to the torque converter.

Lubrication relief valve



Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between spool and valve body	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		22	–0.035 –0.045	+0.013 0	0.035 – 0.058	0.078	
2	Valve spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		59.7	37	97.4 N {9.94 kg}	57.9	92.6 N {9.44 kg}	

3. Valve body
4. Spool

A: From oil cooler
B: Drain
C: Lubrication pressure pickup port

Function

- The lubrication relief valve is installed to the transmission valve and used for maintaining the pressure of the lubrication circuit below the set pressure.
  Set pressure: 0.26 MPa {2.7 kg/cm^2}
  (Cracking pressure)

WA600-6 Wheel loader

Form No. SEN00403-02

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

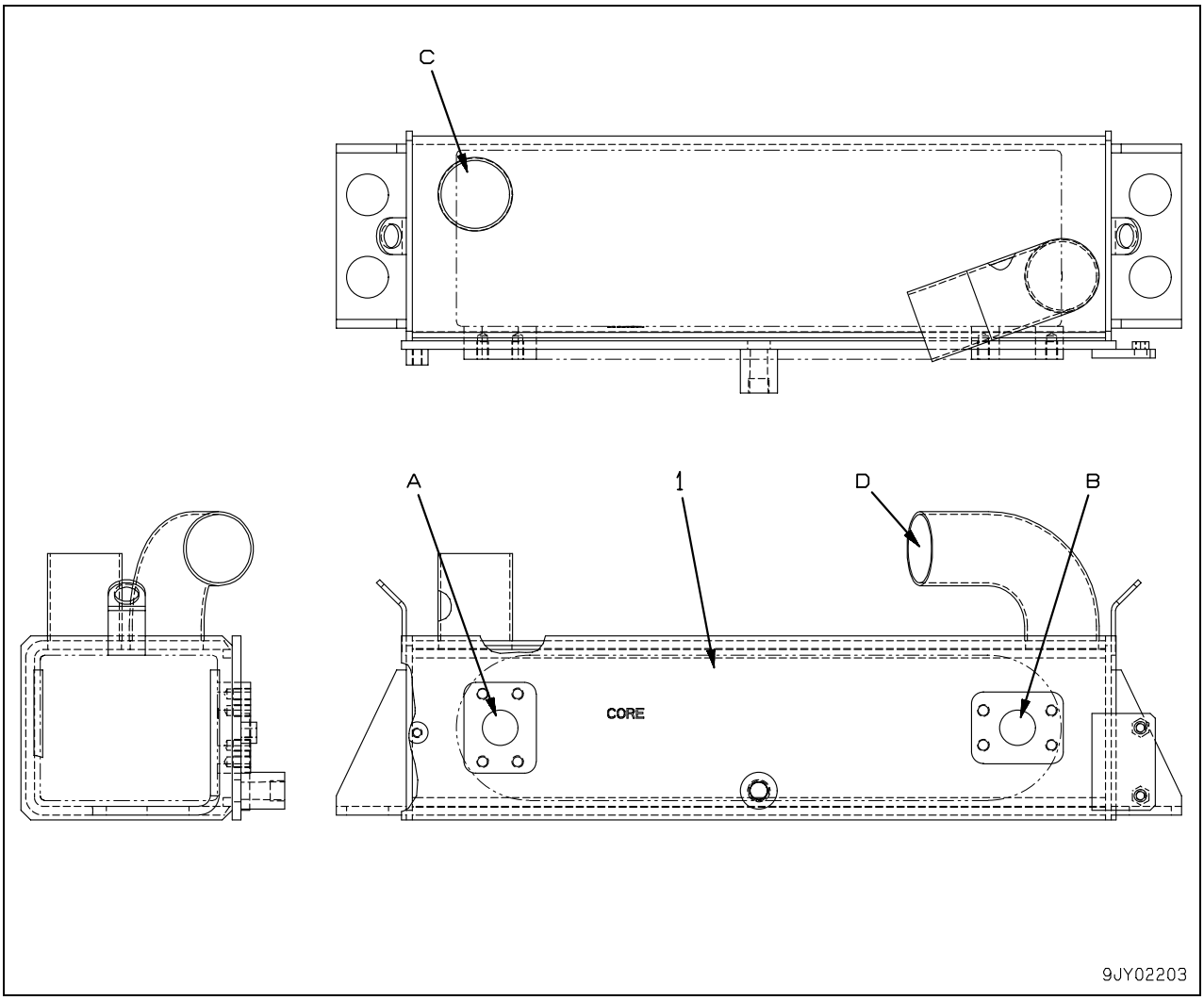
10 Structure, function and maintenance standard

Power train, Part 2

Power train, Part 2 2
Torque converter oil cooler 2
Torque converter oil filter 3
Drive shaft 5
Center support 6
Axle 8
Differential 12
Limited slip differential 21
Final drive 26

Power train, Part 2

Torque converter oil cooler



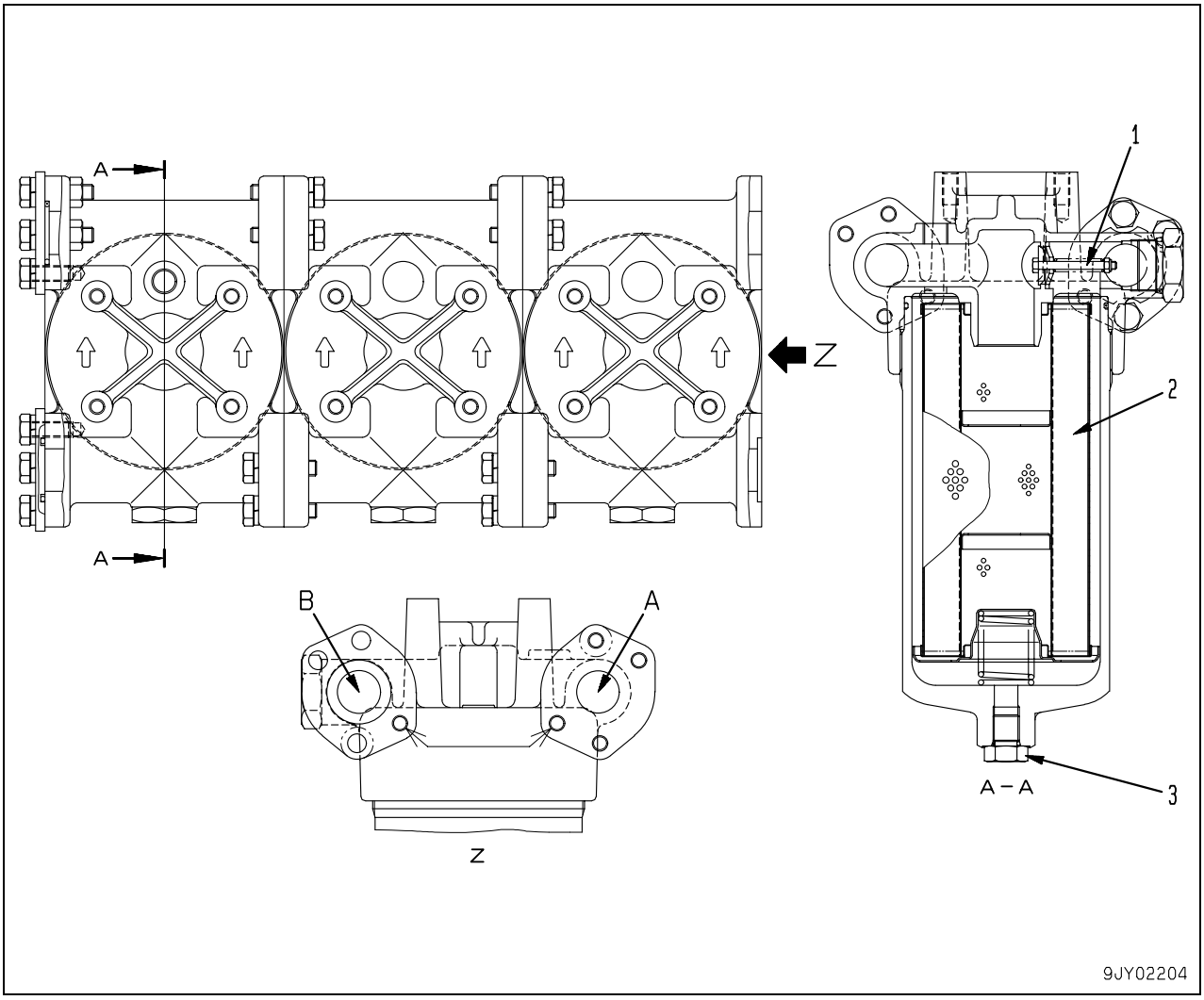
1. Torque converter oil cooler

A: Inlet port
B: Outlet port
C: Coolant inlet
D: Coolant outlet

Outline

Oil from the torque converter is heated by power transmitting energy. This torque converter oil cooler enters the torque converter oil cooler through inlet port (A) to be cooled by engine coolant. Then it flows into the transmission lubrication system through outlet port (B).

Torque converter oil filter



1. Relief valve
2. Element
3. Drain plug

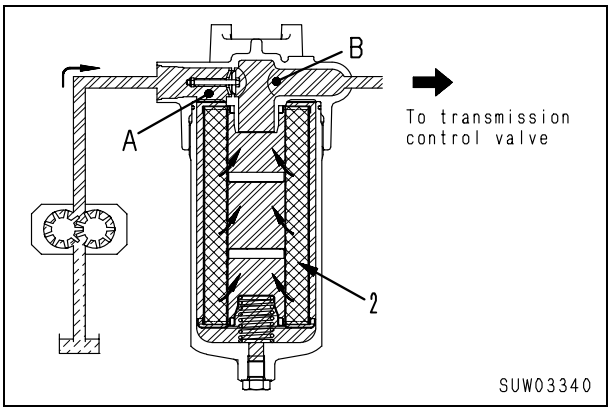
A: Outlet port
B: Inlet port

Specifications

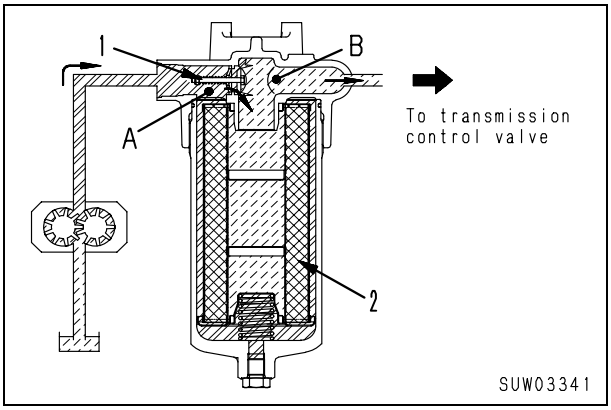
- Filtering area: 8,900 cm^2 x 3
- Relief pressure: 0.29 – 0.34 MPa
  {3 – 3.5 kg/cm^2}
  (Bypass pressure)

Operation

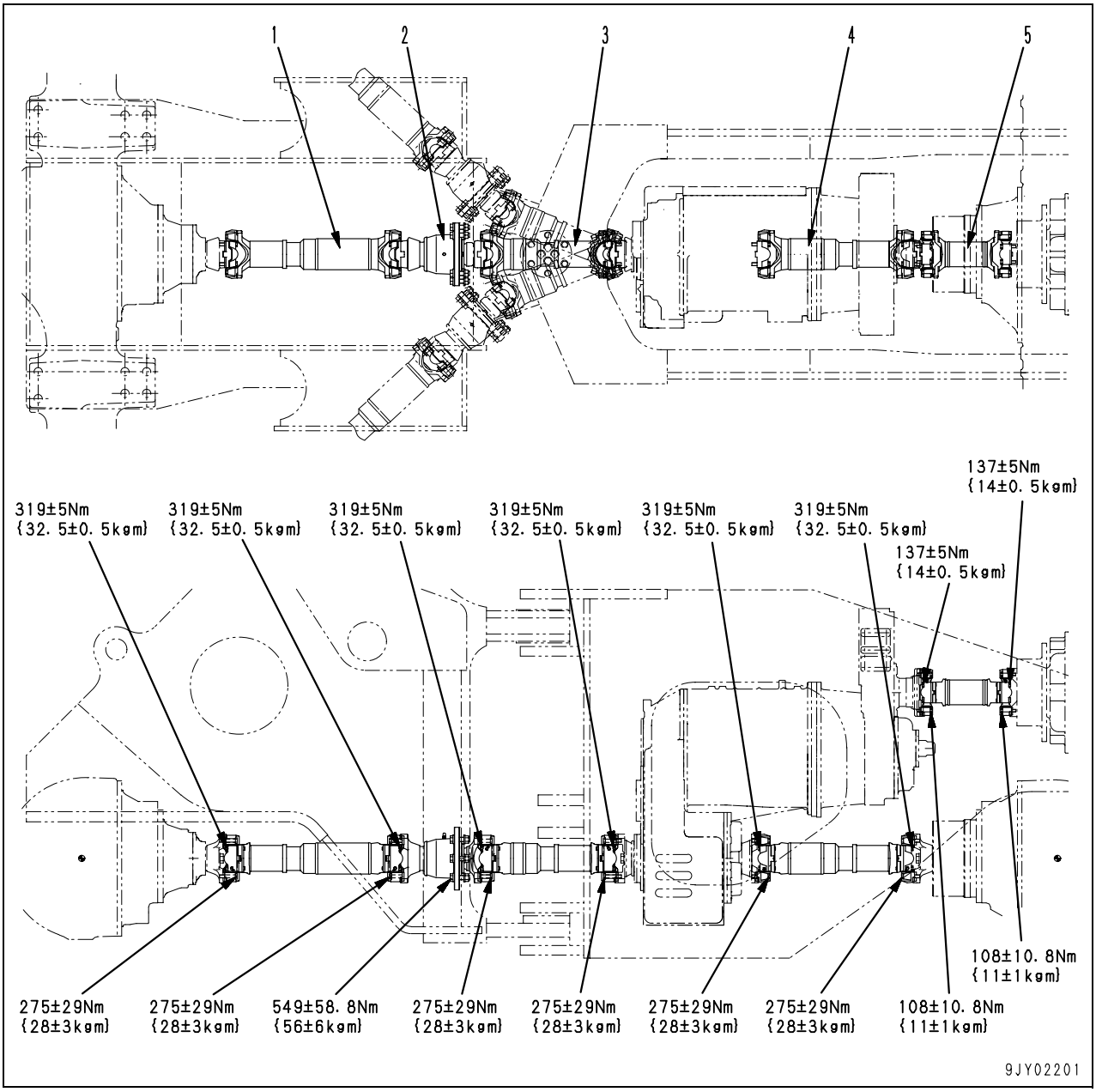
- Oil from the torque converter charge pump enters filter inlet port (A). It passes from outside to inside of element (2), and flows to outlet port (B).



- When element (2) is clogged with foreign matters, or when low oil temperature has caused pressure at inlet port (A) to increase, oil from inlet port (A) opens relief valve (1) to flow to outlet port (B) directly, preventing the pump and element (2) from being damaged.



Drive shaft

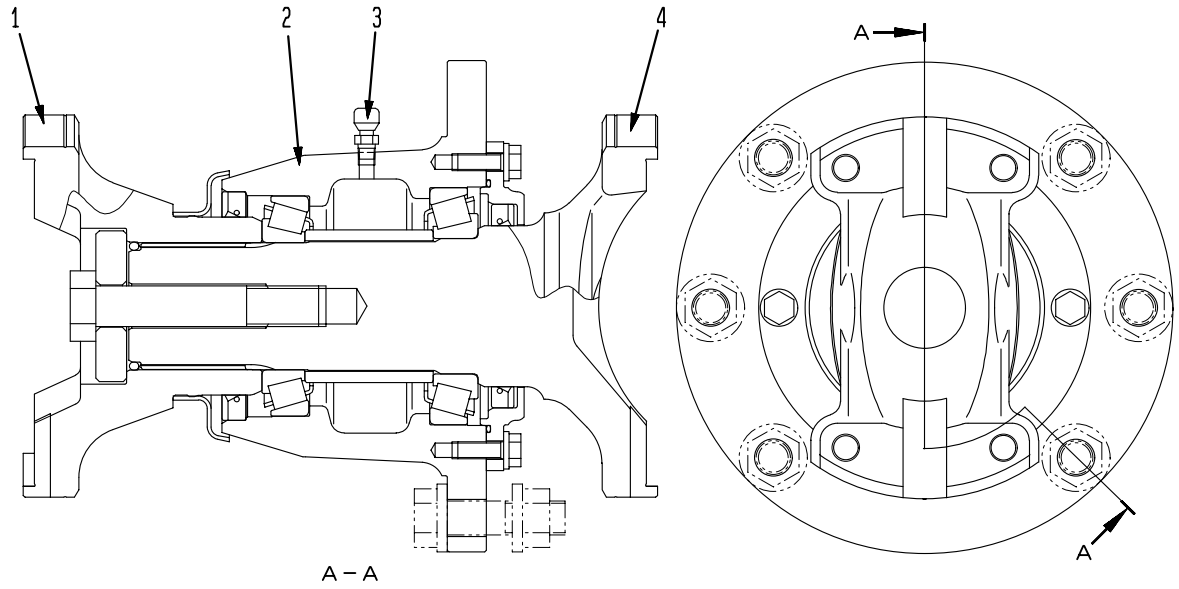


1. Front drive shaft
2. Center support
3. Center drive shaft
4. Rear drive shaft
5. Upper drive shaft

Outline

- Power from the engine is transmitted from the damper through upper drive shaft (5), torque converter, transmission and transfer to rear axle through rear drive shaft (4), and also to front axle from center drive shaft (3) through center support (2) and drive shaft (1).
- The drive shafts have the following purpose besides simple power transmission.
- When the machine is articulated or when it receives traveling impacts or working impacts, the distances between the engine, transmission and the front and rear axles change. The drive shafts absorb the fluctuation of the angle and length with the universal joints and slip joints so that the power will be transmitted without damaging the parts even when the positions of the components change.

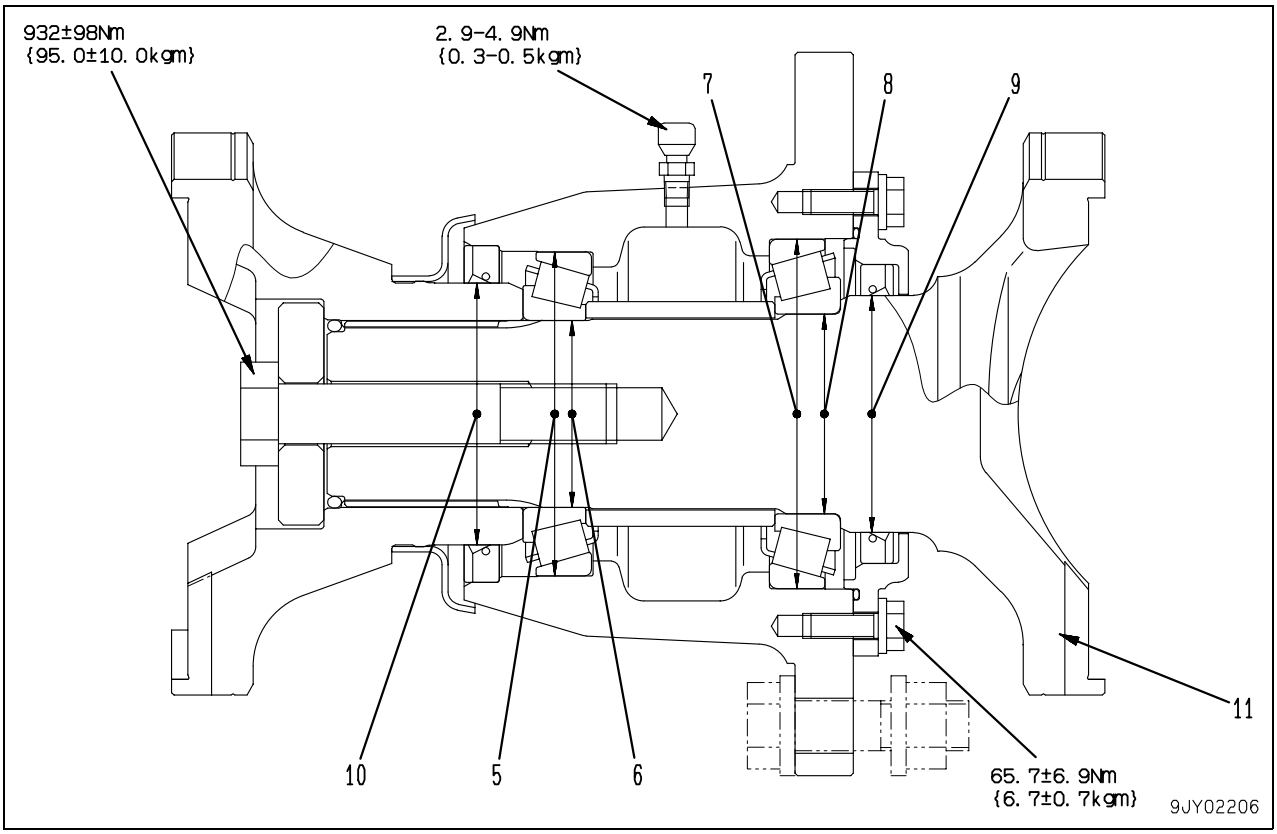
Center support



1. Front coupling
2. Case
3. Breather
4. Rear coupling

Outline

- The center support is installed between the center drive shaft and the front drive shaft mounted on the front frame.
- With the articulating frame, this part is constantly twisting from side to side, so there is liable to be large stress on the drive shaft. Therefore, the center support is used to transmit the power smoothly, to reduce the stress on the drive shafts, and in this way improve the durability of the drive shafts.

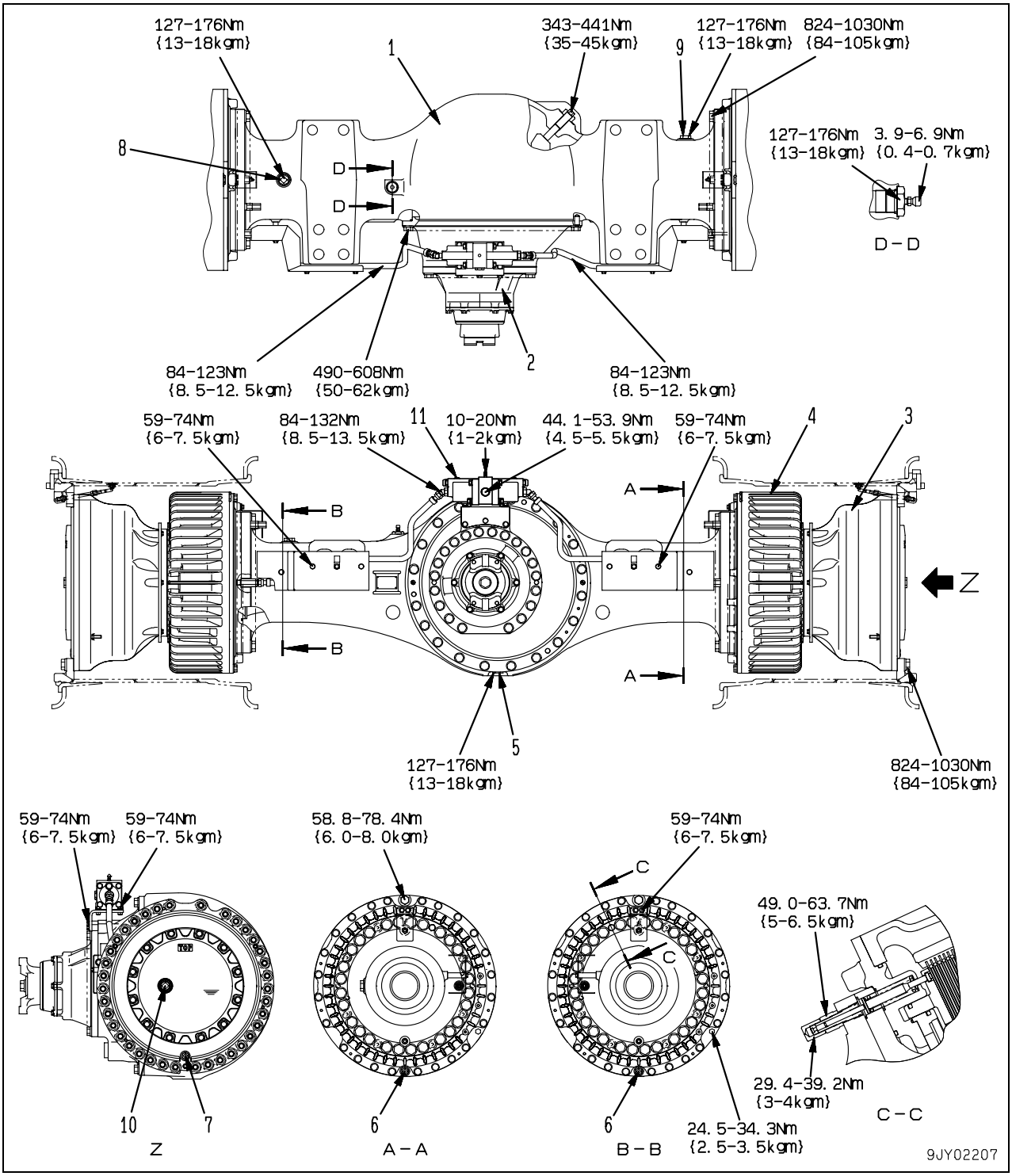


Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
5	Clearance between case and bearing	130	0 –0.018	–0.036 –0.061	–0.018 – –0.061	–0.015	Replace
6	Clearance between coupling shaft and bearing	75	+0.051 +0.032	0 –0.015	–0.032 – –0.066	–0.029	
7	Clearance between case and bearing	140	0 –0.018	–0.036 –0.061	–0.018 – –0.061	–0.015	
8	Clearance between coupling shaft and bearing	80	+0.051 +0.032	0 –0.015	–0.032 – –0.066	–0.029	
		Standard size		Tolerance		Repair limit	
9	Wear of oil seal contact surface	95		0 –0.087		–0.18	Finish with grinder after chrome-plating repair or replace
10	Wear of oil seal contact surface	105		0 –0.087		–0.18	
11	End play of coupling shaft	Max. 0.22 (Free rotational torque: Not exceeding 3.9 Nm{0.4 kgm})					Adjust

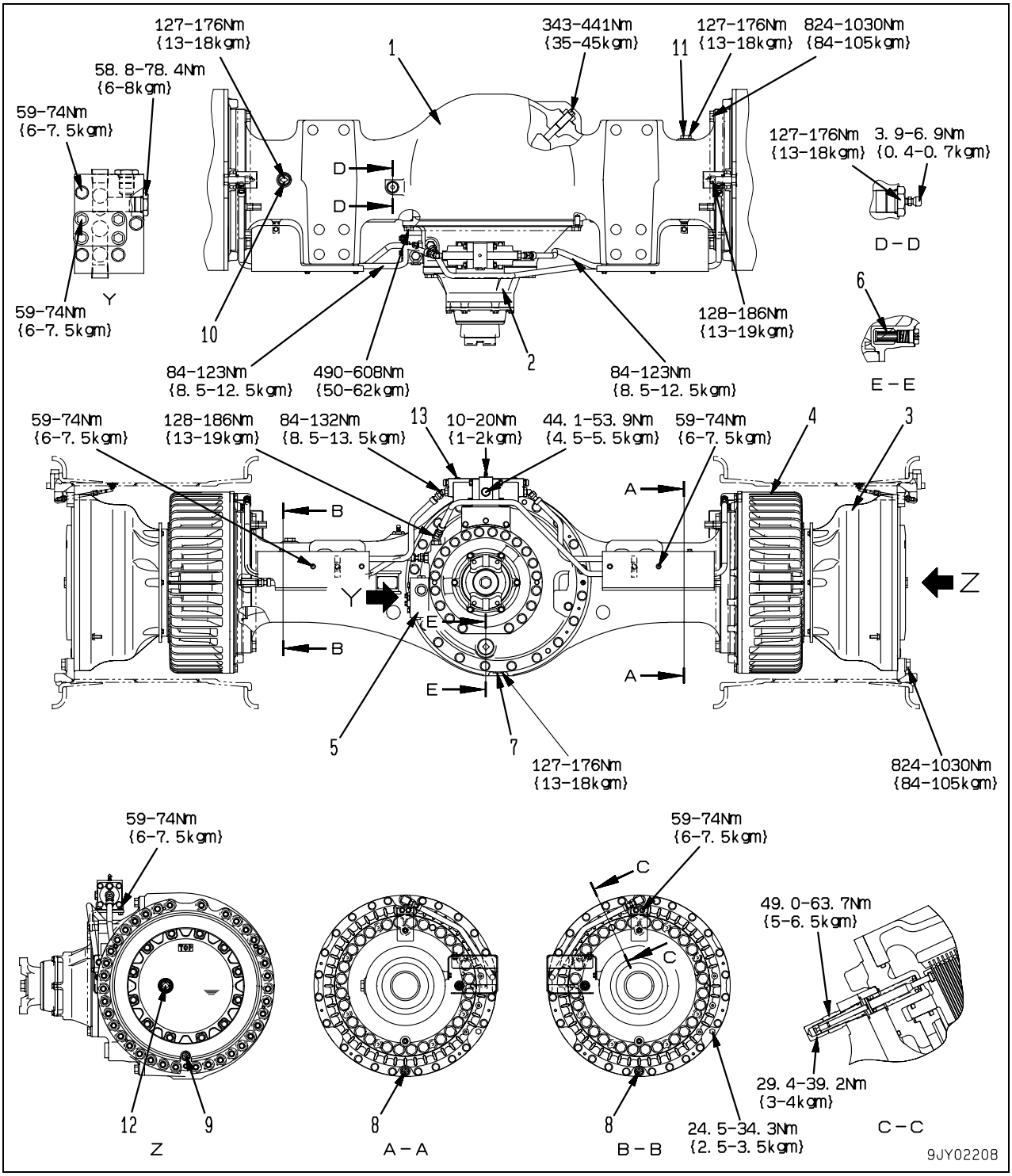
Axle

Front axle



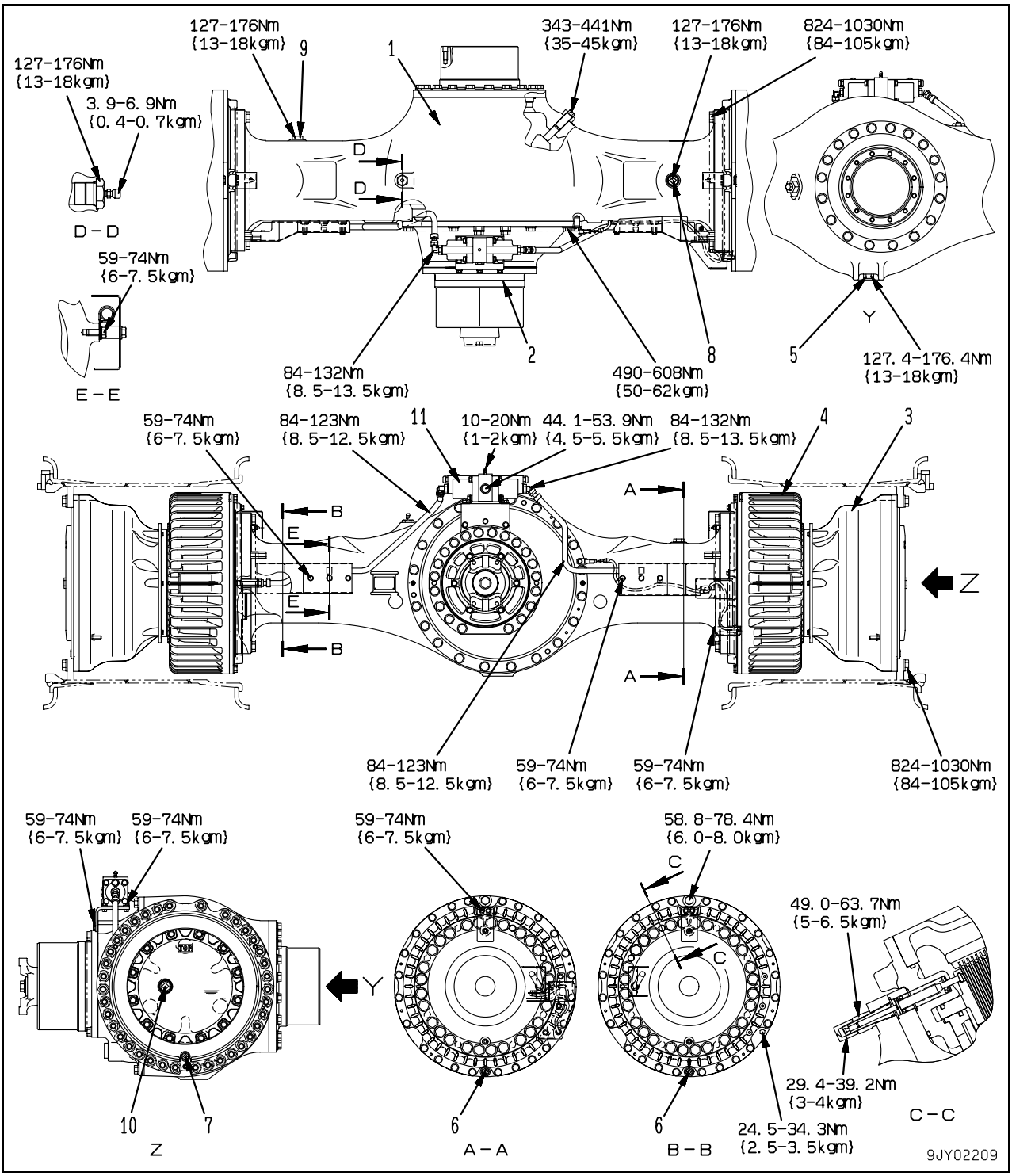
1. Front axle
2. Front differential
3. Final drive
4. Front brake
5. Drain plug (differential)
6. Drain plug (front brake)
7. Drain plug (final drive)
8. Oil filler plug
9. Level plug (front axle)
10. Level plug (final drive)
11. Slack adjuster

Front axle
(with forcible brake cooling system)



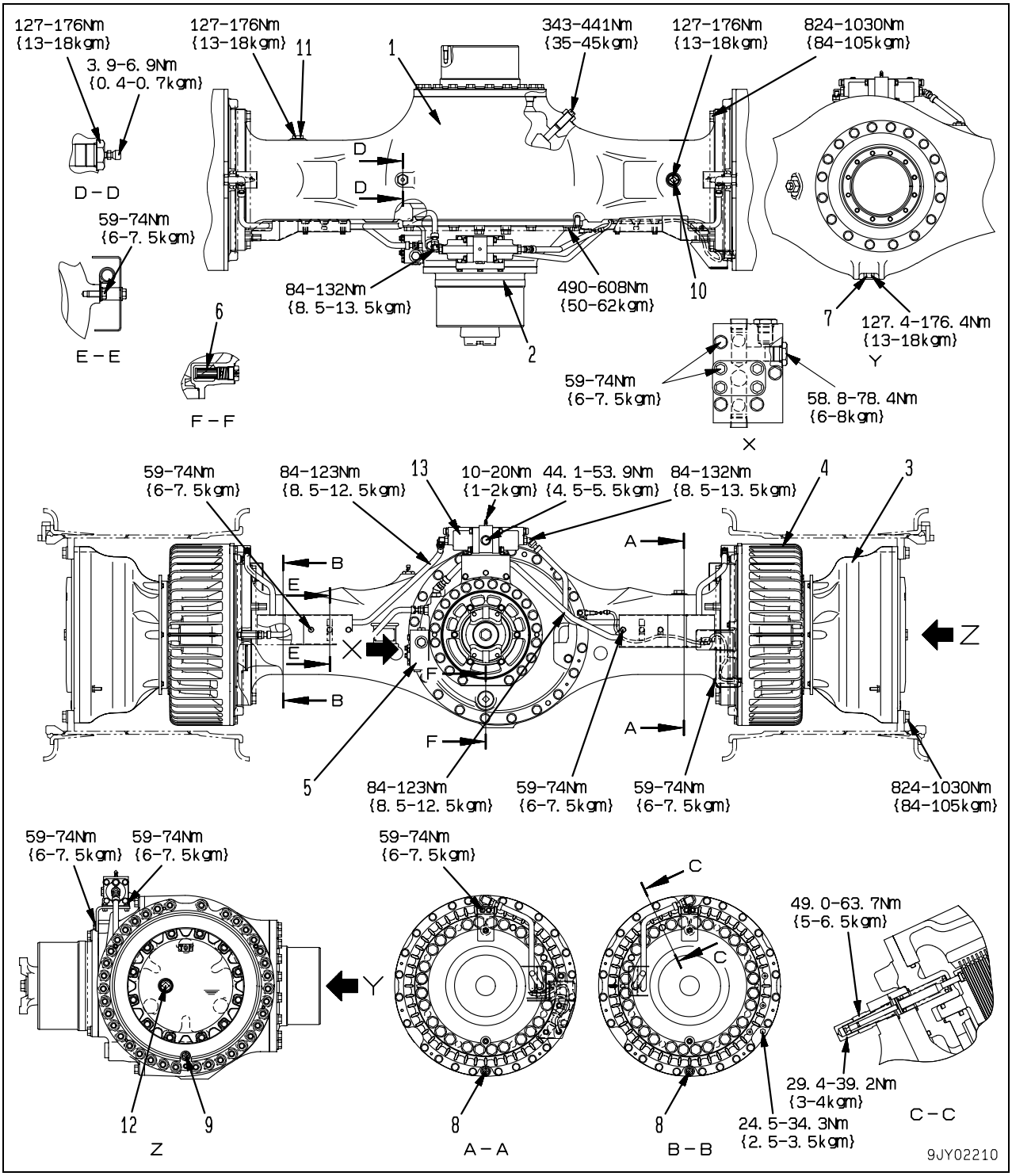
1. Front axle
2. Front differential
3. Final drive
4. Front brake
5. Block
6. Strainer
7. Drain plug (differential)
8. Drain plug (front brake)
9. Drain plug (final drive)
10. Oil filler plug
11. Level plug (front axle)
12. Level plug (final drive)
13. Slack adjuster

Rear axle



1. Rear axle
2. Rear differential
3. Final drive
4. Rear brake
5. Drain plug (differential)
6. Drain plug (rear brake)
7. Drain plug (final drive)
8. Oil filler plug
9. Level plug (rear axle)
10. Level plug (final drive)
11. Slack adjuster

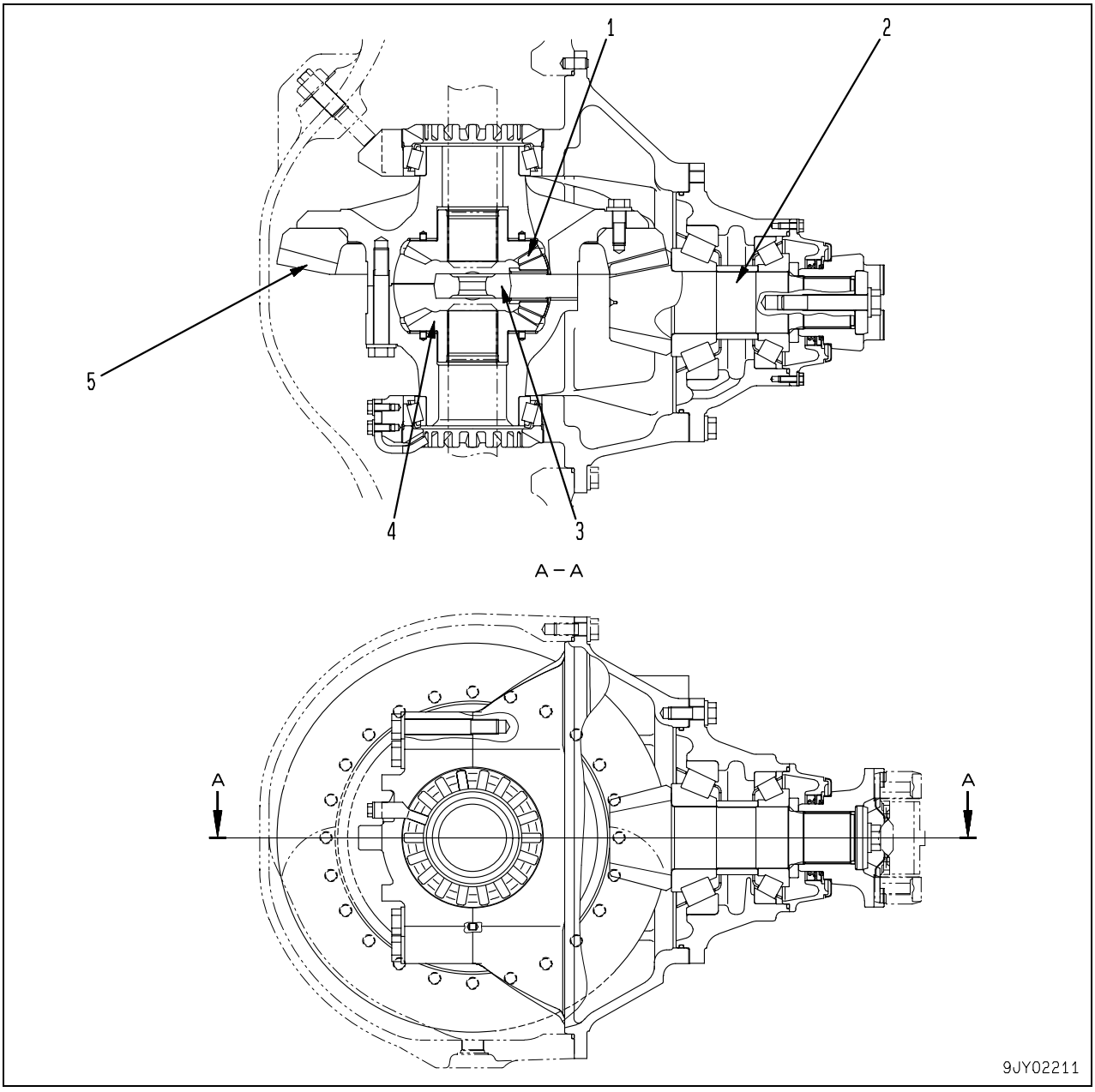
Rear axle
(with forcible brake cooling system)



1. Rear axle
2. Rear differential
3. Final drive
4. Rear brake
5. Block
6. Stainer
7. Drain plug (differential)
8. Drain plug (rear brake)
9. Drain plug (final drive)
10. Oil filler plug
11. Level plug (rear axle)
12. Level plug (final drive)
13. Slack adjuster

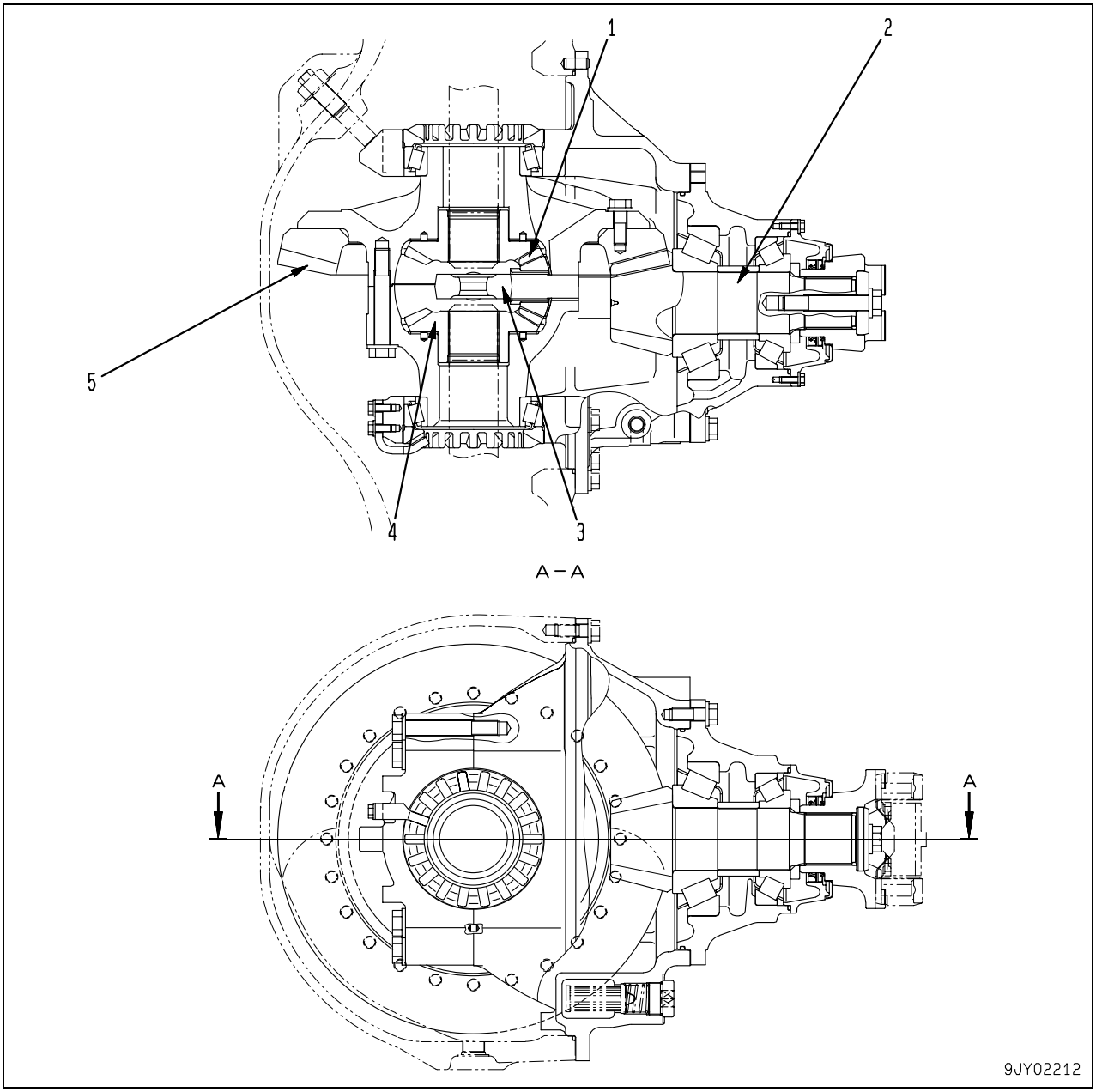
Differential

Front differential



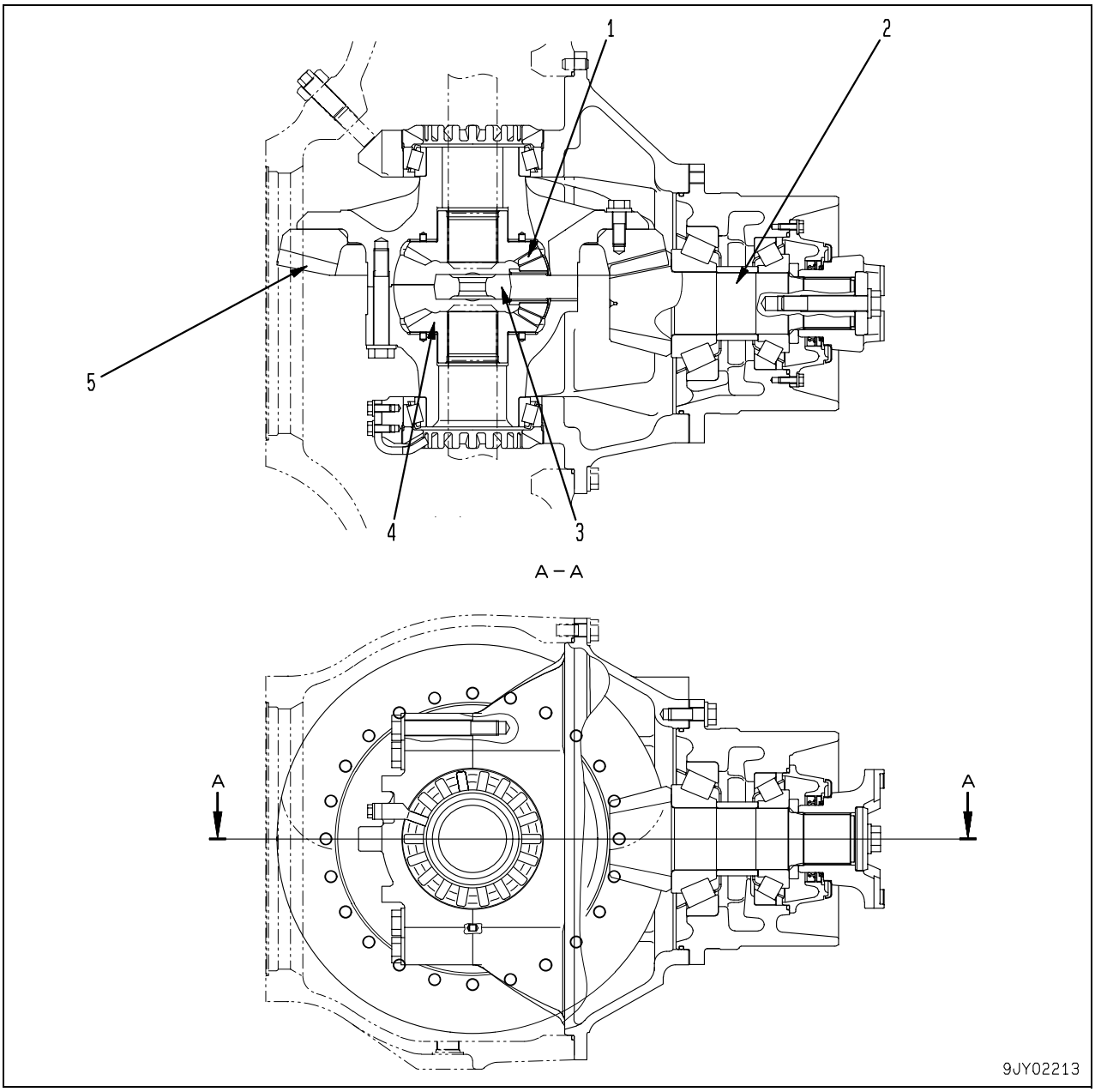
1. Pinion (Number of teeth: 12)
2. Bevel pinion (Number of teeth: 9)
3. Shaft
4. Side gear (Number of teeth: 24)
5. Bevel gear (Number of teeth: 42)

Front differential
(with forcible brake cooling system)



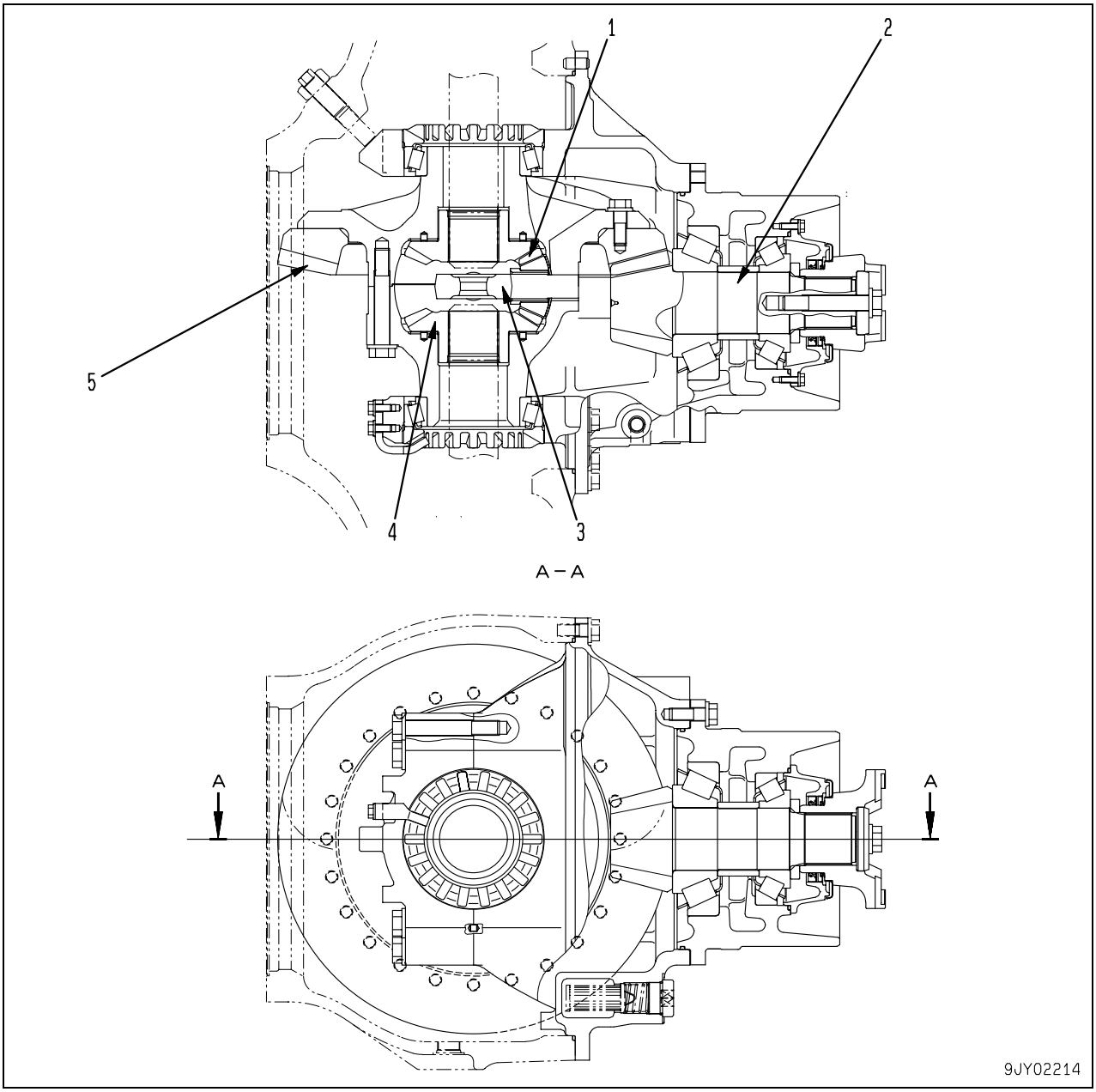
1. Pinion (Number of teeth: 12)
2. Bevel pinion (Number of teeth: 9)
3. Shaft
4. Side gear (Number of teeth: 24)
5. Bevel gear (Number of teeth: 42)

Rear differential



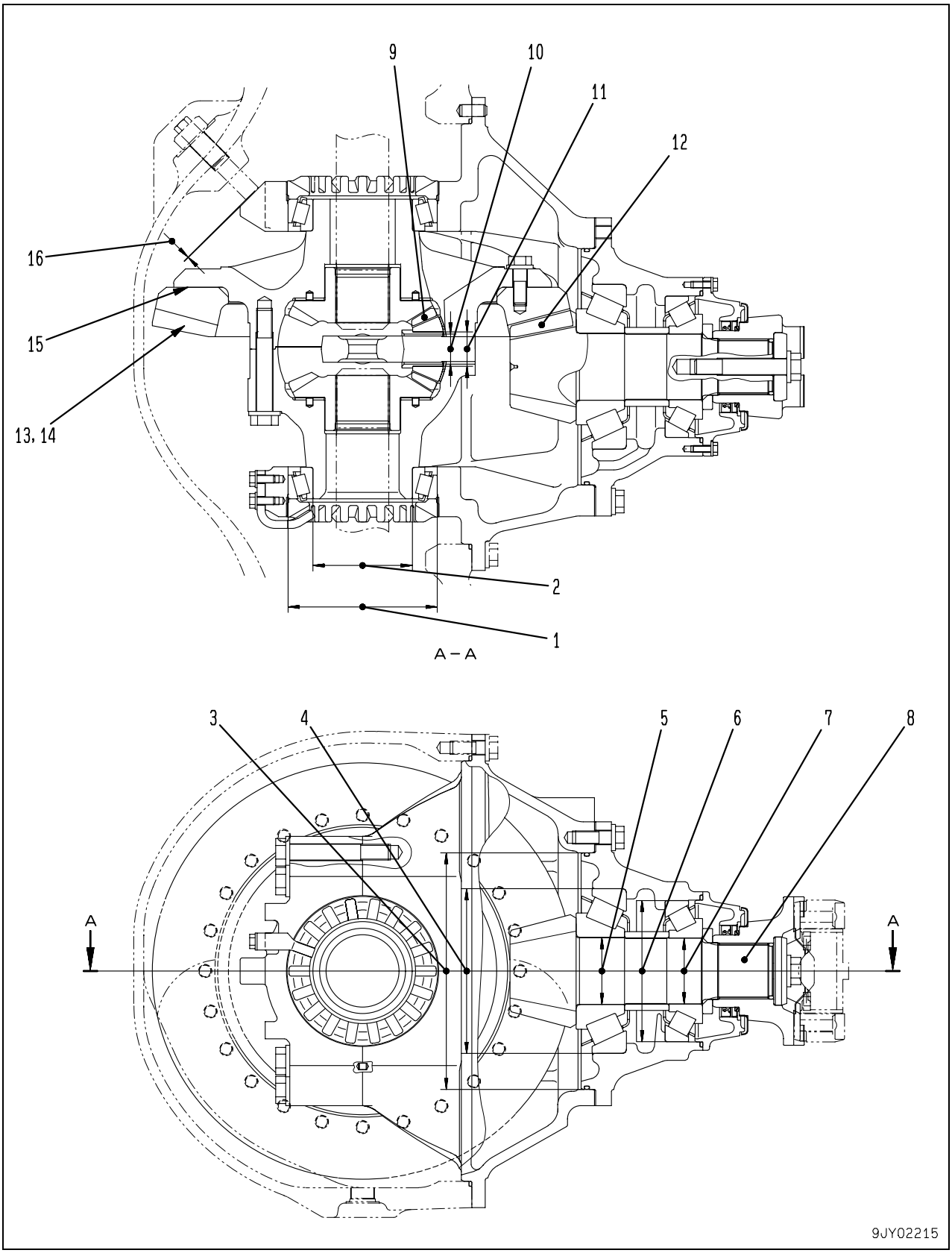
1. Pinion (Number of teeth: 12)
2. Bevel pinion (Number of teeth: 9)
3. Shaft
4. Side gear (Number of teeth: 24)
5. Bevel gear (Number of teeth: 42)

Rear differential
(with forcible brake cooling system)



1. Pinion (Number of teeth: 12)
2. Bevel pinion (Number of teeth: 9)
3. Shaft
4. Side gear (Number of teeth: 24)
5. Bevel gear (Number of teeth: 42)

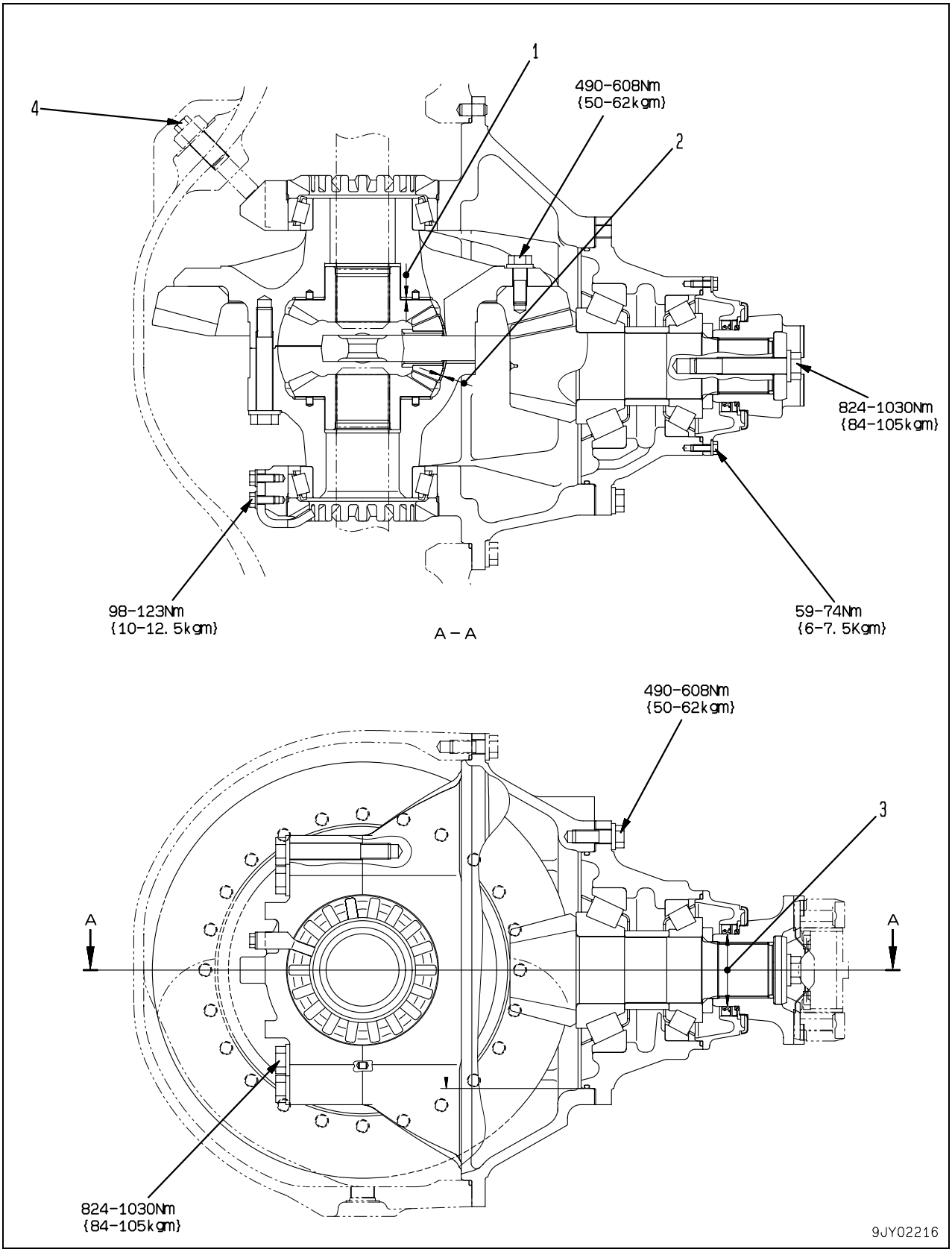
★ This diagram shows the front differential mechanism.



Unit: mm

No	Check item	Criteria					Remedy
1	Clearance in side bearing outer race of differential gear assembly	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		225	0 –0.015	+0.013 –0.016	0.028 – –0.016	—	
2	Clearance in side bearing inner race of differential gear assembly	150	+0.090 +0.065	0 –0.025	0.065 – –0.115	—	
3	Clearance between differential carrier and gauge	360	–0.018 –0.075	+0.057 0	0.018 – –0.132	—	
4	Clearance in outer race of pinion shaft bearing	250.825	+0.025 0	+0.020 –0.027	0.020 – –0.052	—	
5	Clearance in inner race of pinion shaft bearing	101.6	+0.069 +0.047	+0.025 0	0.022 – –0.069	—	
6	Clearance in outer race of pinion shaft bearing	215	0 –0.030	+0.033 –0.079	–0.003 – –0.079	—	
7	Clearance in inner race of pinion shaft bearing	100	+0.035 +0.013	0 –0.020	–0.013 – –0.055	—	
8	End play of pinion gear	0.290					
9	Backlash of differential gear	0.25 – 0.33					
10	Clearance between spider and differential pinion bushing	Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
		46	–0.13 –0.18	+0.03 –0.02	0.021 – –0.11	—	
11	Clearance between spider and differential pinion bushing	52	–0.13 –0.18	+0.03 –0.02	0.21 – 0.11	—	
12	Backlash of bevel gear	0.41 – 0.56					
13	Free rotational torque of bevel gear	6.28 – 18.74 (0.64 – 1.91 kgm)					
14	Bevel gear preload	9.81 – 19.61 kN (1,000 – 2,000 kg)					
15	Rear runout of bevel gear	0.1					
16	Clearance between bolt and cap	0.08 – 0.13					

★ This diagram shows the front differential mechanism.

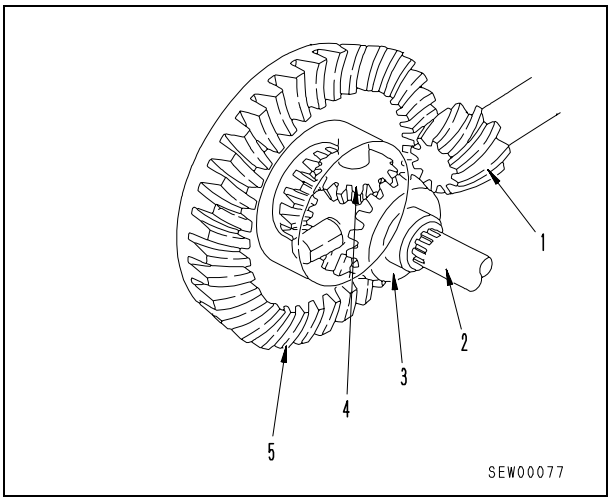


Unit: mm

No	Check item	Criteria			Remedy
1	Thickness of side gear washer	Standard size	Tolerance	Repair limit	Replace
		4.0	±0.05	3.5	
2	Thickness of pinion gear washer	3	±0.08	2.8	
3	Wear of oil seal contact surface	110	0 –0.08	2.8	
4	Tightening torque of mounting nut	(1) Press the end of the bolt against the rear of the cap. (2) In state indicated in (1), turn back the bolt by 20 to 30°. (3) In the position cited in (2), tighten the nut to fix it in place. Tightening torque of fixed nut: 343 – 441 Nm {35 – 45 kgm}: After adjusting clearance			Retighten

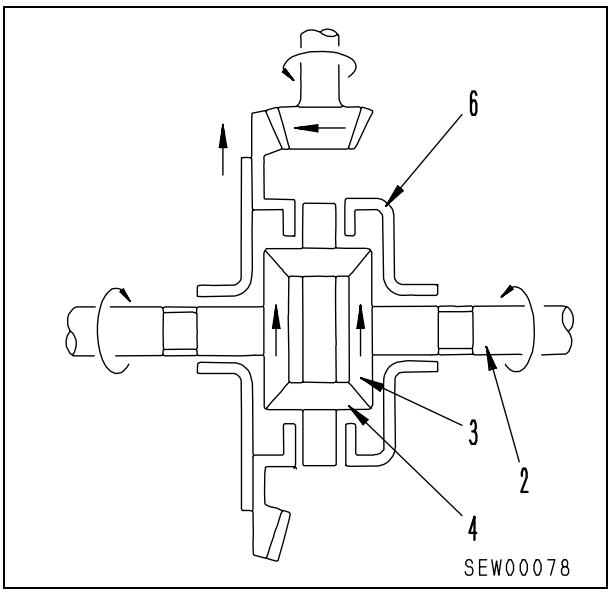
Outline

- The power from the engine is transmitted through the torque converter, transmission, and drive shafts to the front and rear axles.
- In each axle, the direction of the power is changed by 90° and the rotation speed is reduced by bevel pinion (1) and bevel gear (5). Then, the power is transmitted through differential mechanism to axle shafts (2).
- The power of the axle shaft is further reduced in speed by the final drive of the planetary gear type, and then transmitted to the wheels.



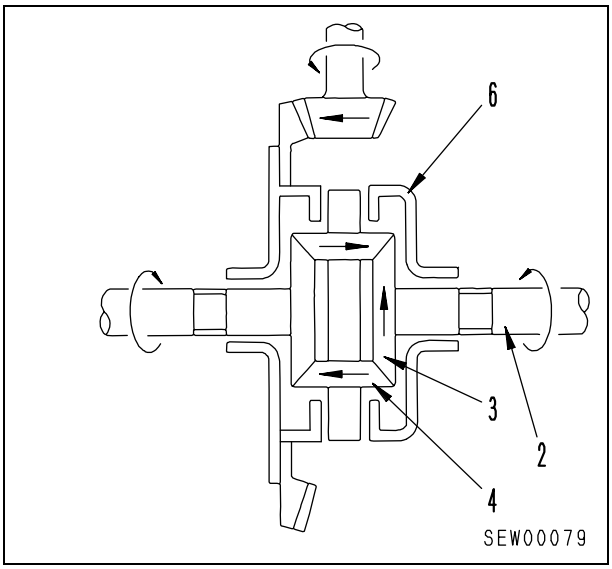
While machine is traveling straight

- While the machine is traveling straight, the right and left wheels rotate at the same speed. Accordingly, pinion gears (4) in the differential assembly do not rotate and the power of carrier (6) is transmitted through pinion gears (4) and side gears (3) to right and left axle shafts (2) evenly.



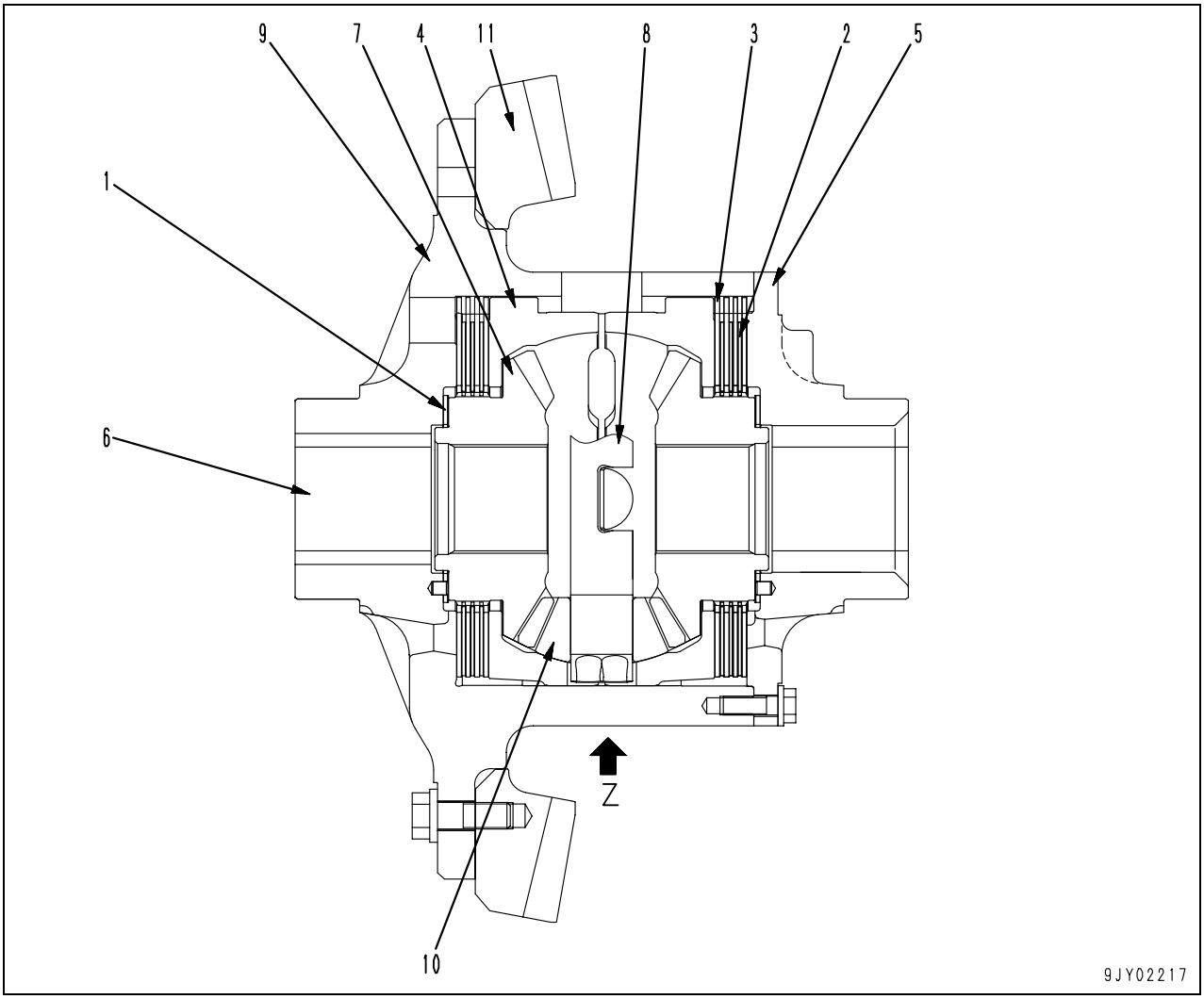
While machine is turning

- While the machine is turning, the right and left wheels rotate at different speeds. Accordingly, pinion gears (4) and side gears (3) in the differential assembly rotate and transmit the power of carrier (6) to axle shafts (2), depending on the difference in rotation speed between the right and left wheels.



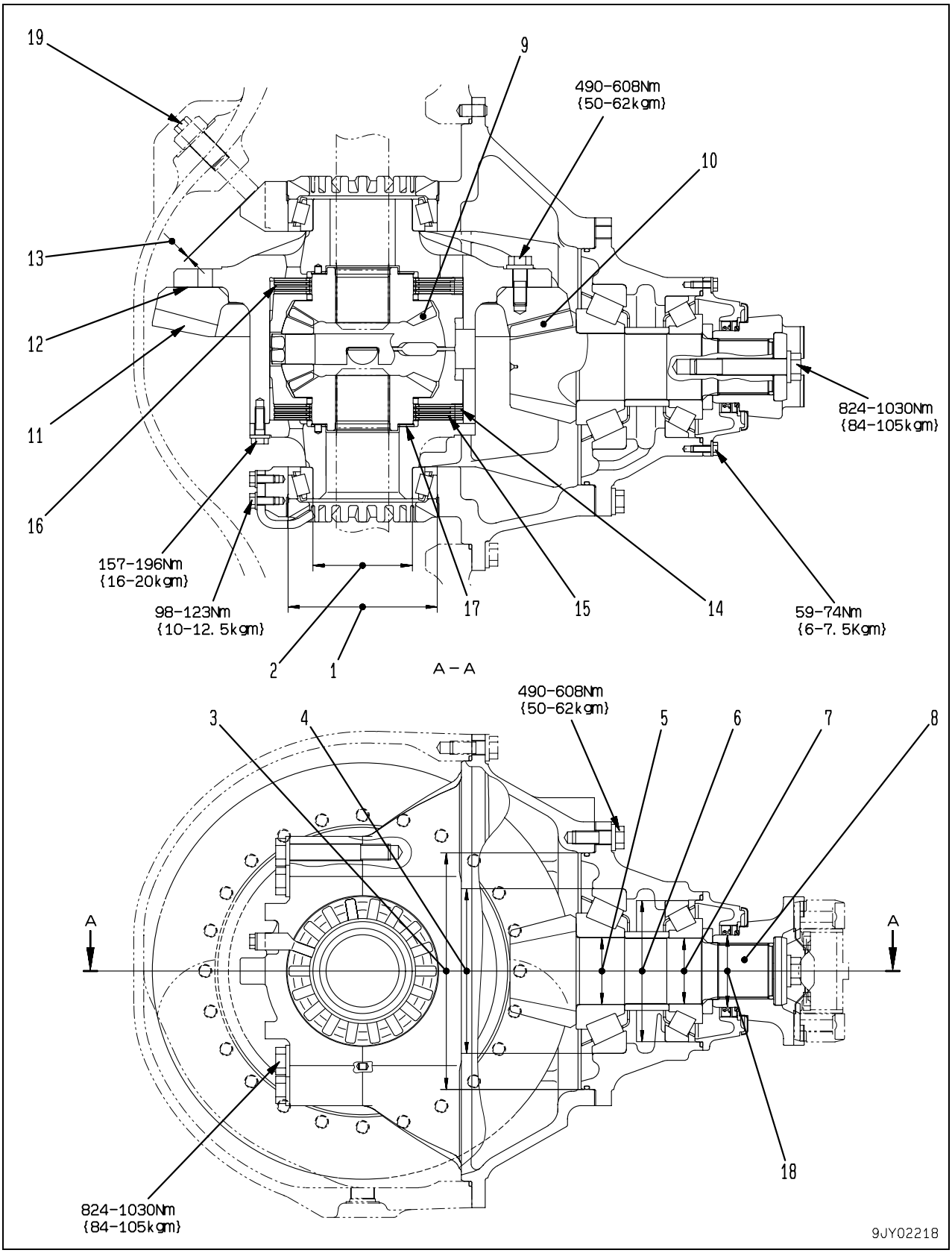
Limited slip differential

(if equipped)



1. Washer
2. Disc
3. Plate
4. Pressure ring
5. Cover
6. Shaft
7. Side gear
8. Shaft
9. Case
10. Pinion
11. Bevel gear

★ This diagram shows the front differential mechanism.



Unit: mm

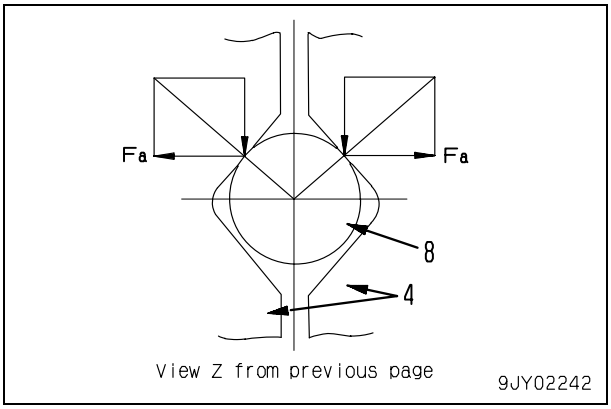
No	Check item	Criteria					Remedy
1	Clearance in side bearing outer race of differential gear assembly	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		225	0 –0.015	+0.013 –0.016	0.028 – –0.016	—	
2	Clearance in side bearing inner race of differential gear assembly	150	+0.090 +0.065	0 –0.025	0.065 – –0.115	—	
3	Clearance between differential carrier and gauge	360	–0.018 –0.075	+0.057 0	0.018 – –0.132	—	
4	Clearance in outer race of pinion shaft bearing	250.825	+0.025 0	+0.020 –0.027	0.020 – –0.052	—	
5	Clearance in inner race of pinion shaft bearing	101.6	+0.069 +0.047	+0.025 0	0.022 – –0.069	—	
6	Clearance in outer race of pinion shaft bearing	215	0 –0.030	+0.033 –0.079	–0.003 – –0.079	—	
7	Clearance in inner race of pinion shaft bearing	100	+0.035 +0.013	0 –0.020	–0.013 – –0.055	—	
8	End play of pinion gear	0 – 0.290					
9	Backlash of differential gear	0.25 – 0.33					
10	Backlash of bevel gear	0.41 – 0.56					
11	Free rotational torque of bevel gear	6.28 – 18.74					
12	Rear runout of bevel gear	0.1					
13	Clearance between stop bolt and cap	0.08 – 0.13					
14	Thickness of plate	Standard size		Tolerance		Repair limit	
		3.4		±0.02		3.3	
		3.5					
15	Thickness of disc	3.2		±0.07		3.1	
16	Clearance between disc and plate (end play)	0.2 – 0.8					
17	Thickness of washer	Standard size		Tolerance		Repair limit	
		3.75		±0.05		3.55	
		4.0					
		4.25					
18	Wear of oil seal contact surface	110		0 –0.087		—	
19	Tightening torque of mounting nut	(1) Press the end of the bolt against the rear of the cap. (2) In state indicated in (1), turn back the bolt by 20 to 30°. (3) In the position cited in (2), tighten the nut to fix it in place. Tightening torque of fixed nut: 343 – 441 Nm {35 – 45 kgm}: After adjusting clearance					Retighten

Operation of limited slip differential

The power from the transmission is transmitted through bevel gear (11), case (9), pressure rings (4), shaft (8), pinion (10) to side gears (7), and then distributed to the right and left shafts (6). Brake mechanism consisting of disc (2) and plate (3) is installed to back side of each side gear (7). It generates braking torque in proportion to the torque transmitted from pressure rings (4) to shaft (8).
Since the brake torque restricts the rotation of side gears (7) and case (9), right and left side gears (7) cannot rotate freely, thus the operation of the differential is restricted.

Mechanism of generation of braking torque by right and left side gears (7)

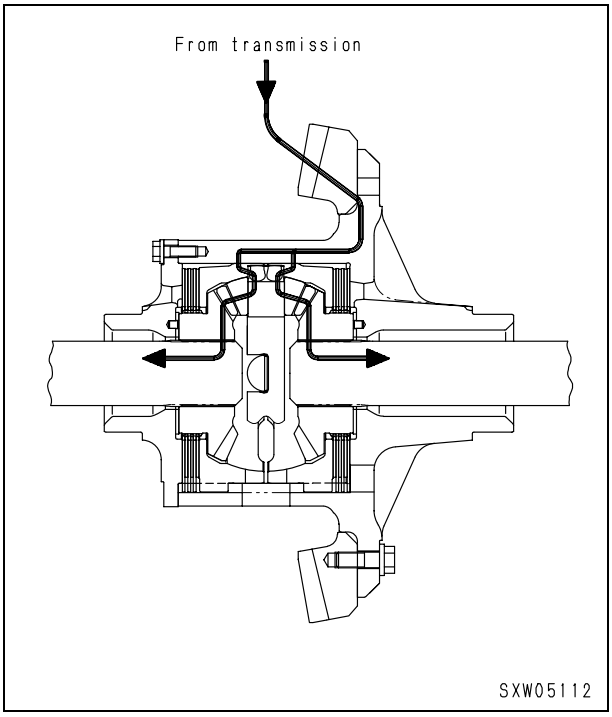
Shaft (8) is supported on the cam surfaces made on the surfaces of pressure rings (4) which are facing each other. The power (= torque) transmitted from pressure rings (4) to shaft (8) is transmitted on the cam surfaces. Force (Fa) to separate both pressure rings (4) is generated by inclination of the cam surfaces in proportion to the transmitted torque.
Separating load (Fa) acts on the brake on the back side of each side gear (7) to generate braking torque.



While machine is traveling straight

1. When drive forces of right and left wheels are balanced

[When the road conditions (coefficients of friction) under both wheels and the wheel loads are even and the center of load is at the center of the bucket]
The power from the transmission is distributed evenly by the differential gears to the right and left. Under this condition, the slip limits of the right and left wheels are the same. Accordingly, when the power from the transmission exceeds the slip limits, both wheels slip and the differential does not work.
No load is applied to the brake on the back side of each side gear.



2. When drive forces of right and left wheels are unbalanced

[When the road conditions (coefficients of friction) under both wheels and the wheel loads are uneven and either wheel slips more easily]

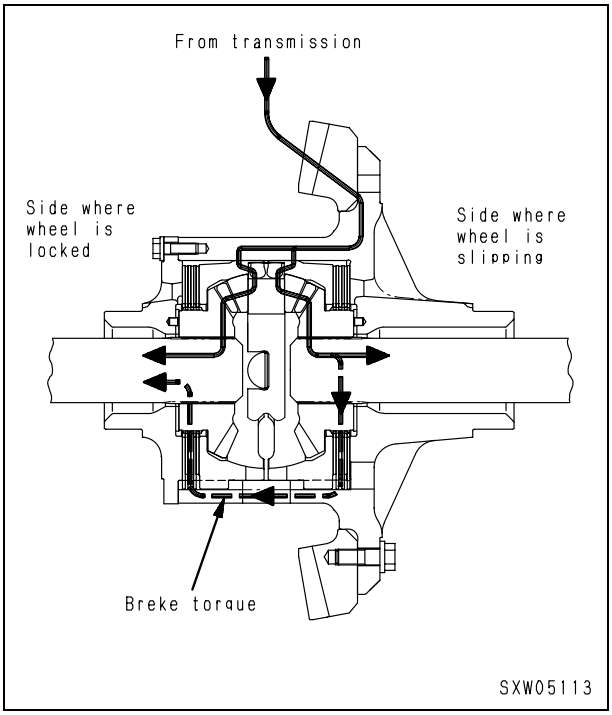
Example 1: When either wheel is on soft ground in digging work

Example 2: When either wheel is on snow and the other one is on asphalt in snow removing work

Example 3: When the right and left wheel loads are unbalanced in travel on a slope

The power from the transmission is distributed evenly by the differential gears to the right and left. If the distributed drive force limits the wheel slip limit on the slipping side, the excess of the drive force is transmitted through the brake on the back side of the side gear and the case to the brake on the opposite side (locked side) and given to the locked wheel.

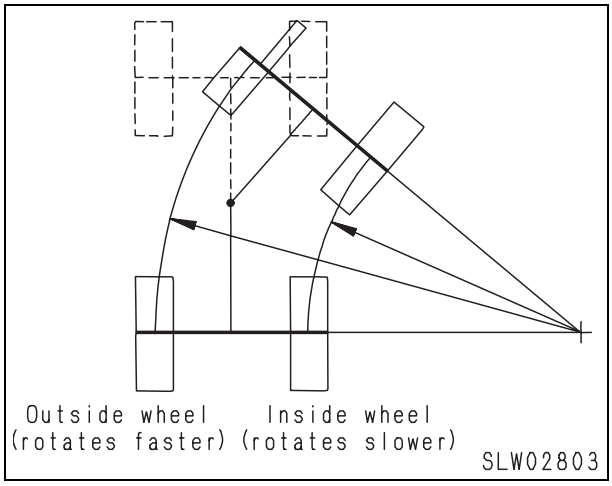
Only when the excessive drive force exceeds the braking force, the differential starts working.



Difference of wheel drive force in each type of differential when either wheel slips

	Wheel drive force (Drive force of slipping wheel is 1)		
	Slipping wheel	Locked wheel	Total (Ratio)
Limited slip differential (if equipped)	1	2.64	3.64 (1.82)
Ordinary differential	1	1	2 (1)

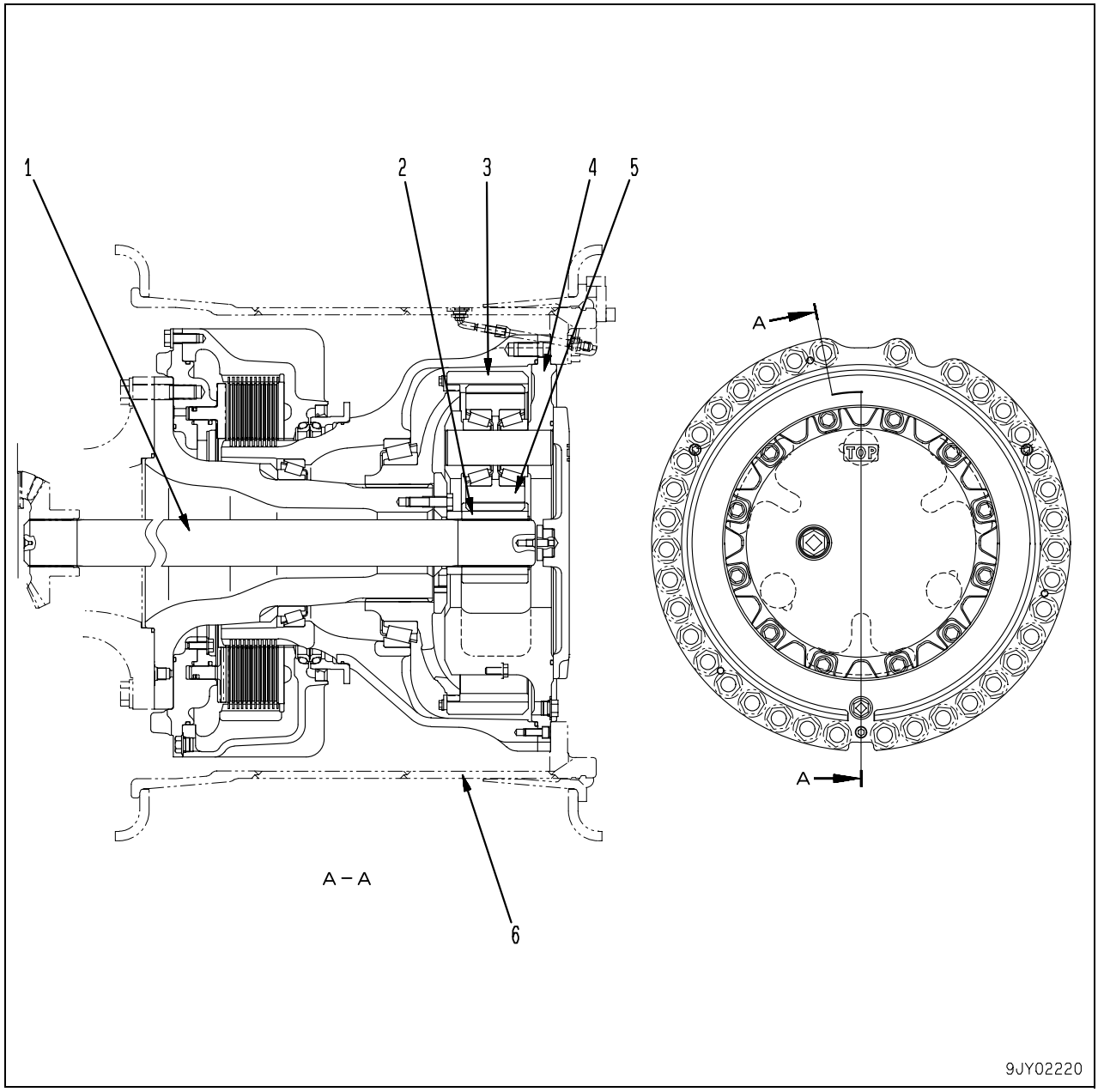
On a road where either wheel slips easily, the drive force of the limited-slip differential is 1.82 times as large as that of the ordinary differential.



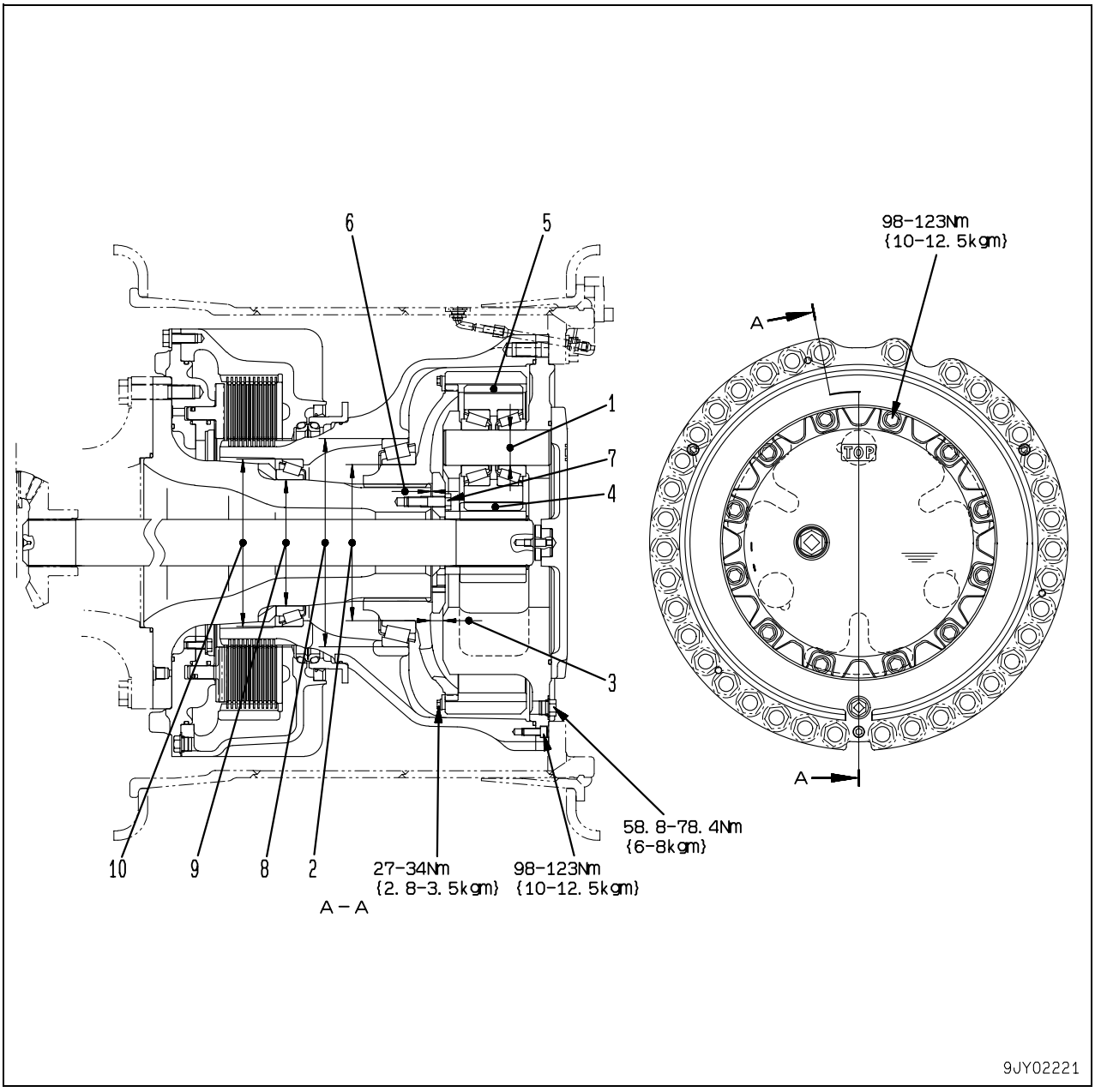
While machine is turning

The differential gears in the limited slip differential operate similarly to those in the ordinary differential. Accordingly, a difference in rotation speed between the outer and inner tires necessary for turning is generated smoothly.

Final drive



1. Axel shaft
2. Sun gear (Number of teeth: 18)
3. Ring gear (Number of teeth: 81)
4. Planetary carrier
5. Planetary gear (Number of teeth: 30)
6. Wheel


6
5
98-123Nm
{10-12.5kgm}
A
1
7
4
TOP
3
A
58.8-78.4Nm
{6-8kgm}
10
9
8
2
27-34Nm
{2.8-3.5kgm}
98-123Nm
{10-12.5kgm}
A-A
9JY02221

Unit: mm

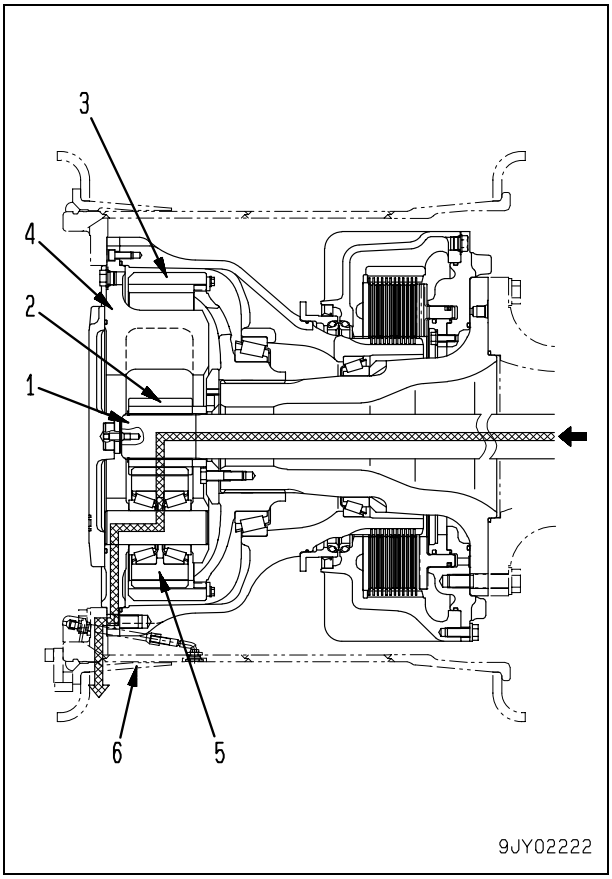
<table>
<tr><th>No</th><th colspan="2">Check item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td colspan="2" rowspan="2">Clearance between planetary shaft and bearing</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="8">Replace</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>60</td><td>+0.015
+0.002</td><td>0
–0.015</td><td>–0.020 –
–0.030</td><td>—</td></tr>
<tr><td>2</td><td colspan="2">Clearance between ring gear hub and bearing</td><td>266.7</td><td>+0.066
+0.034</td><td>+0.025
0</td><td>–0.009 –
–0.066</td><td>—</td></tr>
<tr><td rowspan="2">3</td><td colspan="2" rowspan="2">Thickness of ring gear mounting retainer</td><td colspan="2">Standard size</td><td colspan="2">Tolerance</td><td colspan="2">Repair limit</td></tr>
<tr><td colspan="2">22</td><td colspan="2">±0.1</td><td colspan="2">21.6</td></tr>
<tr><td>4</td><td colspan="2">Backlash of planetary gear and sun gear</td><td colspan="6">0.19</td></tr>
<tr><td>5</td><td colspan="2">Backlash of planetary gear and ring gear</td><td colspan="6">0.20</td></tr>
<tr><td>6</td><td colspan="2">Standard shim thickness of wheel hub</td><td colspan="6">2.3</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">Tightening torque of mounting bolt</td><td>1st time</td><td colspan="6">62.8±4.9 Nm {6.4±0.5 kgm}
(Preload 7,845 – 27,459 N {800 – 2,800 kg})</td><td rowspan="2">Retighten</td></tr>
<tr><td>2nd time</td><td colspan="6">279±29.4 Nm {28.5±3.0 kgm}</td></tr>
<tr><td rowspan="2">8</td><td colspan="2" rowspan="2">Clearance between wheel hub and bearing</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="4">Replace</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>355.6</td><td>+0.051
0</td><td>–0.042
–0.078</td><td>–0.042 –
–0.129</td><td>—</td></tr>
<tr><td>9</td><td colspan="2">Clearance between tube and bearing</td><td>215.9</td><td>–0.015
–0.044</td><td>+0.130
+0.015</td><td>0.174 –
0.030</td><td>—</td></tr>
<tr><td>10</td><td colspan="2">Clearance between wheel hub and bearing</td><td>285.75</td><td>+0.025
0</td><td>–0.037
–0.069</td><td>–0.037 –
–0.094</td><td>—</td></tr>
</table>

Outline

- Final drive is reduced by the planetary gear unit in order to gain increased force, and then drive force is transmitted to the tires.

Operation

- Power transmitted from the differential mechanism to sun gear (2) through axle shaft (1) is transmitted to planetary gear (5). The planetary gear rotates inside fixed ring gear (3) to transmit reduced rotation to planetary carrier (4) and the power is transmitted to wheel (6) mounted onto the planetary carrier.



WA600-6 Wheel loader

Form No. SEN02455-00

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

10 Structure, function and maintenance standard

Steering system

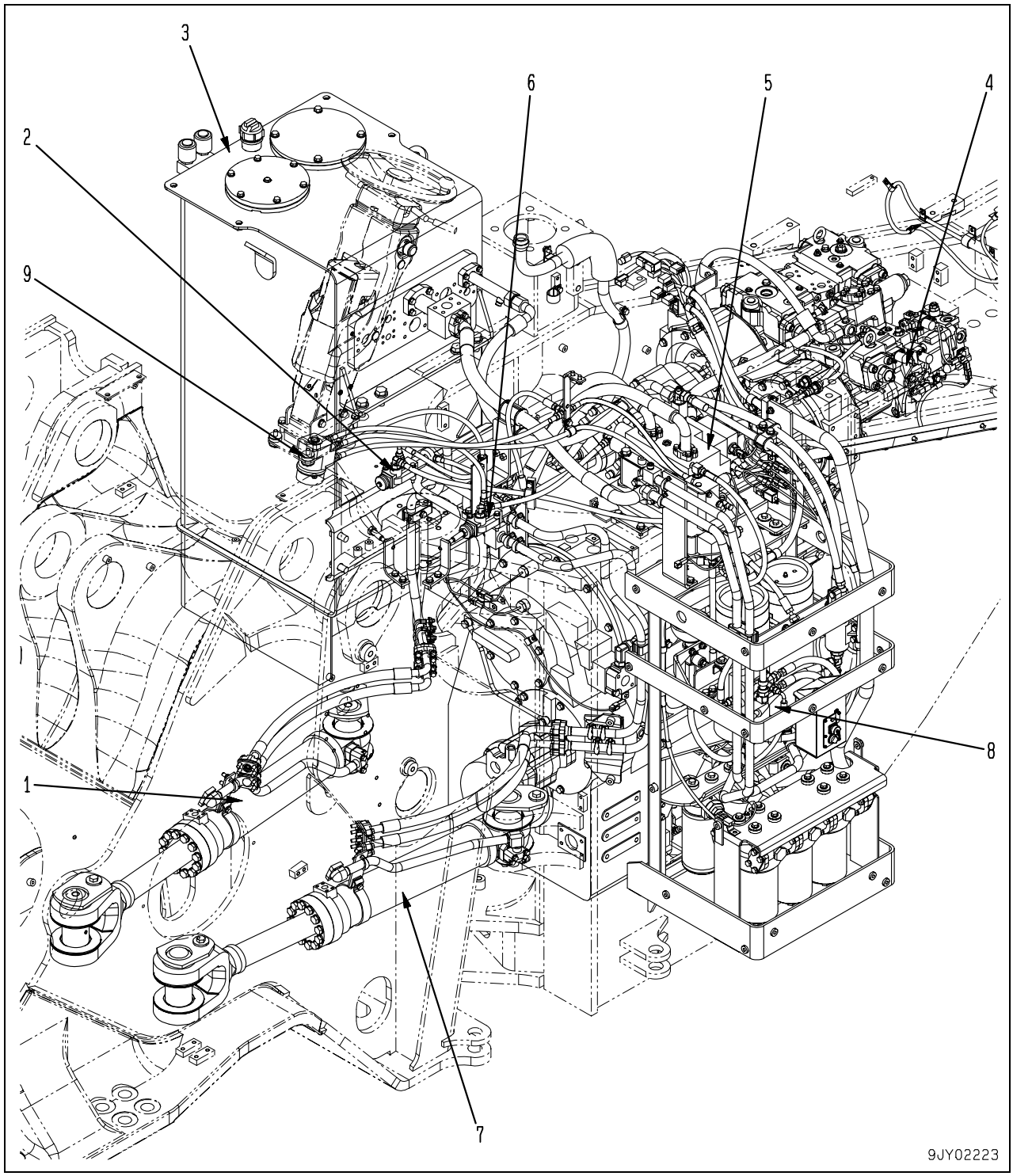
Steering system 4
Steering piping diagram 4
Steering column 6
Joystick steering lever linkage 7
Joystick EPC valve 8
Lock valve 9
Steering valve 10
Rotary valve 13
Steering control valve 16
Two-way restrictor valve 32
Stop valve 33
Steering pump 34
Steering cylinder 48

Emergency steering piping diagram 49
Diverter valve 50
Emergency steering pump 58

Steering system

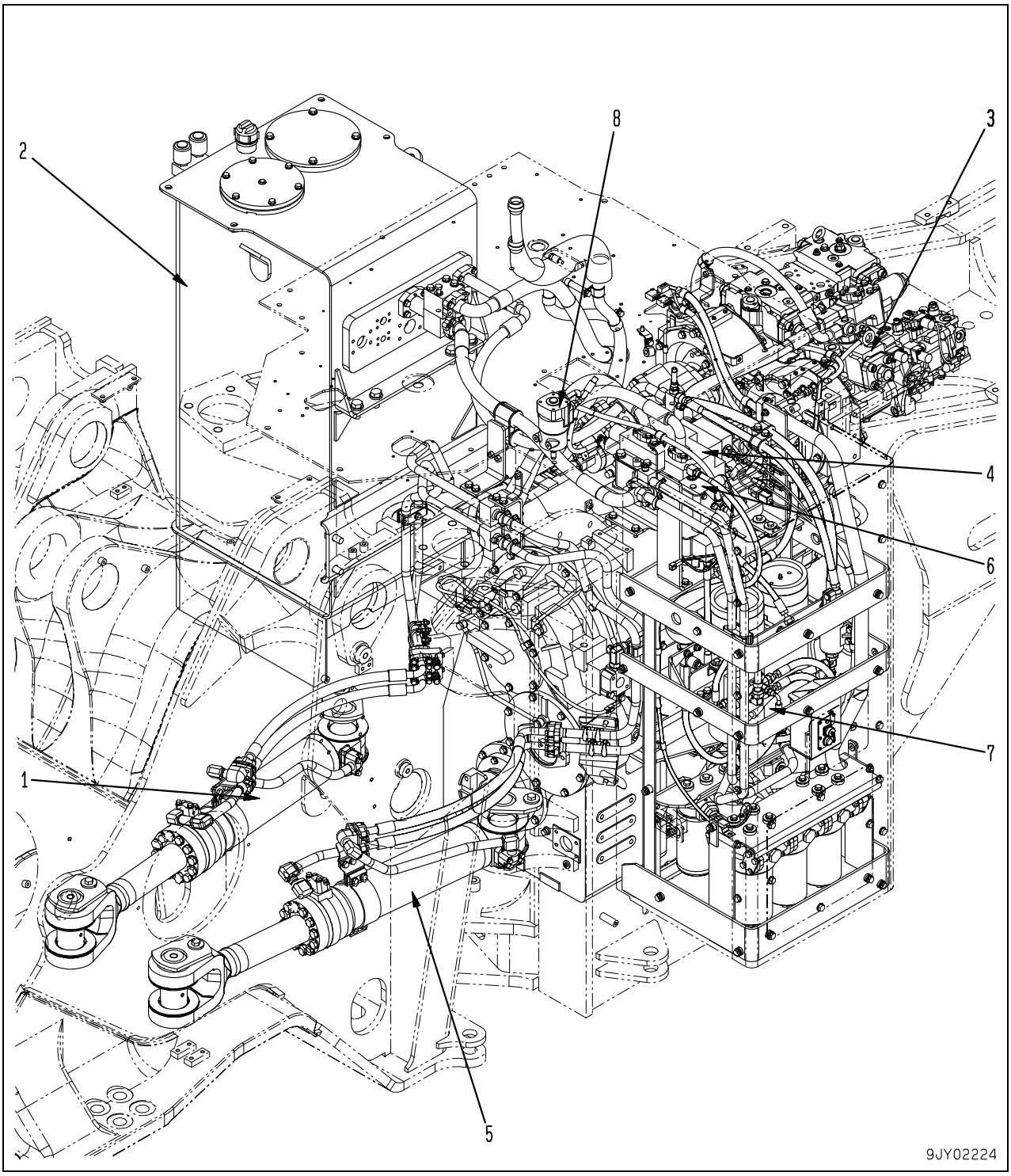
Steering piping diagram

(Steering wheel specification)



1. Steering cylinder (right)
2. Stop valve (right)
3. Hydraulic tank
4. Steering and fan pump
5. Steering control valve
6. Stop valve (left)
7. Steering cylinder (left)
8. Accumulator charge valve
9. Steering valve (Orbit-roll valve)

AJSS (Advanced Joystick Steering System) specification

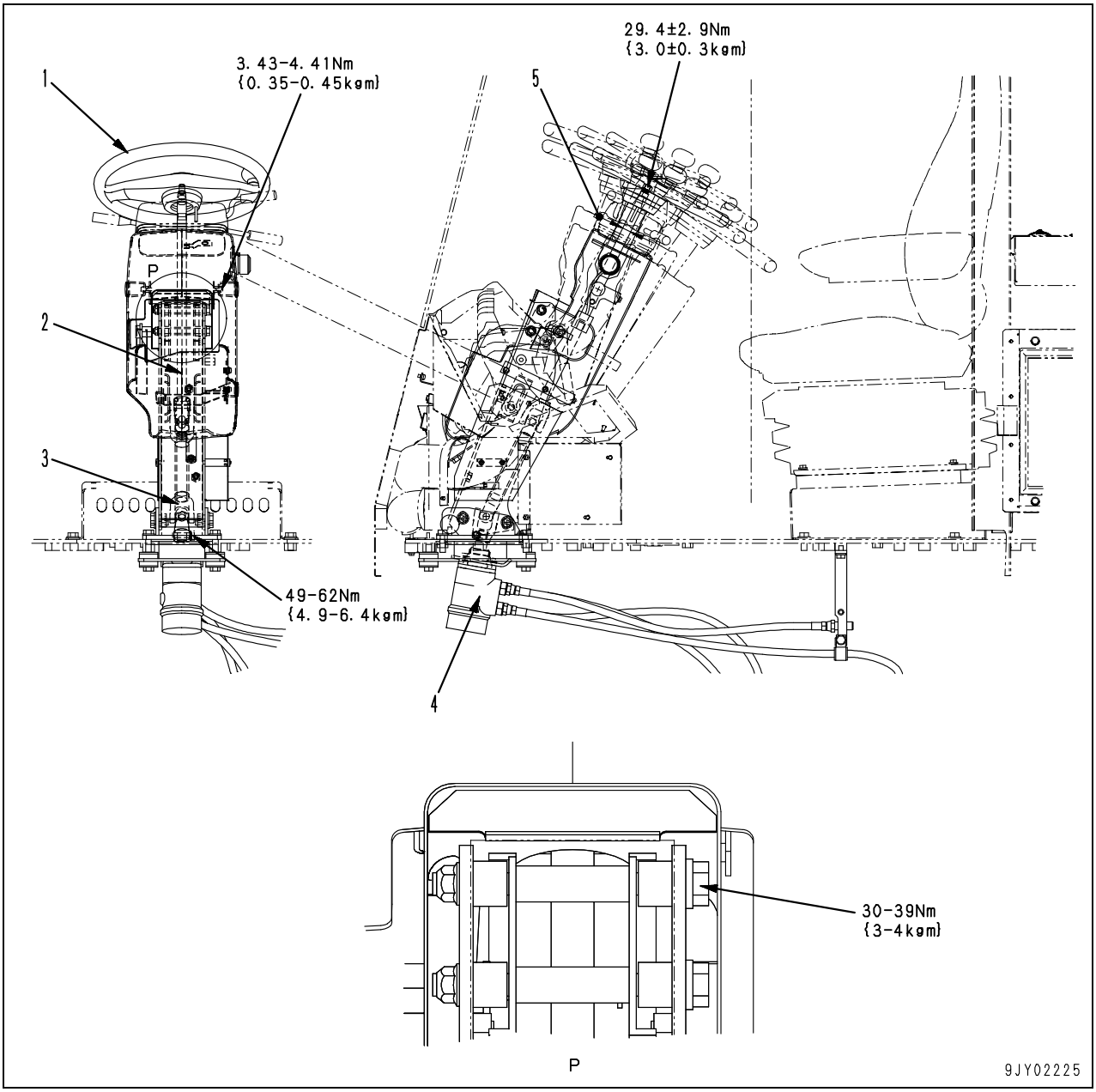


1. Steering cylinder (right)
2. Hydraulic tank
3. Steering and fan pump
4. Steering control valve
5. Steering cylinder (left)
6. EPC valve
7. Accumulator charge valve
8. Rotary valve

★ See the “Work equipment hydraulic circuit diagram”; the steering hydraulic circuit diagram is included in the diagram of the work equipment circuit.

Steering column

(Steering wheel specification)



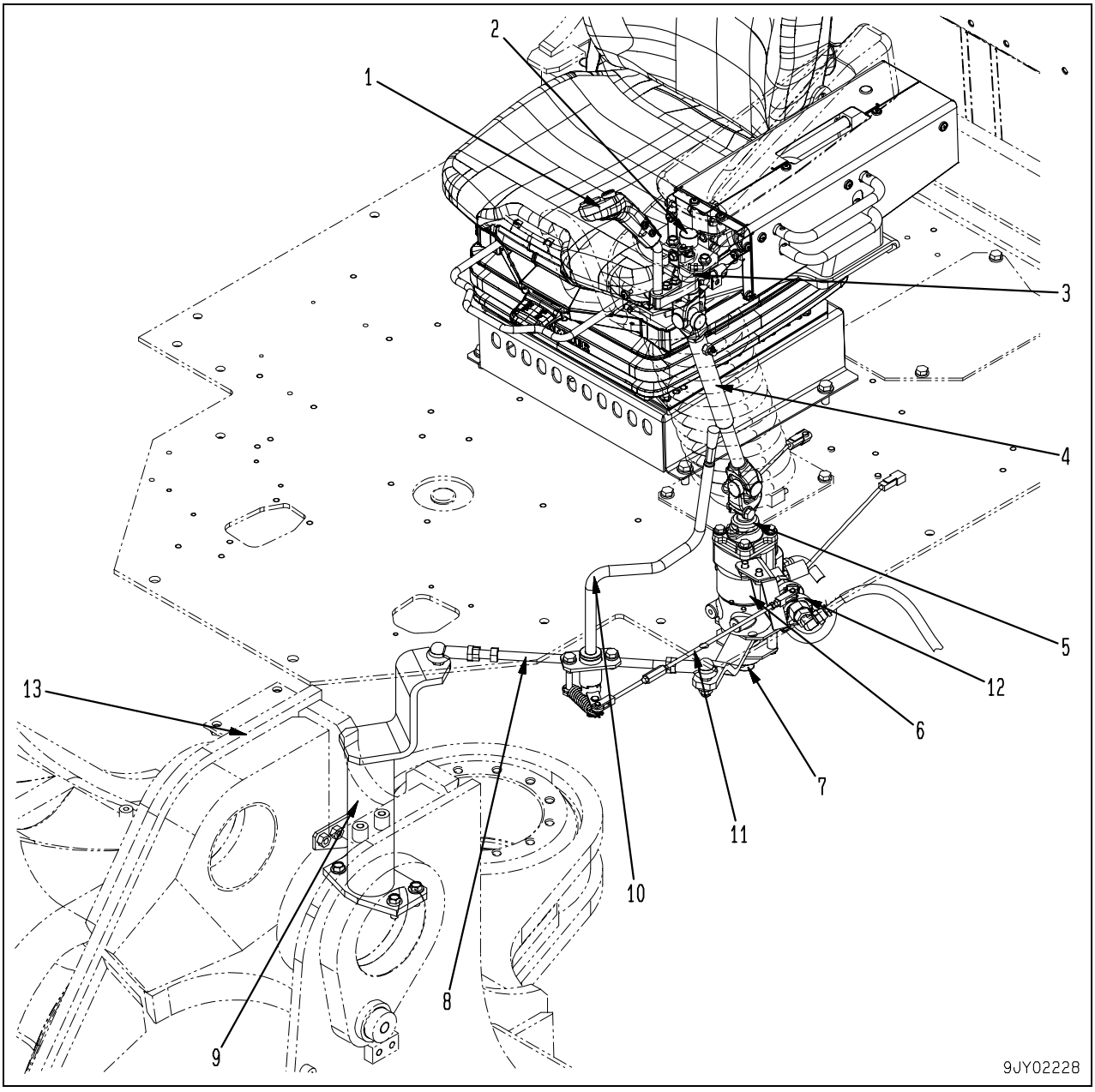
1. Steering wheel
2. Steering column
3. Joint
4. Steering valve (Orbit-roll valve)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
5	Clearance between steering shaft and steering column bearing	19	0 –0.08	+0.15 –0.05	–0.05 – 0.23	0.4	Replace

Joystick steering lever linkage

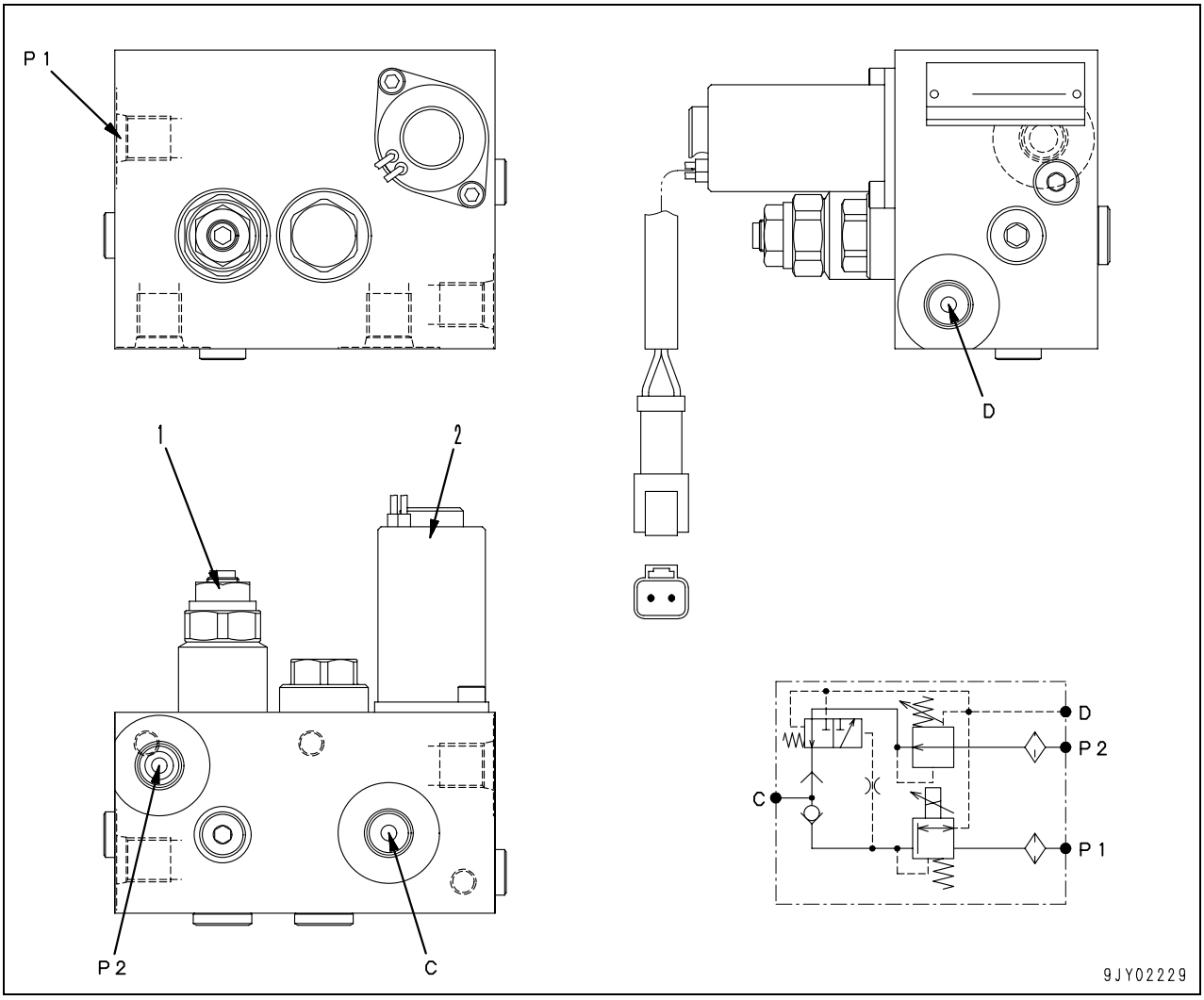
AJSS (Advanced Joystick Steering System) specification



1. Joystick (steering lever)
2. Potentiometer (lever operating angle)
3. Upper joint
4. Universal joint
5. Lower joint
6. Rotary valve
7. Potentiometer (frame angle)
8. Rod (follow up link)
9. Bracket
10. Steering lock lever
11. Rod
12. Lock valve (steering)
13. Front frame

Joystick EPC valve

AJSS (Advanced Joystick Steering System) specification



1. Minimum pressure assurance pressure reducing valve
2. Proportional solenoid valve

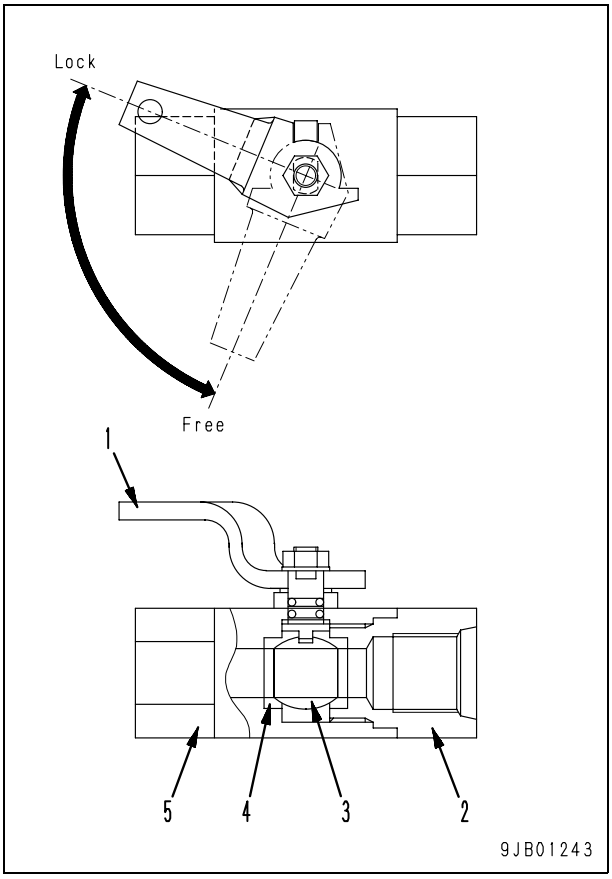
C: To rotary valve
D: To hydraulic tank
P1: From EPC pump
P2: From diverter valve

Function

- EPC valve controls oil supply to the rotary valve by means of a proportional solenoid valve controlled by command current from the machine controller.
- Also, the minimum pressure assurance pressure reducing valve ensures supply of minimum pressure to the rotary valve even if the proportional solenoid valve fails due to failure of the controller system.

Lock valve

AJSS (Advanced Joystick Steering System) specification



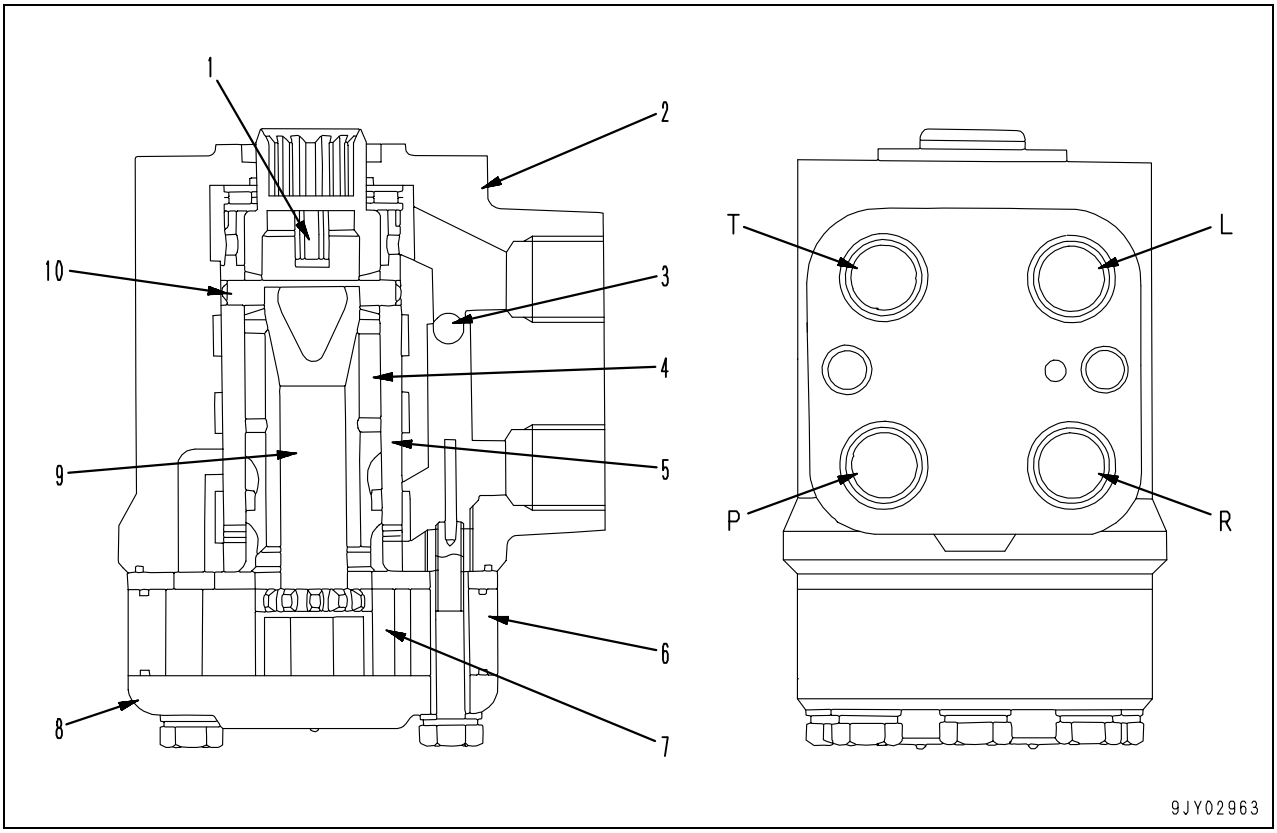
1. Lever
2. End cap
3. Ball
4. Seat
5. Body

Outline

- The lock valve is installed between the EPC valve and rotary valve. When the steering lock lever is set in the “LOCK” position, the lock valve, interlocked with the steering lock lever, operates to shut off the oil in the EPC circuit and disables steering operation.

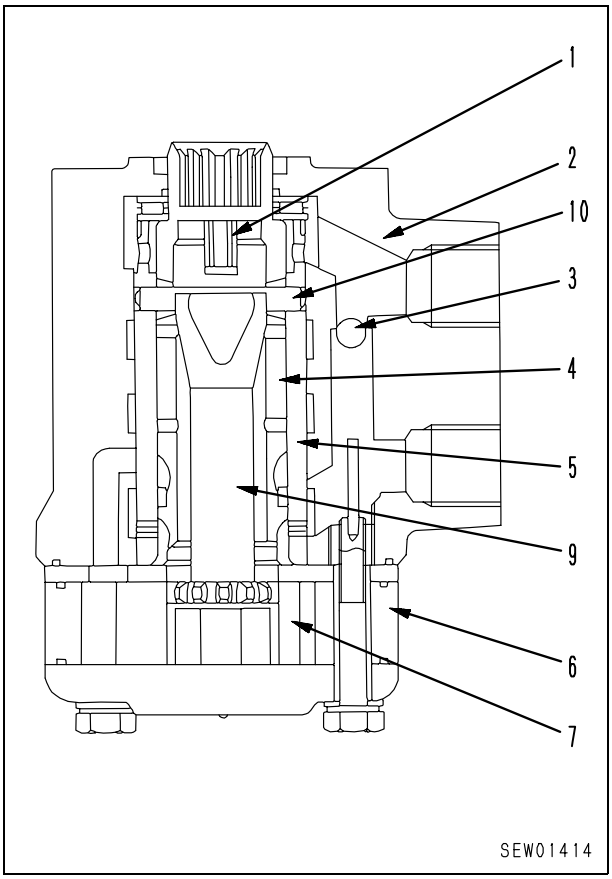
Steering valve

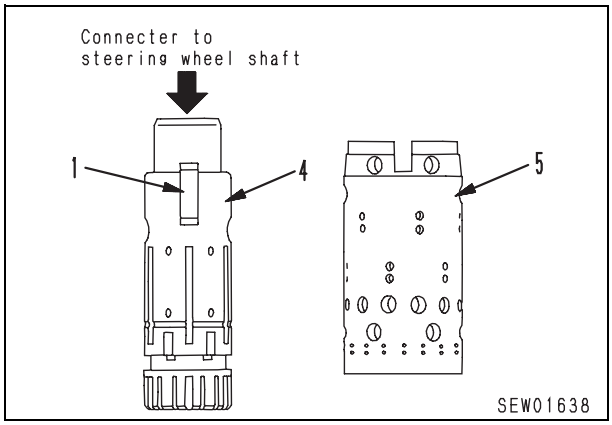
(Steering wheel specification)

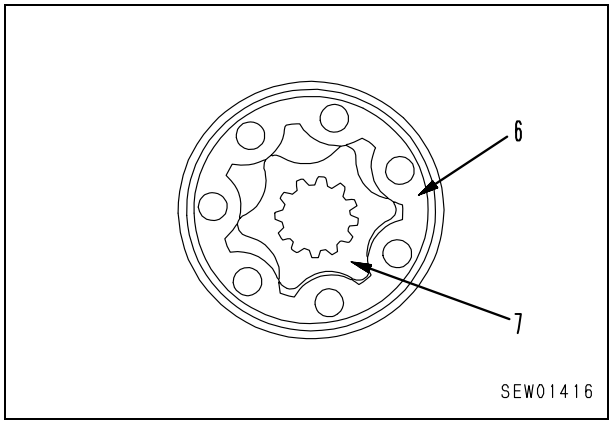


1. Neutral position spring
2. Valve body
3. Check valve
4. Spool
5. Sleeve
6. Gear rim
7. Gear
8. Cover
9. Drive shaft
10. Center pin

L: To steering cylinder (To Pb port of steering valve)
P: From PPC pump
R: To steering cylinder (To Pa port of steering valve)
T: To hydraulic tank







Outline

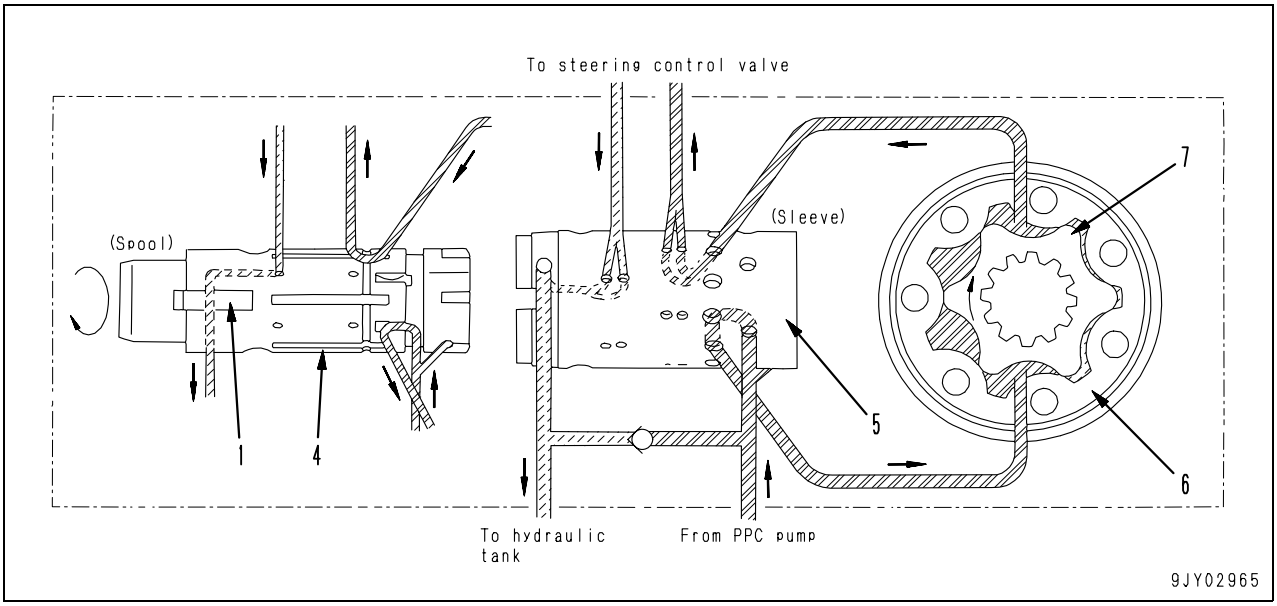
- The steering unit is directly connected to the shaft of the steering wheel. The oil from the PPC pump passes through the steering control valve, and is switched to the left and right steering cylinders to determine the direction of travel of the machine.
- The steering unit can be broadly divided into the following: spool (4) and sleeve (5), which have a rotor type direction selection function, and the gear set (combination of gear (7) and gear rim (6)), which acts as a hydraulic motor when the steering is operated.

Structure

- Spool (4) is interconnected with the drive shaft of the steering wheel and is connected to sleeve (5) by neutral position spring (1) and center pin (10) (when the steering wheel is at neutral, it does not contact the spool).
- The top of drive shaft (9) is meshed with center pin (10) and forms one unit with sleeve (5). The bottom is meshed with the spline of gear (7) of the gear set.
- Valve body (2) has four ports. These are connected respectively to the pump circuit, tank circuit, and pilot circuit of the steering demand valve.
  In addition, the port at the pump end and the port at the tank end are connected by check valve (3) inside the housing. If there is any failure in the PPC pump, oil is sucked in directly from the tank end by the check valve.

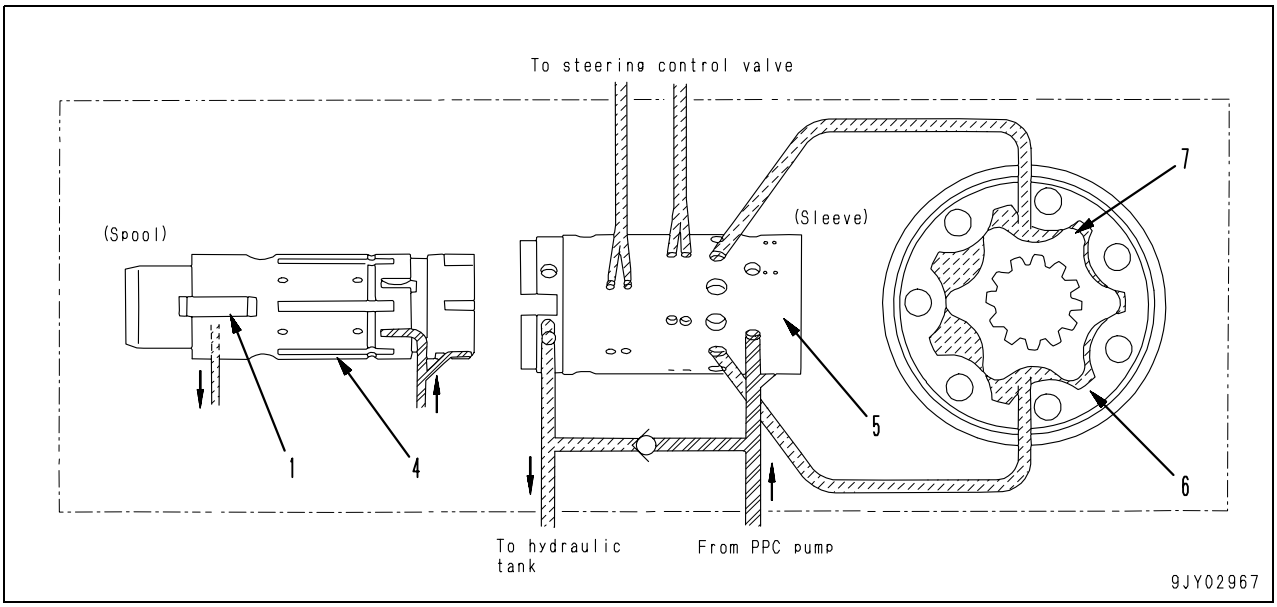
Operation

When turning



- When the steering wheel is turned, spool (4) overcomes neutral position spring (1) and turns slightly in relation to sleeve (5). Because of this rotation, the ports of sleeve (5) and spool (4) overlap, so a passage is formed for the oil to flow, and the oil flows to gear (7).
- When the steering wheel is turned, the oil inside gear (7) flows, passes inside sleeve (5) and spool (4), operates the spool of the steering control valve, and actuates the steering cylinders.

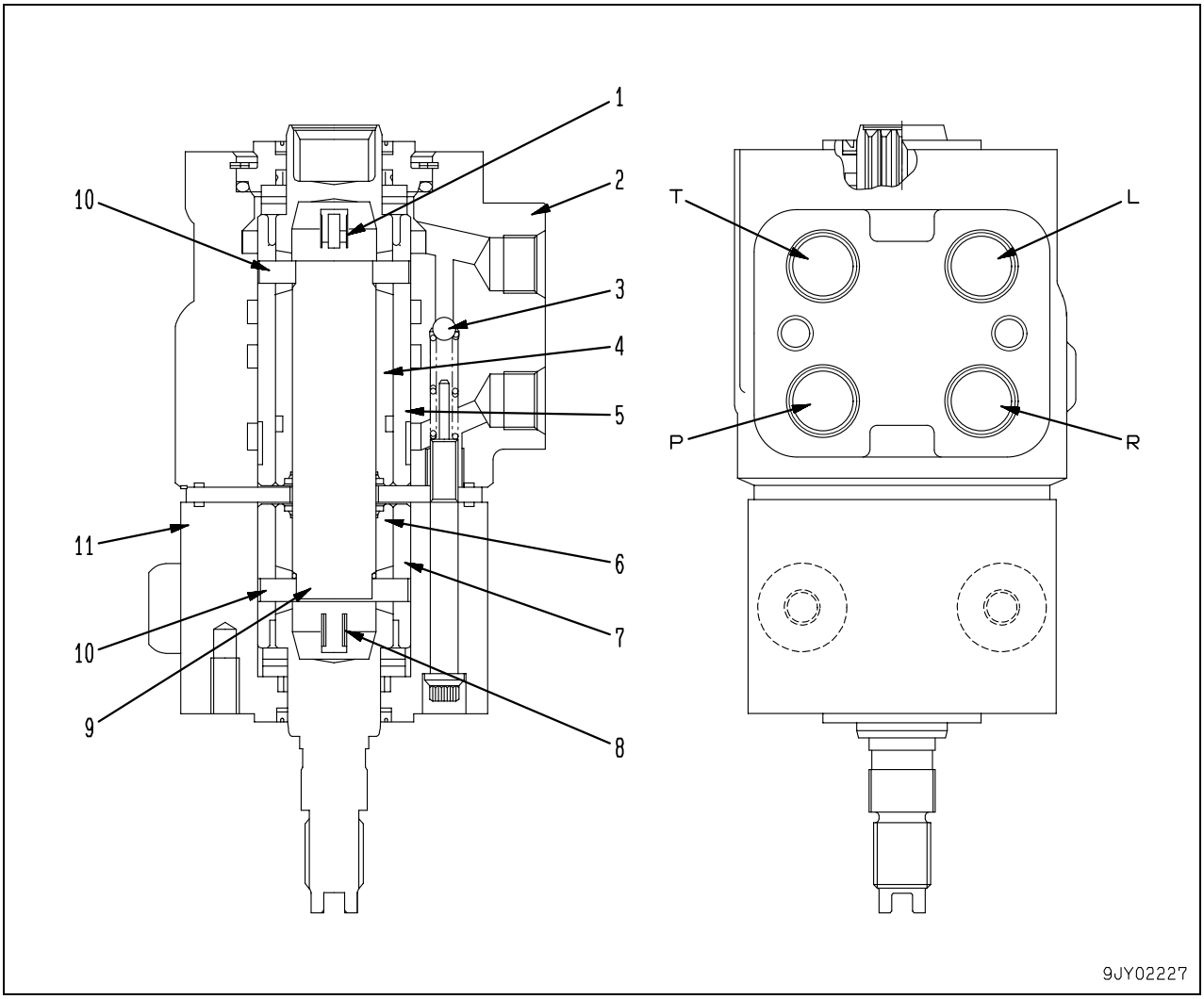
At neutral



- When the turning of the steering wheel is stopped (the rotation of the spool is stopped), the return force of neutral position spring (1) returns spool (4) and sleeve (5) to the neutral position, so the oil passage is shut off and the oil stops flowing.
- When the non-reaction type steering valve is at the neutral position, the steering cylinder and spool (4) and sleeve (5) are blocked, so the reaction from the machine is not transmitted to the steering wheel.

Rotary valve

AJSS (Advanced Joystick Steering System) specification

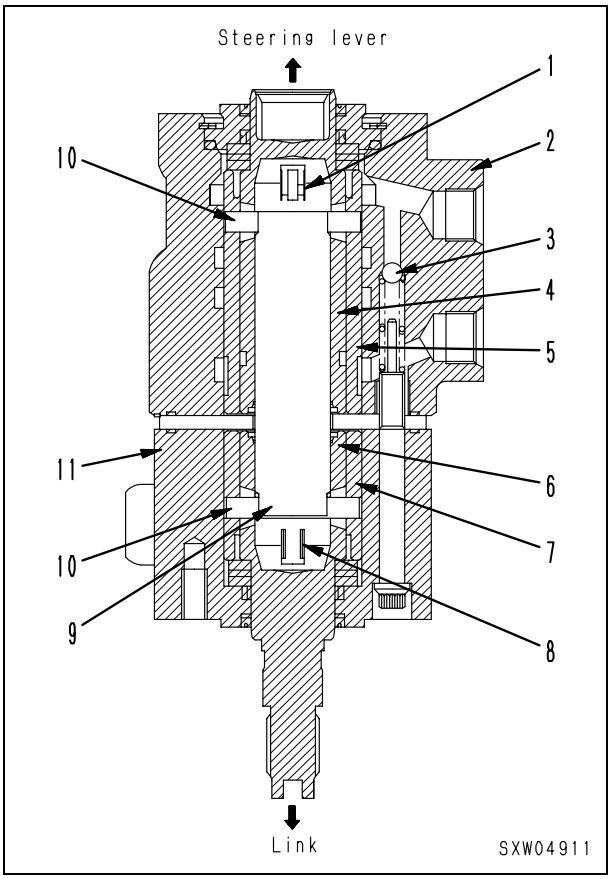


1. Neutral position spring
2. Valve body
3. Check valve
4. Spool
5. Sleeve
6. Feedback spool
7. Feedback sleeve
8. Loose spring
9. Drive shaft
10. Center pin
11. Body

T: To hydraulic tank
L: To Pb port of steering control valve
R: To Pa port of steering control valve
P: From EPC pump

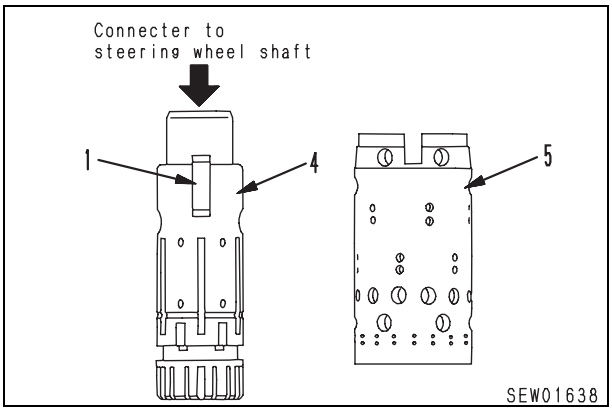
Outline

- With a steering lever connected on the top, the rotary valve switches the flow of oil supplied from the EPC pump through the EPC valve to move the spool of the steering demand valve. This movement of the spool operates the steering cylinder to steer the machine.
- On the other hand, the link installed on the front frame is connected to the underside of the rotary valve, which feeds back the steering angle of the machine.
  This mechanism ensures that the position of the steering lever always matches the steering position of the machine.



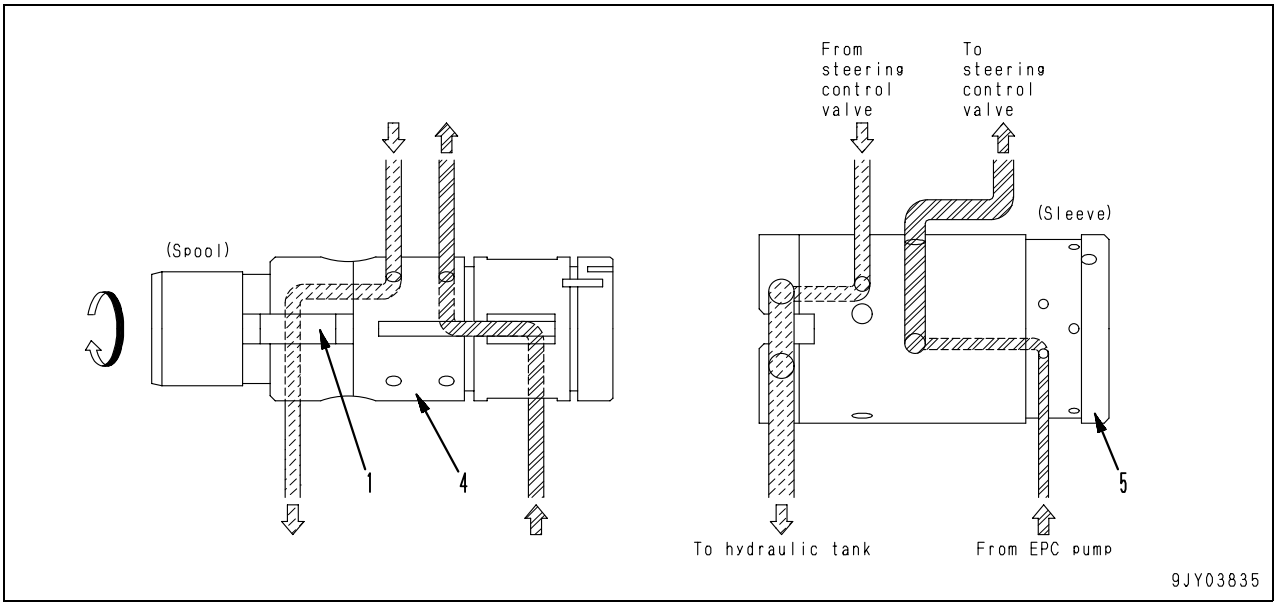
Structure

- Spool (4) connects to sleeve (5) through center pin (10) (which is out of contact with the spool when the steering lever is in “neutral“) and neutral position spring (1).
- The top and the bottom of drive shaft (9) are engaged with center pin (10) and combined with sleeve (5) and feedback sleeve (7) in one body.
- Feedback spool (6) is connected to feedback sleeve (7) through center pin (10) (which is not in contact with the spool while the steering wheel is in “neutral“) and loose spring (8).
- Valve body (2) has 4 ports, which are connected to the pump circuit, tank circuit and the pilot circuit of the steering demand valve respectively.



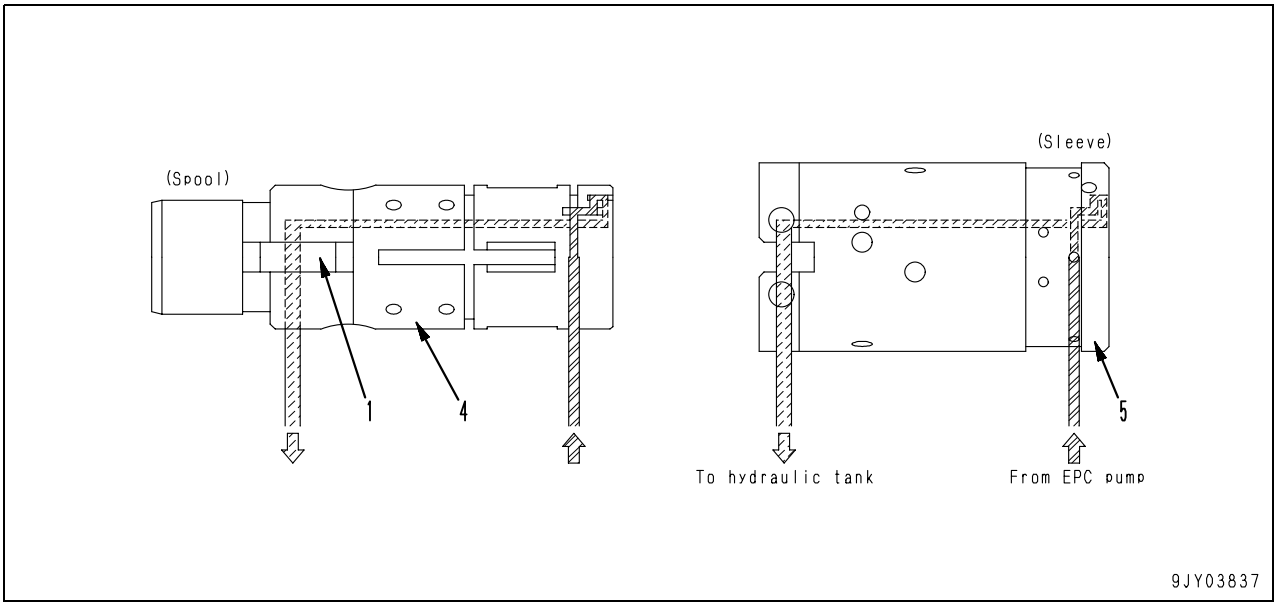
Operation

When turning



- When the steering lever is operated, spool (4) overcomes neutral position spring (1) and turns slightly in relation to sleeve (5). Because of this rotation, the ports of spool (4) and sleeve (5) overlap, so a passage is formed for the oil to flow, and the oil flows to the steering control valve to steer the machine.

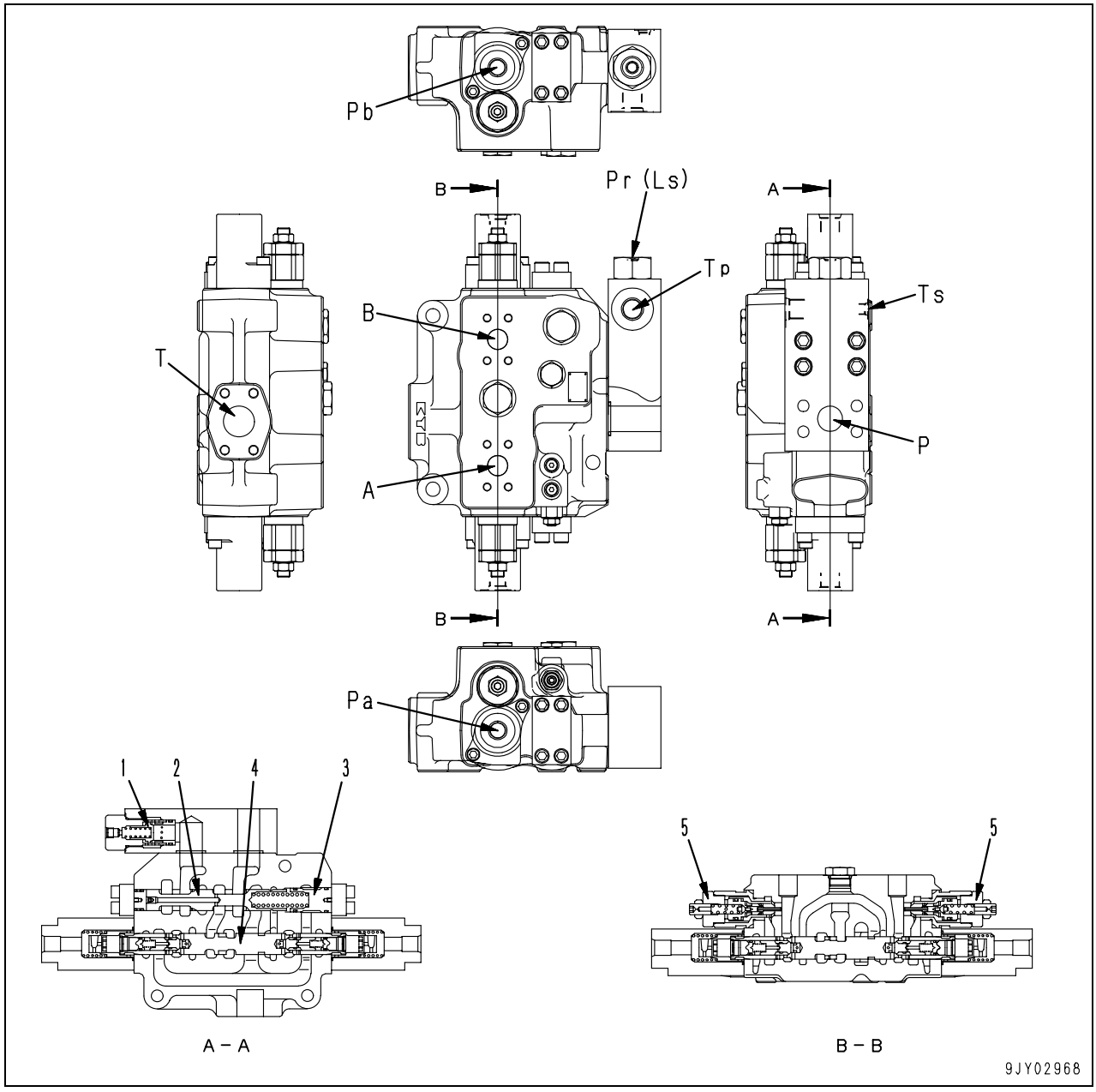
At neutral



- When application of the operating effort on the steering lever is stopped, the return force of neutral position spring (1) returns spool (4) and sleeve (5) to the neutral position, so the oil passage is shut off and the oil stops flowing.
- When the steering lever is held at a certain angle and the machine is steered to the angle equivalent to the operating angle of the steering lever (since sleeve (5) turns according to the steering angle of the machine), spool (4) and sleeve (5) are also returned to the neutral position, and the oil stops flowing.

Steering control valve

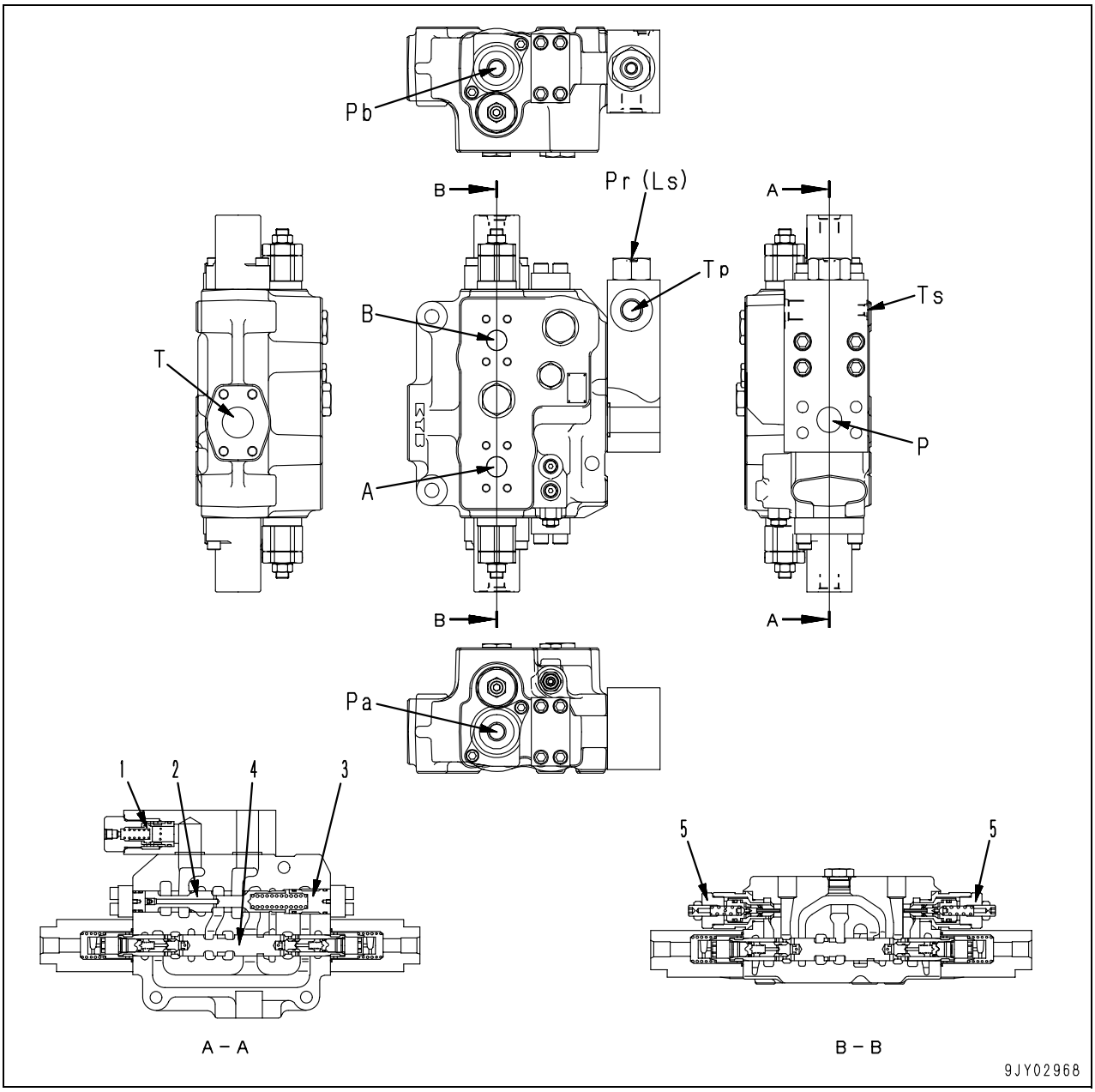
(Steering wheel specification)



1. Relief valve
2. Flow control spool
3. Main relief valve
4. Steering spool
5. Overload relief valve

A: To steering cylinder
B: To steering cylinder
P: From steering pump
Pa: From stop valve
Pb: From stop valve
Pr: To PB port of steering pump
T: To hydraulic tank
Ts: To PLS port of steering pump
Tp: To hydraulic tank

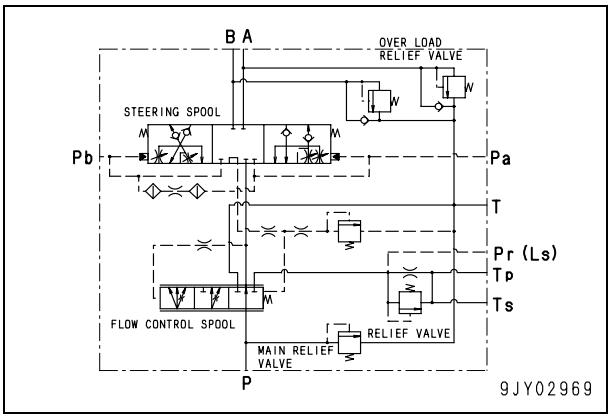
AJSS (Advanced Joystick Steering System) specification



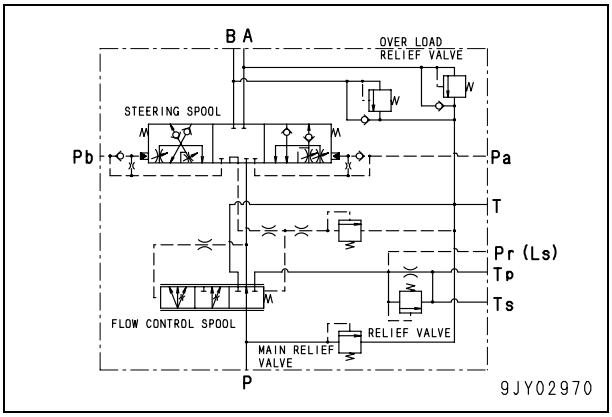
1. Relief valve
2. Flow control spool
3. Main relief valve
4. Steering spool
5. Overload relief valve

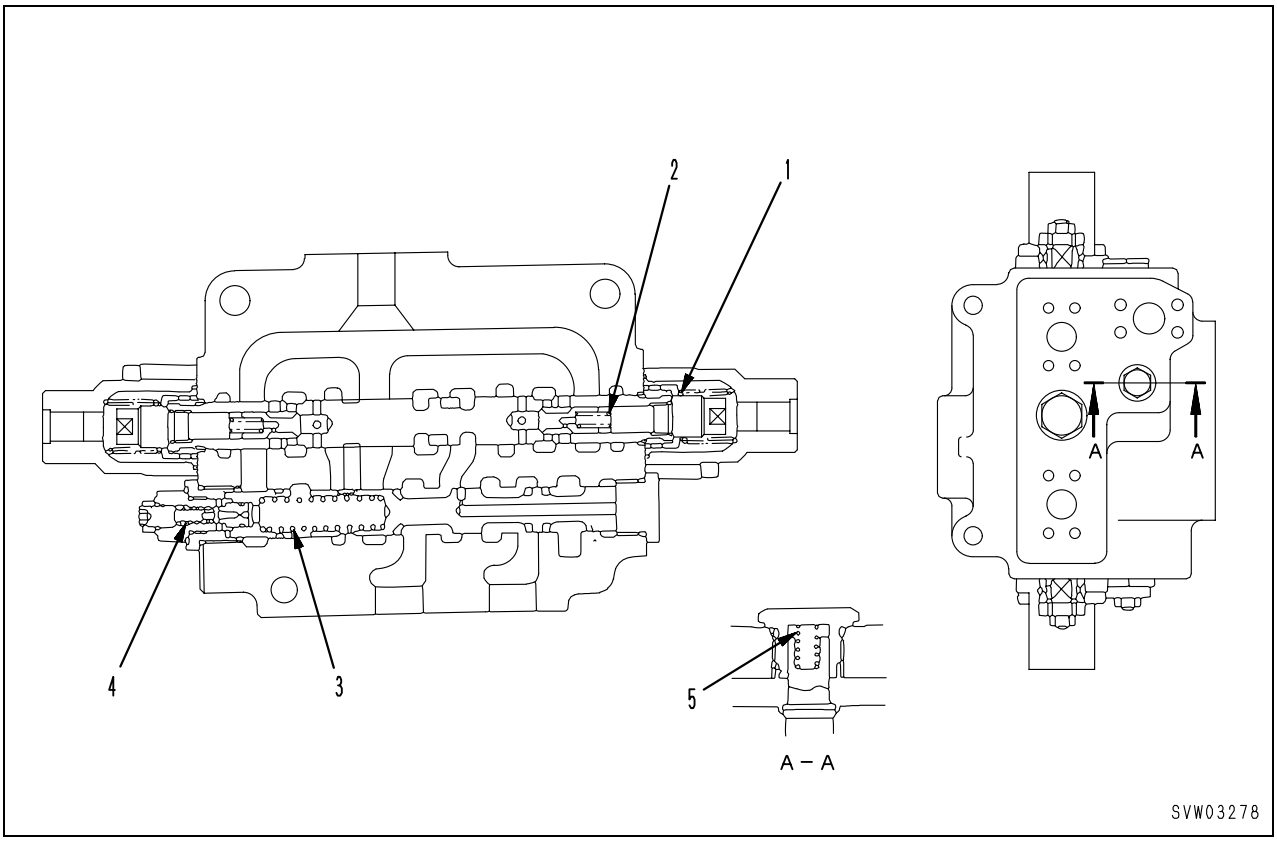
A: To steering cylinder
B: To steering cylinder
P: From steering pump
Pa: From rotary valve
Pb: From rotary valve
Pr: To PB port of steering pump
T: To hydraulic tank
Ts: To PLS port of steering pump
Tp: To hydraulic tank

(Steering wheel specification)



AJSS (Advanced Joystick Steering System) specification



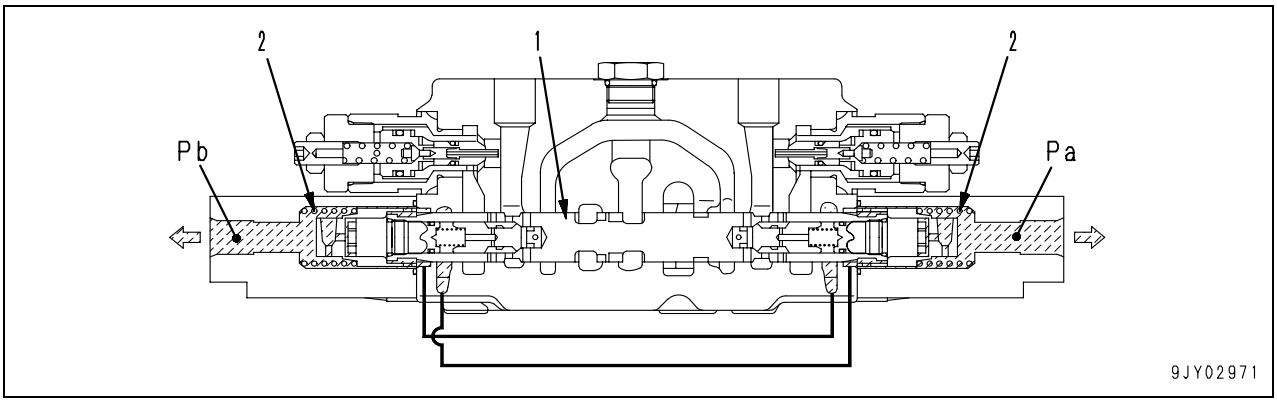


Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Steering spool return spring (Steering wheel specifications)	Free length	Installed length	Installed load	Free length	Installed load	
		41.8	37	94.1 N {9.6 kg}	—	74.3 N {7.6 kg}	
1	Steering spool return spring (AJSS specification)	39.8	35	94.1 N {9.6 kg}	—	74.3 N {7.6 kg}	
2	Load check valve spring	20.9	13.2	8.8 N {0.9 kg}	—	7.0 N {0.71 kg}	Replace
3	Flow control valve return spring	85.1	83	372.7 N {38 kg}	—	297.6 N {30.4 kg}	
4	Main relief valve spring	24.0	22.19	182.4 N {18.6 kg}	—	145.1 N {14.8 kg}	
5	Check valve return spring	20.9	13.2	8.8 N {0.9 kg}	—	7.0 N {0.71 kg}	

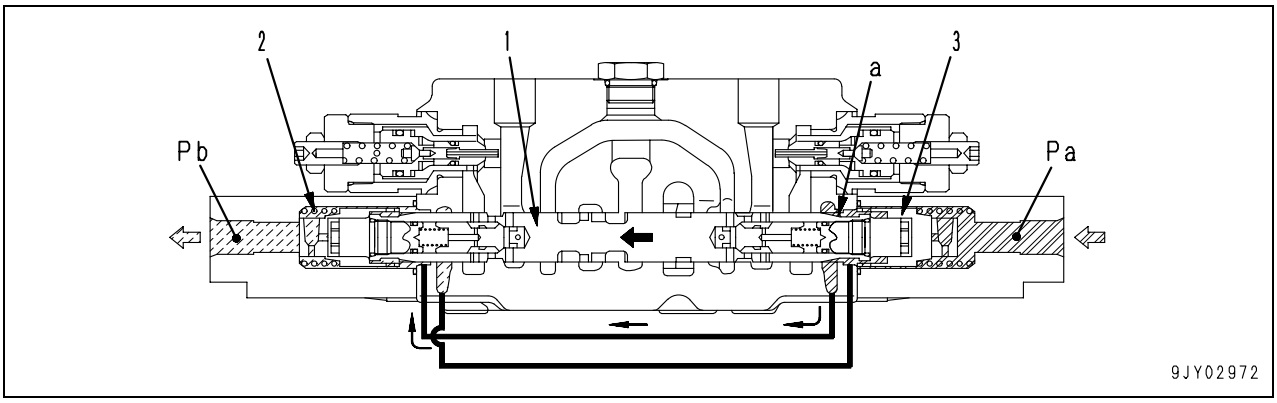
Operation of flow amplifier

When spool is at neutral
(When Orbit-roll valve is not in operation)



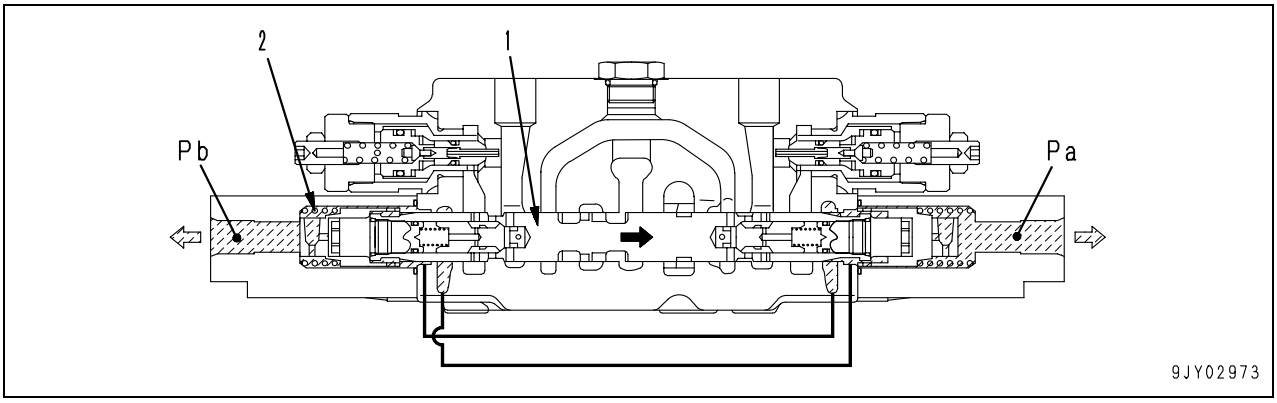
- Since both ports (Pa) and (Pb) are connected through the Orbit-roll valve, steering spool (1) is kept at neutral by right and left return springs (2).

When spool is in operation
(When oil flows in port (Pa))



- The pressure in port (Pa) rises and steering spool (1) compresses left return spring (2) and moves to the left.
- The oil in port (Pa) flows through the hole of spring seat (3) and orifice (a) of steering spool (1) to port (Pb).
- Since port (Pb) is connected through the Orbit-roll valve to the drain circuit, the oil in port (Pb) is drained.
- Since the pressure generated in port (Pa) is in proportion to the flow rate of the oil, steering spool (1) moves to a position where the oil pressure reduced by orifice (a) is balanced with the repulsive force of return spring (2).

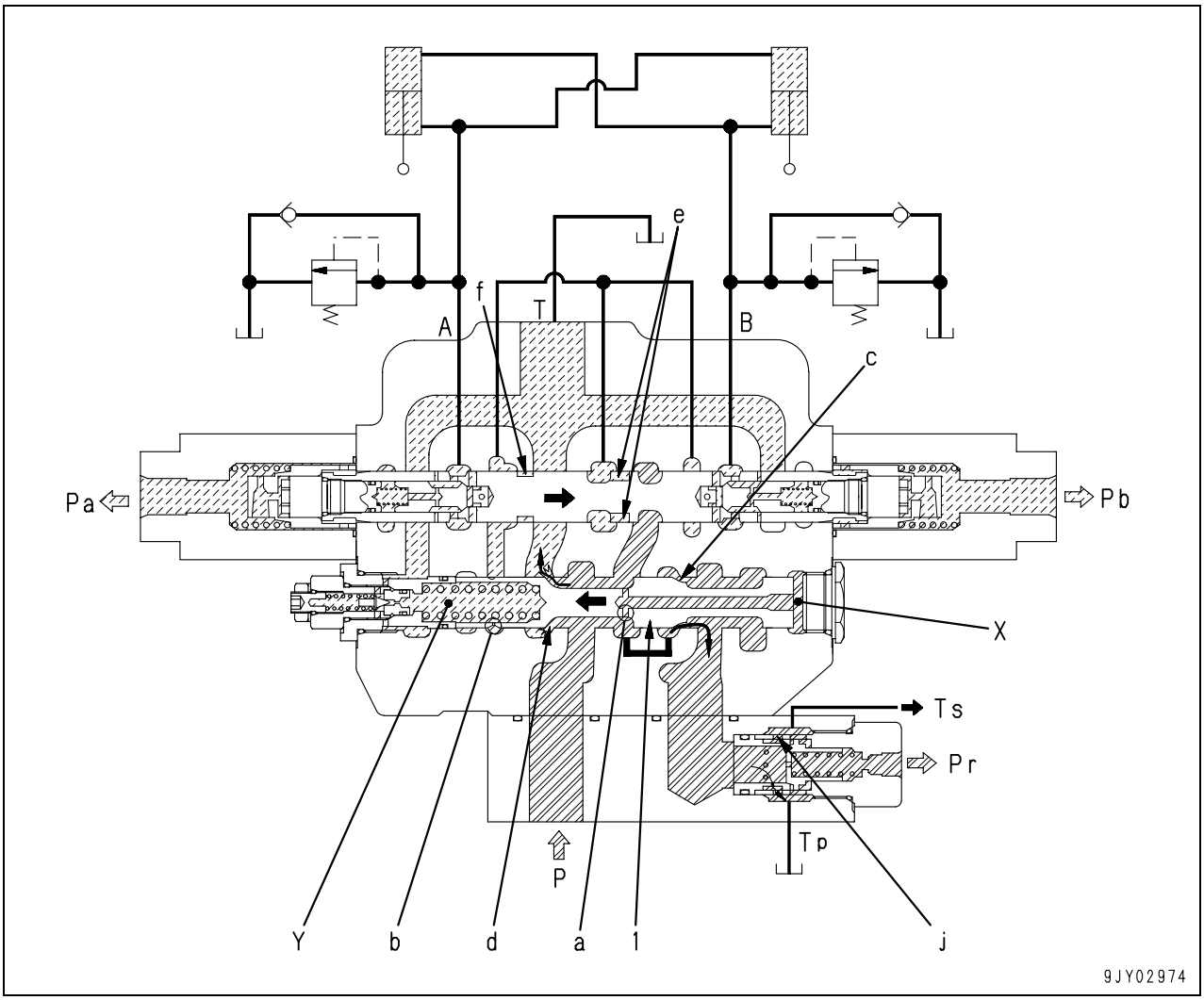
When spool is returned
(When steering wheel is stopped)



- Since both ports (Pa) and (Pb) are connected through the Orbit-roll valve to the drain circuit, steering spool (1) is driven back to neutral by left return spring (2).

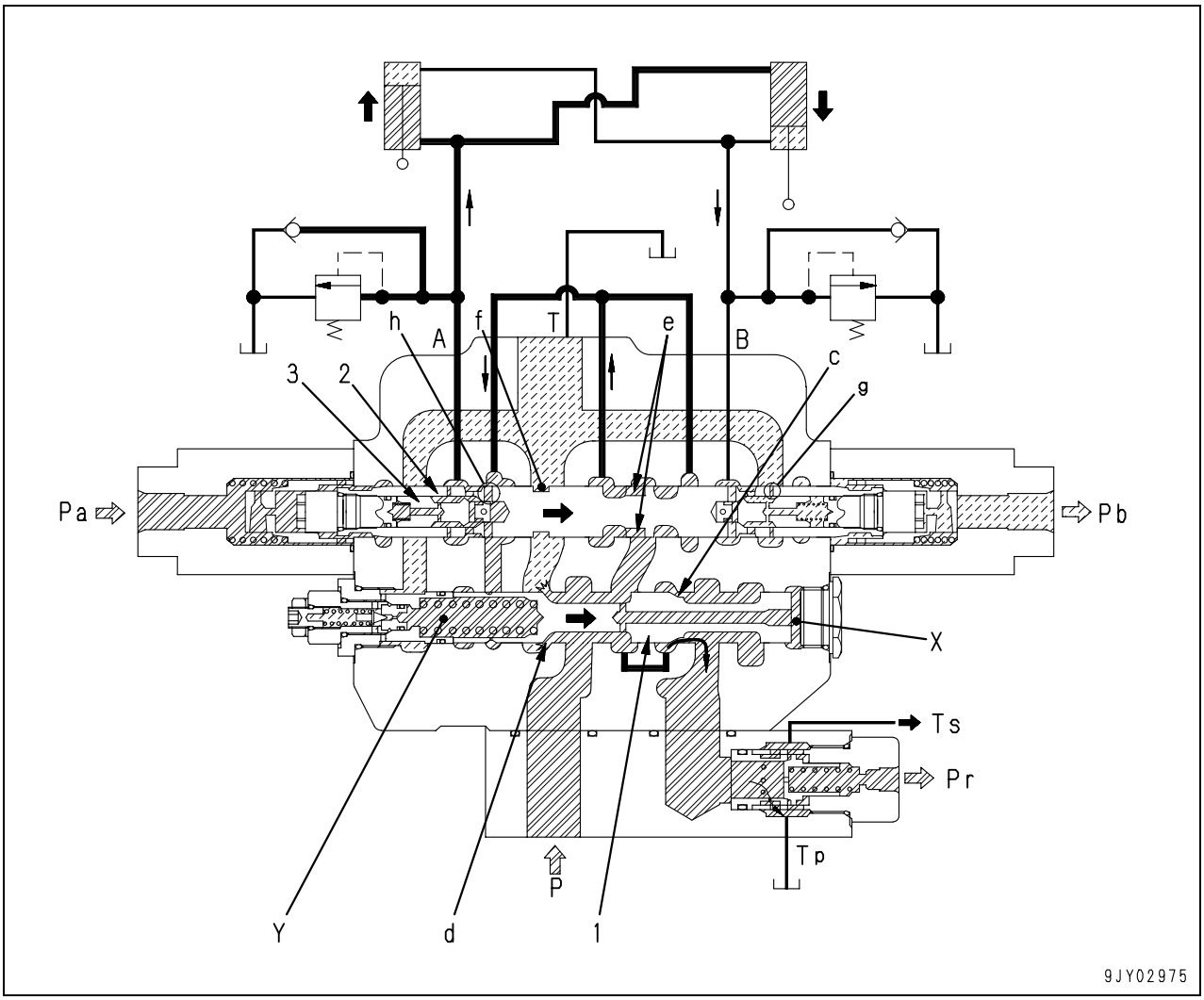
Operation of flow control spool

When steering spool is at neutral position



- The oil from the steering pump flows in port (P).
- Since notch (e) is closed, the oil pressure in port (P) is increased and then led through orifice (a) to pressure receiving chamber (X) to move flow control spool (1) to the left.
- The oil in pressure receiving chamber (Y) is drained from port (T1) through orifice (b), notch (f) and port (T).
- If the oil pressure in pressure receiving chamber (X) rises above the set pressure, flow control spool (1) moves to the left to open notch (c).
- The oil in port (P) flows through notch (c) and port (Pr) to the LS valve of the steering pump.
- Port (Pr) is connected through orifice (j) to port (Tp) and (Ts).
- The oil pressure in port (Pr) is set between the pump pressure and drain pressure of port (Tp) because of the passing resistance of notch (c) and orifice (j).
- If the oil pressure in port (Pr) rises above the set pressure, the swash plate angle of the steering pump is reduced to reduce the delivery.
- If the oil pressure in port (P) keeps rising after the delivery of the pump is minimized, flow control spool (1) moves to the left further.
- If the oil pressure in pressure receiving chamber (X) rises above the set pressure, notch (d) opens and the oil in port (P) is drained through notch (d) and port (T).

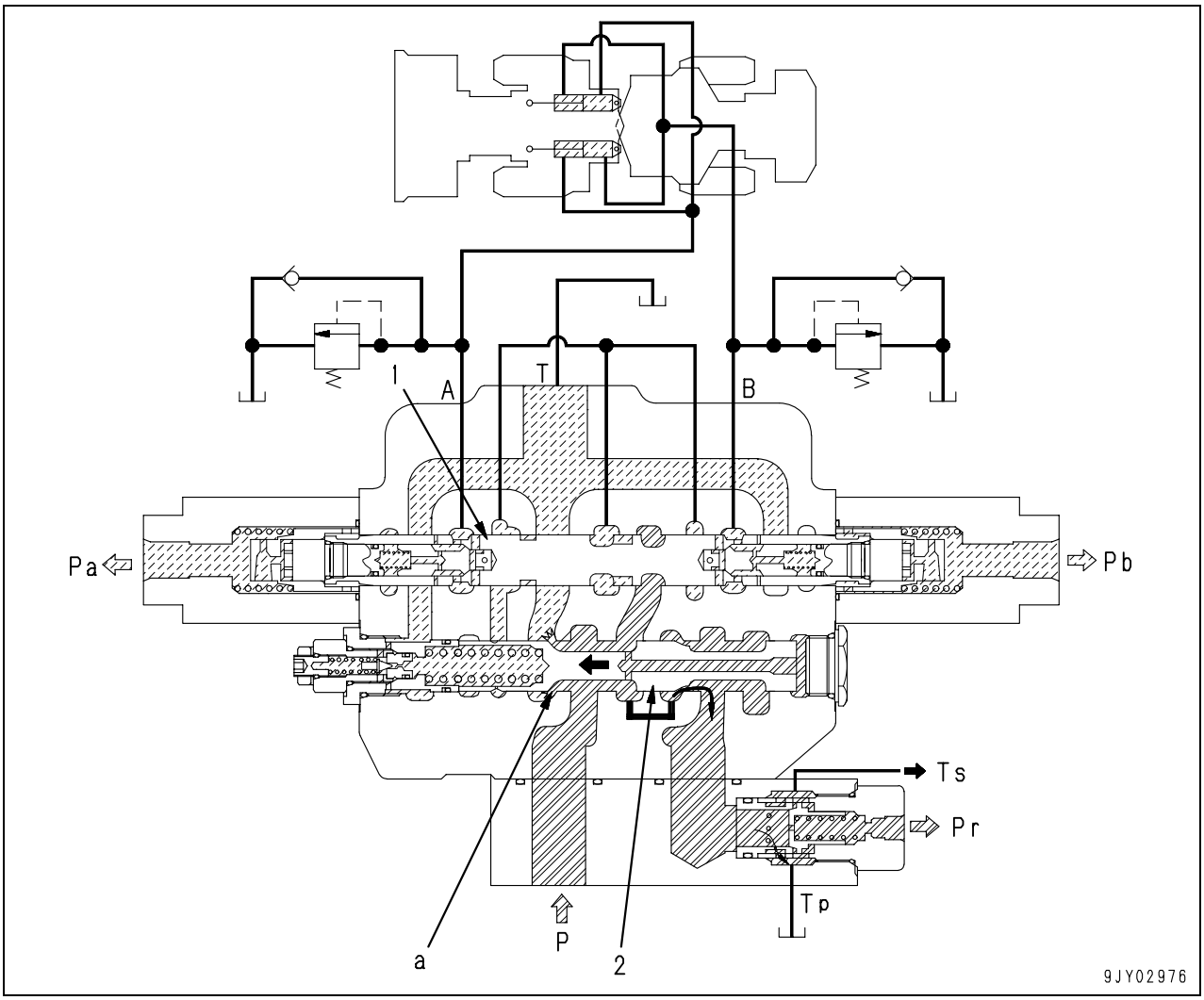
When steering spool operates



- If steering spool (2) operates, notch (f) closes and pressure receiving chamber (Y) and port (T) are disconnected and notch (e) opens.
- The oil pressure in pressure receiving chamber (Y) rises and flow control spool (1) moves to the right and the open area of notch (d) reduces.
- The oil before notch (e) is led to pressure receiving chamber (X) and the oil after notch (e) is led to pressure receiving chamber (Y).
- If the oil pressure in pressure receiving chamber (Y) rises higher than that in port (A), the oil flowing from orifice (h) pushes and opens load check valve (3) to the left.
- Since the oil from notch (e) flows through port (A) to the steering cylinder, a pressure difference is made between before and after notch (e).
- Since flow control spool (1) works to keep the differential pressure between before and after notch (e) to the set pressure, the oil is discharged to the steering cylinder according to the open rate of notch (e).
- The excessive oil from the steering pump is drained through notch (d) and port (T).
- The oil returning from the steering cylinder is drained through orifice (g) and port (T1).
- Even after flow control spool (1) moves to the right to close notch (d), it moves further to the right, as long as the pressure before notch (e) is below the set pressure.
- Since the open area of notch (c) reduces, the oil flow into port (Pr) is reduced and the oil pressure in port (Pr) lowers.
- If the oil pressure in port (Pr) lowers, the LS valve of the steering pump increases the delivery of the pump to keep the oil pressure in port (Pr) to the set pressure.
- Flow control spool (1) is held at a position where the pressure in port (P) is balanced with the pressure in port (Pr), thus the delivery of the pump is kept constant.
- If the open rate of notch (e) changes, the steering pump delivery changes according to it to keep the oil pressure in port (Pr) constant.

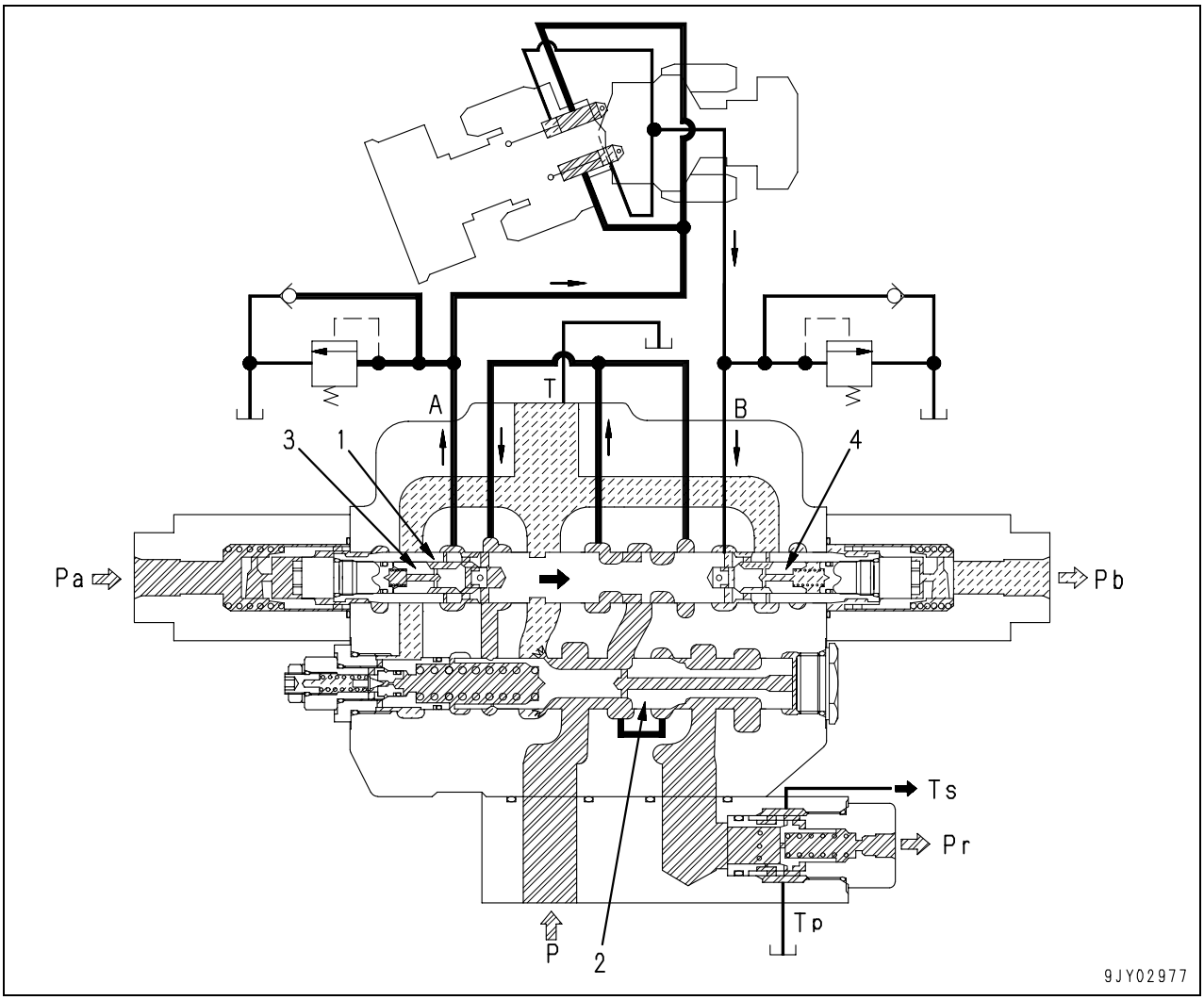
Operation of steering valve

At neutral



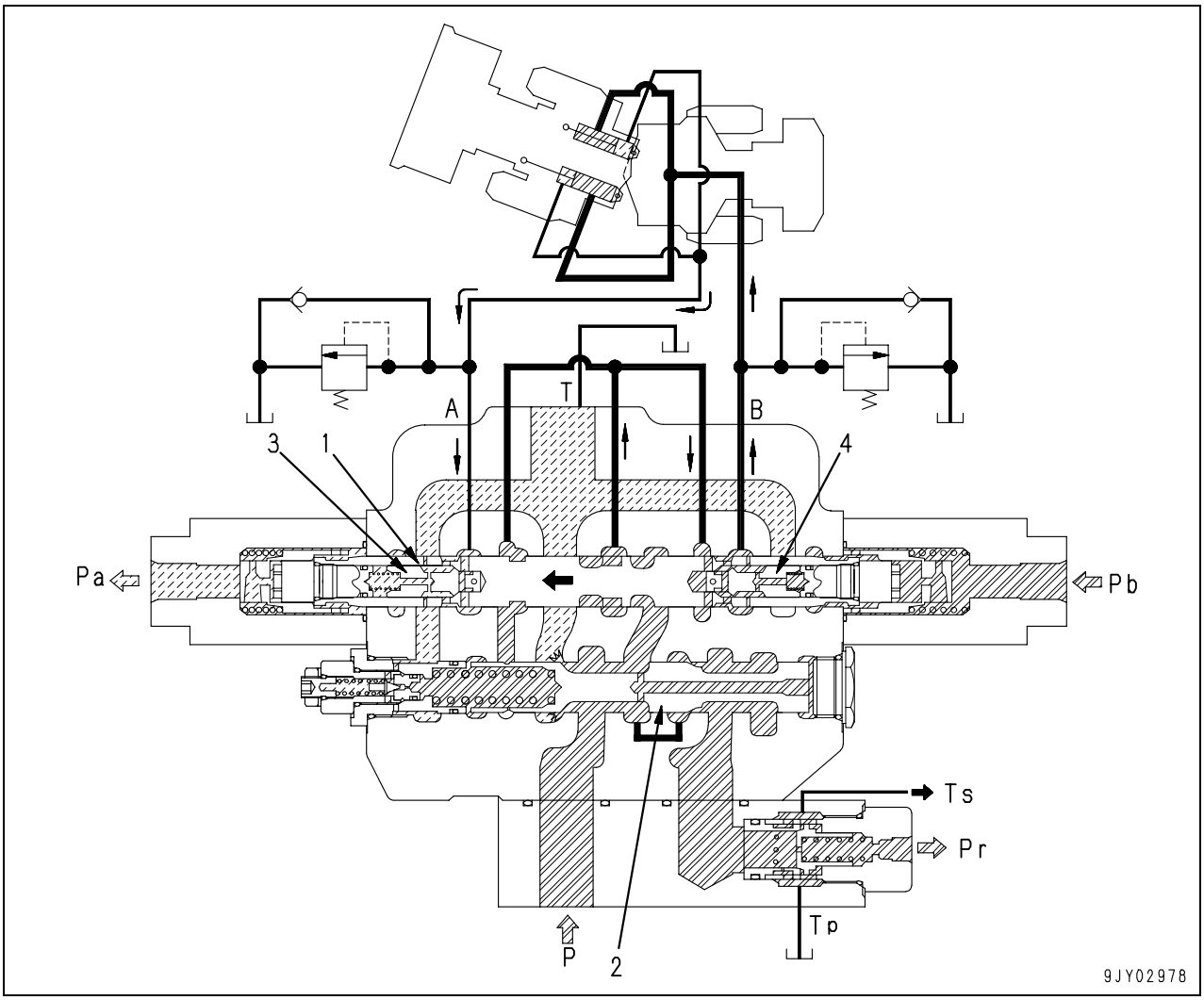
- Since the steering wheel is not operated, steering spool (1) does not move.
- The oil from the steering pump flows in port (P).
- If the oil pressure in port (P) rises, flow control spool (2) moves to the left and the oil from the steering pump is drained through notch (a) and port (T).

Turning left



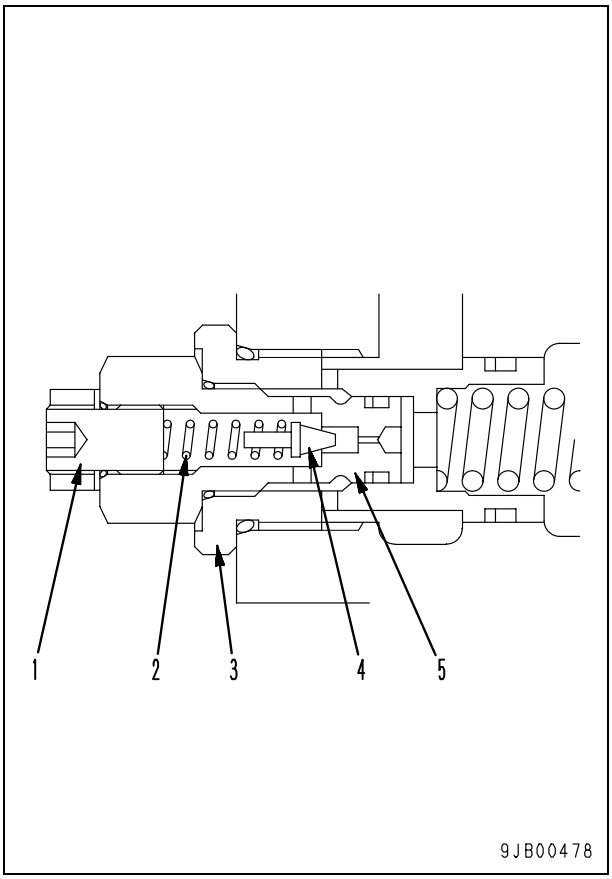
- If the steering wheel is turned to the left, the output pressure from the Orbit-roll valve enters port (Pa) and steering spool (1) is pushed to the right.
- The oil from the steering pump flows in port (P), and then flows through flow control spool (2) to steering spool (1).
- Load check valve (3) is pushed to the left and opened, conducting oil to the head side of the left steering cylinder and to the bottom side of the right steering cylinder to turn the machine to the left.
- The oil returning from the right and left steering cylinders is drained through load check valve (4) and port (T).

Turning right



- If the steering wheel is turned to the right, the output pressure from the Orbit-roll valve enters port (Pb) and steering spool (1) is pushed to the left.
- The oil from the steering pump flows in port (P), and then flows through flow control spool (2) to steering spool (1).
- Load check valve (4) is pushed to the right and opened, conducting the oil flows to the head side of the right steering cylinder and to the bottom side of the left steering cylinder to turn the machine to the right.
- The oil returning from the right and left steering cylinders is drained through load check valve (3) and port (T).

Main relief valve

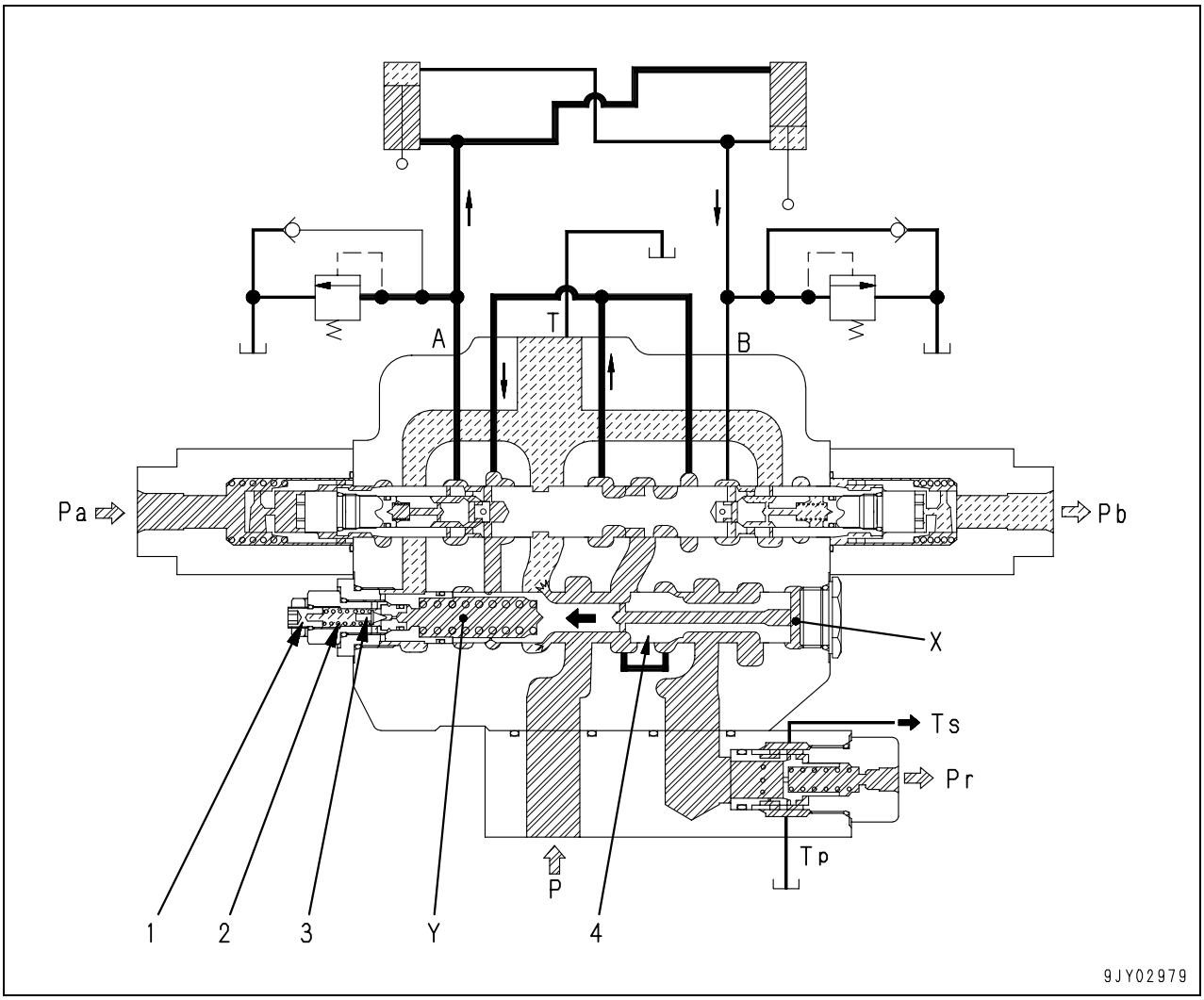


1. Adjustment screw
2. Spring
3. Plug
4. Pilot poppet
5. Valve seat

Function

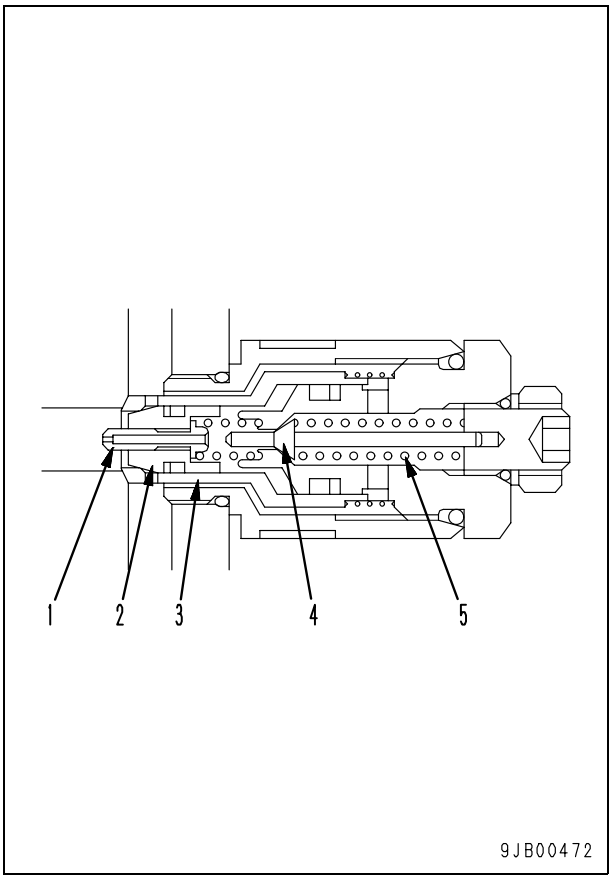
- The main relief valve is installed to the steering valve. It maintains the oil pressure in the steering circuit to the set pressure during the steering operation.

Operation of main relief valve



- If the oil pressure in the steering circuit rises to the level being set with adjustment screw (1) and spring (2), pilot poppet (3) opens and the oil is drained through port (T).
- Pressure balance between receiving chambers (X) and (Y) is lost and flow control spool (4) moves to the left.
- As flow control spool (4) operates, the oil from the steering pump is drained and the pressure in the steering circuit is kept below the set pressure.

Overload relief valve



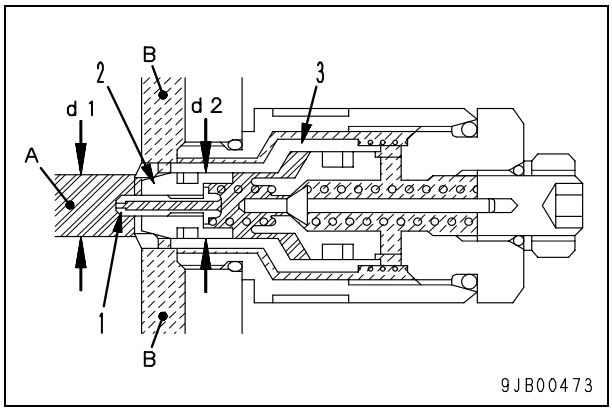
1. Poppet
2. Relief valve poppet
3. Check valve poppet
4. Pilot poppet
5. Spring

Function

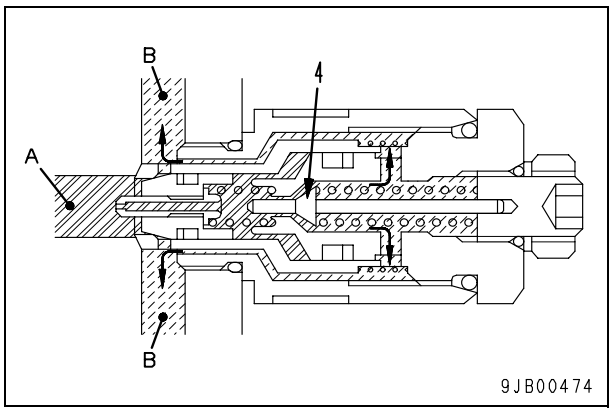
- The overload relief valve is installed to the steering valve. It protects the cylinder circuit from abnormally high pressure that can be generated if an impact is applied to the cylinder while the steering valve is in neutral.
- If abnormally high pressure is generated on the cylinder side, the overload relief valve works as a safety valve to prevent breakage of the cylinder and hydraulic piping.
- If negative pressure is generated on the cylinder side, the overload relief valve works as a suction valve to prevent occurrence of vacuum in the circuit.

Operation

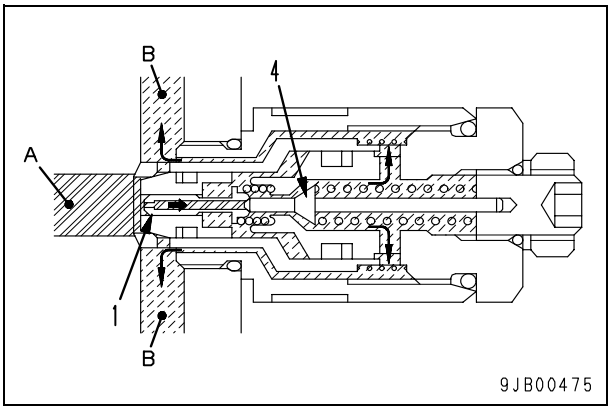
Operation as relief valve



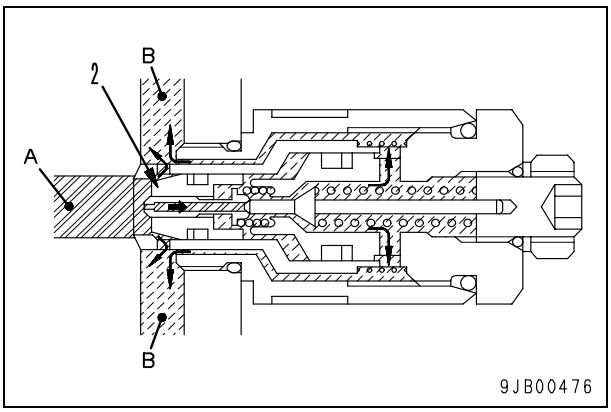
- Port (A) and port (B) are connected to the cylinder circuit and drain circuit, respectively.
- The oil flows through the hole of poppet (1) to the inside of relief valve poppet (2).
- Check valve poppet (3) and relief valve poppet (2) are seated securely by the area difference between diameters (d1) and (d2).



- If the oil pressure in port (A) rises above the set pressure of the relief valve, pilot poppet (4) is pushed and opened to the right.
- The oil flows through pilot poppet (4) and hole to port (B).

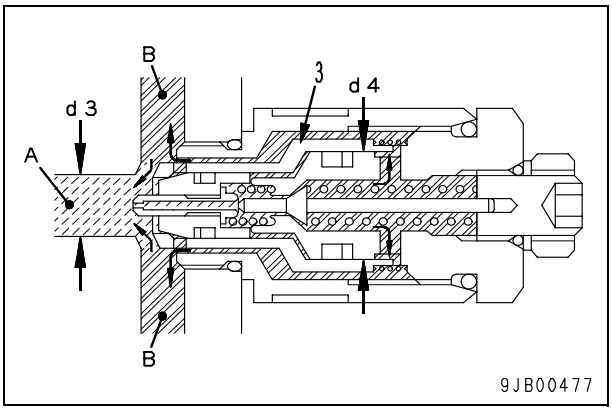


- As pilot poppet (4) opens, the oil pressure inside of poppet (1) lowers.
- Poppet (1) moves to the right to seat pilot poppet (4).



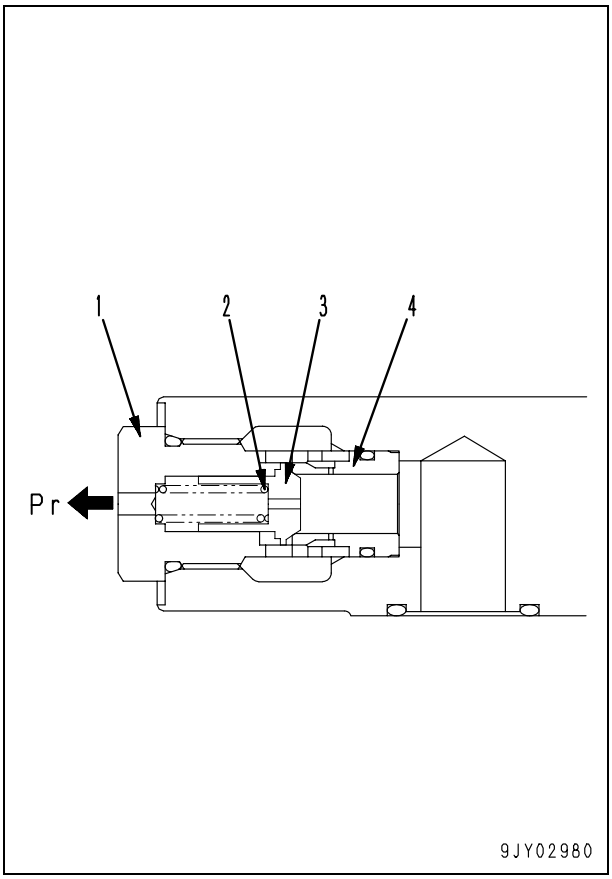
- The oil pressure of inside of relief valve poppet (2) becomes lower than the oil pressure in port (A).
- The oil pushes and opens relief valve poppet (2) to the right and flows through port (A) to port (B), thus the circuit is protected from abnormally high pressure.

Operation as suction valve



- If negative pressure is generated in port (A), it acts on the area difference between diameters (d3) and (d4) and pushes and opens check valve poppet (3) to the right.
- The oil flows through port (B) to port (A) to prevent occurrence of vacuum.

Relief valve

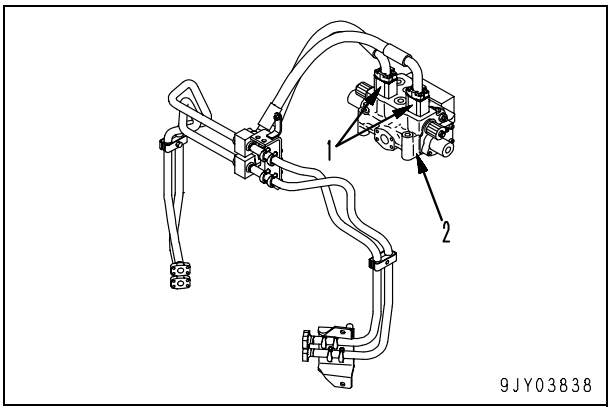


1. Plug
2. Spring
3. Valve
4. Valve seat

Function

- The relief valve is installed to the steering valve. If the oil pressure in port (Pr) rises above the set pressure, the relief valve relieves the oil to protect the LS circuit of the steering pump from abnormally high pressure.

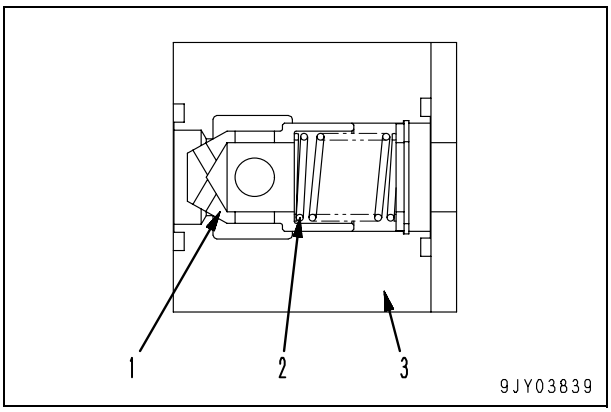
Two-way restrictor valve



1. Two-way restrictor valve
2. Steering control valve

Function

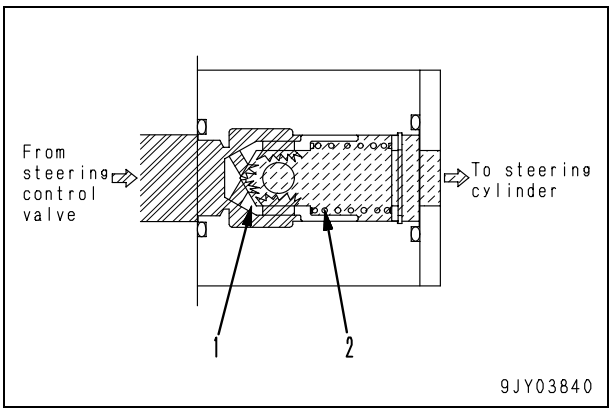
- To reduce the shock caused by the inertia of the machine when the steering is operated, an orifice is installed in the oil line of the return circuit from the cylinder. This applies pressure to the returning oil, and regulates the movement of the cylinder piston.



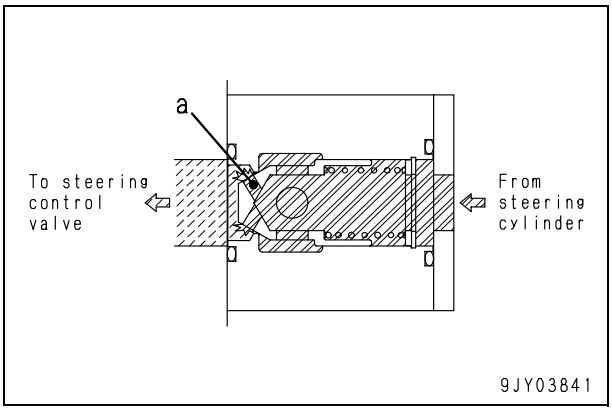
1. Poppet
2. Spring
3. Body

Operation

- When the oil is flowing to arrow →, it pushes spring (2) and flows through the orifice, and between poppet (1) and the poppet seat.

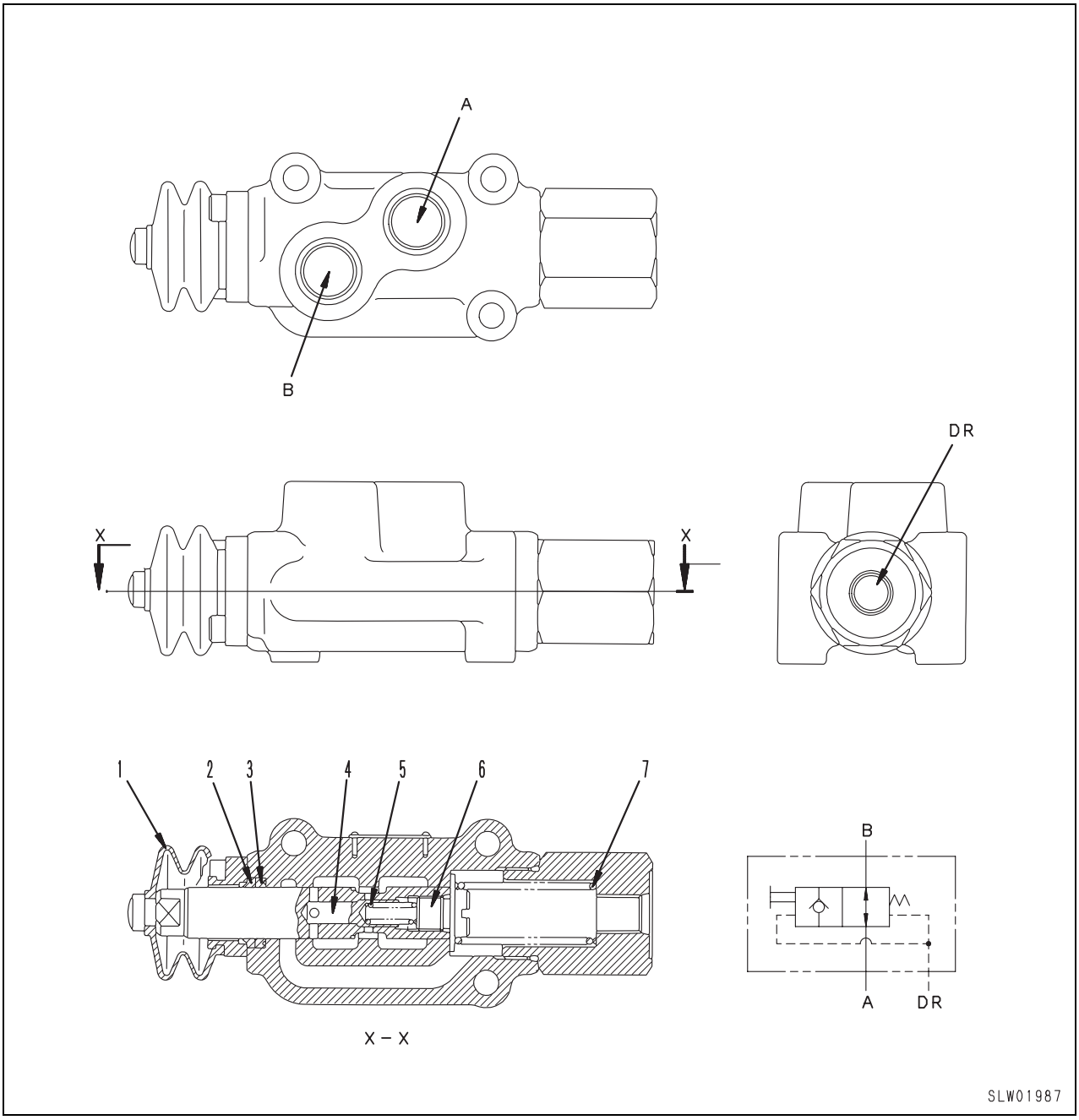


- When the oil is flowing to arrow ←, the oil flows only from orifice (a) inside poppet (1), so the flow is controlled.



Stop valve

(Steering wheel specification)

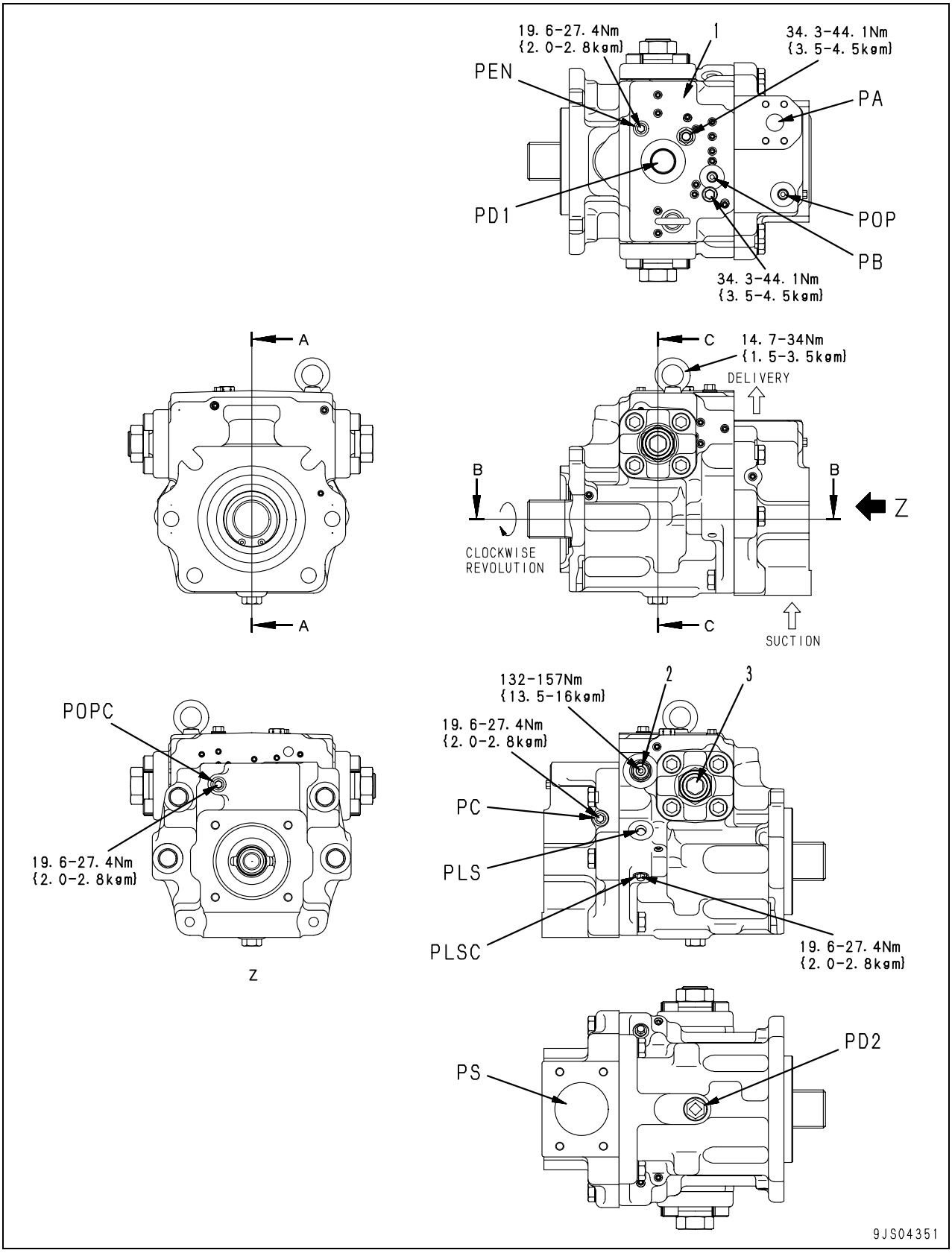


1. Boot
2. Wiper
3. Seal
4. Poppet
5. Spring
6. Spool
7. Spring

A: From steering valve (Orbit-roll valve)
B: To steering control valve
DR: Drain

Steering pump

Type: HPV125

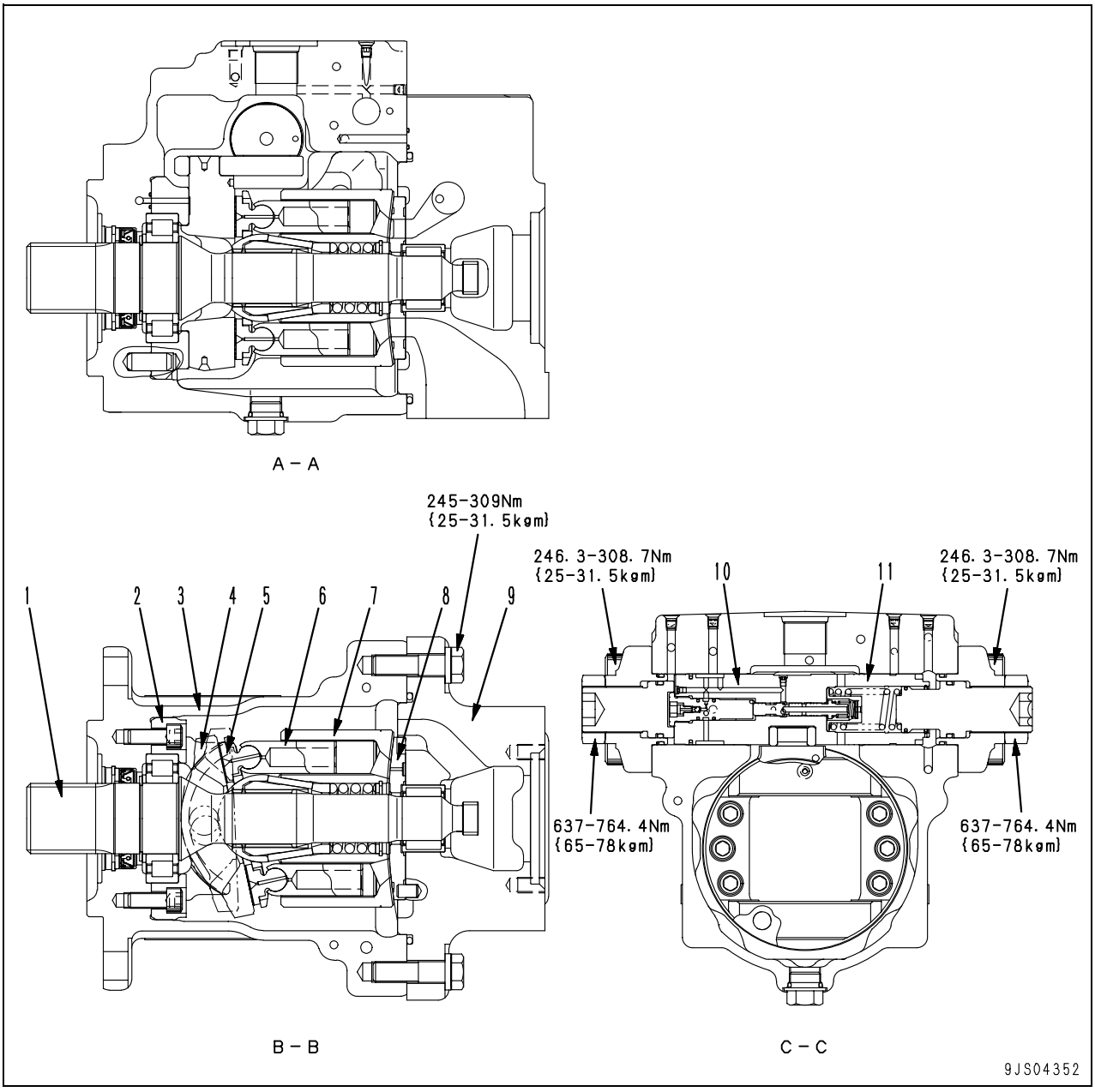


Outline

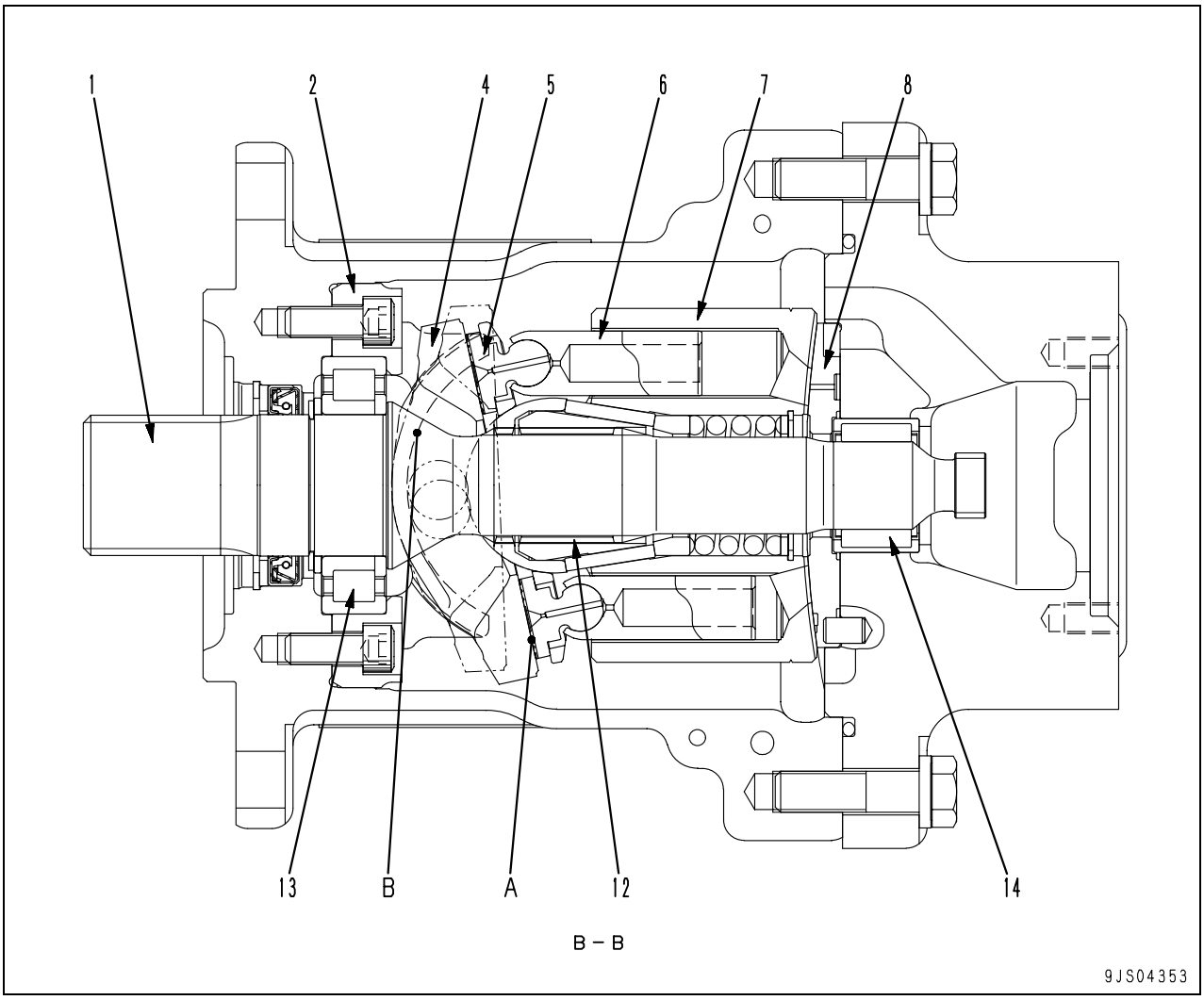
- The pump unit is composed of the variable-capacity swash plate-type piston pump, CO valve, and LS valve.

PA : Pump discharge port
PB : Pump discharge pressure input port
PC : Pump discharge pressure pick-up port
PD1 : Case drain port
PD2 : Drain plug
PEN : Control pressure pick-up port
PLS : Load pressure input port
PLSC : Load pressure pick-up port
POP : External pilot pressure input port
POPC : External pilot pressure pick-up port
PS : Pump suction port

1. Main pump
2. LS valve
3. CO valve



1. Shaft
2. Cradle
3. Case
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. End cap
10. Servo piston
11. CO valve



Function

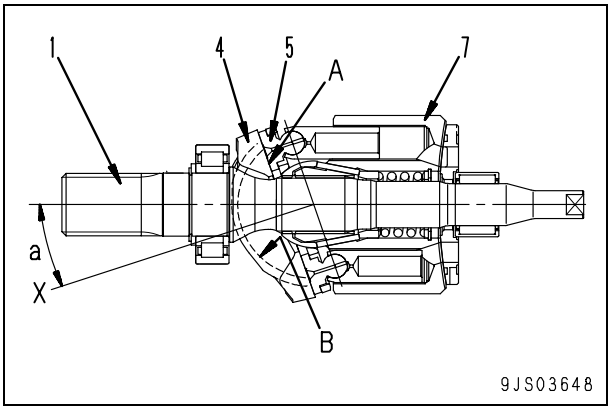
- The pump converts the engine rotation transmitted to its shaft to oil pressure and delivers pressurized oil corresponding to the load.
- It is possible to change the discharge amount by changing the swash plate angle.

Structure

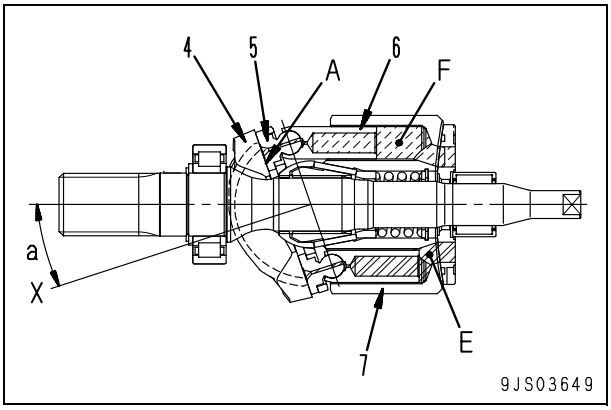
- Cylinder block (7) is supported to shaft (1) by spline (12).
- Shaft (1) is supported by bearings (13) and (14).
- Tip of piston (6) is shaped as a concave ball and shoe (5) is caulked to it to form one unit.
- Piston (6) and shoe (5) form a spherical bearing.
- Rocker cam (4) has flat surface (A), and shoe (5) is always pressed against this surface while sliding in a circular movement.
- Rocker cam (4) conducts high pressure oil to cylinder surface (B) with cradle (2), which is secured to the case, and forms a static pressure bearing when it slides.
- Piston (6) carries out relative movement in the axial direction inside each cylinder chamber of cylinder block (7).
- Cylinder block (7) seals the pressurized oil to valve plate (8) and carries out relative rotation.
- This surface is designed so that the oil pressure balance is maintained at a suitable level.
- The oil inside each cylinder chamber of cylinder block (7) is suctioned and discharged through valve plate (8).

Operation of pump

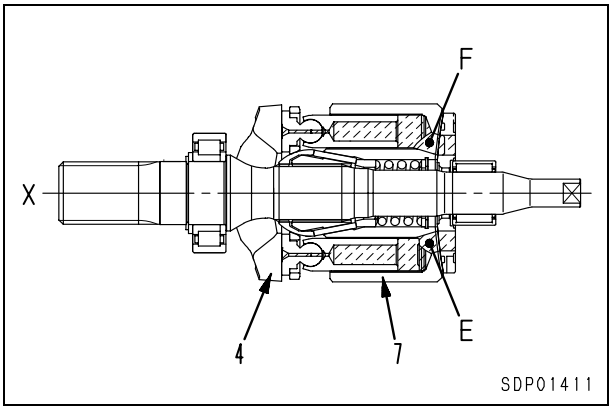
- Cylinder block (7) rotates together with shaft (1), and shoe (5) slides on flat surface (A).
- When this happens, rocker cam (4) moves along cylindrical surface (B), so angle (a) between center line (X) of rocker cam (4) and the axial direction of cylinder block (7) changes.
- Angle (a) is called the swash plate angle.



- With center line (X) of rocker cam (4) at swash plate angle (a) in relation to the axial direction of cylinder block (7), flat surface (A) acts as a cam in relation to shoe (5).
- In this way, piston (6) slides on the inside of cylinder block (7), so a difference between volumes (E) and (F) is created inside cylinder block (7).
- A single piston (6) sucks and discharges the oil by the amount (F) – (E).
- As cylinder block (7) rotates and the volume of chamber (E) becomes smaller, the pressurized oil is discharged.
- On the other hand, the volume of chamber (F) grows larger and, in this process, the oil is suctioned.

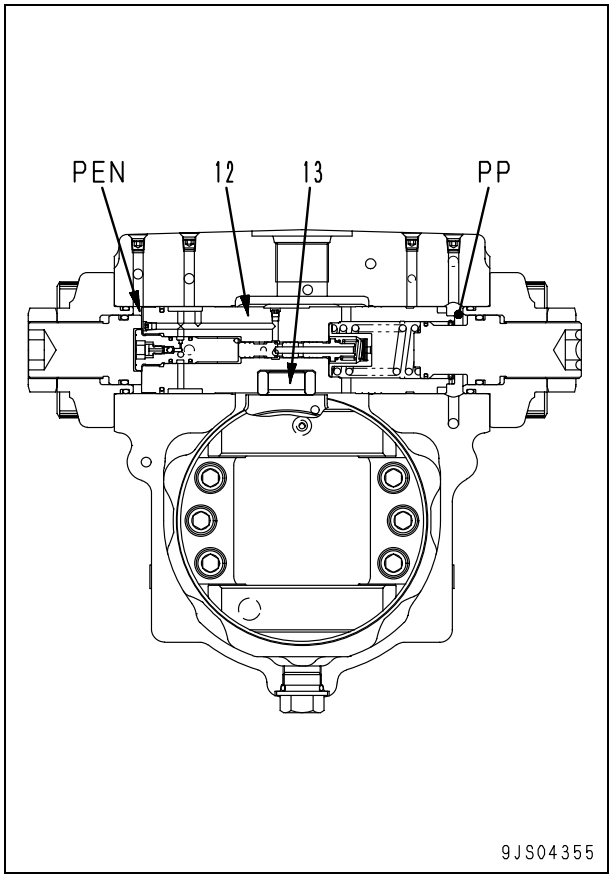


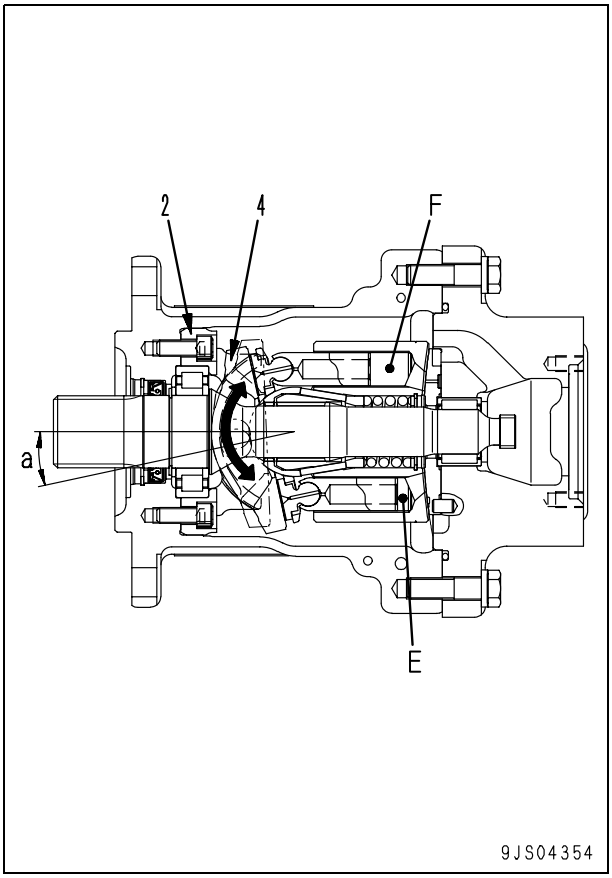
- As center line (X) of rocker cam (4) matches the axial direction of cylinder block (7) (swash plate angle (a) = 0), the difference between volumes (E) and (F) inside cylinder block (7) becomes 0.
- Suction and discharge of pressurized oil is not carried out in this state. Namely pumping action is not performed. (Actually, however, the swash plate angle is not set to 0)



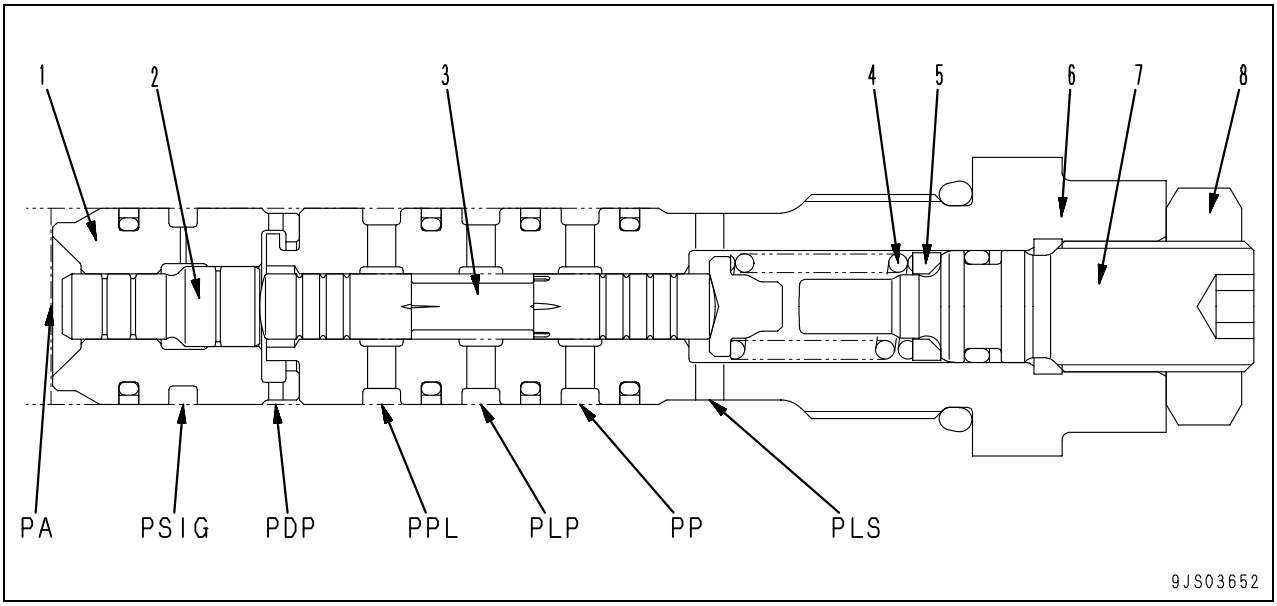
Control of delivery

- If the swash plate angle (a) becomes larger, the difference between volumes (E) and (F) becomes larger and pump delivery (Q) increases.
- Servo piston (12) is used for changing swash plate angle (a).
- Servo piston (12) reciprocates straight according to the signal pressure of CO and LS valve.
- This linear movement is transmitted to rocker cam (4) through slider (13).
- Being supported by cradle (2) on the cylindrical surface, rocker cam (4) slides on the surface while continuing revolving movement.
- Space of the pressure receiving area of servo piston (12) are not identical on the left side and right side. Main pump discharge pressure (self pressure) (PP) is always brought to the pressure chamber of the small diameter piston side.
- Output pressure (PEN) of the LS valve is brought to the chamber receiving the pressure at the large diameter piston end.
- The relationship in the size of pressure (PP) at the small diameter piston end and pressure (PEN) at the large diameter piston end, and the ratio between the area receiving the pressure of the small diameter piston and the large diameter piston controls the movement of servo piston (12).





1. LS valve

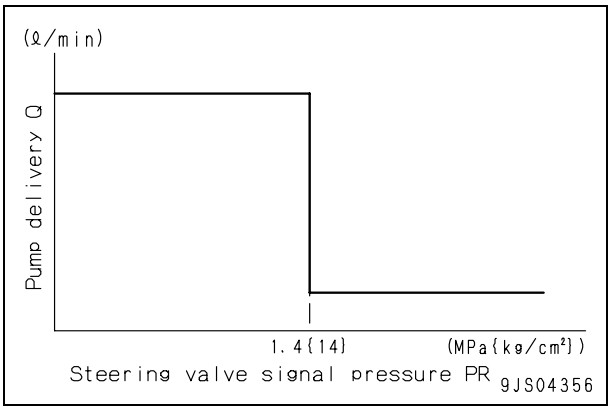


PA : Pump port
PDP : Drain port
PLP : LS control pressure output port
PLS : LS pressure input port
PP : Pump port
PPL : Load pressure input port
PSIG : Drain port

1. Sleeve
2. Piston
3. Spool
4. Spring
5. Seat
6. Sleeve
7. Plug
8. Locknut

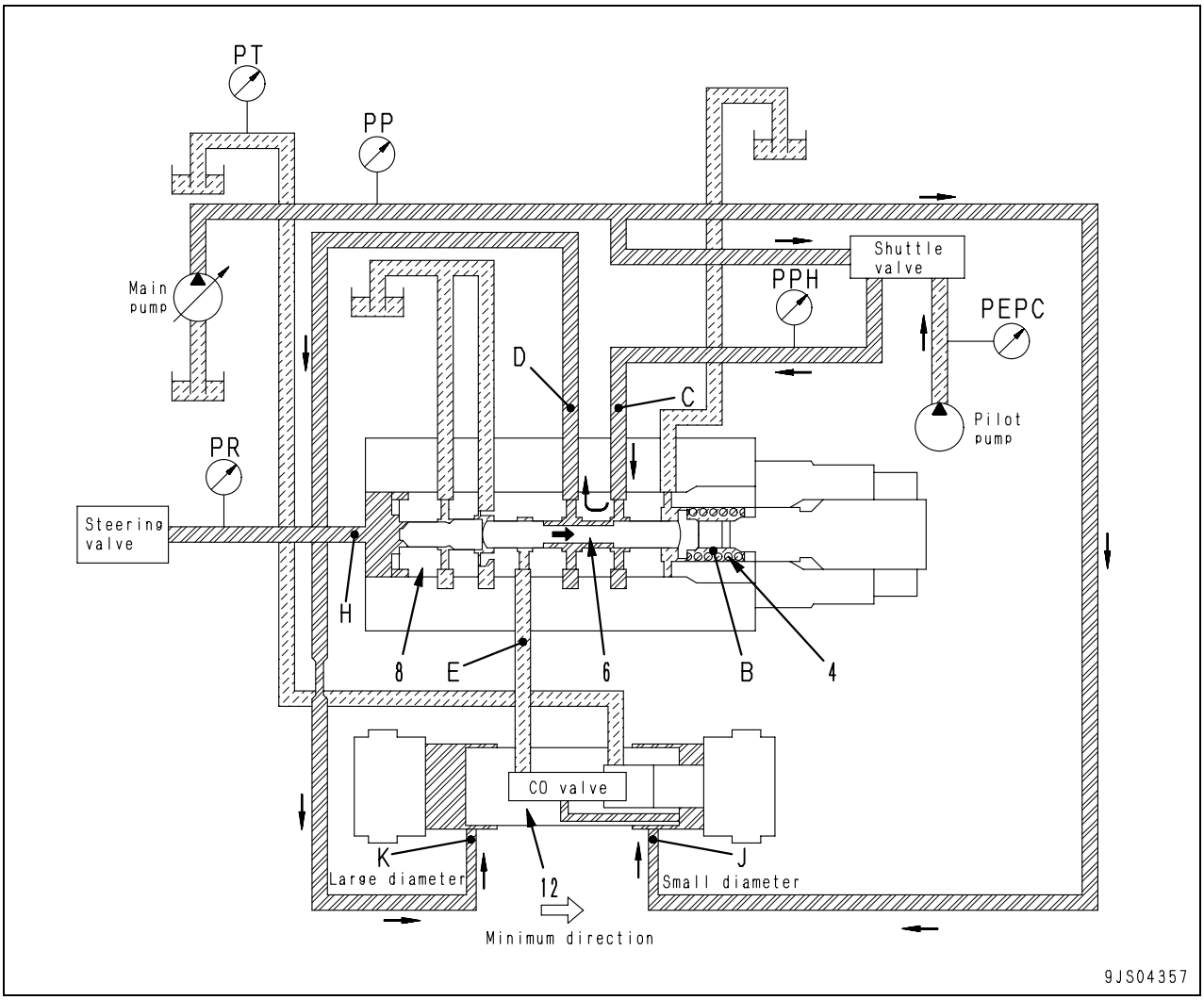
Function

- The LS (load sensing) valve detects the load and controls the discharge amount.
- This valve controls the main pump discharge (Q) with the steering pump signal pressure (PR).

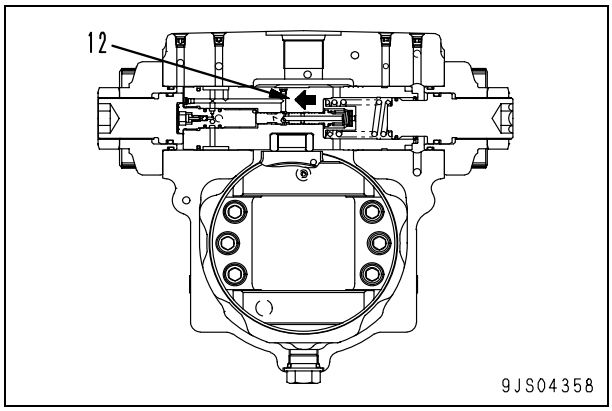


Operation

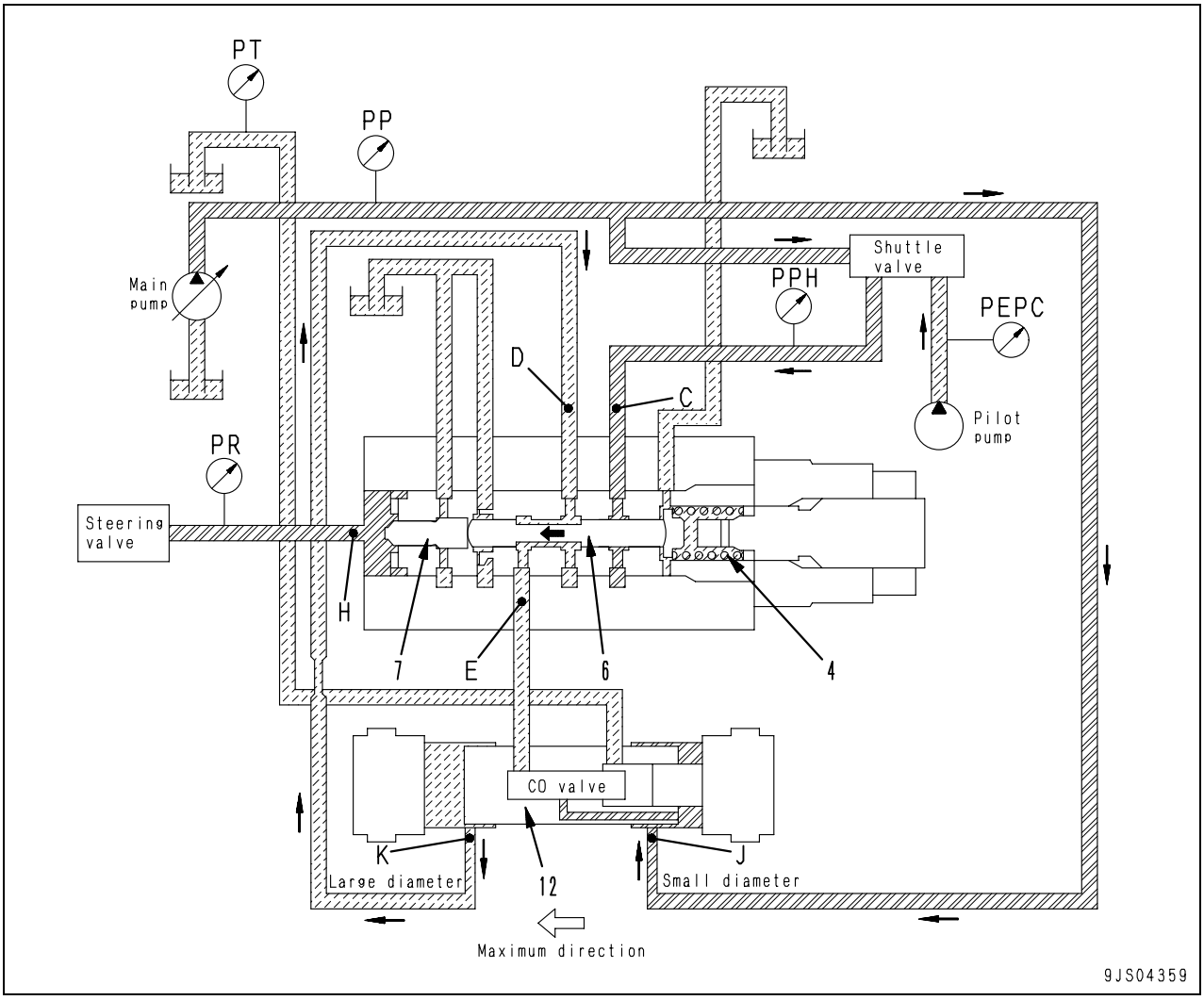
1) When the control valve is situated at neutral



- LS valve is a 3-way selector valve, and signal pressure (PR) from the steering valve is led to port (H) of sleeve (8).
- Position of spool (6) is determined by the size of force of spring (4) and the force of signal pressure (PR) from the steering valve.
- Before starting engine, servo piston (12) is pressed to the left. (See the figure to the right)
- If the control lever is in neutral when starting engine, steering valve signal pressure (PR) reads 1.4 MPa {14 kg/cm^2}.
- Spool (6) stops at a position where the openings from port (D) to port (C) and from port (D) to port (E) are approximately equal.
- Shuttle valve output pressure (PPH) enters the large diameter side of the piston from port (K).
- Pump pressure (PP) is present in port (J) on the small diameter side of the piston.
- According to the difference in the areas on servo piston (12), the pressure moves in to the direction of minimizing the swash plate angle.

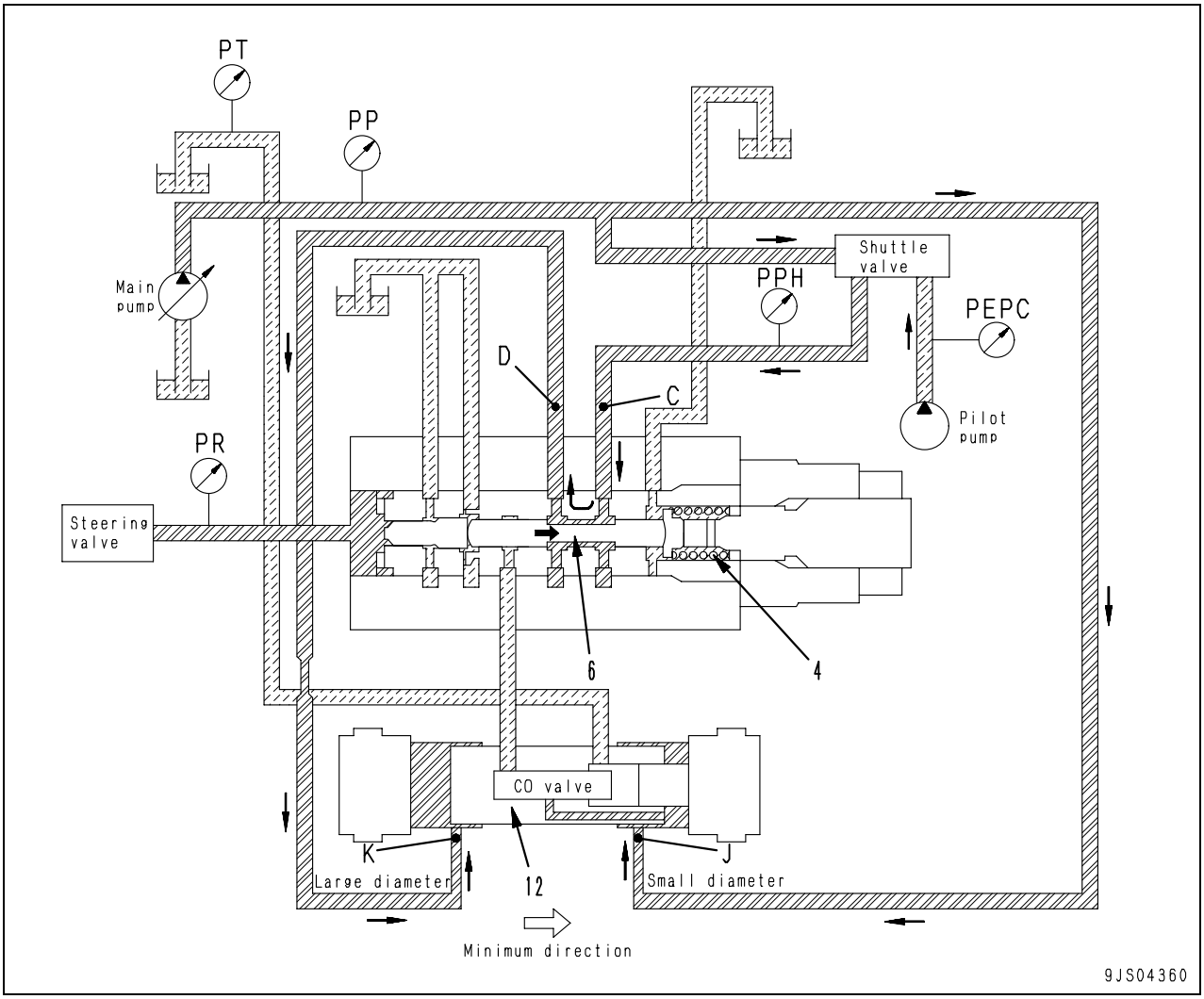


2) Action for the direction of maximizing the pump delivery



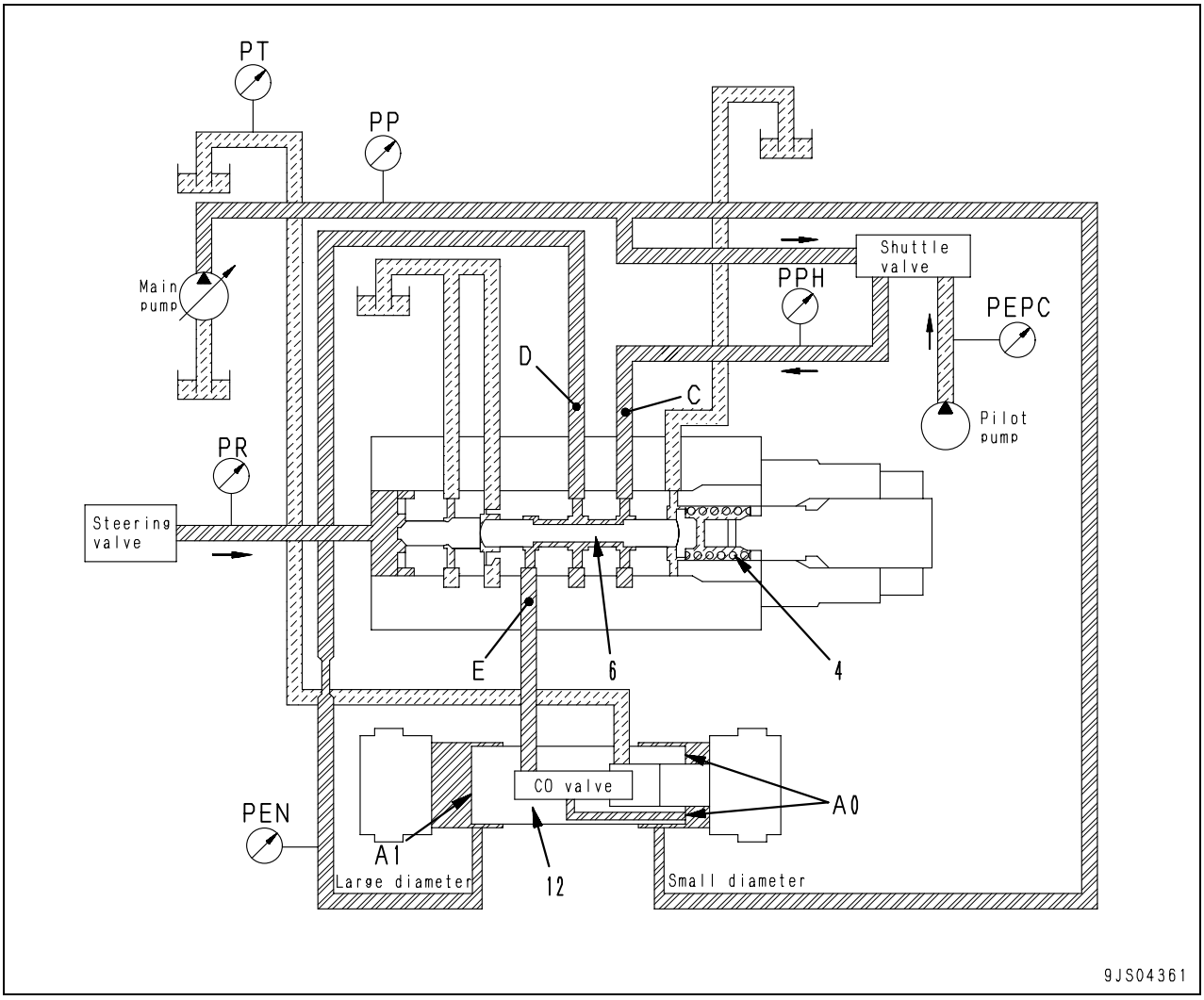
- If signal pressure (PR) from the steering pump becomes smaller, spool (6) is pressed to the left by the force of spring (4).
- As a result of the movement of spool (6), ports (D) and (E) are connected, then to CO valve.
- CO valve is connected to the drain port, and the pressure between circuits (D) and (K) becomes equal to drain pressure (PT). (Operation of CO valve to be described later on)
- The pressure at the large diameter end of servo piston (12) becomes drain pressure (PT), and pump pressure (PP) enters port (J) at the small diameter end, so servo piston (12) is pushed to the left side. Therefore, the swash plate is moved in the direction to make the discharge amount larger.

3) Action for the direction of minimizing the pump delivery



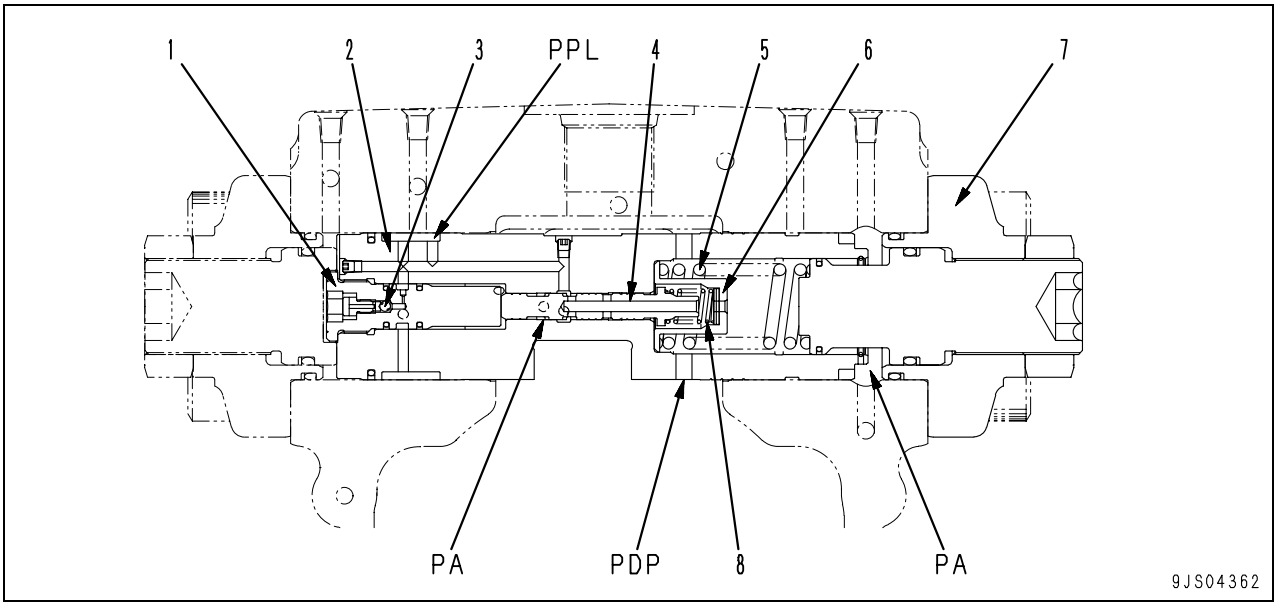
- If steering pump signal pressure (PR) becomes larger, spool (6) is pressed to the right by the force of signal pressure (PR).
- As a result of the movement of spool (6), shuttle valve output pressure (PPH) flows from port (C) to port (D), then from port (K) to the large diameter side of the piston.
- While main pump pressure (PP) is present in port (J) of the smaller diameter side of the piston, servo piston (12) is pressed to the right by its area difference between the larger and the smaller diameter sides. As the result, servo piston (12) moves in the direction to minimize the swash plate angle.

4) When servo piston is balanced



- Let us take the area receiving the pressure at the large diameter end of the piston as (A1), the area receiving the pressure at the small diameter end as (A0), and the pressure flowing into the large diameter end of the piston as (PEN).
- Combined force of LS valve steering pump signal pressure (PR) and spring (4) is balanced and servo piston (12) stops where it is when a relation of (A0) x (PP) = (A1) x (PEN) is established.
- And the swash plate of the pump will be held in an intermediate position. [Spool (6) will be stopped at a position where the distance of the opening from port (D) to port (E) and the distance from port (C) to port (D) is almost the same.]
- At this point, the relationship between the pressure receiving areas across servo piston (12) is (A0) : (A1) = 3 : 5, so the pressure applied across the piston when it is balanced becomes (PP) : (PEN) ≒ 5 : 3.
- The force of spring (4) is adjusted to determine the balanced stop position of this spool (6) at the center of the standard when (PP) – (PLS) = 1.4 MPa {14 kg/cm^2}.

2. CO valve

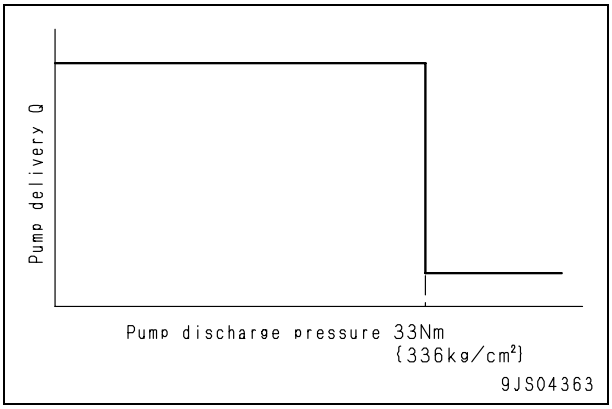


PA : Pump port
PDP : Drain port
PPL : CO control output port

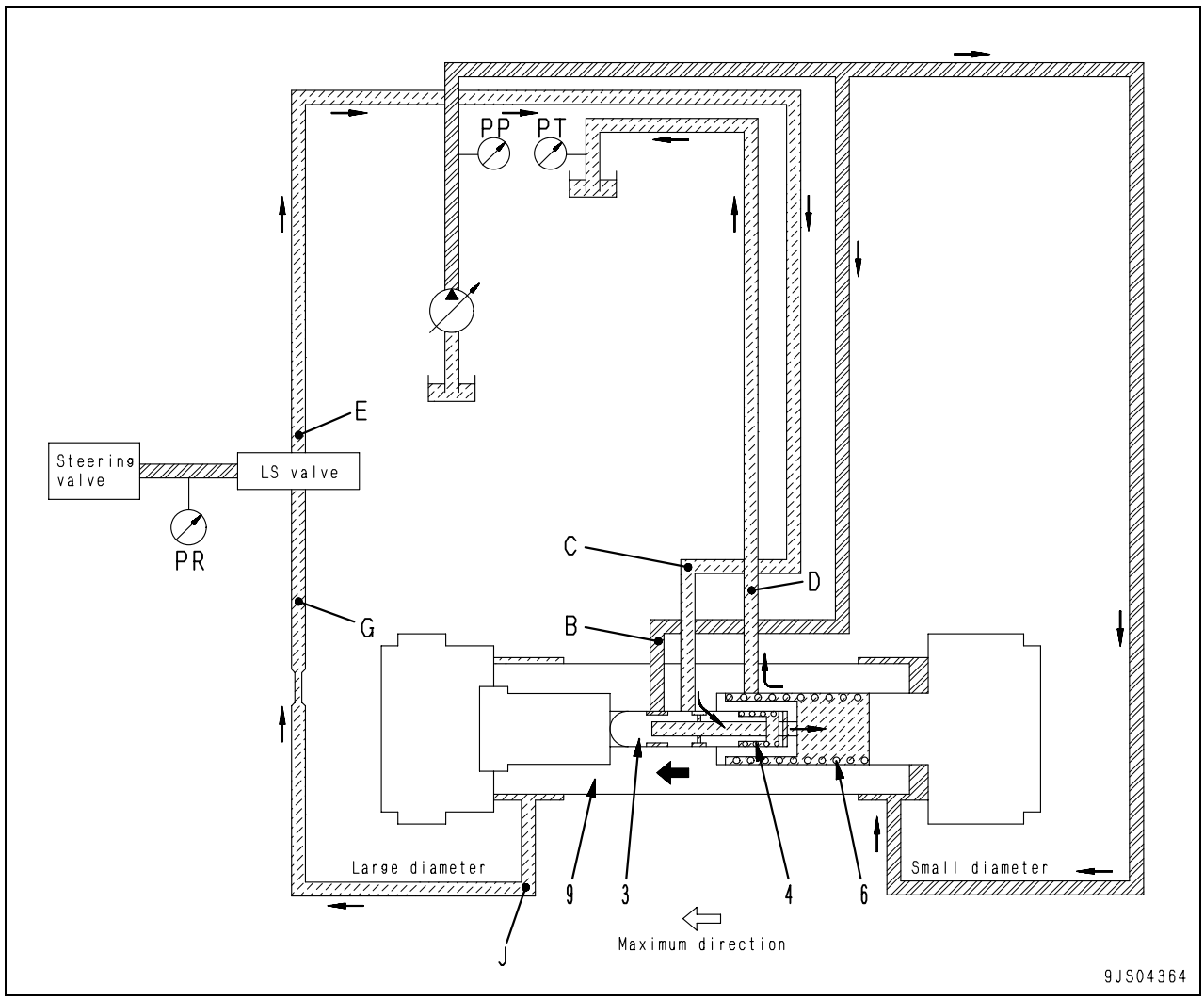
1. Plug
2. Servo piston assembly
3. Ball
4. Spool
5. Spring
6. Retainer
7. Cover
8. Spring

Function

- When the pump pressure in the hydraulic circuit reaches the maximum level, CO (Cut Off) valve minimizes the pump swash plate angle and protects the circuit by suppressing the rise of pressure.
- The minimum pump swash plate angle given reduces the pump suction torque to improve fuel economy.

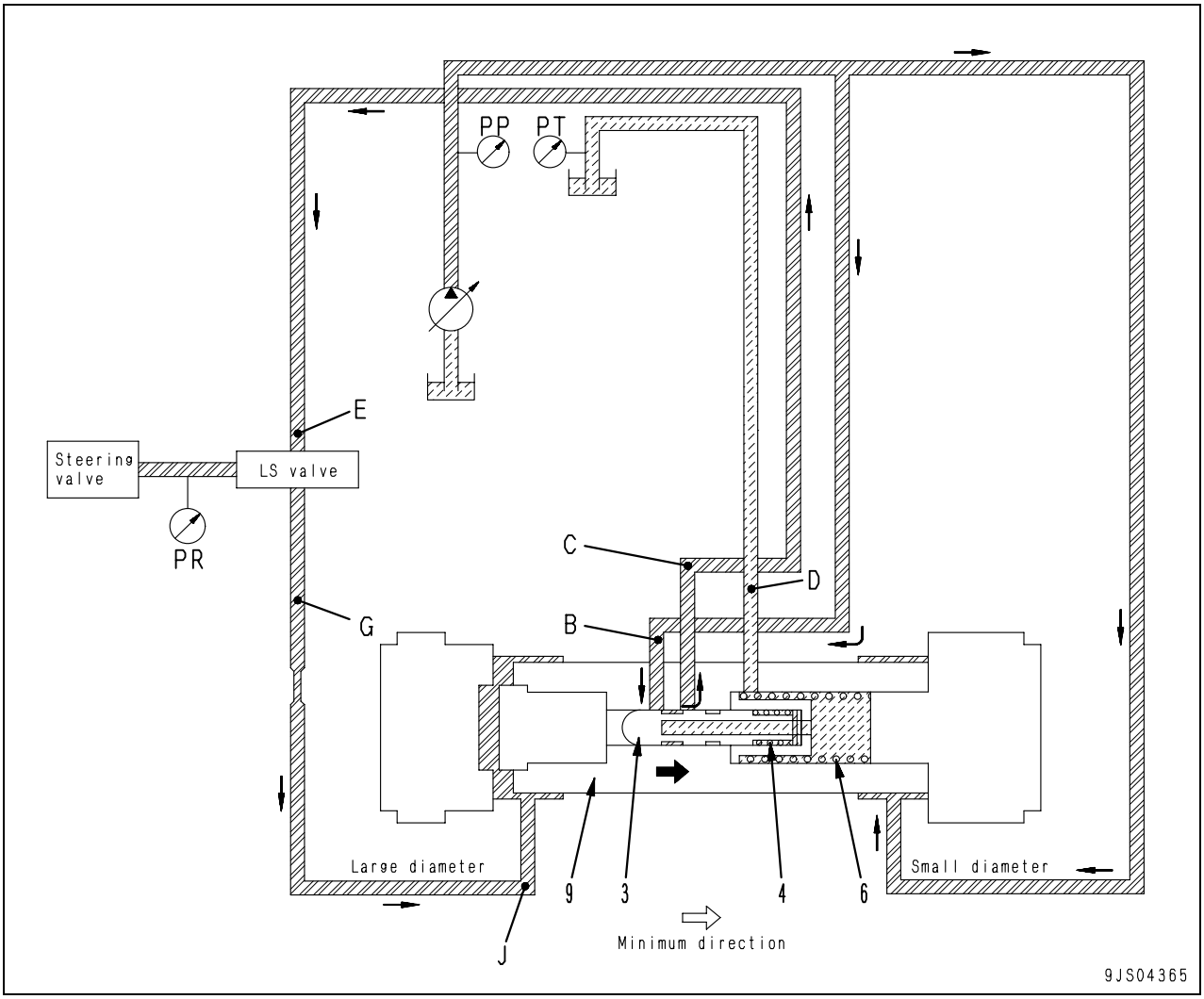


1) When the actuator load is small and pump discharge pressure (PP) is low



- Spool (3) is positioned closer to the left, and ports (C) and (D) are connected through internal passage of spool (3).
- Port (C) of CO valve is connected to port (E) of LS valve.
- Pump pressure (PP) is present in port (B) and on the smaller diameter side of servo piston (9). Port (E) of LS valve has the pressure equal to that of drain pressure (PT).
- When ports (E) and (G) of LS valve are connected, the pressure on the larger diameter side of the piston becomes equal to drain pressure (PT), and servo piston (9) moves to the left.
- The swash plate angle of the pump becomes larger and the pump discharge increases.

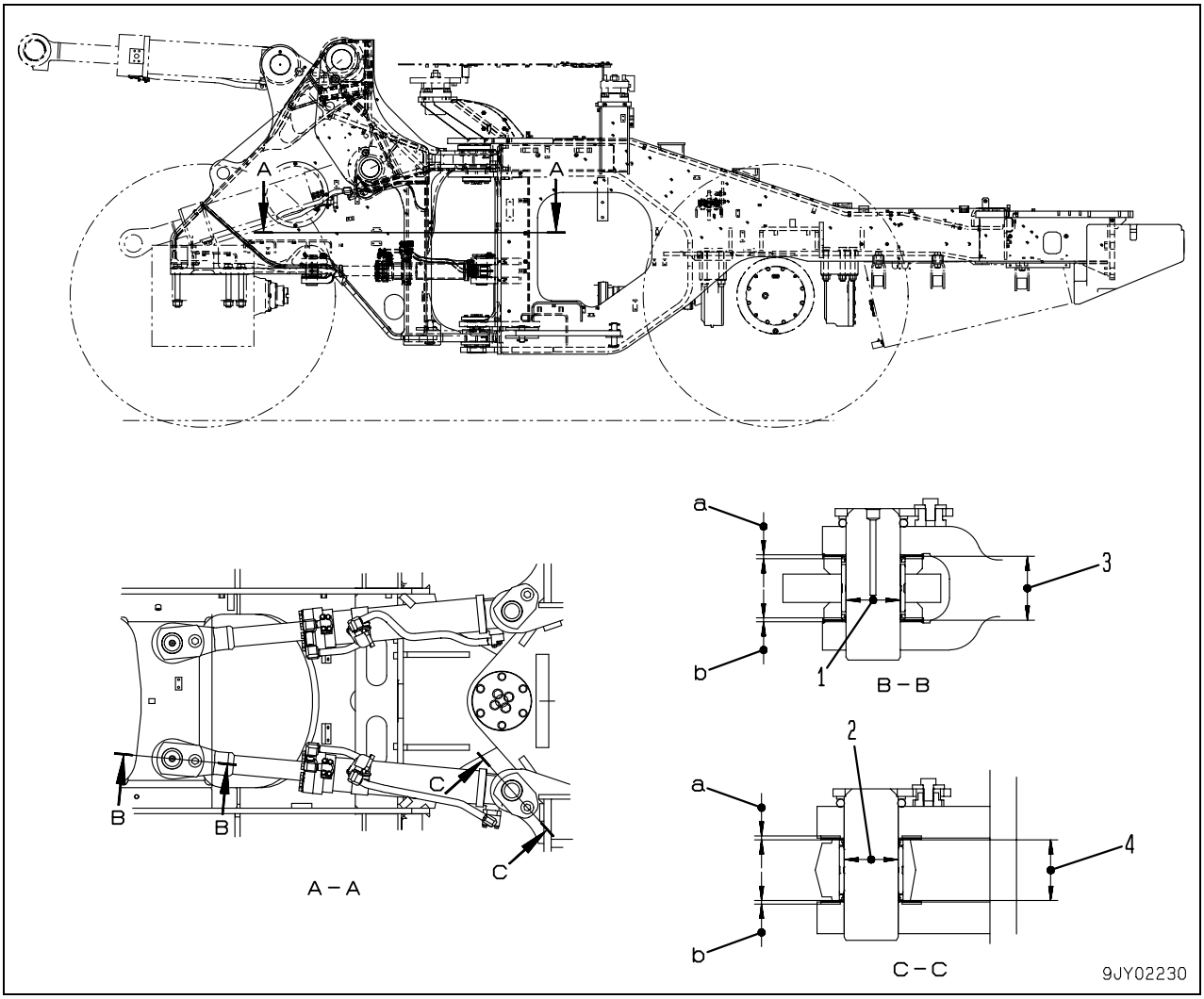
2) When the actuator load is large, and pump discharge pressure (PP) reaches the maximum pressure



- When load is large and pump discharge pressure (PP) is high, the force pressing spool (3) to the right becomes larger, and spool (3) moves to the position as shown in the diagram above.
- Port (C) of CO valve is connected to port (E) of LS valve.
- Pump pressure (PP) is present in port (B) and on the smaller diameter side of servo piston (9).
- Pressure flowing from port (C) to LS valve becomes main pump pressure (PP) from port (B).
- When ports (E) and (G) of LS valve are connected, main pump pressure (PP) enters the larger diameter side of servo piston (9).
- While main pump pressure (PP) is present in the smaller diameter side of the piston, servo piston (9) is pressed to the right by its area difference between the larger and the smaller diameter sides.
- As the servo piston moves to the direction to minimize the pump swash plate angle, the pump discharge is reduced accordingly.

Steering cylinder

Installation of steering cylinder

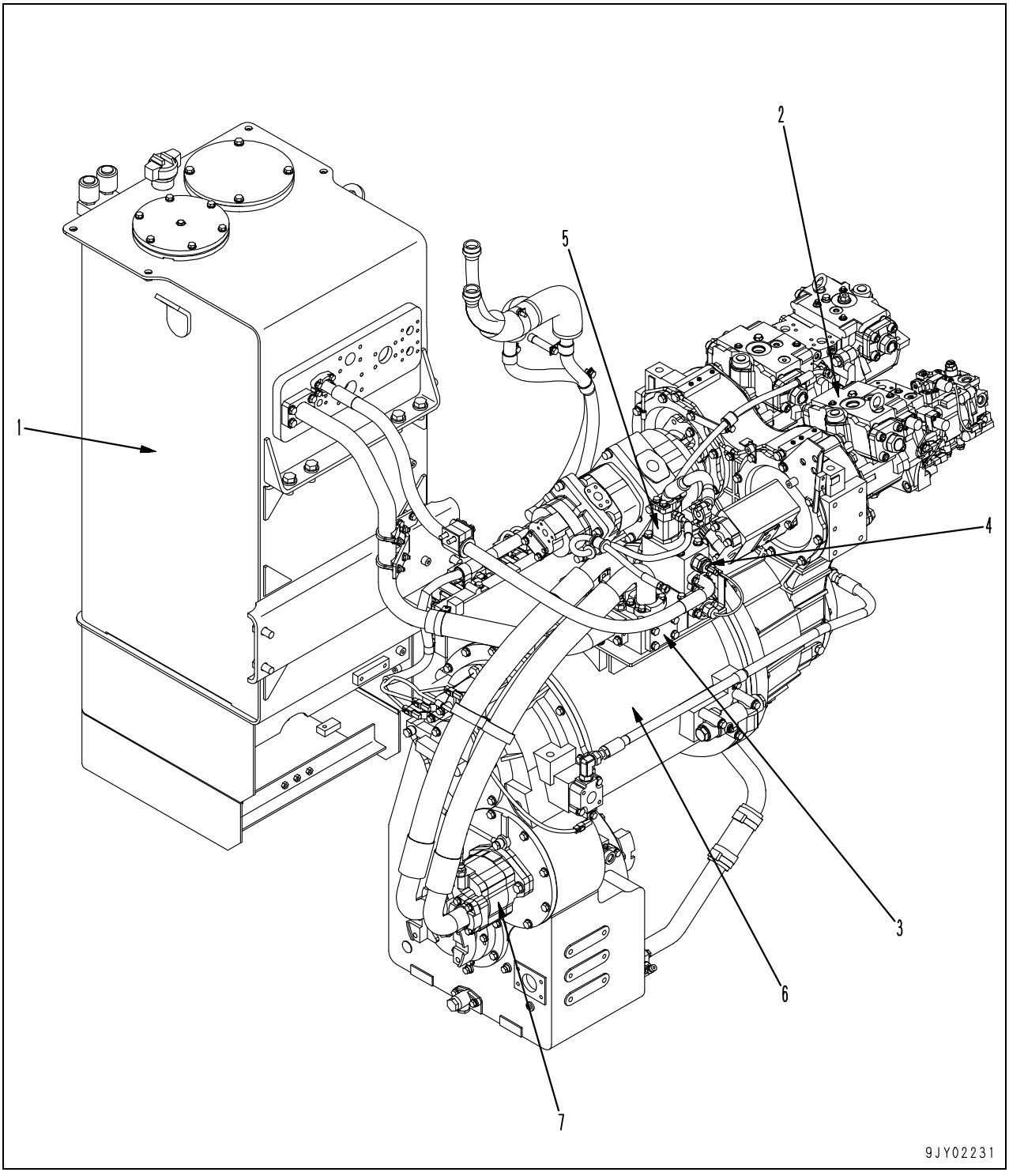


Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between steering cylinder rod and bushing of frame joint and mounting pin	85	+0.036 +0.090	+0.207 +0.120	0.156 – 0.297	0.7	Replace
2	Clearance between steering cylinder bottom and bushing of frame joint and mounting pin	85	+0.036 +0.090	+0.207 +0.120	0.156 – 0.297	0.7	
3	Steering cylinder and front frame joint	Width of bushing		Width of hinge		Standard clearance (clearance of a + b)	
		101 ± 2		106 ± 1.5		Max. 0.5 (after shim is adjusted)	
4	Steering cylinder and rear frame joint	96 ± 1.2		101.5 ± 1		Max. 0.5 (after shim is adjusted)	

Emergency steering piping diagram

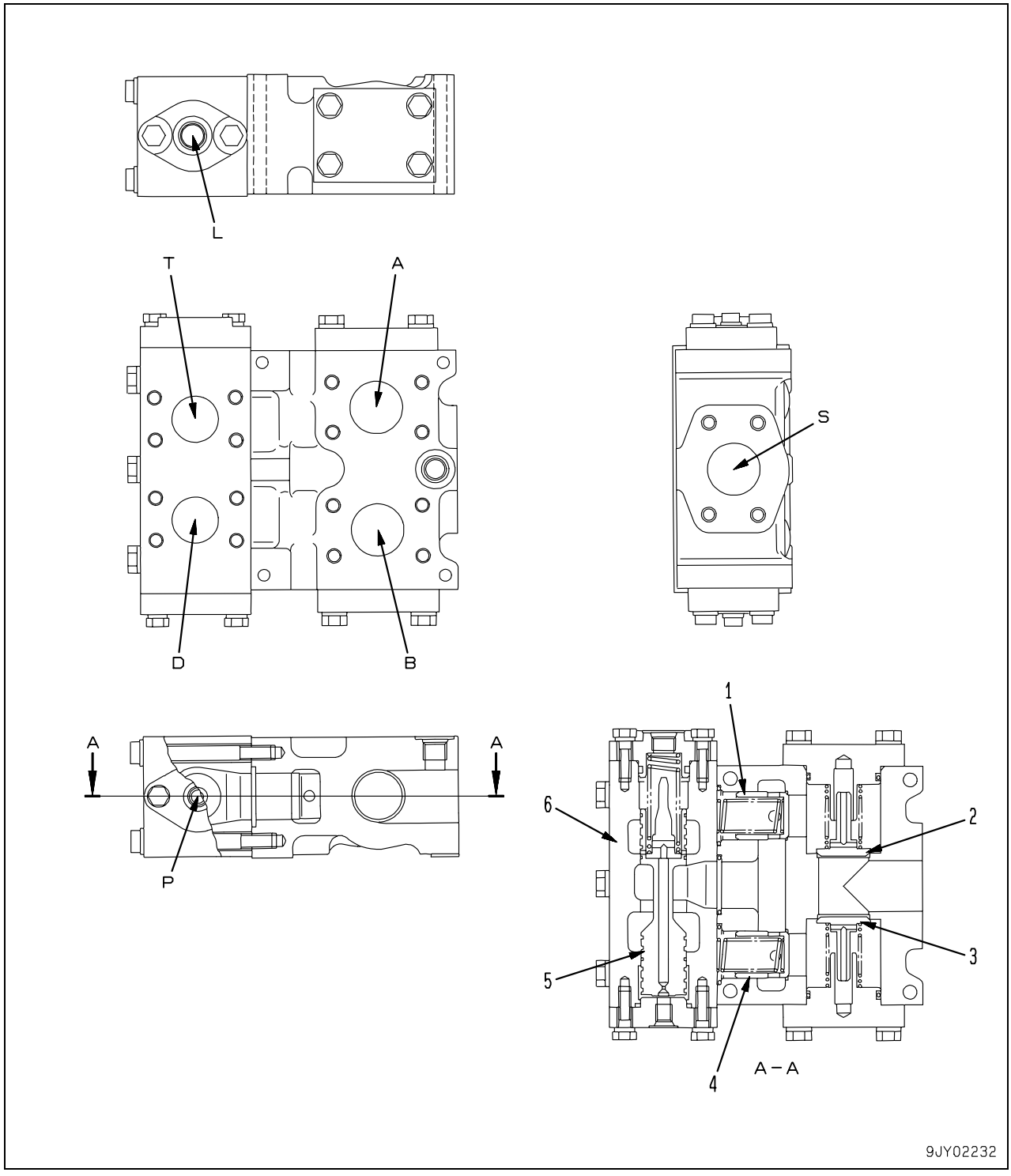
(Only machine with emergency steering system)



1. Hydraulic tank
2. Steering and fan pump
3. Diverter valve
4. Emergency steering relief valve
5. Check valve
6. Transmission
7. Emergency pump

Diverter valve

(Emergency steering) (Only machine with emergency steering system)

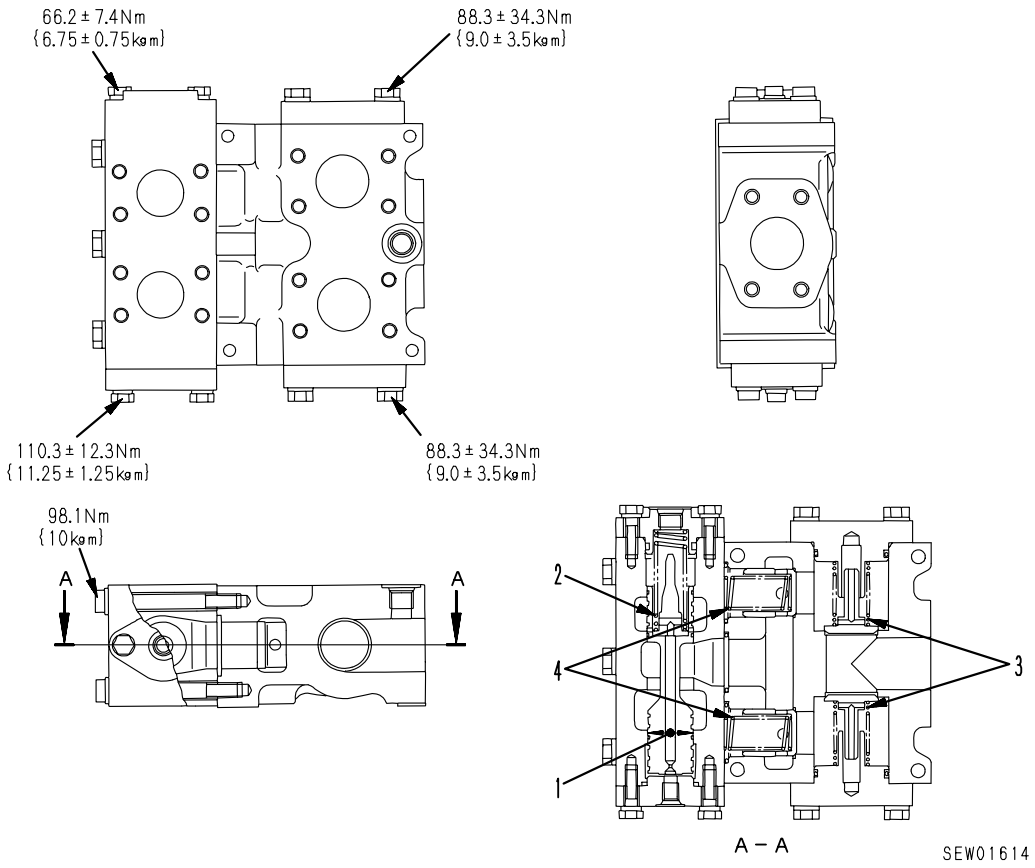


1. Check valve
2. Check valve
3. Check valve
4. Check valve
5. Spool
6. Valve body

A: From emergency pump
B: From emergency pump
D: To hydraulic tank
L: Sensor mounting port
P: From steering pump
S: From hydraulic tank
T: To steering control valve

Function

- In a case where steering is disabled due to engine stop or pump seizure during machine traveling, this function enables operation of the steering wheel, utilizing rotations of the tires through the transmission to operate the emergency pump.



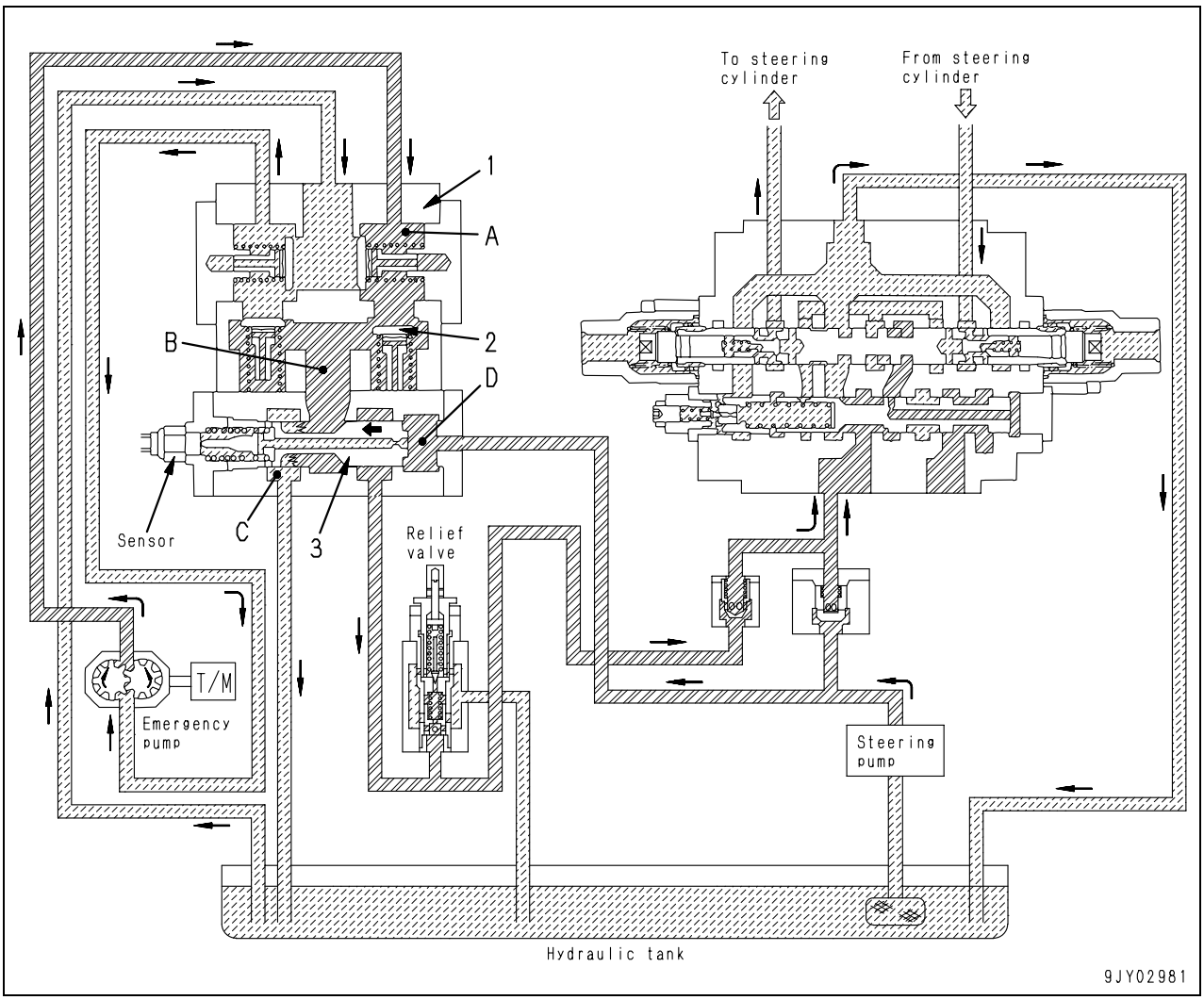
Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between body and spool	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		40	–0.013 –0.015	+0.015 +0.007	0.020 – 0.030	—	
2	Spool return spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		122.6	84	216.7 N {22.1 kg}	120.7	205.9 N {21.0 kg}	
3	Check valve spring	79.2	54.5	5.6 N {0.57 kg}	77.9	5.3 N {0.54 kg}	
4	Check valve spring	79.2	57.5	4.9 N {0.50 kg}	77.9	4.6 N {0.47 kg}	

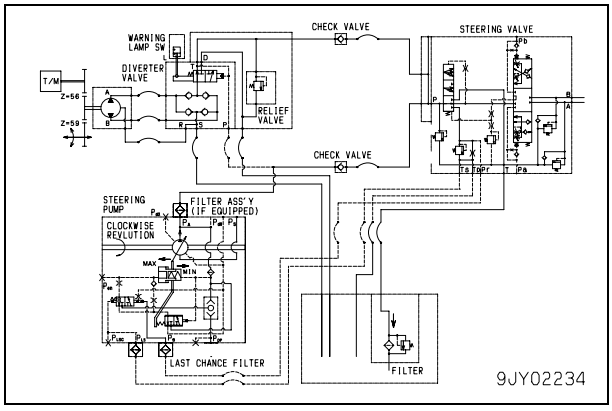
(Steering wheel specification)

Operation

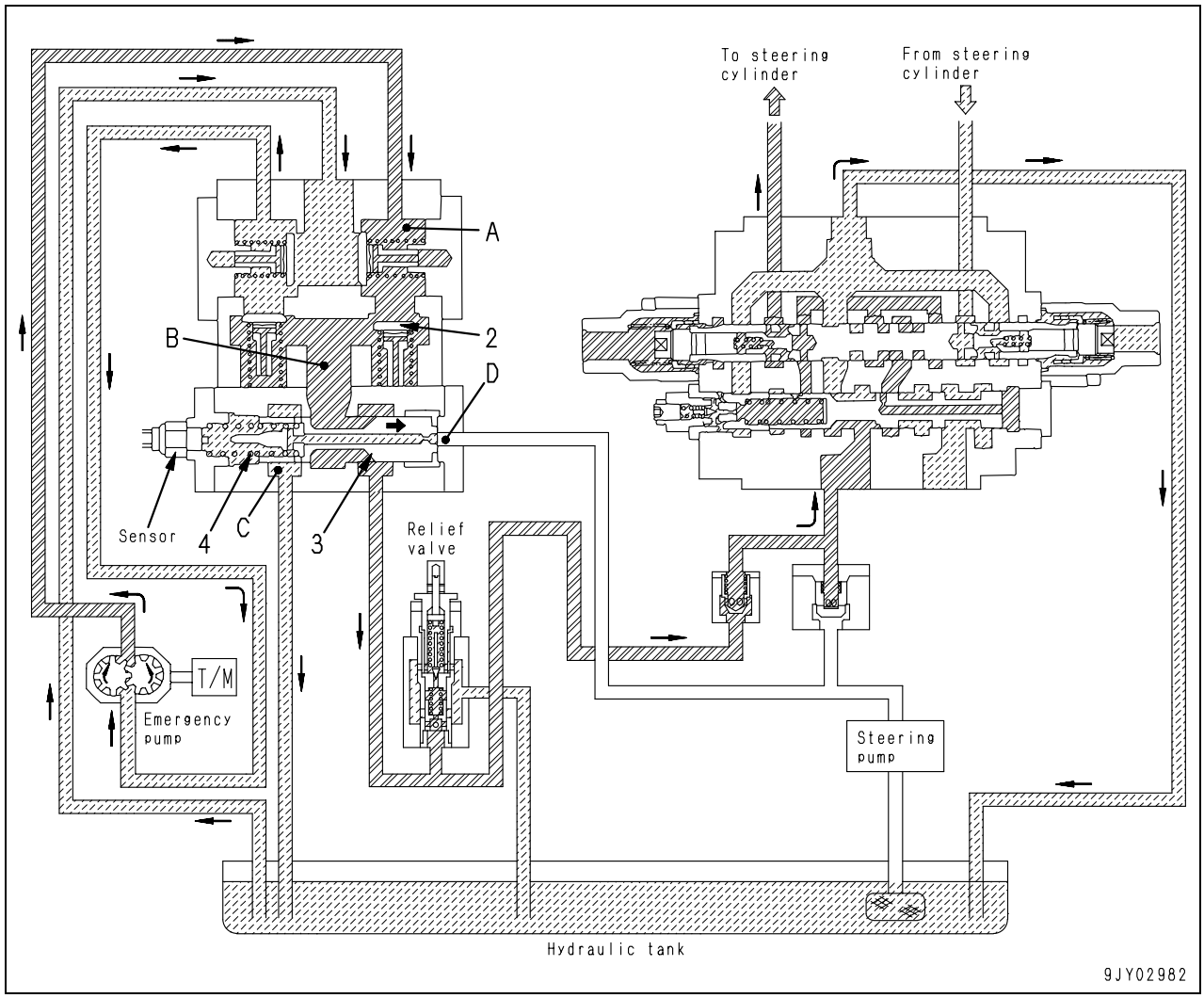
- **If the pump and engine are normal**



- If the steering pump and engine are operating normally, the steering pump is operated by the engine, and oil can be sent to the steering valve, which enables steering.
  The emergency pump is operated by the external travel force and pushes check valve (2) open through port (A) of diverter valve (1) and supplies the oil to port (B).
  Spool (3) is pressed to the left as pressure oil is flowing from the steering pump toward port (D).
  For that reason, oil at port (B) flows to port (C) to be drained to the hydraulic tank.

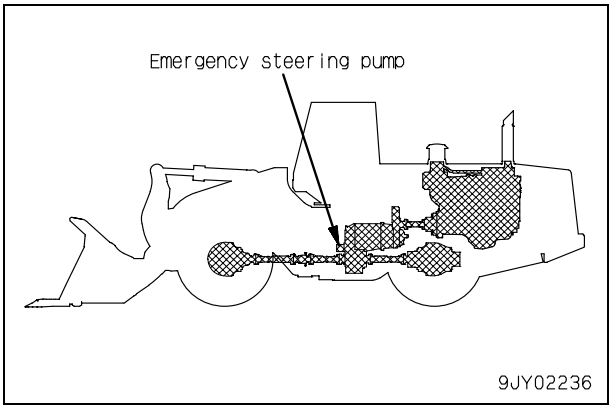


- **If the machine is running and the pump or engine has failed**



- In a case where the machine is running and the pump or engine has failed, rotations from the tires operate the emergency pump through the transmission.
  No pressure oil appears at port (D) because the steering pump is not operating. For that reason, spool (3) is pressed by spring (4) to the right.
  Oil from the emergency pump goes through port (A) and port (B), and then flows to the rotary valve and the steering valve, enabling steering.

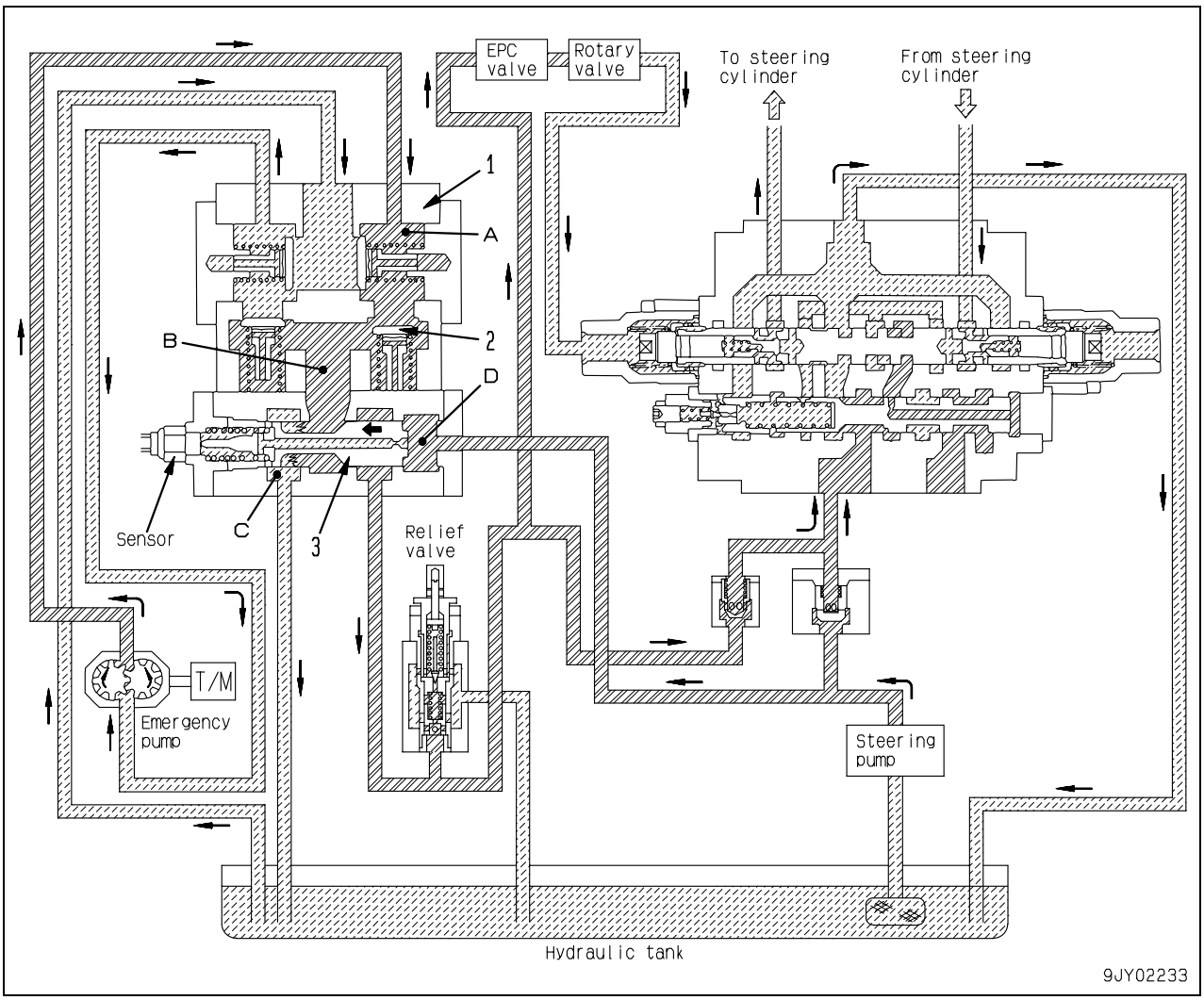
★ The emergency pump is enabled for normal and reverse rotations.



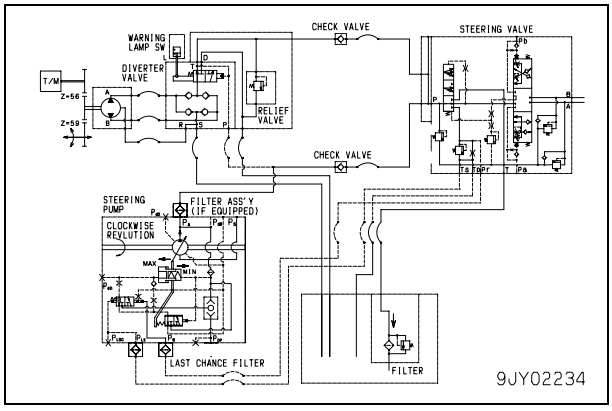
AJSS (Advanced Joystick Steering System) specification

Operation

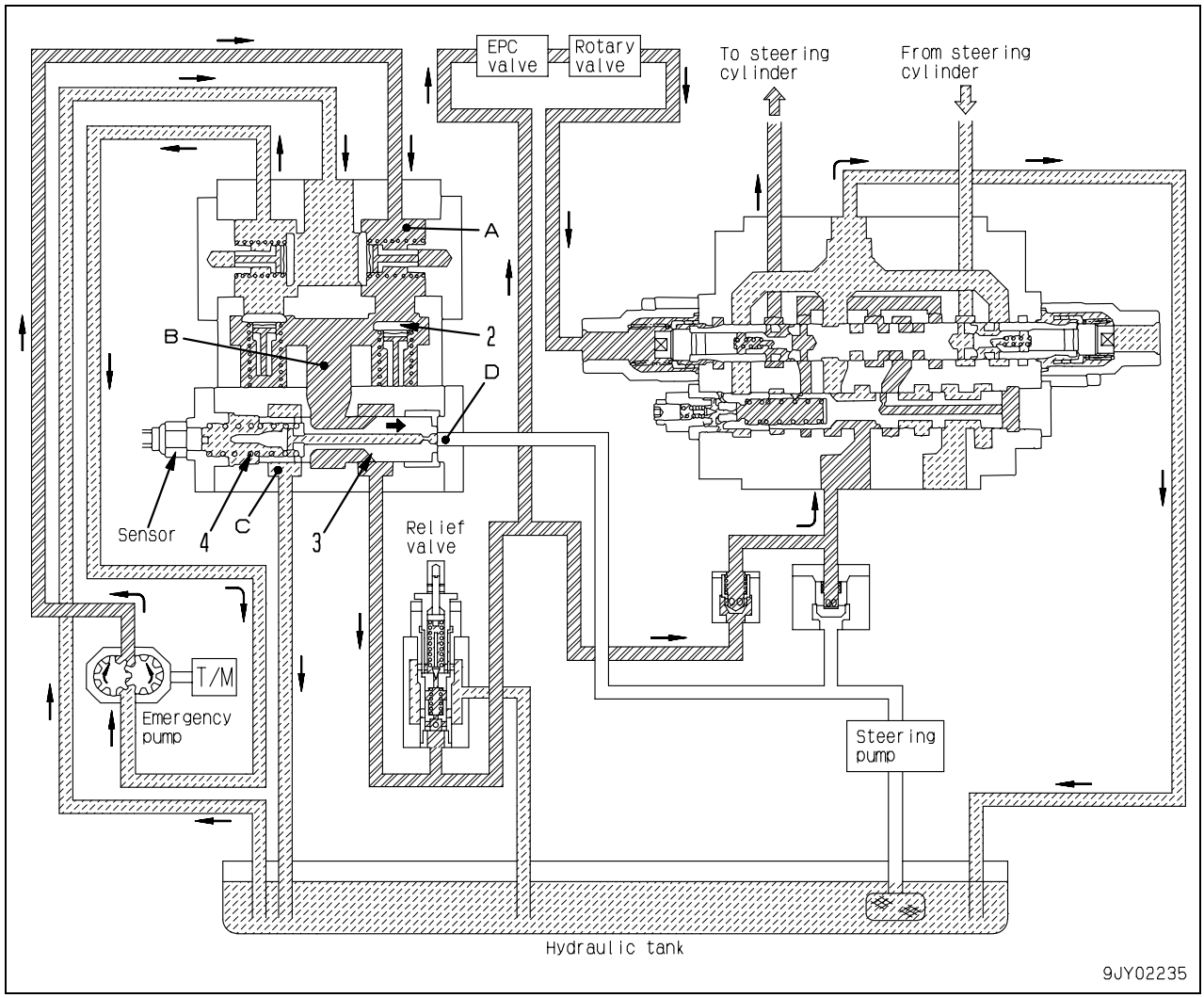
- **If the pump and engine are normal**



- If the steering pump and engine are operating normally, the steering pump is operated by the engine, and oil can be sent to the steering valve, which enables steering.
  The emergency pump is operated by the external travel force and pushes check valve (2) open through port (A) of diverter valve (1) and supplies the oil to port (B).
  Spool (3) is pressed to the left as pressure oil is flowing from the steering pump toward port (D).
  For that reason, oil at port (B) flows to port (C) to be drained to the hydraulic tank.

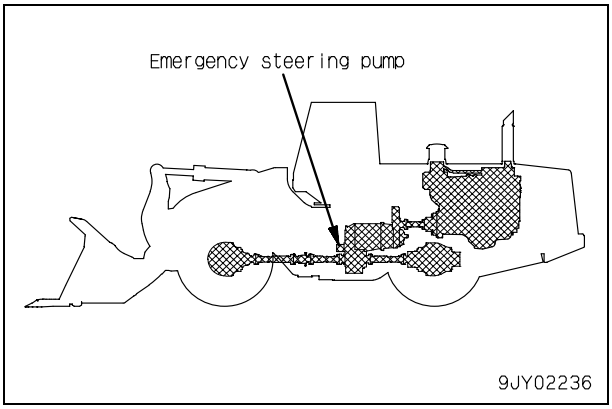


- **If the machine is running and the pump or engine has failed**



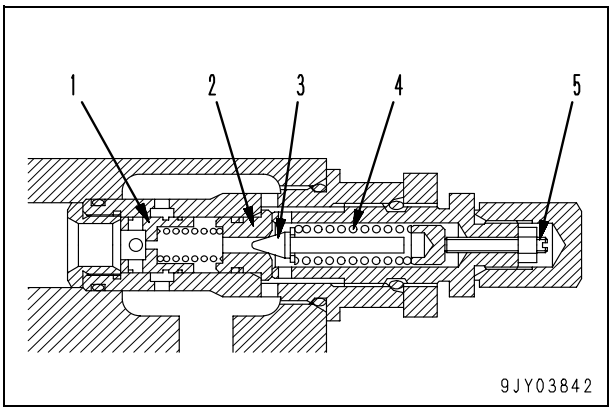
- In a case where the machine is running and the pump or engine has failed, rotations from the tires operate the emergency pump through the transmission.
  No pressure oil appears at port (D) because the steering pump is not operating. For that reason, spool (3) is pressed by spring (4) to the right.
  Oil from the emergency pump goes through port (A) and port (B), and then flows to the rotary valve and the steering valve, enabling steering.

★ The emergency pump is enabled for normal and reverse rotations.



Emergency steering relief valve

(Only machine with emergency steering system)



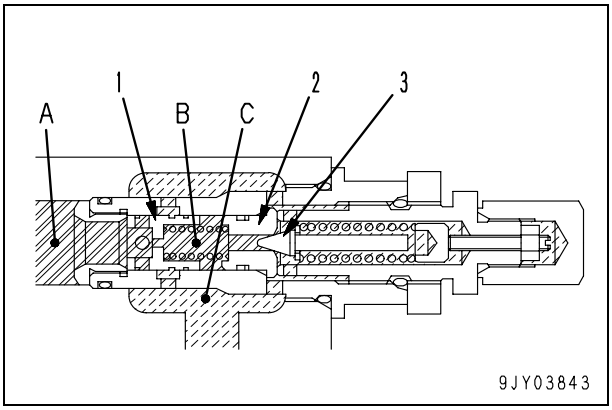
1. Main valve
2. Valve seat
3. Pilot poppet
4. Spring
5. Adjustment screw
   Set pressure: 20.6 MPa {210 kg/cm²}

Function

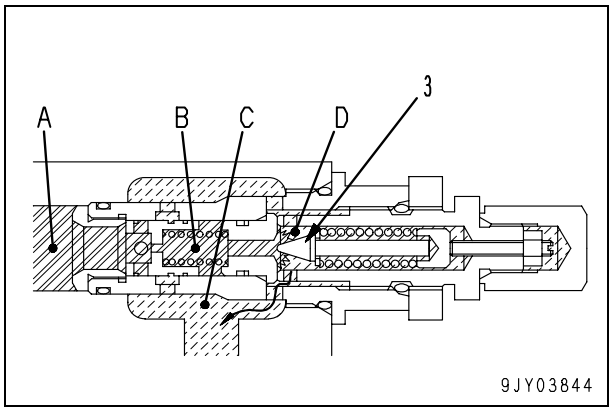
Compared to the steering control valve relief pressure of 34.3 MPa {350 kg/cm²}, the rated pressure of the emergency steering pump and diverter valve are both 20.6 MPa {210 kg/cm²}. Therefore, to protect the emergency steering pump and diverter valve, there is a relief valve in the piping from the diverter valve to the steering valve. When the emergency steering is being operated, and the hydraulic pressure generated by the steering exceeds 20.6 MPa {210 kg/cm²}, the relief valve is actuated.

Operation

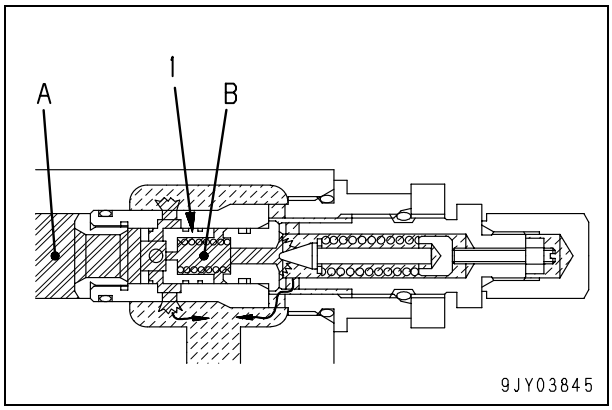
- Port (A) is connected to the pump circuit, and port (C) is connected to the drain circuit. The oil passes through the orifice in main valve (1) and fills port (B). Pilot poppet (3) is in contact with valve seat (2).



- When the pressure inside ports (A) and (B) reaches the pressure set by the poppet spring (set pressure), pilot poppet (3) opens and the hydraulic pressure at port (B) escapes from port (D) to port (C). This lowers the pressure at port (B).

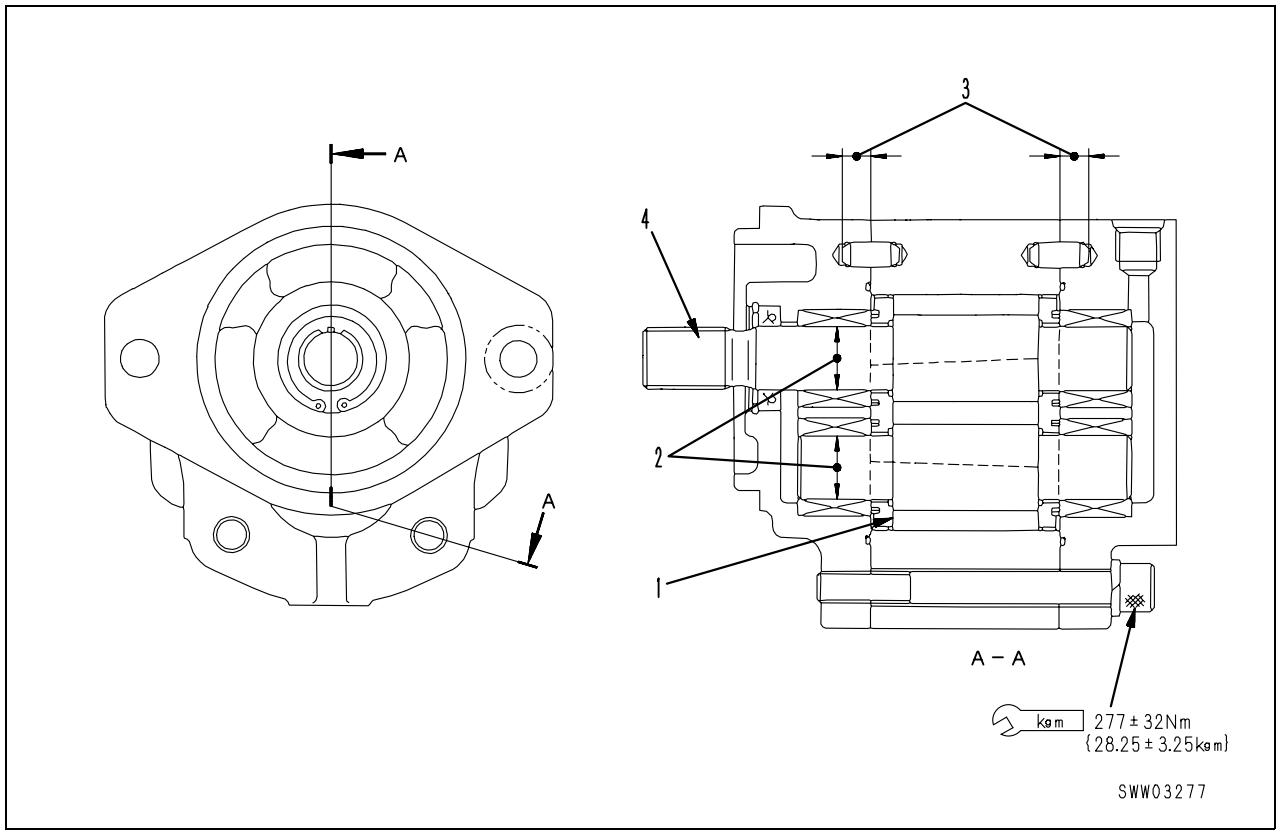


- When the pressure at port (B) drops, the orifice of main valve (1) generates a difference in pressure between port (A) and port (B). Main valve (1) is opened by the pressure at port (A) and the oil at port (A) is relieved.



Emergency steering pump

(Only machine with emergency steering system)
SAM(3)100



Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between body and spool	Type		Tolerance		Standard clearance	Replace
		SAM(3)-100		0.10 – 0.15		0.19	
2	Clearance between inside diameters of plain bearing and gear shaft	SAM(3)-100		0.020 – 0.043		0.075	
3	Driven depth of pin	Type	Standard size	Tolerance		Repair limit	
		SAM(3)-100	14	0 –0.5			
4	Rotation torque of spline shaft	6.86 – 11.8 Nm{0.7 – 1.2 kgm}					—
—	Discharge oil: EO10-CD Oil temperature: 45 – 55°C	Type	Speed (rpm)	Discharge pressure (MPa {kg/cm²})	Standard discharge (ℓ/min)	Allowable discharge (ℓ/min)	
		SAM(3)-100	2,500	20.6 {210}	214	189	

WA600-6 Wheel loader

Form No. SEN00404-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

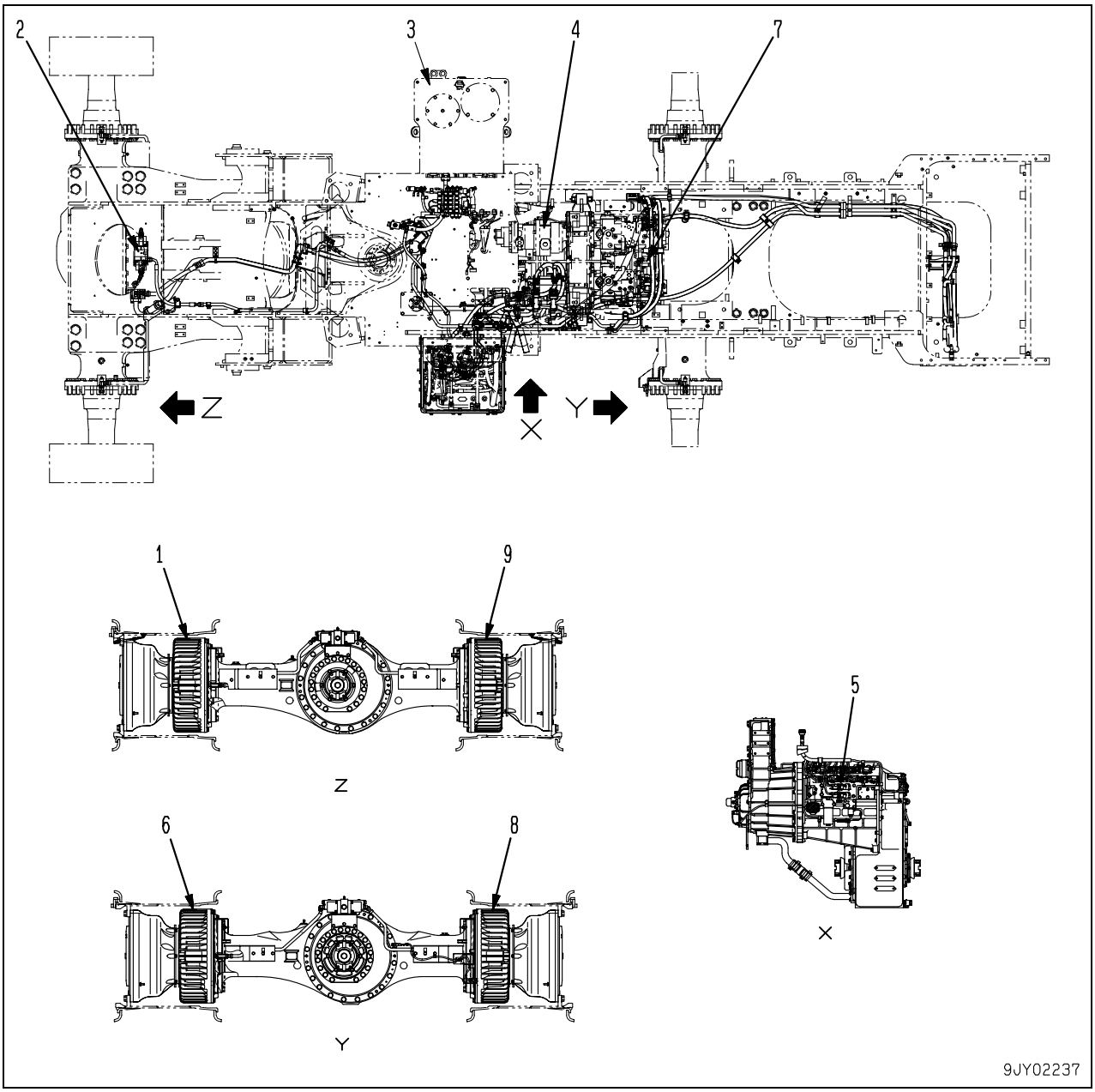
10 Structure, function and maintenance standard

Brake system

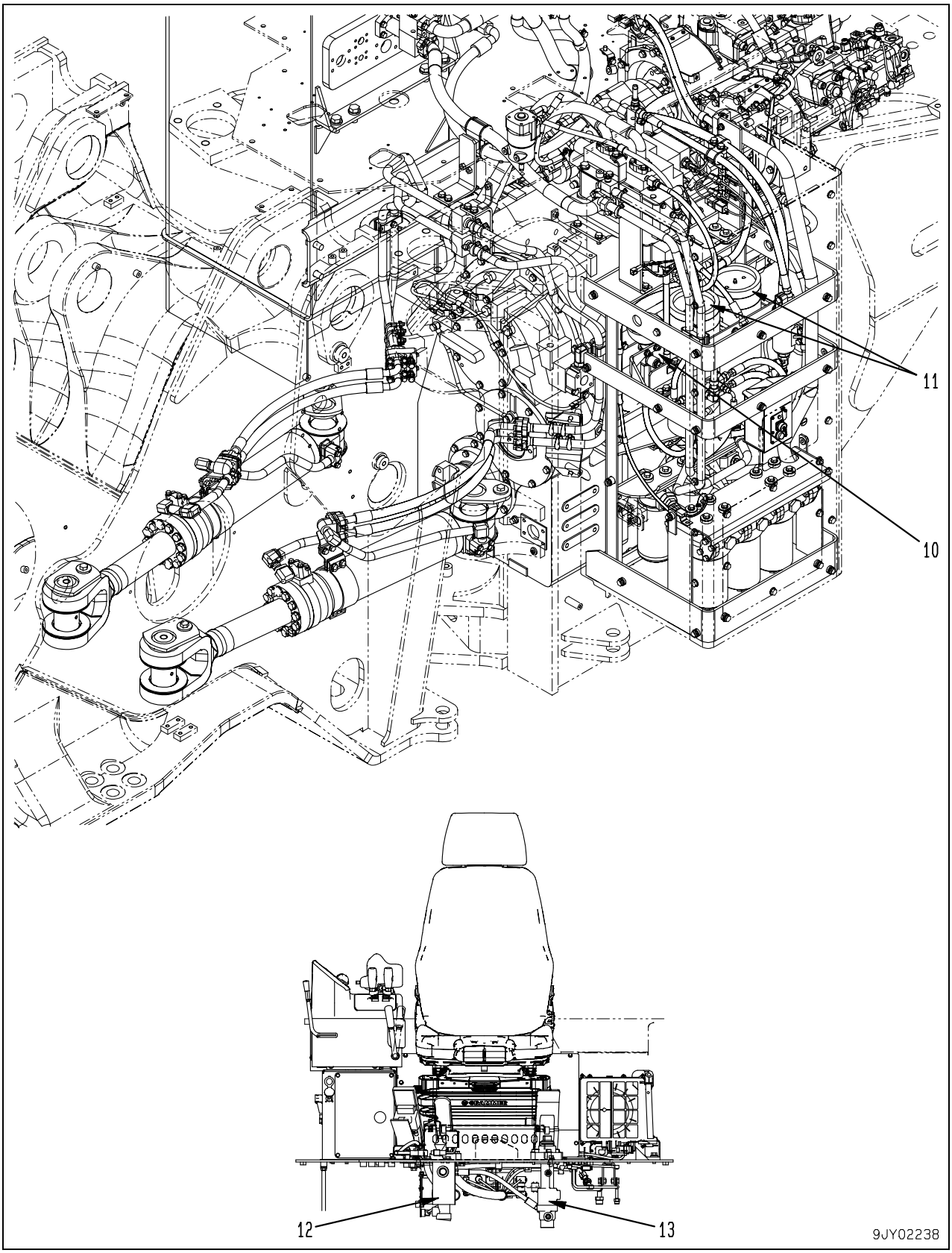
Brake system 2
Brake piping diagram 2
Brake 4
Brake valve 8
Accumulator charge valve 16
EPC relief valve 22
Accumulator (for brake) 24
Slack adjuster 26
Parking brake 30
Parking brake solenoid valve 32
Emergency parking brake release valve 34
Brake cooling pump 35

Brake system

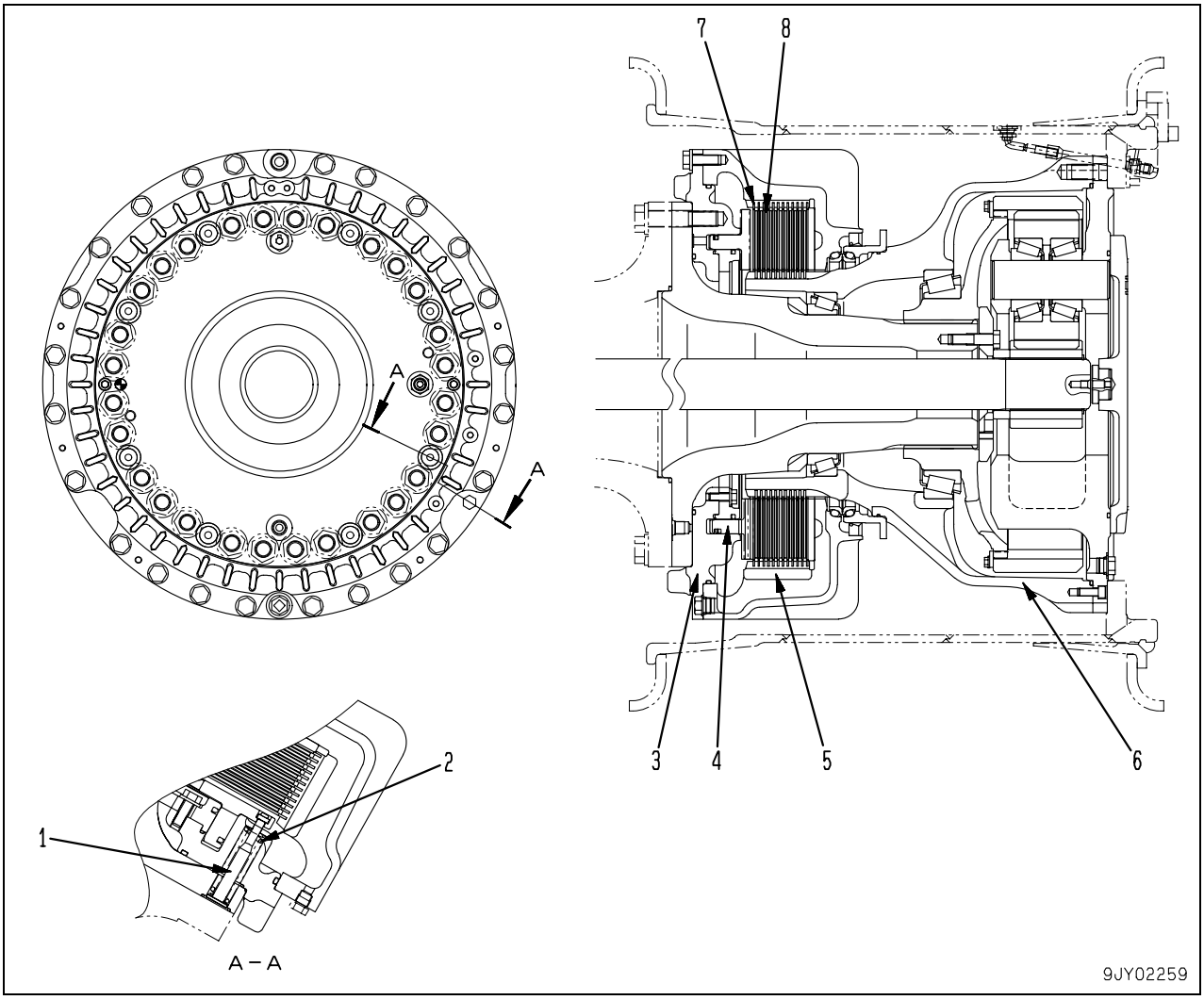
Brake piping diagram



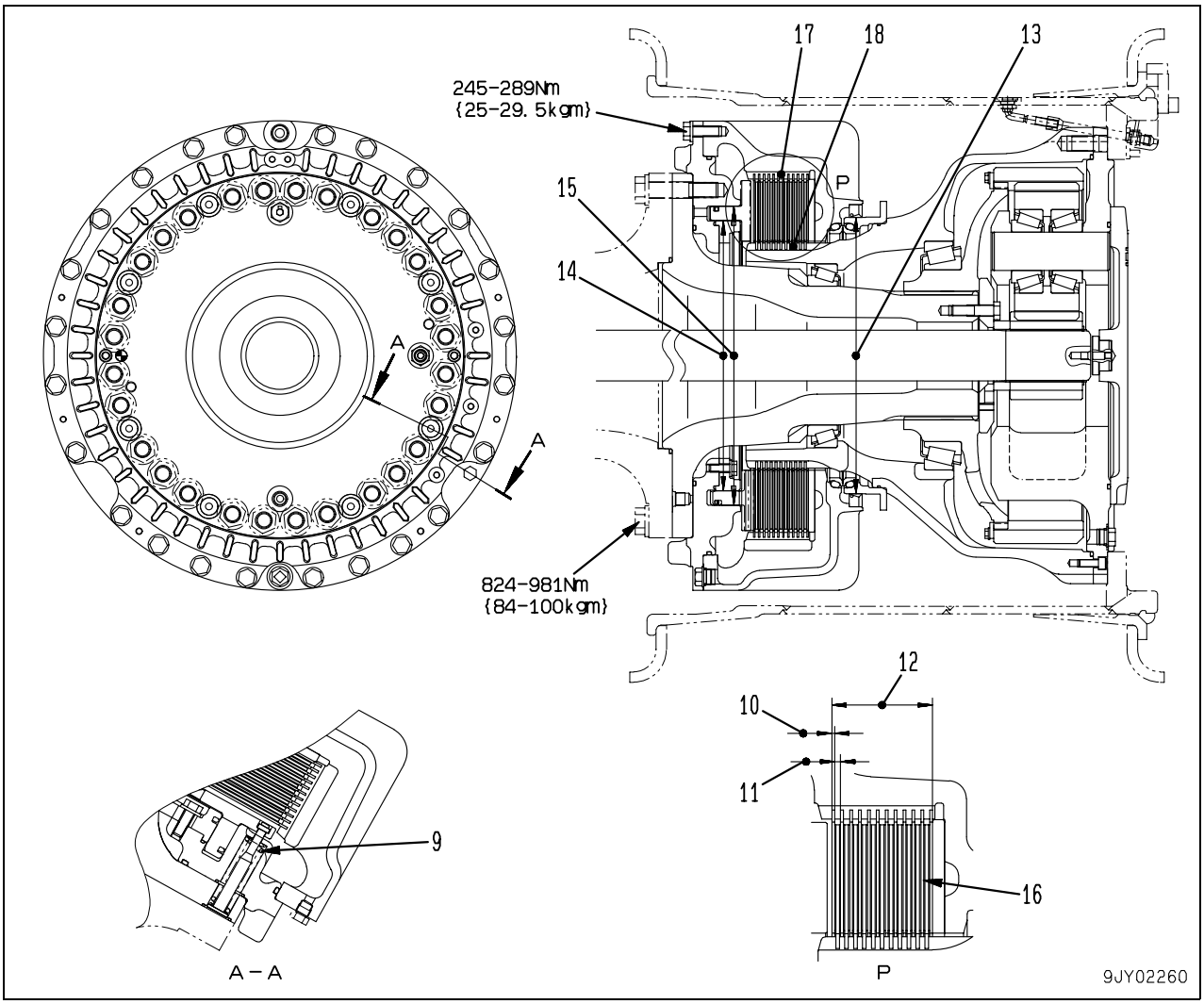
1. Front brake (right)
2. Slack adjuster (front)
3. Hydraulic tank
4. Brake EPC pump
5. Transmission control valve
6. Rear brake (right)
7. Slack adjuster (rear)
8. Rear brake (left)
9. Front brake (left)
10. Accumulator charge valve
11. Accumulator
12. Brake valve (right)
13. Brake valve (left)


11
10
12
13
9JY02238

Brake



1. Guide pin
2. Return spring
3. Cylinder
4. Brake piston
5. Outer gear
6. Hub gear
7. Plate
8. Disc



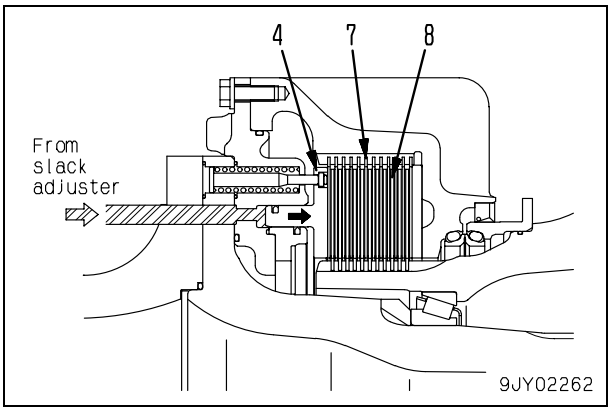
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
9	Return spring	Free length	Installed length	Installed load	Free length	Installed load	
		104.8	91.5	725 N {73.9 kg}	102.7	689 N {70.2 kg}	
10	Thickness of plate	Standard size		Tolerance		Repair limit	
		2.4		—		2.15	
11	Thickness of disc	5.1		—		4.6	
12	Assembled thickness of plate discs	84.9		—		79.4	
13	Wear of seal contact surface	430		0 –0.155		—	Replace
14	Wear of piston seal contact surface	420		+0.097 0		—	
15	Wear of piston seal contact surface	465		+0.097 0		—	
16	Strain of plate and disc contact surface	Standard strain			Repair limit		
		Max. 0.5			0.7		
17	Backlash of outer gear and plate	0.24 – 0.72					
18	Backlash of inner gear and disc	0.19 – 0.62					

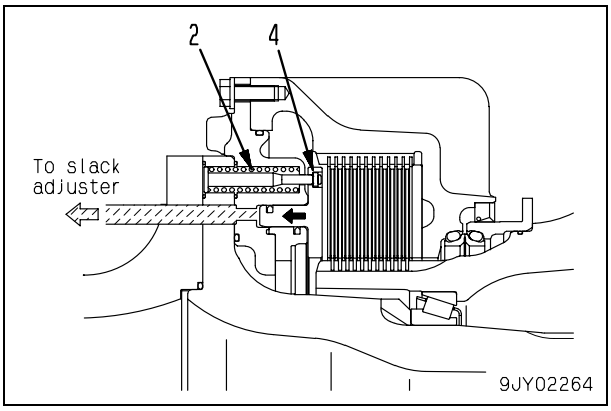
Function

- All the 4 wheels are equipped with a main brake, which is a wet-type multi-disc brake.

- When the brake pedal is pressed down, pressure oil from the slack adjuster moves brake piston (4) in the direction shown by an arrow mark to press disc (8) to contact plate (7). This generates friction force between the disc and the plate. While the wheel is rotating with the disc, this friction causes the machine to slow down and stop.

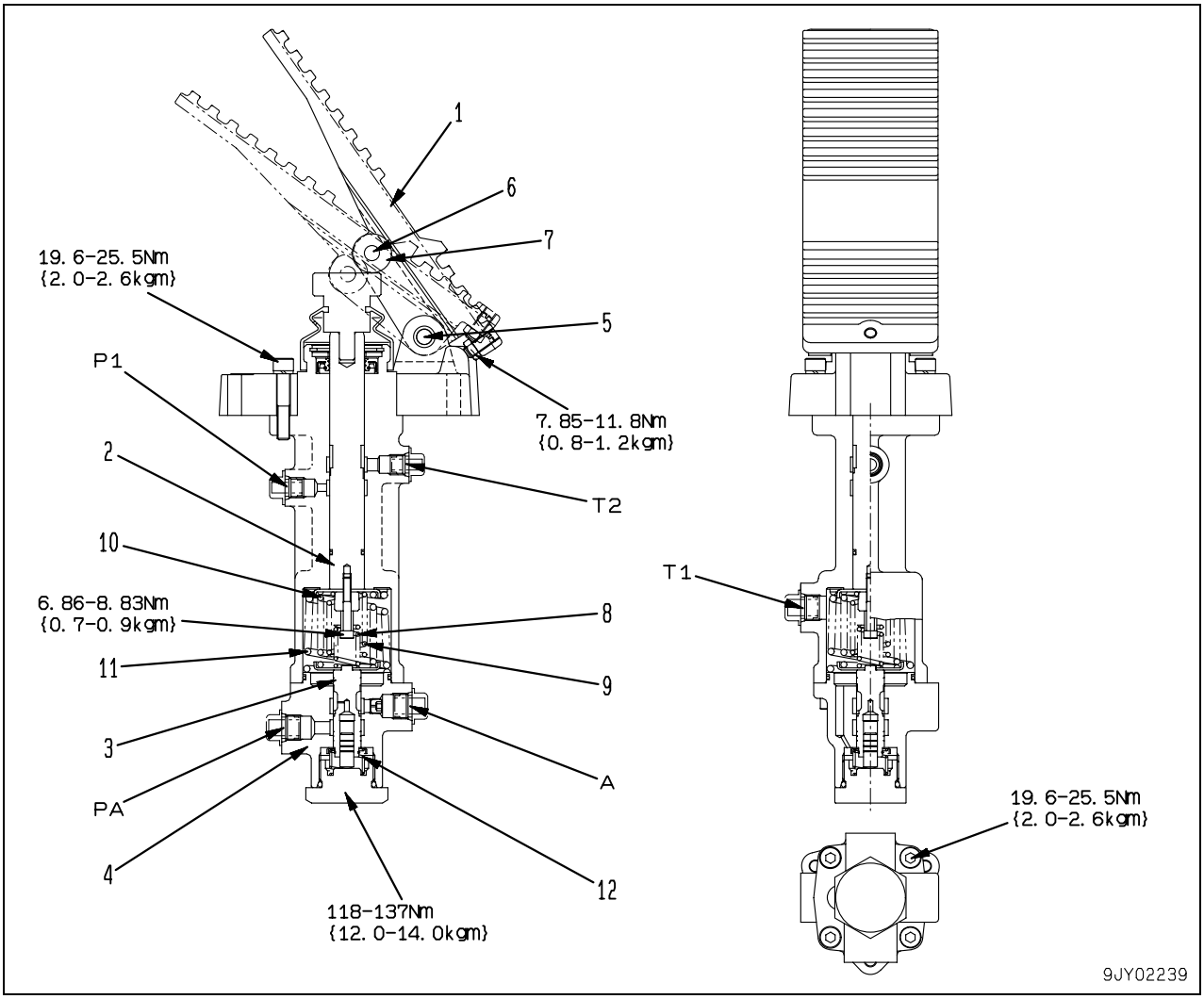


- When the brake pedal is released, back pressure on brake piston (4) is released and force of return spring (2) moves the piston in the direction shown by an arrow mark to release the brake.



Brake valve

Brake valve (Left)



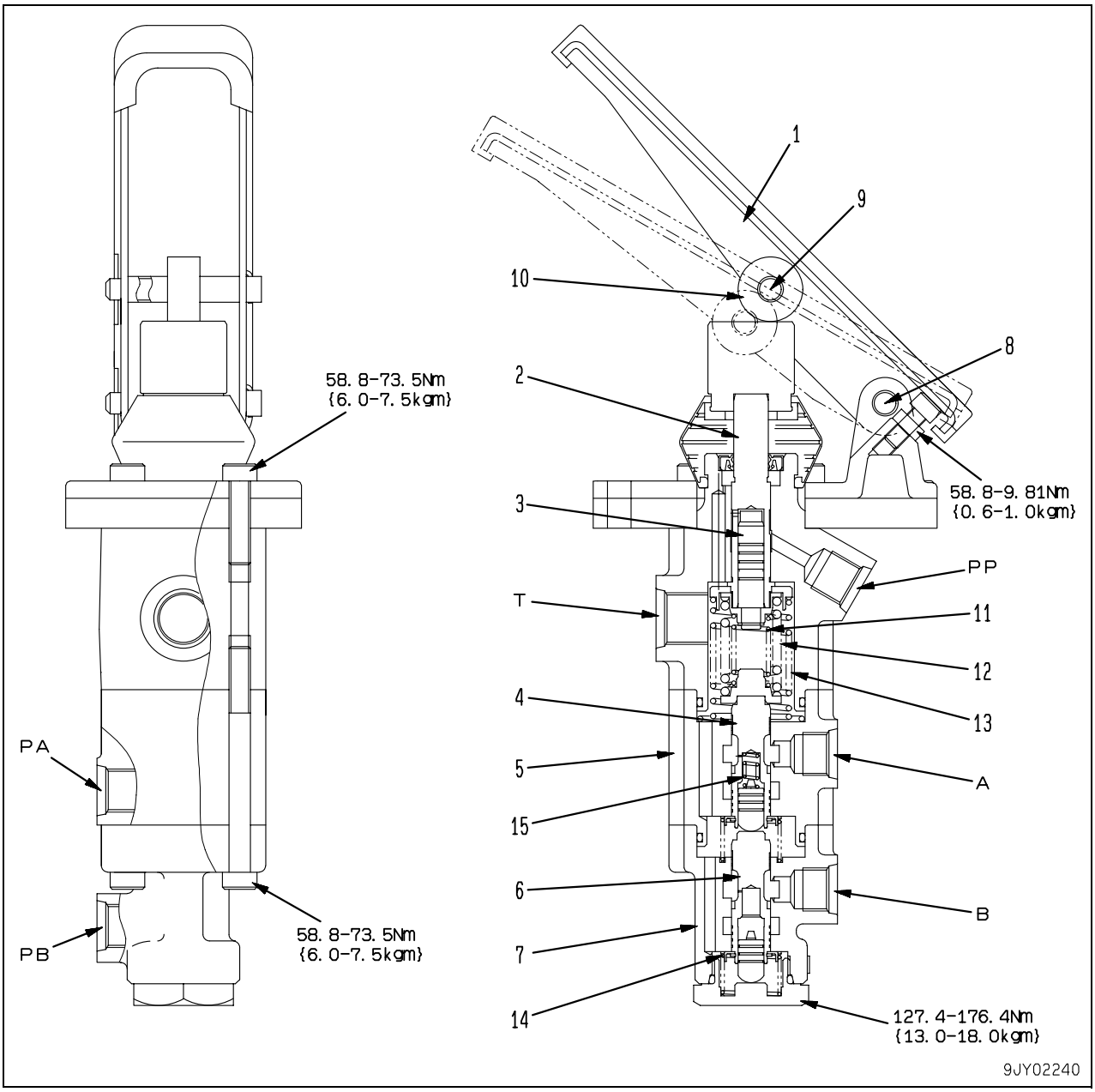
1. Brake pedals
2. Rod
3. Spool
4. Cylinder

A: To pilot port
P1: From accumulator charge valve
PA: From transmission modulation clutch ECMV
T1: Drain port
T2: To transmission tank

Unit: mm

No.	Check item	Criteria					Remedy
5	Clearance between bevel mounting hole and pin	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		ϕ10	–0.01 –0.09	+0.022 0	0.112 – 0.01	0.25	
6	Clearance between roller and pin	ϕ10	–0.01 –0.09	+0.022 0	0.112 – 0.01	0.25	
7	Outside diameter of roller	Standard size		Tolerance	Repair limit		
		25.5		±0.1	25.1		
8	Control spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		27.7	26.5	72 N {7.4 kg}	26.7	—	
9	Control spring	42.4	39	60.4 N {6.2 kg}	41.4	—	
10	Control spring	50.4	49.5	19.6 N {2.0 kg}	49.4	—	
11	Return spring	56.9	52.4	57.9 N {5.9 kg}	51	—	
12	Return spring	35.3	17.2	24.5 N {2.5 kg}	32	—	

Brake valve (right)



1. Brake pedals
2. Rod
3. Piton and pilot
4. Spool
5. Cylinder, upper
6. Spool
7. Cylinder, lower

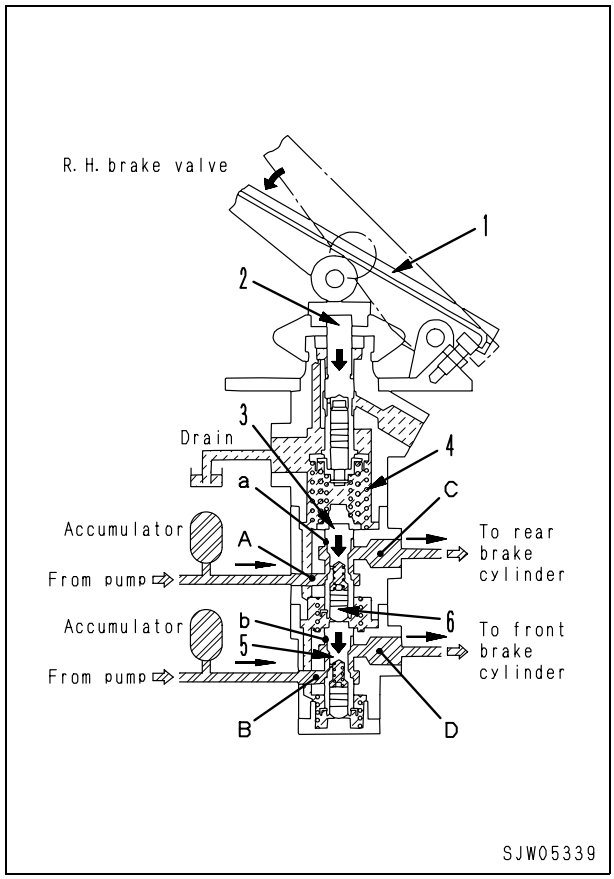
A: To rear brake
B: To front brake
PA: From accumulator charge valve
PB: From accumulator charge valve
PP: From pilot port
T: Drain port

Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Clearance between bevel mounting hole and pin</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="15">Replace</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>ϕ10</td><td>–0.025
–0.075</td><td>–0.1
0</td><td>0.025 –
0.175</td><td>0.25</td></tr>
<tr><td>9</td><td>Clearance between roller and pin</td><td>ϕ10</td><td>–0.025
–0.075</td><td>+0.1
0</td><td>0.025 –
0.175</td><td>0.25</td></tr>
<tr><td rowspan="2">10</td><td rowspan="2">Outside diameter of roller</td><td colspan="2">Standard size</td><td>Tolerance</td><td colspan="2">Repair limit</td></tr>
<tr><td colspan="2">30</td><td>0
–0.5</td><td colspan="2">29.2</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Control spring</td><td colspan="3">Standard size</td><td colspan="2">Repair limit</td></tr>
<tr><td>Free length</td><td>Installed length</td><td>Installed load</td><td>Free length</td><td>Installed load</td></tr>
<tr><td>34</td><td>3.0</td><td>7.66 N
{0.781 kg}</td><td>33</td><td>—</td></tr>
<tr><td>12</td><td>Control spring</td><td>46</td><td>46</td><td>0 N
{0 kg}</td><td>45</td><td>—</td></tr>
<tr><td>13</td><td>Return spring</td><td>86.2</td><td>58</td><td>60.8 N
{6.2 kg}</td><td>78</td><td>—</td></tr>
<tr><td>14</td><td>Return spring</td><td>31.5</td><td>19.5</td><td>16.7 N
{1.7 kg}</td><td>28</td><td>—</td></tr>
<tr><td>15</td><td>Return spring</td><td>17</td><td>16.5</td><td>17.7 N
{1.8 kg}</td><td>16</td><td>—</td></tr>
</table>

Outline

- There are 2 brake valves installed in parallel to front lower part of the operator's seat. They are operated by pressing the pedal.
- If the right pedal is pressed, the oil is supplied to the brake cylinder to operate the brake.
- If the left pedal is pressed, the oil is supplied to the right pedal and the brake is operated similarly to when the right pedal is pressed.
- If the left brake pedal is pressed down, the modulation clutch pressure is reduced to reduce the drive force of the tires according to the pressing angle of the pedal.



Operation

When brake is applied (right brake valve)

Upper section

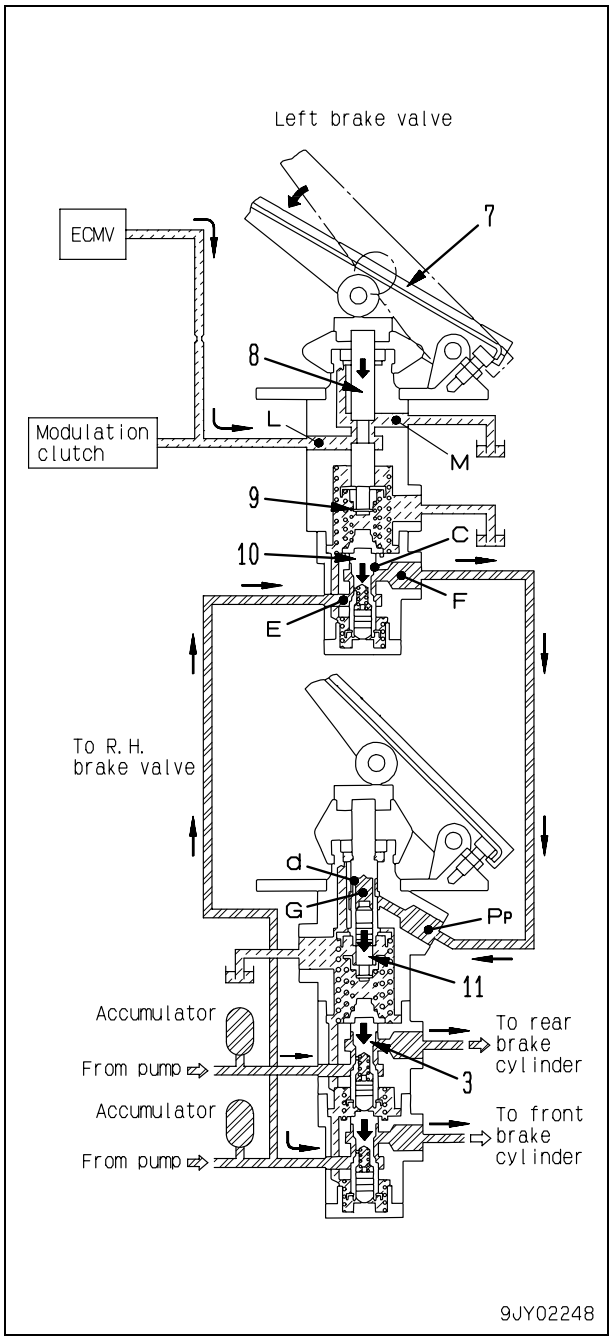
- If pedal (1) is pressed, the pressing effort is transmitted through rod (2) and spring (4) to spool (3). If spool (3) lowers, drain port (a) is closed and the oil from the pump and accumulator flows through port (A) to port (C) to operate the rear brake cylinder.

Lower section

- If pedal (1) is pressed, the pressing effort is transmitted through rod (2) and spring (4) to spool (3). When spool (3) lowers, the force is transmitted through plunger (6) to cause spool (5) to go down. As a result, drain port (b) is closed and the oil from the pump and accumulator flows through port (B) to port (D) to operate the front brake cylinder.

When brake is applied (left brake valve)

- If pedal (7) is stepped down, the stepping force pushes spool (10) down through rod (8) and spring (9) to close drain port (c). The oil from the pump and accumulator flows through port (E) to port (F).
- Since port (F) of the left brake valve is connected to port (PP) of the right brake valve by the hose, the oil flowing to port (F) flows further to pilot port (PP) of the right brake valve.
- The oil flowing to pilot port (PP) flows further through orifice (d) to port (G) and pushes pilot piston (11) down. It then pushes down spool (3) through spring and performs the same operation as that caused by stepping down the right brake valve.
- When rod (8) is pushed down, the notch of rod (8) opens to cause oil for the modulation clutch to flow from port (L) to port (M), and then is drained. This lowers pressure of the modulation clutch, and drive force transmitted from the engine to the tires continuously lowers according to the stepping angle of the pedal.

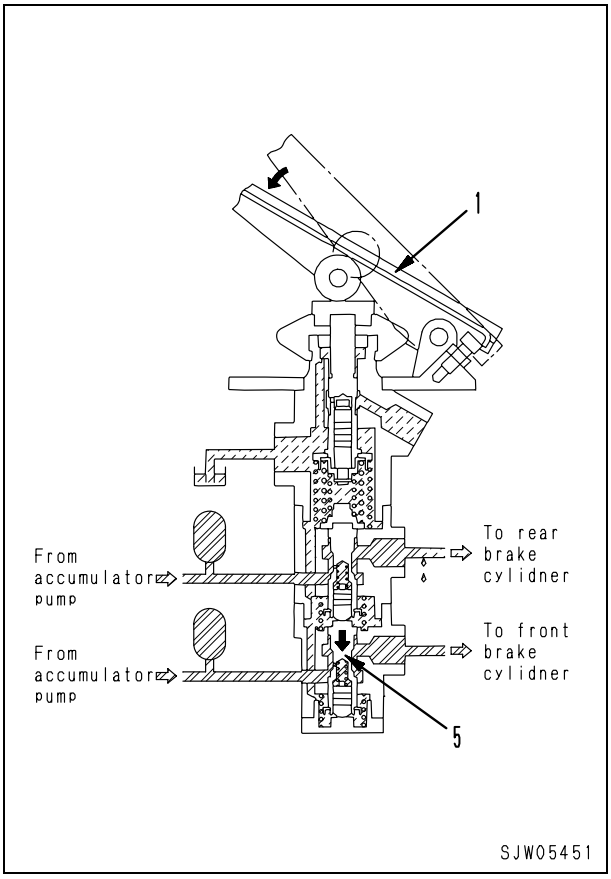


Operation of brake when upper valve has trouble (right brake valve)

- Even if the oil leaks from the piping on the upper side, if pedal (1) is pressed, spool (5) is moved mechanically and the brake on the lower side operates normally.
  The upper side brake does not operate.

Operation of brake when lower valve has trouble (right brake valve)

- Even if the oil leaks from the piping on the lower side, the brake on the upper side operates normally.



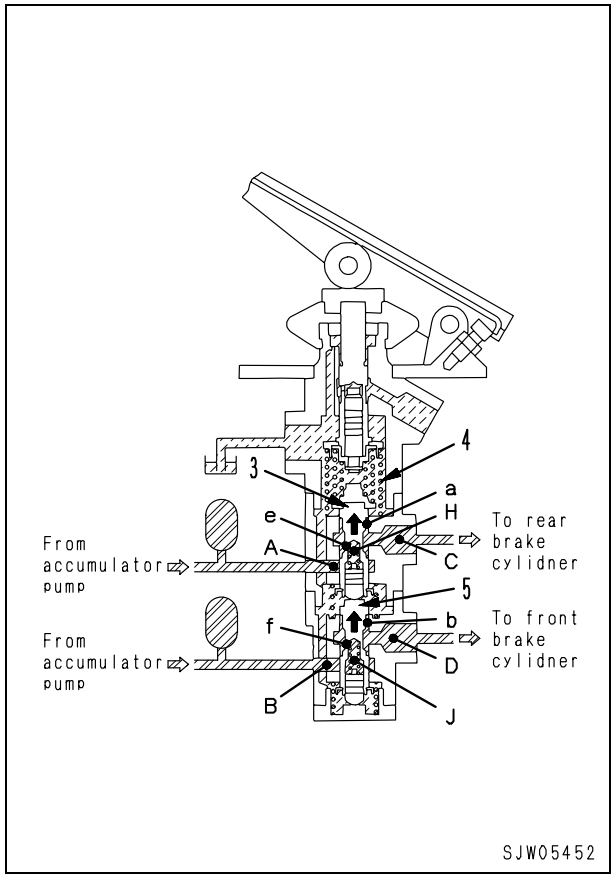
Balancing operation

Upper section

- When the rear brake cylinder is filled with oil and the oil pressure rises between port (A) and port (C), oil entering port (H) from orifice (e) of spool (3) resists spring (4) and pushes up spool (3) to disconnect port (A) from port (C). At this time, drain port (a) remains closed and the oil entering the brake cylinder is retrained there to maintain the brake in operation.

Lower section

- At the same time when spool (3) in the upper section goes upward and port (A) is disconnected from port (C), the front brake cylinder is also filled with oil and the oil pressure rises between port (B) and port (D). Then, oil entering port (J) through orifice (f) of spool (5) pushes up spool (5) as much as the amount of movement of spool (3) to disconnect the port (B) from port (D). Also, as drain port (b) remains closed and the oil entering the brake cylinder is retrained there to maintain the brake in operation.
- The pressure in the upper section is balanced with the pedal pressing force and the pressure in the lower section is balanced with the pressure in the upper section. When spools (3) and (5) move in full stroke, the line is fully open between ports (A) and (C) and ports (B) and (D). Thus, the pressure in the upper and lower sections and the oil pressure in the right and left brake cylinders become the same as the oil pressure from the pump.
  Therefore, until the piston moves in full stroke, the effect of the brake can be adjusted by the degree of stepping on the pedal.



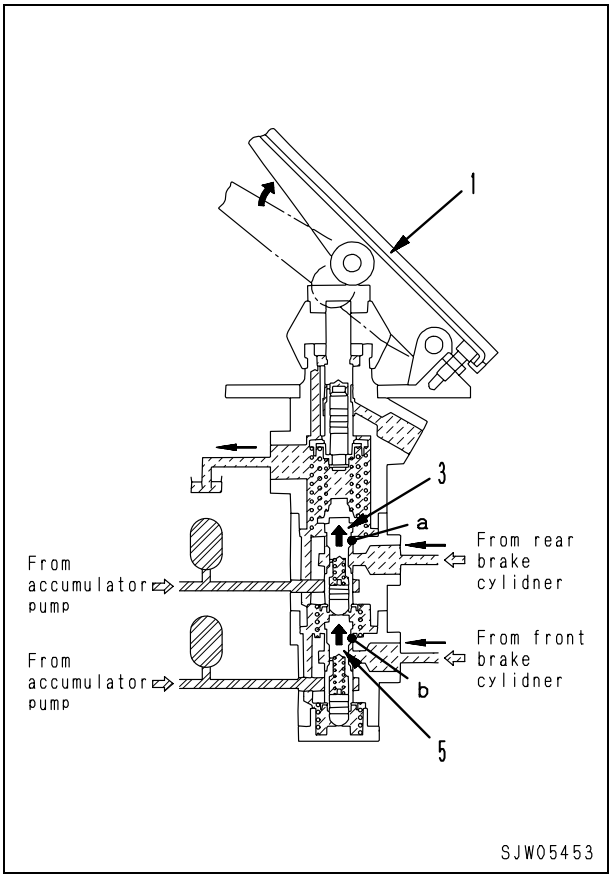
When brake is released (right brake valve)

Upper section

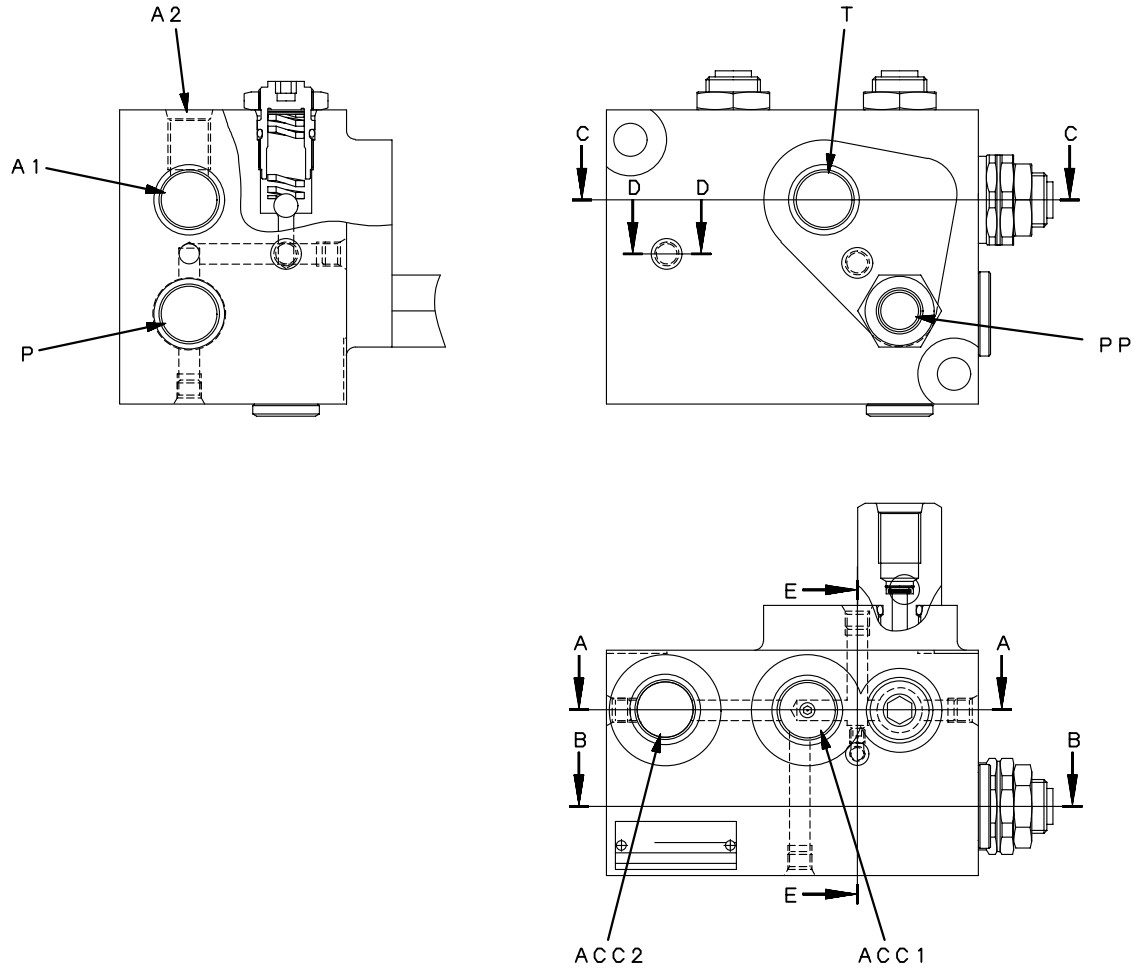
- When pedal (1) is released and the stepping force is removed from the upper section of the spool, back pressure from the brake cylinder and the spool return spring raise spool (3) to release drain port (a). Oil from the brake cylinder flows to the hydraulic tank return circuit to release the rear brake.

Lower section

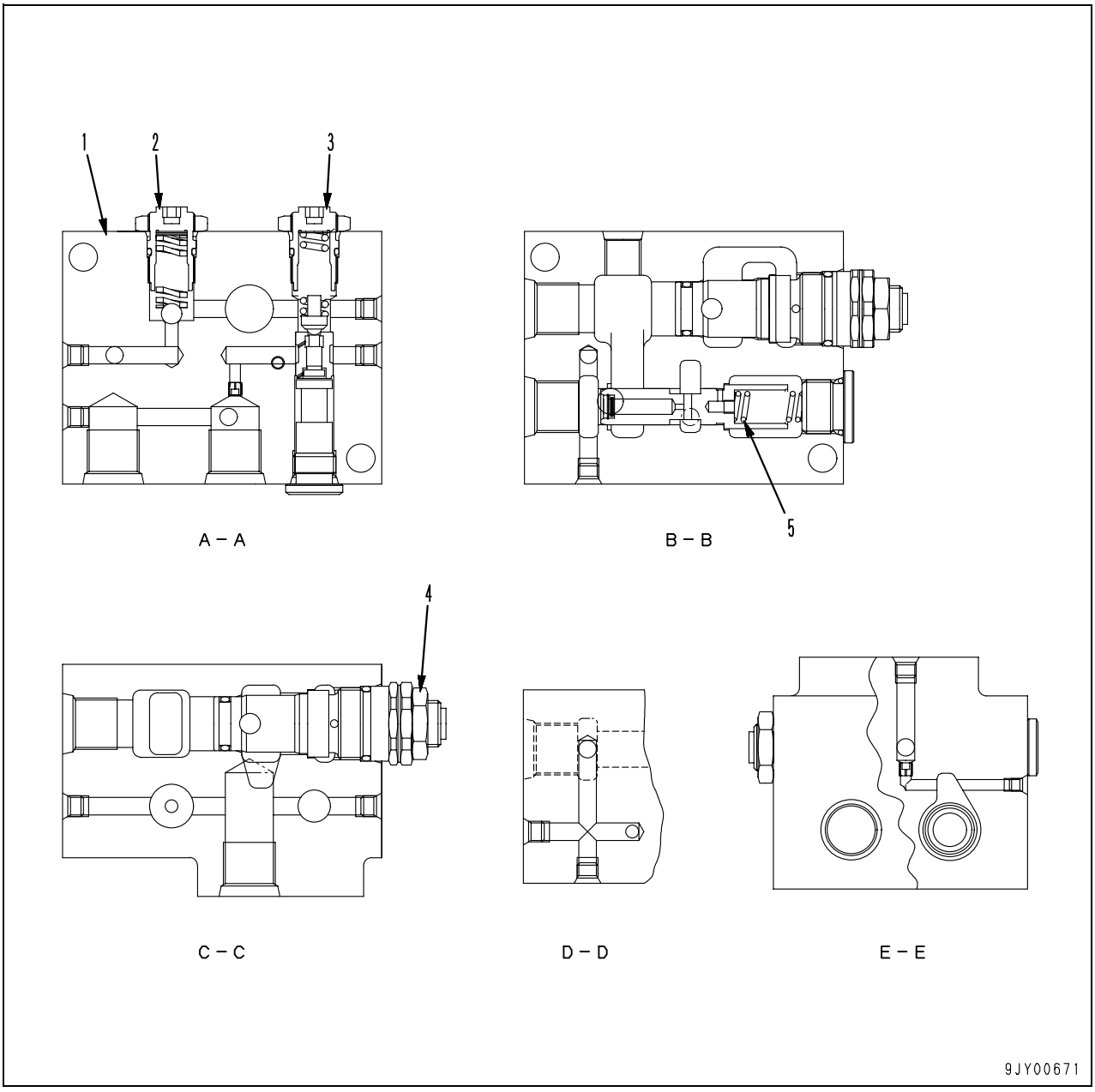
- When the pedal is released, spool (3) of the upper section moves upward and at the same time, back pressure from the brake cylinder and the spool return spring move spool (5) to release drain port (b). Then, oil from the brake cylinder flows to the tank return circuit to release the front brake.



Accumulator charge valve



A1: To steering valve (steering wheel specification)
A1: To EPC valve (AJSS specification)
A2: To work equipment valve
ACC1: To right brake valve port PB
To left brake valve port P1
ACC2: To right brake valve port PA
P1: From pump
PP1: To right brake valve port PB
To left brake valve port P1
T: Drain



1. Valve body
2. Main relief valve (R3)
3. Relief valve (R1)
4. PPC relief valve (R2)
   (steering wheel specification)
4. EPC relief valve (R2) (AJSS specification)
5. Relief valve (H1)

Function

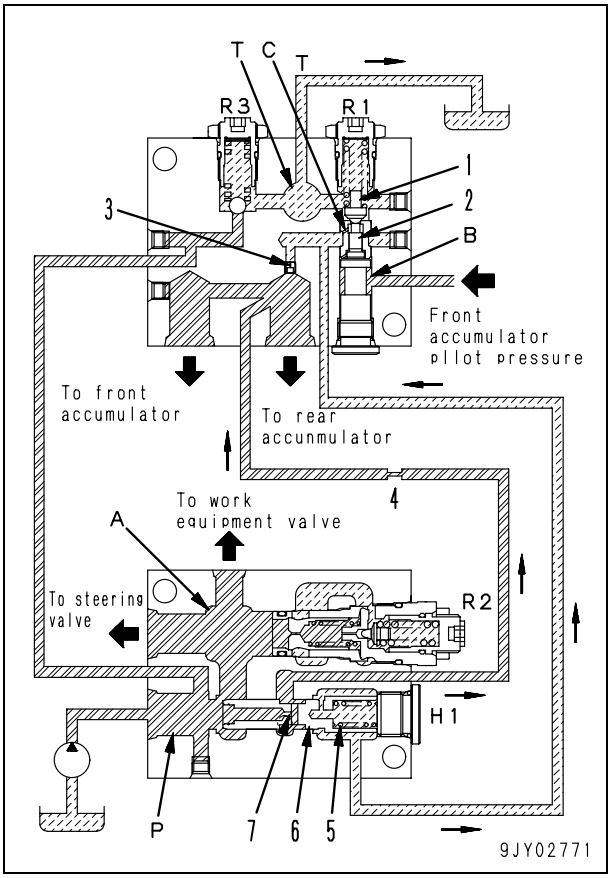
- The accumulator charge valve keeps the oil pressure from the pump to the set pressure and stores it in the accumulator.
- If the oil pressure rises above the set pressure, the oil from the pump is led to the drain circuit to reduce the load on the pump.

(Steering wheel specification)

Operation

1. When oil is not supplied to accumulator (cut-out state)

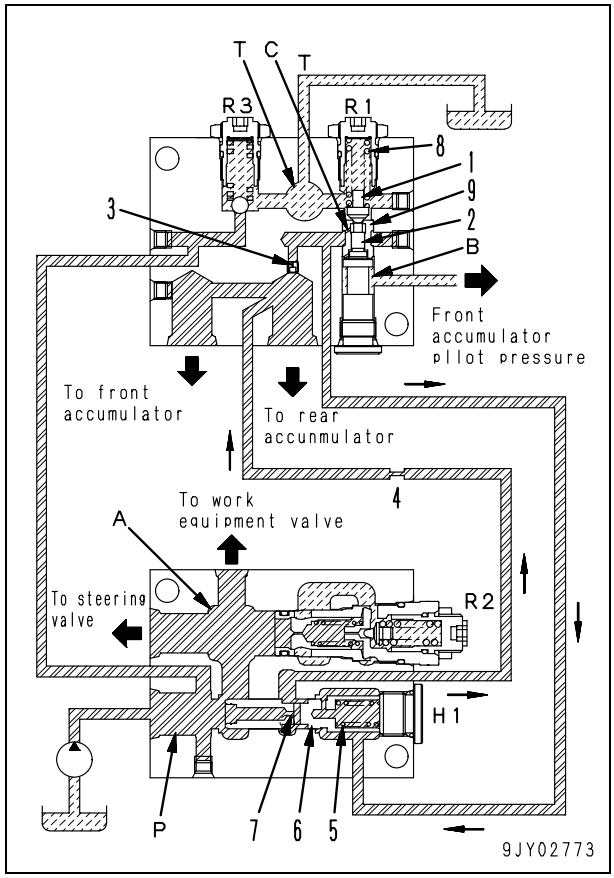
- Since the pressure at port (B) is higher than the set pressure of relief valve (R1), piston (2) is forced to move upward by the hydraulic pressure of port (B). As this move opens poppet (1), port (C) and port (T) are shorted.
- As the rightmost spring chamber of spool (6) leads to port (C) of relief valve (R1), tank pressure prevails.
- Oil from the pump enters port (P) and pushes spool (6) to the right with a low pressure equivalent to the load of spring (5) and then flows from port (A) to the EPC valve and the work equipment valve. At the same time, it flows to the tank through orifices (7), (4) and (3).



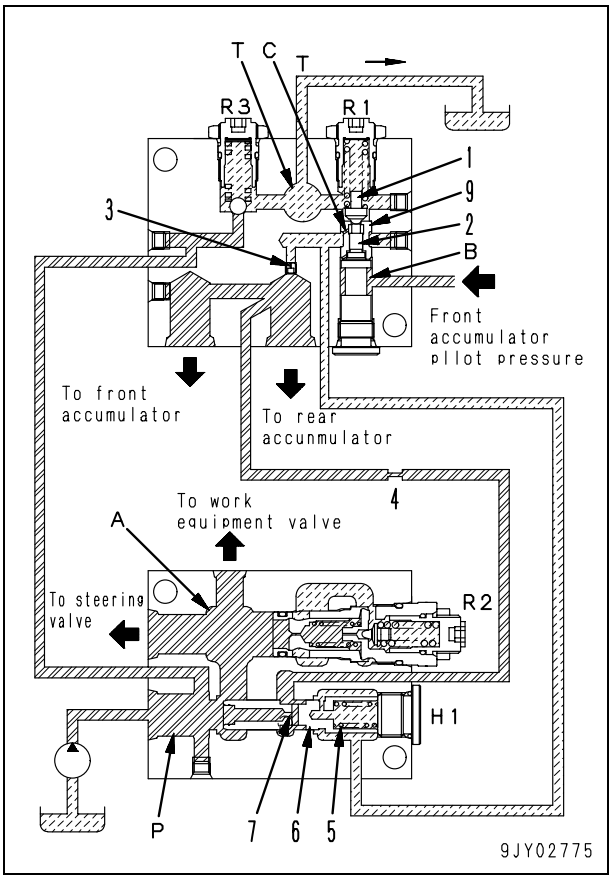
2. When oil is supplied to accumulator

1) Cut-in state

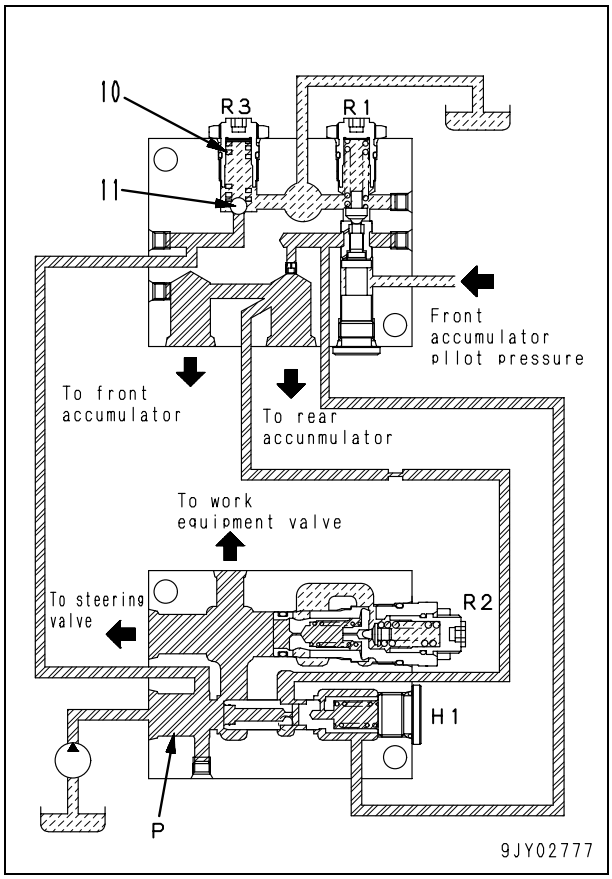
- If the pressure at port (B) drops below the set pressure of relief valve (R1), piston (2) is returned downward by the tension of spring (8). This causes valve seat (9) to closely contact poppet (1) to disconnect port (C) from port (T).
- The right-hand side spring chamber of spool (6) also gets shuttered off from port (T) to increase pressure, leading to pressure at port (P) to rise as well.
- When pressure at port (P) exceeds the pressure at port (B) (accumulator pressure), oil supply to the accumulator starts. This timing is determined by the area size of orifice (7) and pressure differential before and after (equivalent to the load of spring (5)). A fixed amount of oil is supplied regardless of the engine speed, and the remaining amount flows to port (A).



2) When pressure reaches cut-out pressure
- When pressure at port (B) (accumulator pressure) reaches the set pressure for relief valve (R1), poppet (1) leaves valve seat (9) to generate a flow of oil, creating relief operation.
- The relief operation creates vertical pressure differential for piston (2). Thus, piston (2) moves upward to force poppet (1) to open, shorting ports (C) and (T).
- As the rightmost spring chamber of spool (6) leads to port (C) of relief valve (R1), tank pressure prevails.
- Since the pressure at port (P) also drops to the level equivalent to the load of spring (5), oil supply to port (B) is stopped as well.



3. Safety relief valve (R3)
- If the pressure at port (P) (pump pressure) rises above the set pressure for relief valve (R3), the oil from the pump resists spring (10) and pushes ball (11) upward to cause oil to flow into the tank circuit, thus protecting the circuit by defining the maximum pressure for the brake circuit.

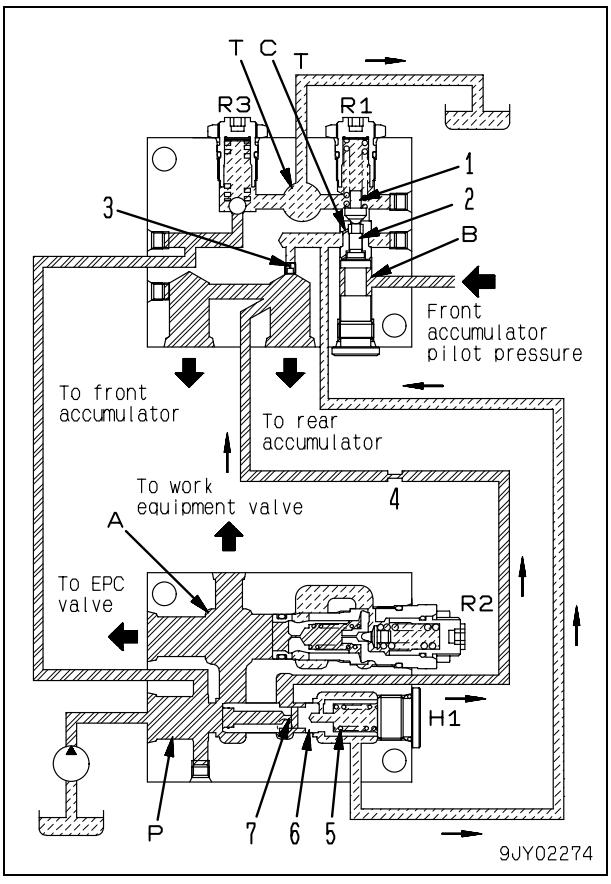


AJSS (Advanced Joystick Steering System) specification

Operation

1. When oil is not supplied to accumulator (cut-out state)

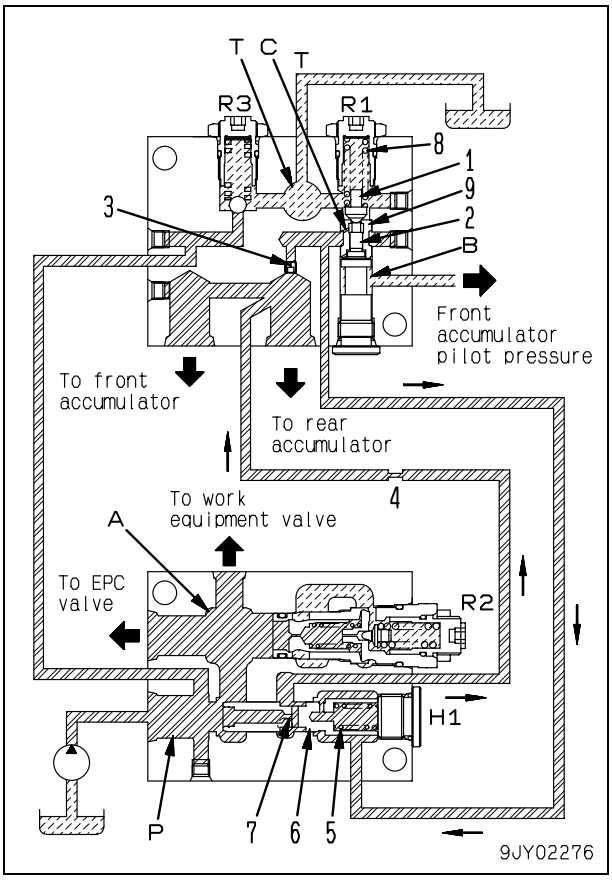
- Since the pressure at port (B) is higher than the set pressure of relief valve (R1), piston (2) is forced to move upward by the hydraulic pressure of port (B). As this move opens poppet (1), port (C) and port (T) are shorted.
- As the rightmost spring chamber of spool (6) leads to port (C) of relief valve (R1), tank pressure prevails.
- Oil from the pump enters port (P) and pushes spool (6) to the right with a low pressure equivalent to the load of spring (5) and then flows from port (A) to the EPC valve and the work equipment valve. At the same time, it flows to the tank through orifices (7), (4) and (3).



2. When oil is supplied to accumulator

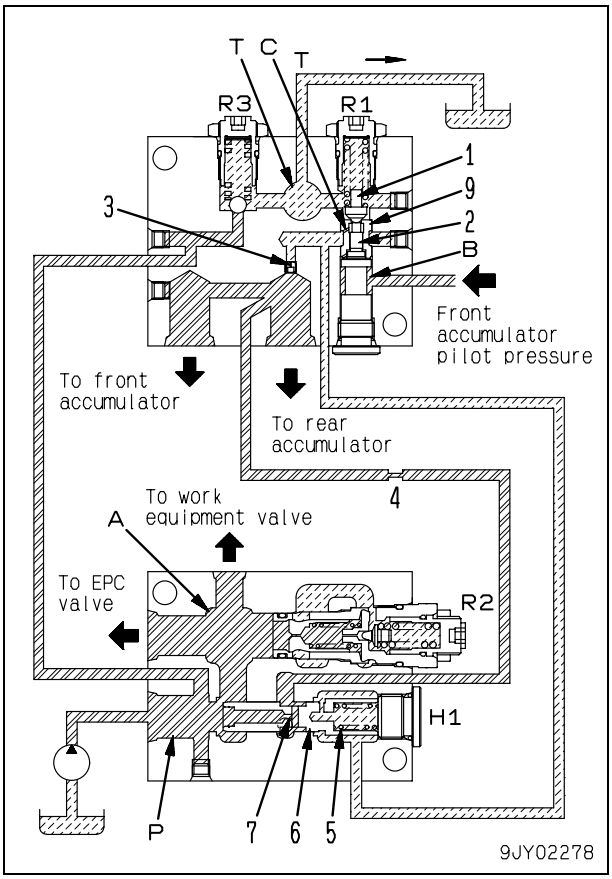
1) Cut-in state

- If the pressure at port (B) drops below the set pressure of relief valve (R1), piston (2) is returned downward by the tension of spring (8). This causes valve seat (9) to closely contact poppet (1) to disconnect port (C) from port (T).
- The right-hand side spring chamber of spool (6) also gets shuttered off from port (T) to increase pressure, leading to pressure at port (P) to rise as well.
- When pressure at port (P) exceeds the pressure at port (B) (accumulator pressure), oil supply to the accumulator starts. This timing is determined by the area size of orifice (7) and pressure differential before and after (equivalent to the load of spring (5)). A fixed amount of oil is supplied regardless of the engine speed, and the remaining amount flows to port (A).



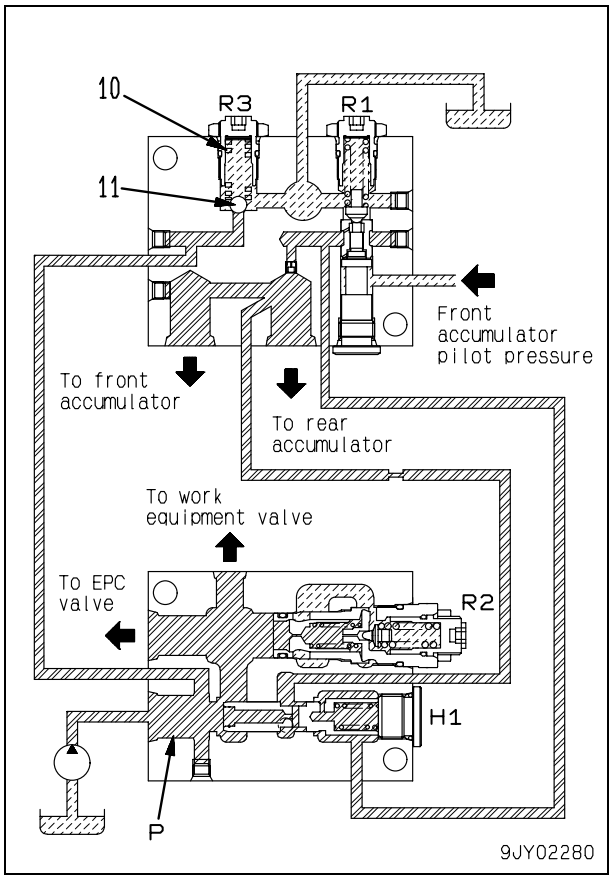
2) When pressure reaches cut-out pressure

- When pressure at port (B) (accumulator pressure) reaches the set pressure for relief valve (R1), poppet (1) leaves valve seat (9) to generate a flow of oil, creating relief operation.
- The relief operation creates vertical pressure differential for piston (2). Thus, piston (2) moves upward to force poppet (1) to open, shorting ports (C) and (T).
- As the rightmost spring chamber of spool (6) leads to port (C) of relief valve (R1), tank pressure prevails.
- Since the pressure at port (P) also drops to the level equivalent to the load of spring (5), oil supply to port (B) is stopped as well.

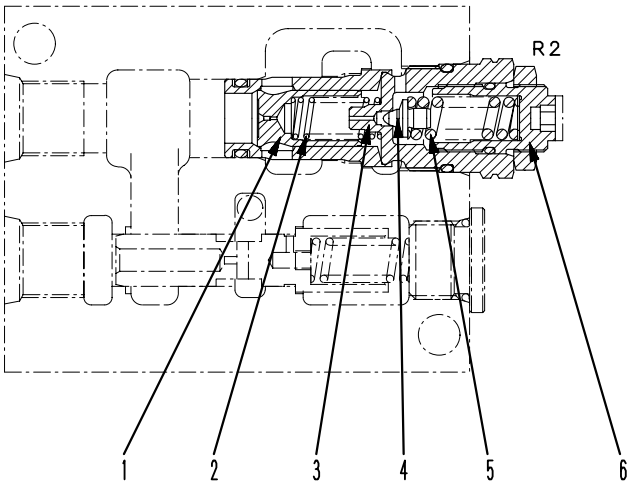


3. Safety relief valve (R3)

- If the pressure at port (P) (pump pressure) rises above the set pressure for relief valve (R3), the oil from the pump resists spring (10) and pushes ball (11) upward to cause oil to flow into the tank circuit, thus protecting the circuit by defining the maximum pressure for the brake circuit.



EPC relief valve



1. Main valve
2. Spring
3. Valve seat
4. Pilot poppet
5. Spring
6. Screw

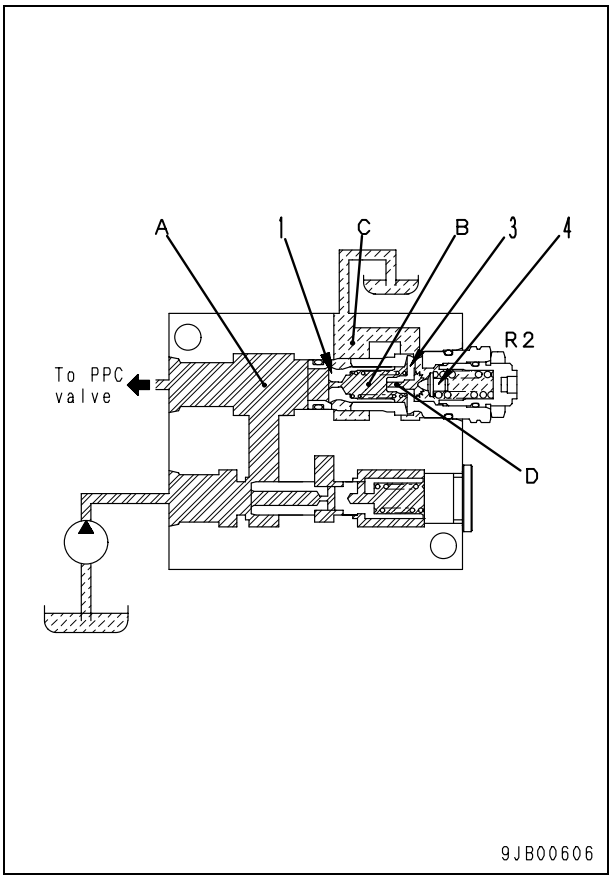
Function

- The EPC relief valves are located between the EPC brake pump and the EPC valve and between work equipment units. When the EPC valve is not operating, or when any abnormal pressure has occurred in the EPC circuit, oil from the pump is relieved from this valve in order to protect the pump and the circuit from damage.

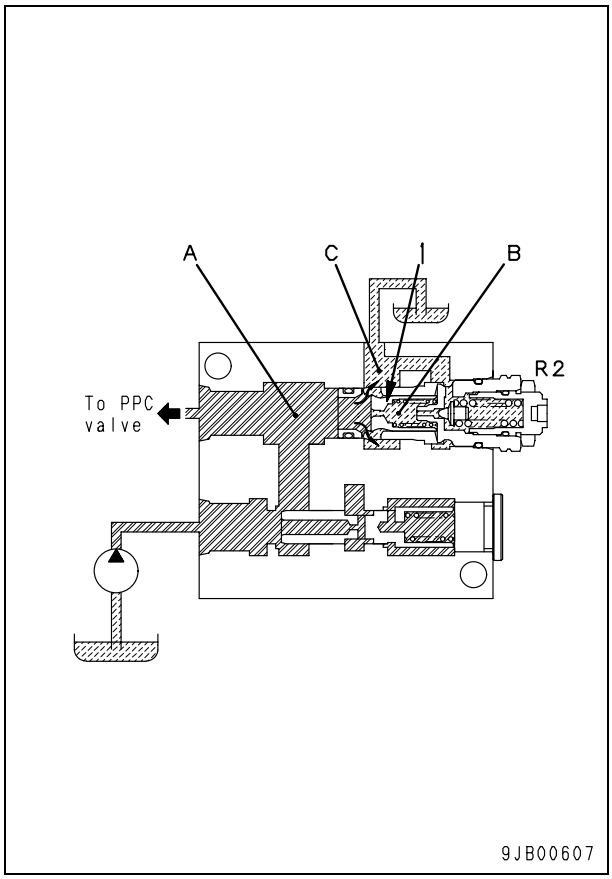
★ For the steering wheel specification model, read “EPC” as “PPC”.

Operation

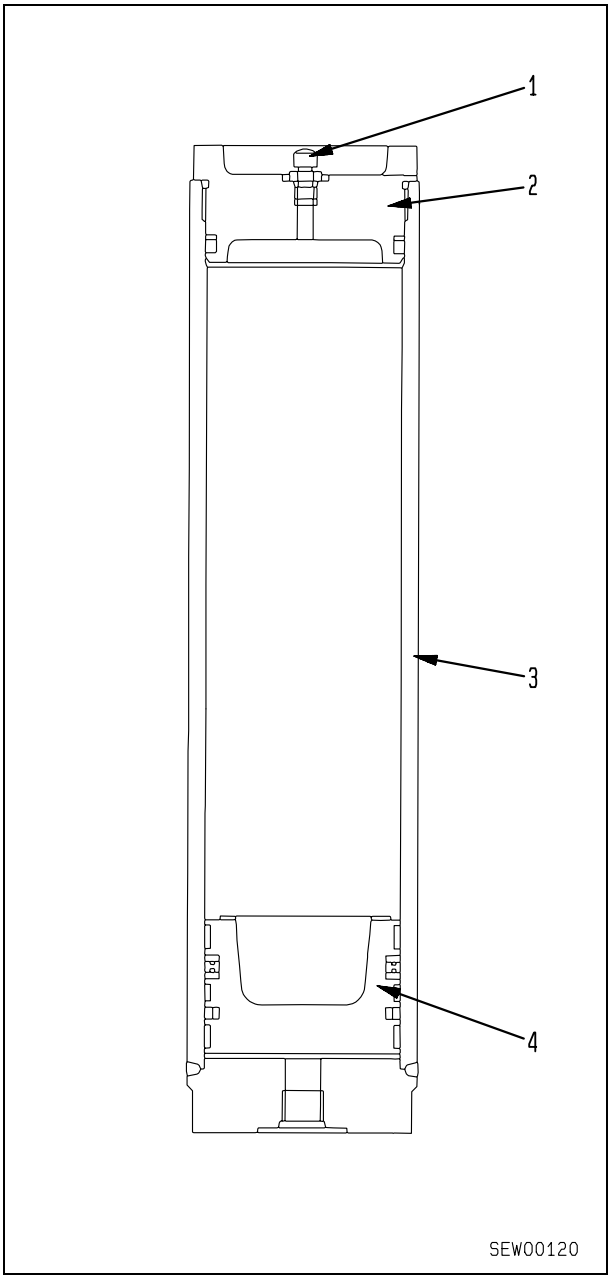
- The relief valve is installed on the charge valve. Port (A) is connected to the pump circuit, and port (C), to the drain circuit.
  Oil runs through the orifice of main valve (1) and fills port (B).
  Pilot poppet (4) is seated on the valve seat (3).
- When pressure at ports (A) and (B) reaches the set pressure, pilot poppet (4) opens and oil pressure at port (B) is carried from port (D) to port (C), causing pressure at port (B) to drop.



- When pressure at port (B) drops, the orifice of main valve (1) functions so as to allow pressure differential to occur at ports (A) and (B), causing main valve (1) to open due to pressure from port (A) and oil in port (A) is drained to port (C) for relief.



Accumulator (for brake)



1. Valve
2. Top cover
3. Cylinder
4. Piston

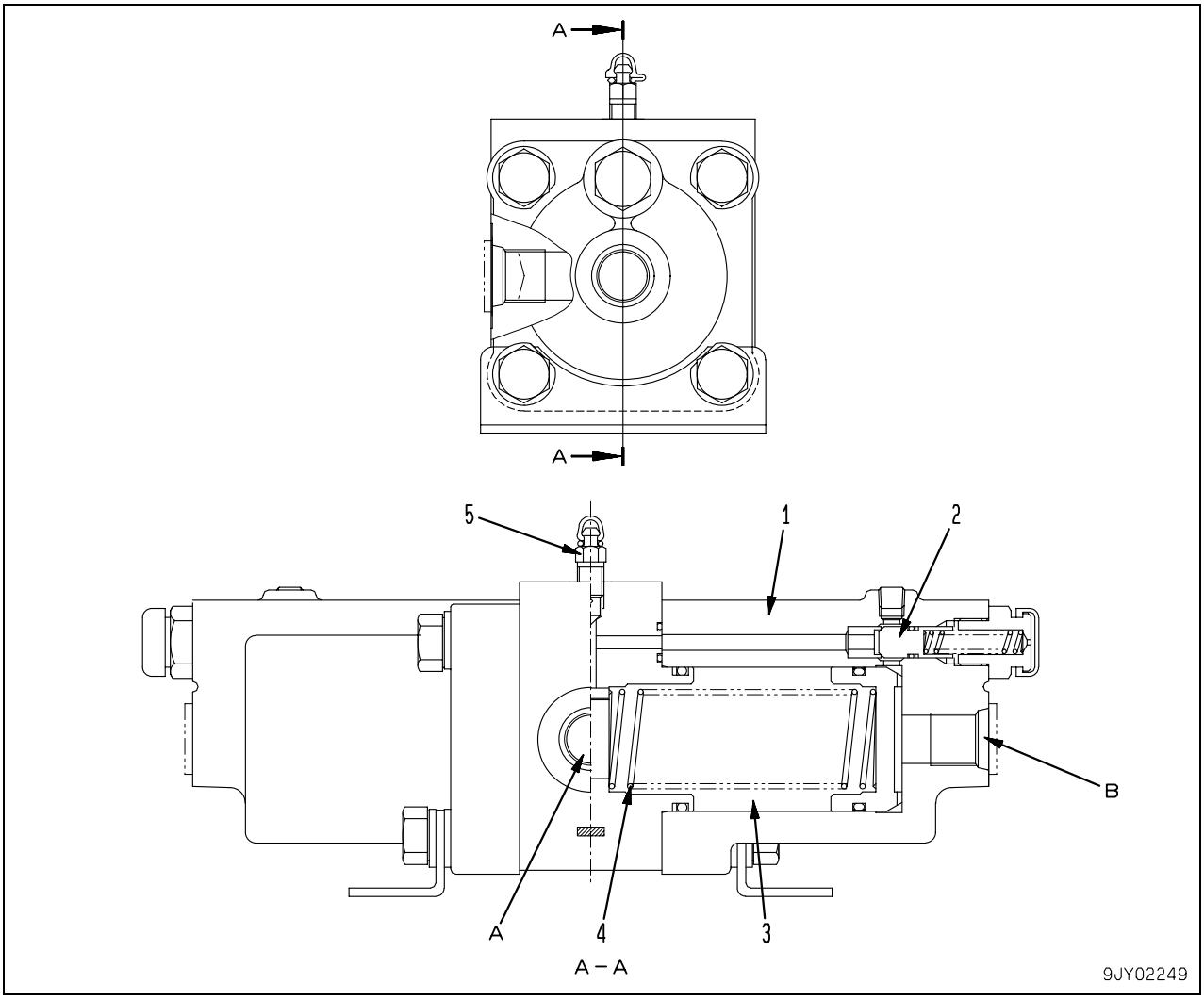
Function

- The accumulator is installed between the charge valve and brake valve. The space between cylinder (3) and free piston (4) is filled with nitrogen gas. The nitrogen gas absorbs the hydraulic pulses generated by the hydraulic pump and secures the braking force and operability when the engine stops by utilizing its compressibility.

Specifications

Gas used: Nitrogen gas
Amount of gas: 6,000 cc
Charge pressure:
3.4 ± 0.15 MPa {35 ± 1.5 kg/cm^2} (at 50°C)

Slack adjuster

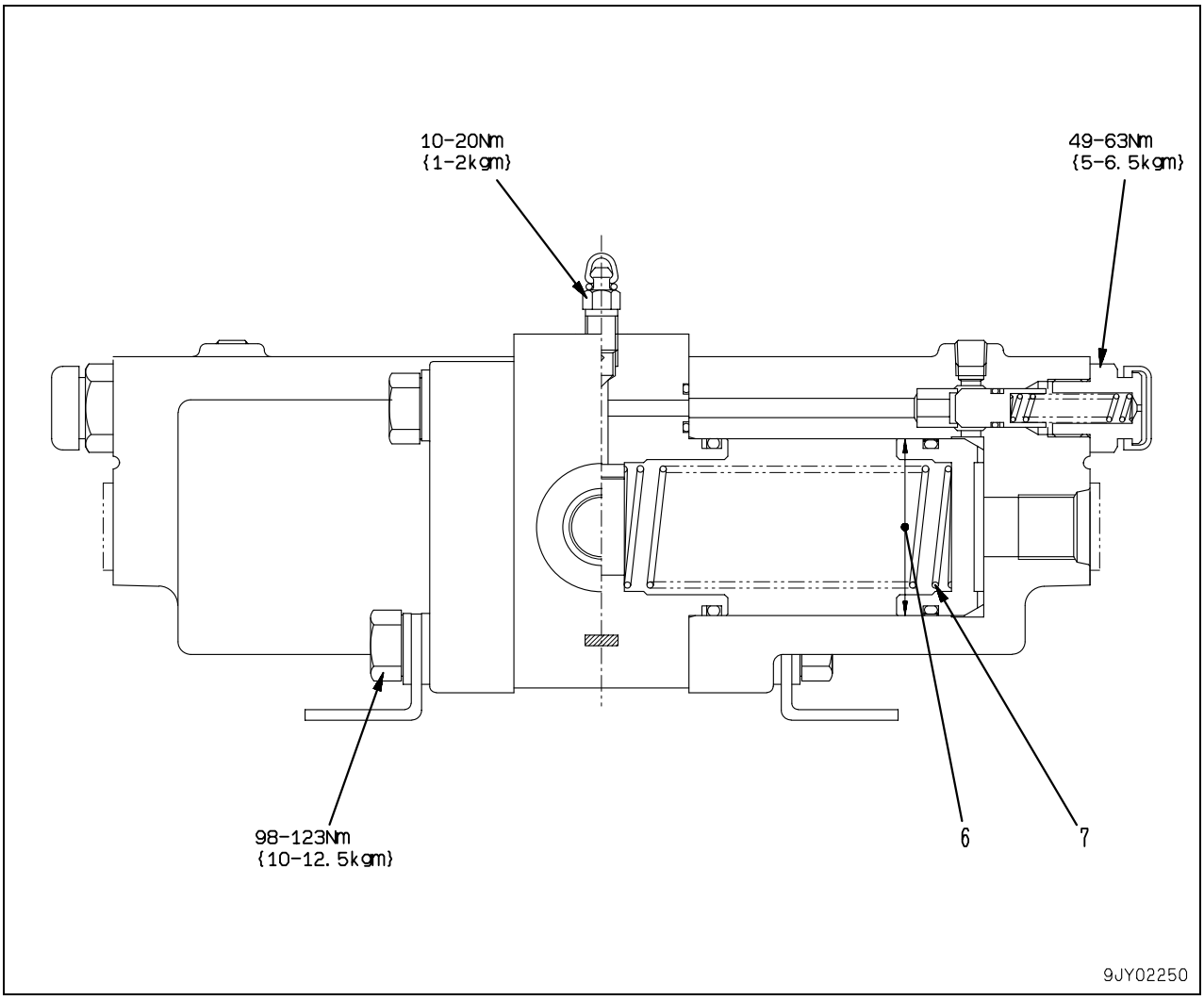


1. Cylinder
2. Check valve
3. Piston
4. Spring
5. Bleeder

A: Inlet port
B: Outlet port

Function

- The slack adjuster is installed on the brake oil line leading to the brake piston from the brake valve, and functions to keep the time lag during brake operation at a fixed level.



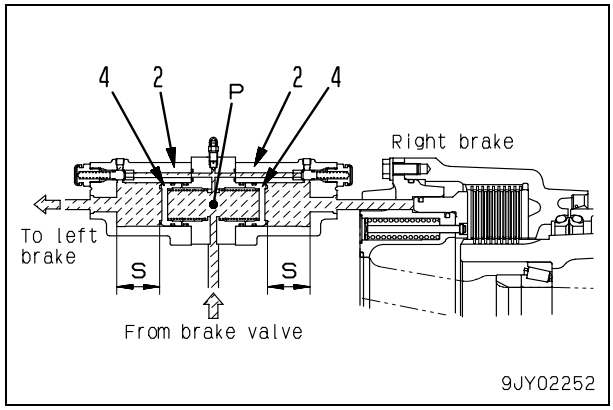
Unit: mm

No.	Check item	Criteria					Remedy
6	Clearance between body and piston	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		55	–0.030 –0.076	+0.074 0	0.030 – 0.150	0.25	
7	Slack adjuster spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		198	90	49 N {5.0 kg}	181	—	

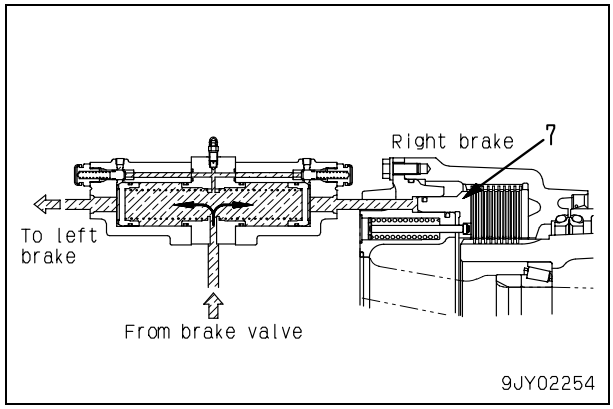
Operation

1. When the brake pedal is pressed down

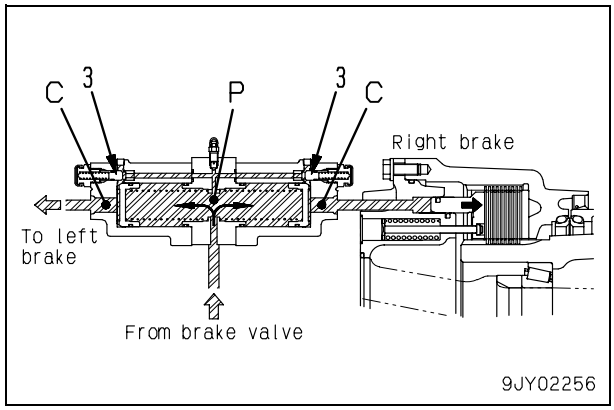
- Before the brake is pressed down, piston (4) is restored as much as the amount of stroke (S) (a full stroke). When the brake pedal is pressed down, oil discharged from the brake valve branches into right and left cylinders (2) from port (P) of the slack adjuster to move piston (4) as much as the amount of stroke (S) to the right and the left.



- This move causes brake piston (7) to move as much as stroke (S). At this time, the relationship between brake piston (7) and the disc is simply that the clearance is reduced to zero, and no braking force is generated.

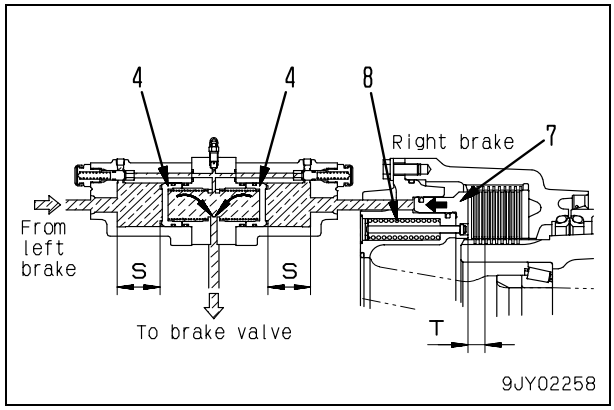


- As the brake valve is kept pressed down further, oil pressure from the brake valve exceeds the specified to open check valve (3) and port (C) is imposed pressure to function as braking force.
  Thus, the time lag when the brake is in operation is maintained the same.

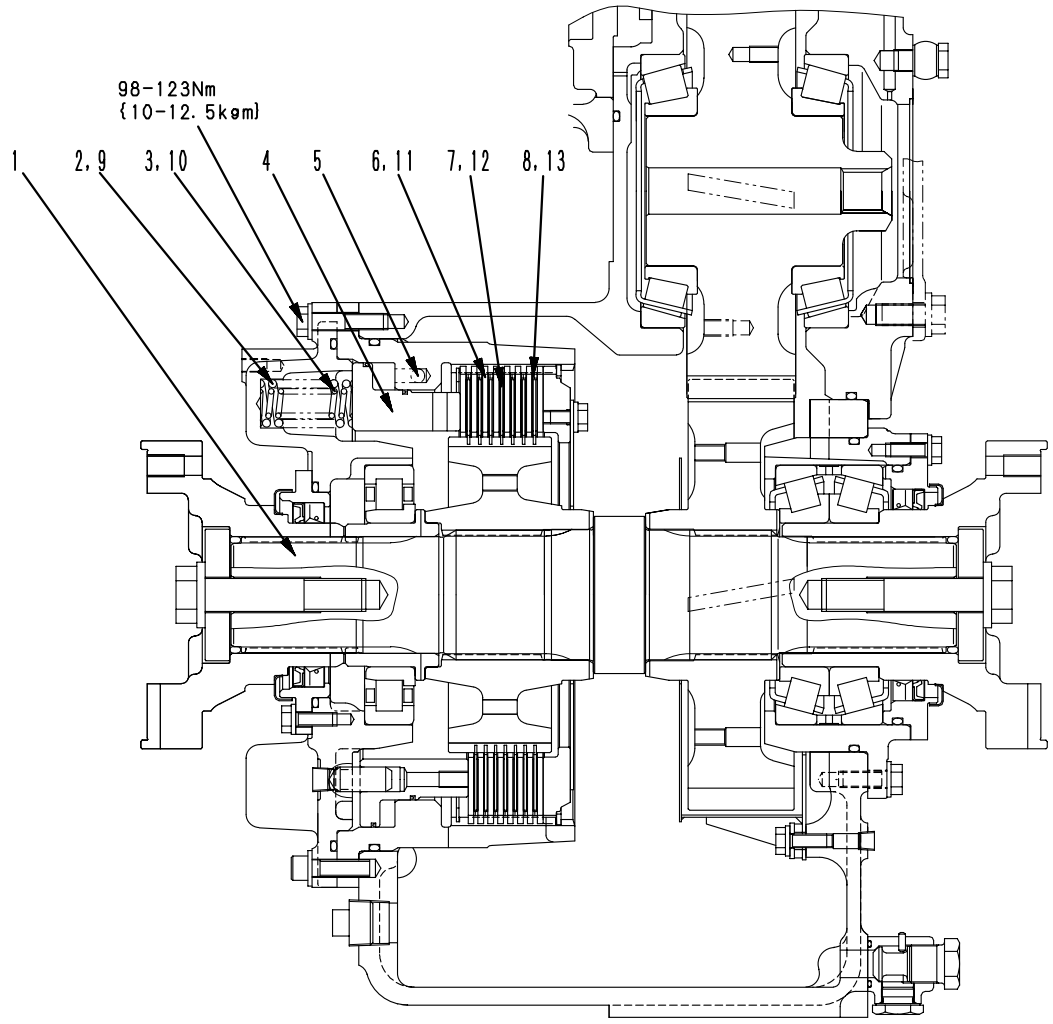


2. When the brake pedal is released

- When the brake is released, return spring (8) of the brake restores piston (4) as much as the amount of oil of stroke (S) and the brake returns to its released state. In other words, return stroke (T) of brake piston (7) depends on the amount of oil of stroke (S) and the braking time lag stays the same regardless of the amount of wear of the brake disc.



Parking brake



1. Output shaft
2. Spring (outside)
3. Spring (inside)
4. Piston
5. Parking brake oil port
6. Plate
7. Disc
8. Wave spring

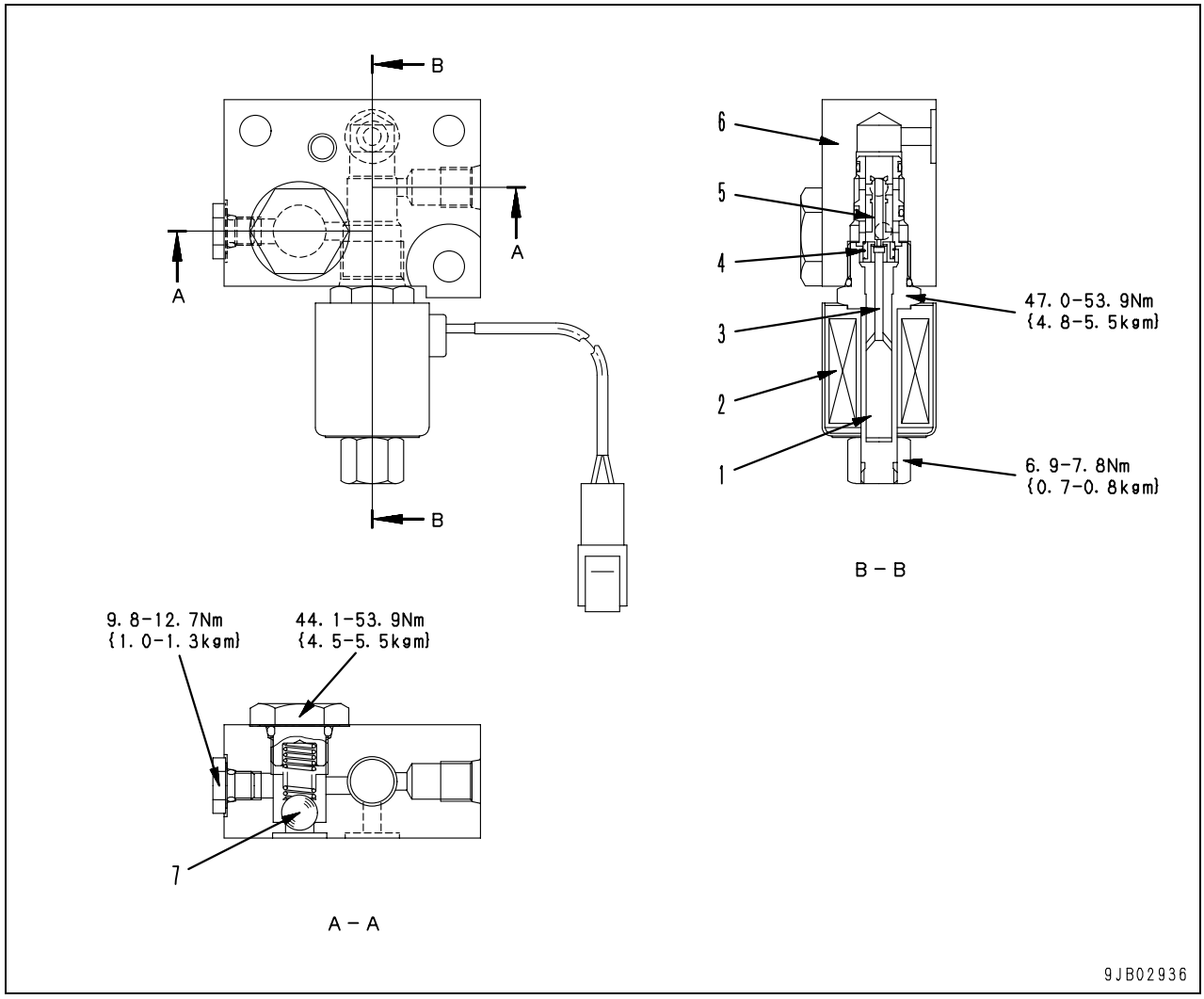
Outline

- The parking brake is a wet-type multi-disc brake, which is operated mechanically with the spring and stops output shaft (1).
- The tension of springs (2) and (3) presses disc (7) against plate (6) with piston (4) to stop output shaft (1).
- When releasing, the oil pressure from parking brake oil port (5) operates piston (4) to release the pressing force being applied to disc (7) and plate (6).

Unit: mm

No.	Check item		Criteria					Remedy
			Standard size			Repair limit		
9	Parking brake spring (outside)		Free length	Installed length	Installed load	Free length	Installed load	
			94	72.6	1,266 N {129.2 kg	91.2	1,203 N {122.7 kg}	
10	Parking brake spring (inside)		94	72.6	662 N {67.6 kg}	91.2	630 N {64.2 kg}	
			Standard size		Tolerance	Repair limit		Replace
11	Plate	Thick-ness	4.0		±0.05	3.9		
		Strain	—		0.05	0.6		
12	Disc	Thick-ness	3.2		±0.08	2.97		
13	Load of wave spring (testing height: 3.2 mm)		626.4 N {63.9 kg}		±176.5 N {±18 kg}	533 N {54.3 kg}		

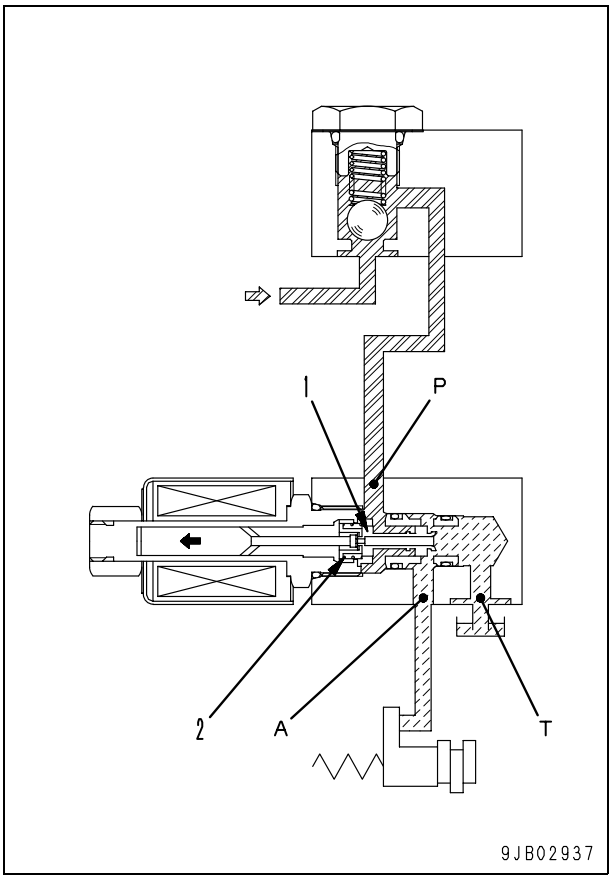
Parking brake solenoid valve



1. Movable core
2. Coil
3. Push pin
4. Spring
5. Spool
6. Block
7. Check valve

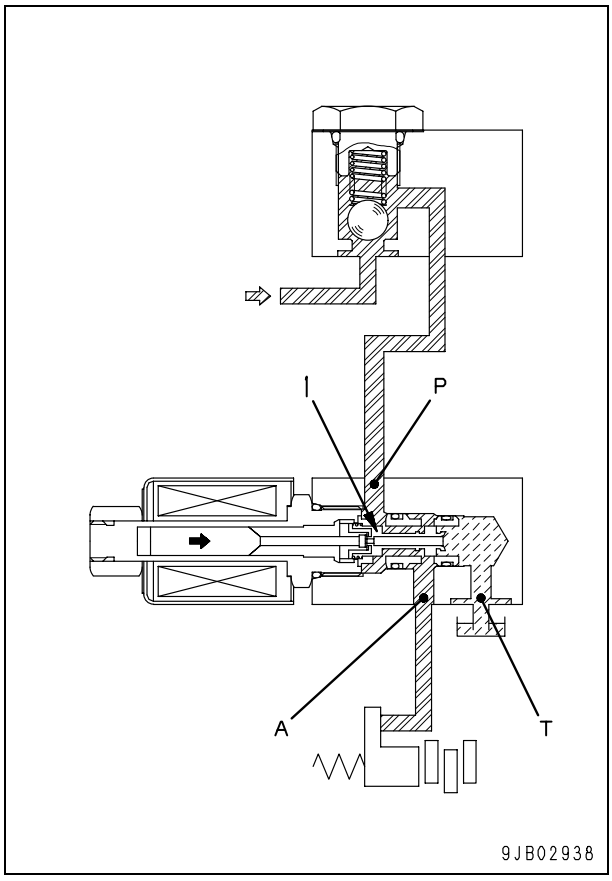
Operation

When parking brake is applied (when solenoid is de-energized)



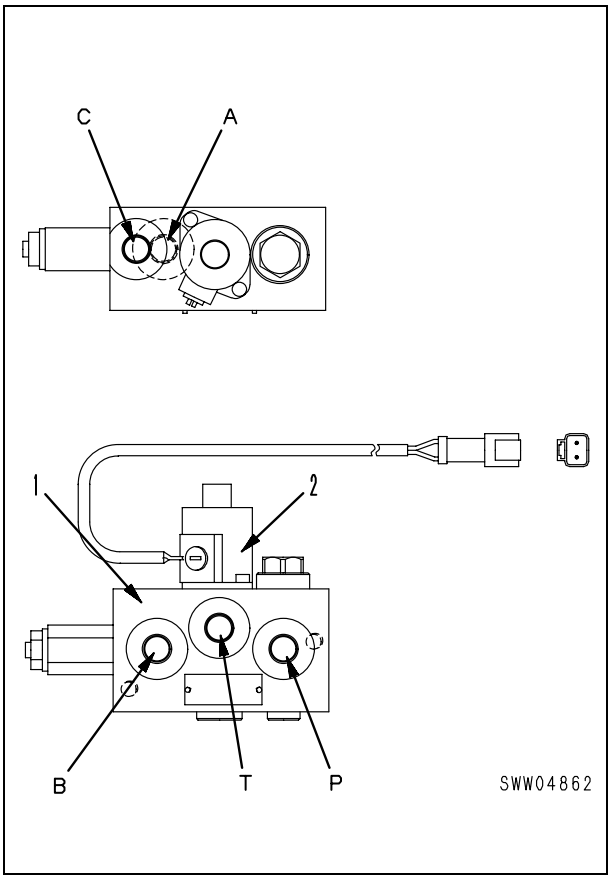
- If the parking brake switch is turned “ON”, the solenoid is turned “OFF”. As the result, spool (1) is pushed back in the left direction by the tension of spring (2). Accordingly, pump port (P) is disconnected from parking brake port (A), stopping flow of the pressurized oil from the pump to the parking brake.
- At the same time, the oil from the parking brake is drained through ports (A) and (T). As a result, the disc in the parking brake is pressed by the spring and the parking brake is applied.

When parking brake is released (when solenoid is energized)



- If the parking brake switch is turned “OFF”, the solenoid is turned “ON” and spool (1) is moved rightward. Accordingly, the pressurized oil from the pump flows to the parking brake through port (P), inside of spool (1) and port (A). At the same time, port (T) is closed and the oil is not drained. As a result, the spring in the parking brake is pushed back by the oil pressure and the parking brake is released.

Emergency parking brake release valve



1. Valve
2. Solenoid valve

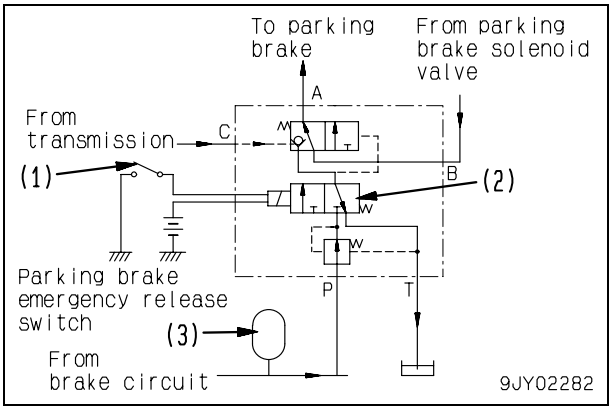
A: To parking brake
B: From parking brake valve
C: From pilot circuit
T: Drain
P: From brake (accumulator circuit)

Function

- The emergency release solenoid valve is installed between the transmission and transmission control. It operates solenoid of the parking brake release switch installed at the operator's seat when oil pressure is not available from the transmission pump due to engine failure, etc. in order to supply accumulator charge pressure in the brake circuit to the parking brake cylinder.

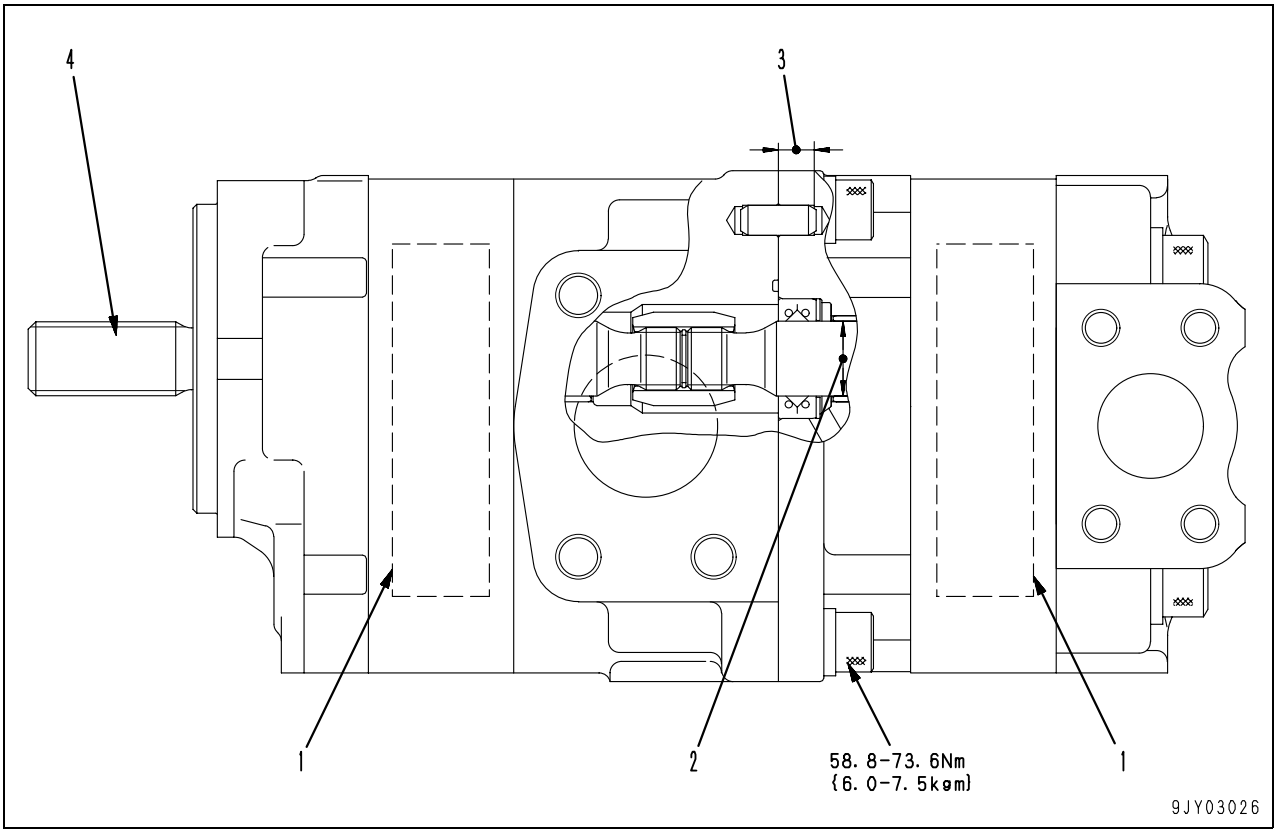
Operation

- When parking brake emergency release switch (1) is turned to “ON”, solenoid valve (2) starts operating. and oil pressure from accumulator (3) enters port (P). Then pilot pressure switches the circuit, and the pressure moves to the parking brake from port (A) to release the parking brake.



Brake cooling pump

SAL(1)22+22
(If equipped)



Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between body and spool	Type	Tolerance		Repair limit		Replace
		SAL(1)-22	0.10 – 0.15		0.19		
		SAL(1)-22					
2	Clearance between inside diameters of plain bearing and gear shaft	SAL(1)-22	0.06 – 0.119		0.20		
		SAL(1)-22					
3	Driven depth of pin	Type	Standard size	Tolerance		Repair limit	
		SAL(1)-22	10	0 –0.5		—	
		SAL(1)-22					
4	Rotation torque of spline shaft	3.9 – 9.8 Nm {0.4 – 1.0 kgm}					—
—	Discharge oil: EO10-CD Oil temperature: 45 – 55°C	Type	Speed (rpm)	Discharge pressure (MPa {kg/cm²})	Standard discharge (ℓ/min)	Allowable discharge (ℓ/min)	
		SAL(1)-22	3,500	20.6 {210}	73.1	67.5	
		SAL(1)-22					

WA600-6 Wheel loader

Form No. SEN00405-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

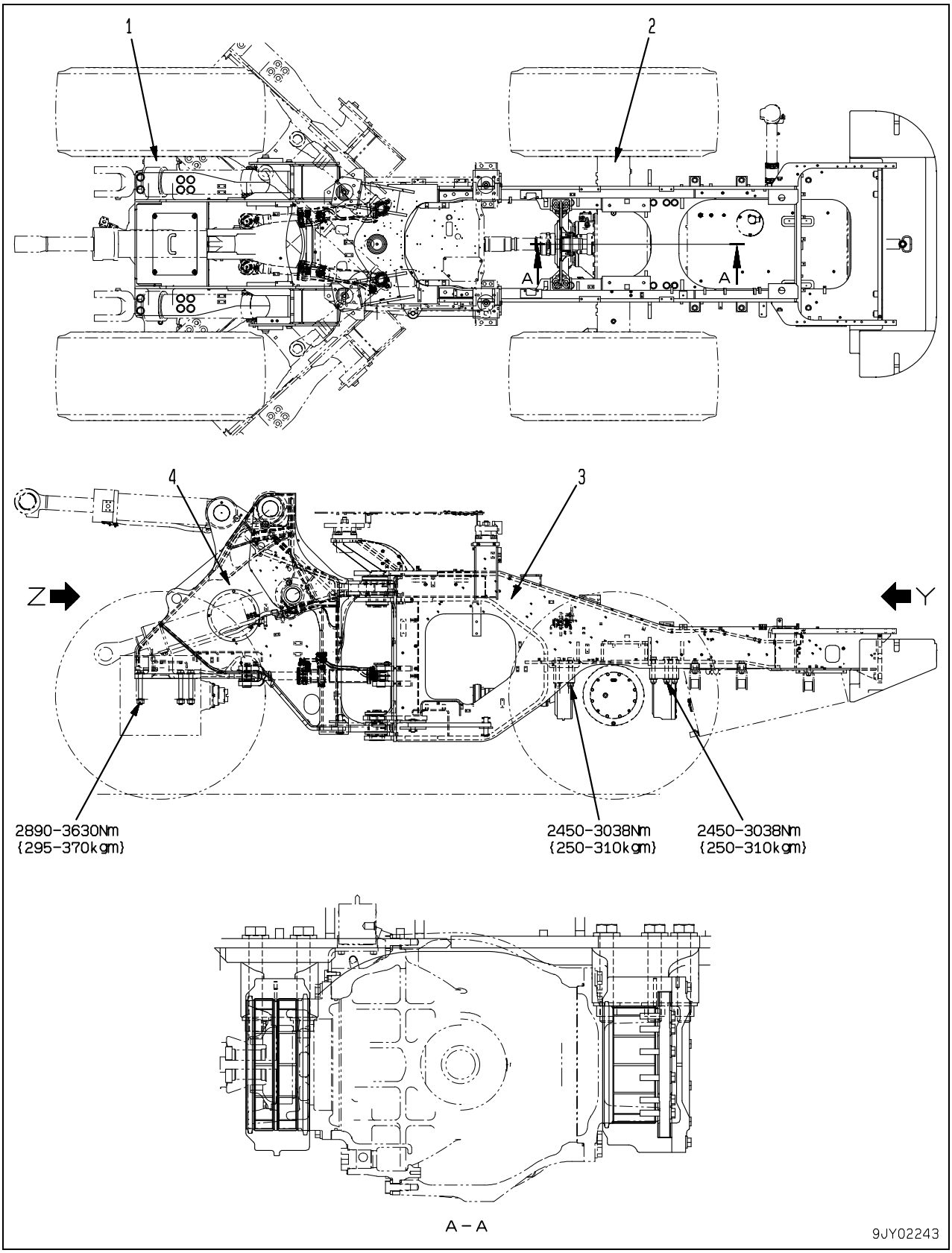
10 Structure, function and maintenance standard

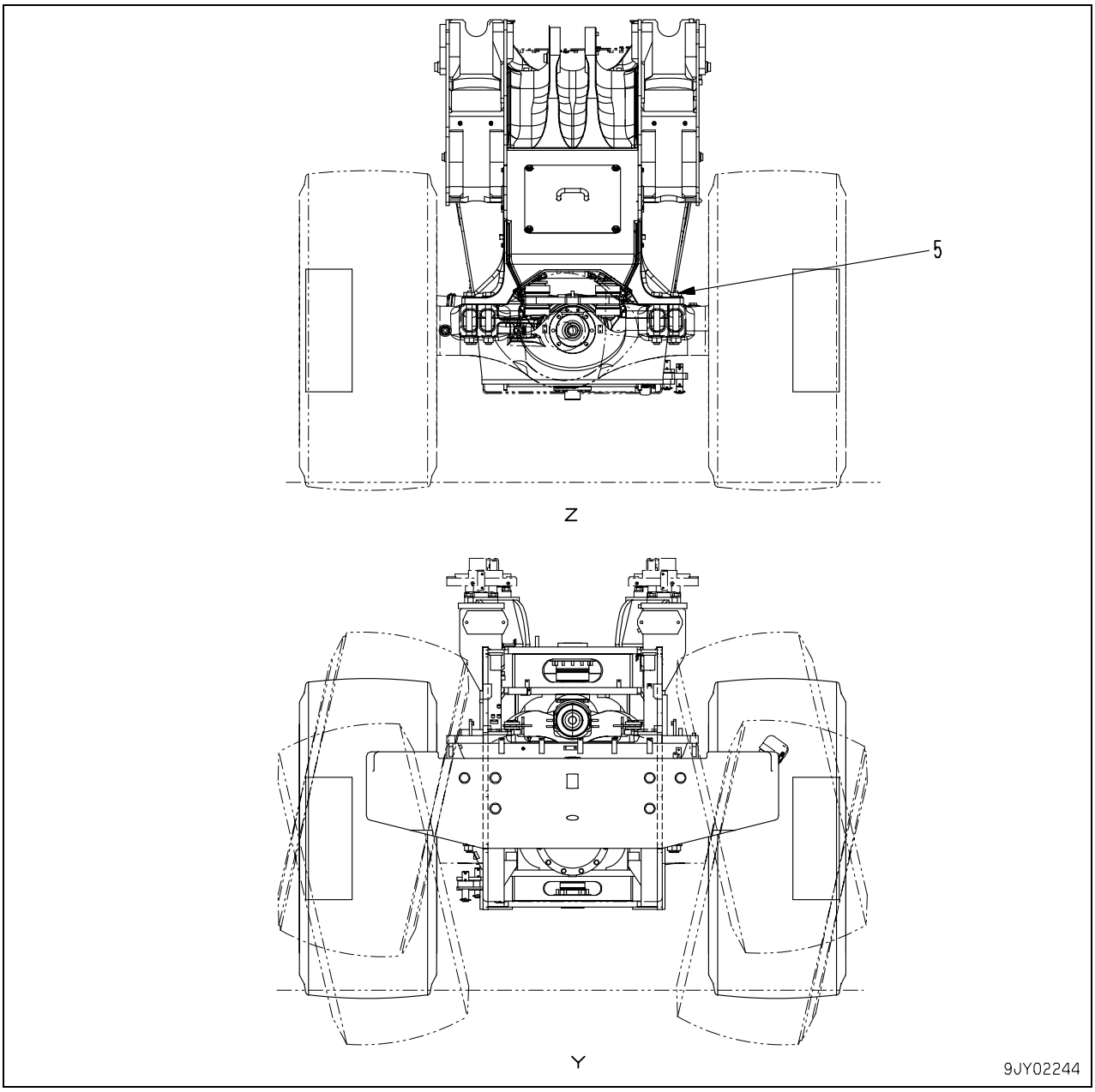
Undercarriage and frame

Undercarriage and frame 2
Axle mount 2
Center hinge pin 7

Undercarriage and frame

Axle mount





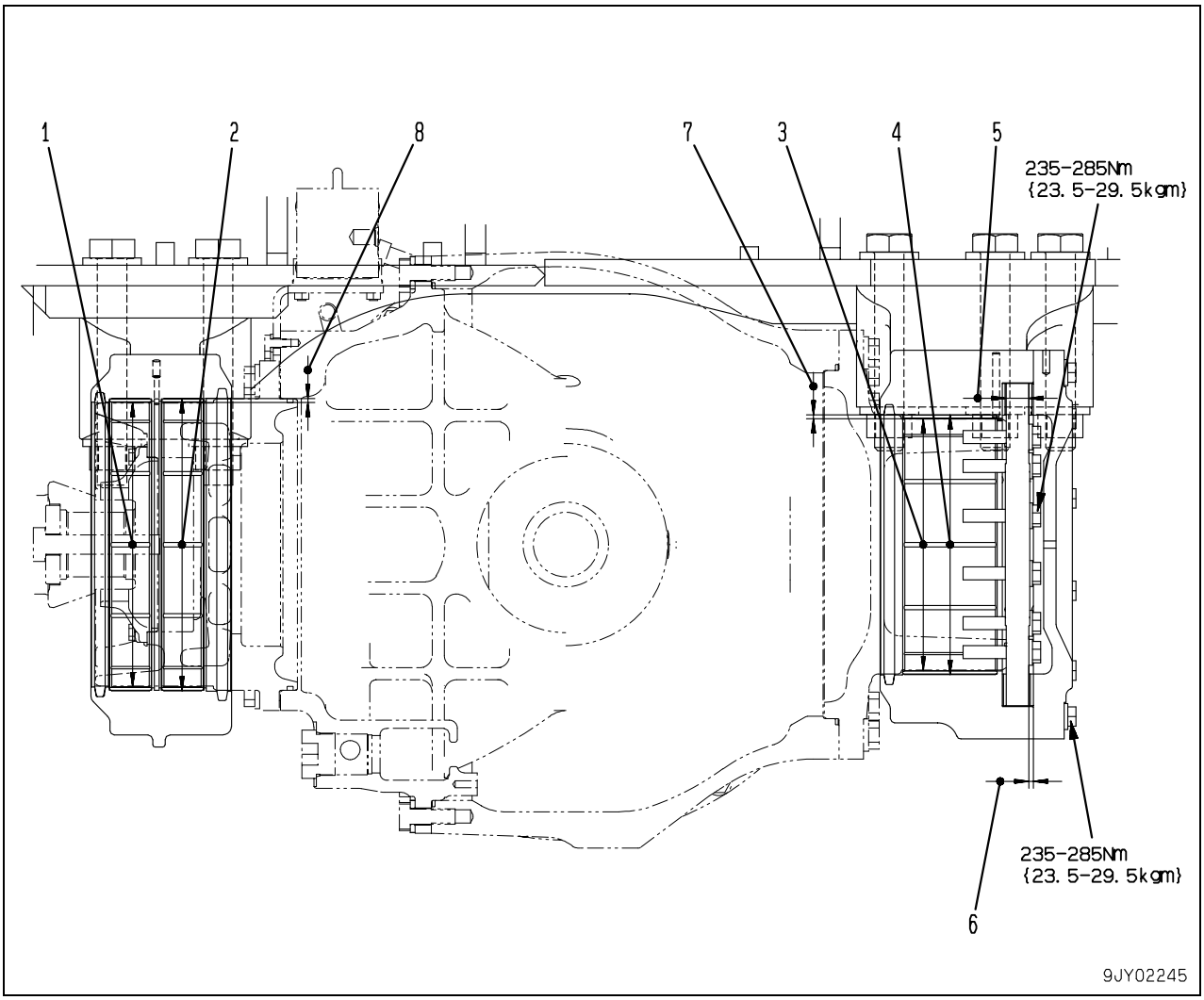
1. Front axle
2. Rear axle
3. Rear frame
4. Front frame
5. Axle mount bolt

Front axle

- Front axle (1) is directly fixed to front frame (4) with axle mount bolt (5) as it is directly subjected to the working force.

Rear axle

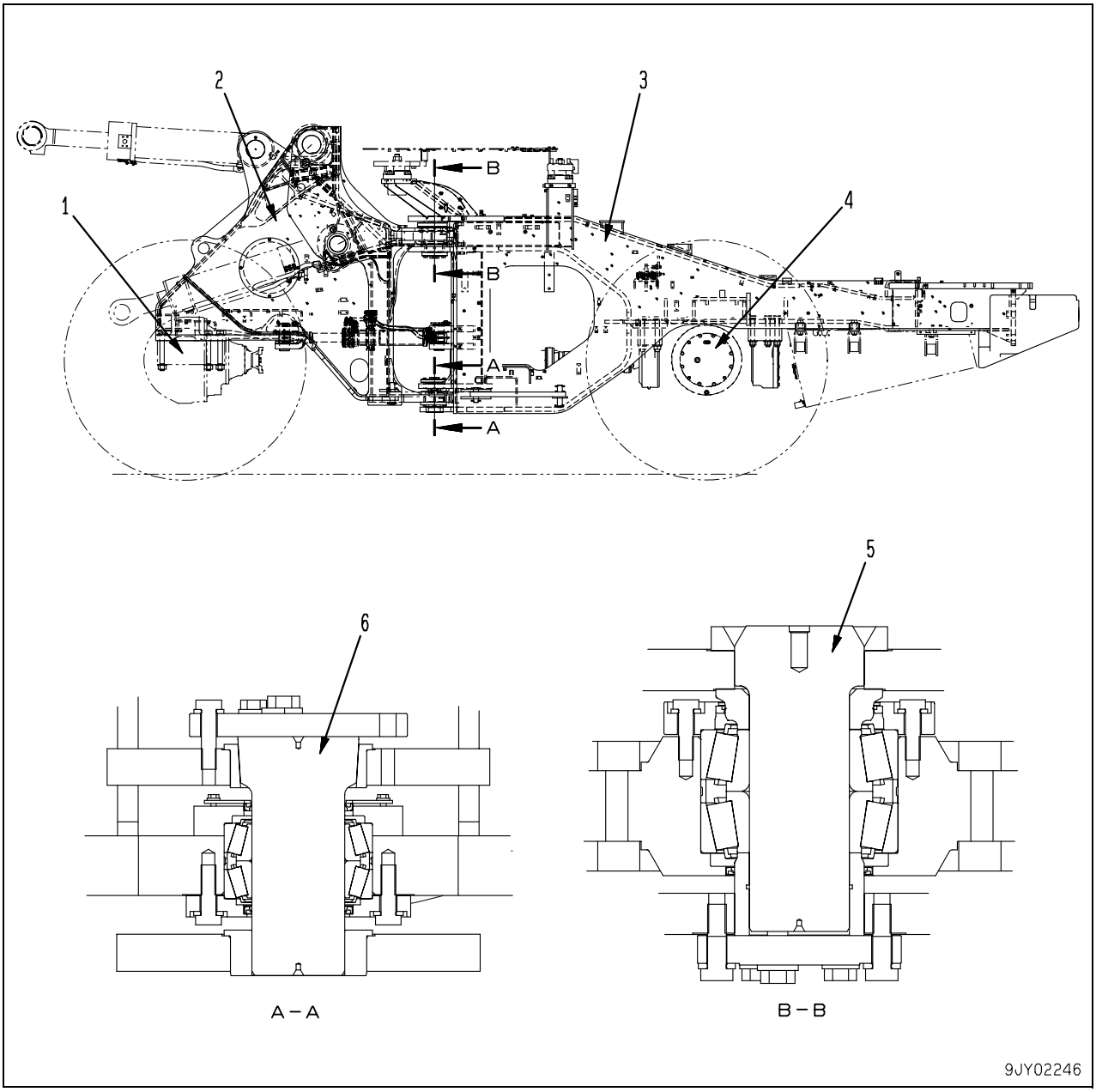
- Rear axle (2) has swaying structure at the center of rear axle to enable each tire to make contact with the ground during travel on a soft ground.


1
2
8
7
3
4
5
235-285Nm
{23.5-29.5kgm}
235-285Nm
{23.5-29.5kgm}
6
9JY02245

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between shaft and hole on front support side (before press fitting bushing)	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		350	–0.062 –0.151	+0.381 +0.066	0.128 – 0.582	1.0	
2	Clearance between shaft and hole on front support side (before press fitting bushing)	360	+2.5 +1.0	+0.089 0	–0.911 – –2.5	—	
3	Clearance between shaft and hole on rear support side (before press fitting bushing)	310	–0.056 –0.137	+0.381 +0.061	0.117 – 0.518	1.0	
4	Clearance between shaft and hole on rear support side (before press fitting bushing)	320	+2.5 +1.0	+0.089 0	–0.911 – –2.5	—	
5	Thickness of thrust plate	Standard size		Tolerance		Repair limit	
		27.6		–0.25 –0.39		—	
6	Thickness of thrust washer	5		+0.3 –0.1		1.3	
7	Thickness of rear bushing	4.9		±0.1		—	
8	Thickness of front bushing	4.9		±0.1		—	

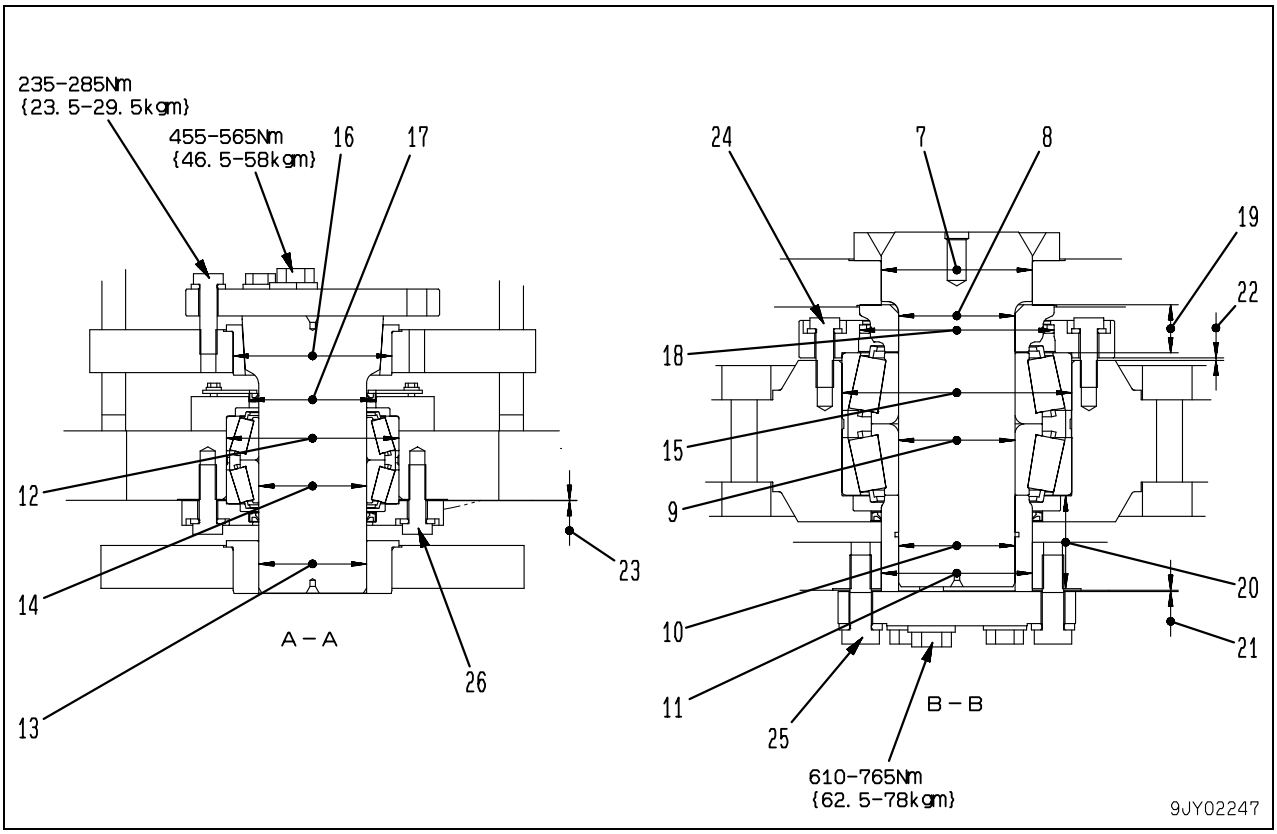
Center hinge pin



1. Front axle
2. Front frame
3. Rear frame
4. Rear axle
5. Upper hinge pin
6. Lower hinge pin

Outline

- Front frame (2) and rear frame (3) are coupled with each other by the bearing with center hinge pins (5) and (6).The steering cylinders connect the left and right front frame and rear frame. They adjust the bending angle of the frame, or the turning radius of the machine.


235-285Nm
{23. 5-29. 5kgm}
455-565Nm
{46. 5-58kgm}
16
17
12
14
13
23
26
A-A
24
7
8
19
22
18
15
9
20
21
10
11
25
B-B
610-765Nm
{62. 5-78kgm}
9JY02247

Unit: mm

No.	Item	Criteria					Remedy
7	Clearance between upper hinge pin and rear frame	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		140	–0.25 –0.30	–0.15 –0.25	0 – 0.15	—	
8	Clearance between upper hinge pin and spacer (small)	108	–0.101 –0.152	0 –0.05	0.051 – 0.152	1.0	
9	Clearance between upper hinge pin and bearing	107.95	–0.051 –0.102	+0.025 0	0.051 – 0.127	1.0	
10	Clearance between upper hinge pin and bushing	108	–0.101 –0.152	0 –0.05	0.051 – 0.152	1.0	
11	Clearance between rear frame and bushing	140	–0.250 –0.300	–0.150 –0.200	0.05 – 0.15	—	
12	Clearance between front frame and lower hinge bearing	160	0 –0.025	–0.077 –0.127	–0.127 – –0.052	—	
13	Clearance between lower hinge pin and bushing	100	–0.076 –0.127	+0.025 –0.020	0.056 – 0.152	—	
14	Clearance between lower hinge pin and bearing	100	–0.076 –0.127	0 –0.020	0.056 – 0.127	1.0	
15	Clearance between front frame and upper hinge bearing	212.725	+0.025 0	–0.051 –0.102	–0.127 – –0.051	—	
16	Clearance between lower hinge rear frame and bushing	147	+0.013 –0.012	+0.076 +0.013	0 – 0.088	—	
17	Clearance in seal fitting part of lower hinge	117.45	+0.28 +0.18	+0.025 –0.030	–0.310 – –0.155	—	
18	Clearance in seal fitting part of upper hinge pin	180	+0.26 +0.16	+0.063 0	–0.260 – –0.097	—	
19	Height of upper hinge bushing	Standard size		Tolerance		Repair limit	
		43.9		±0.1		—	
20	Height of upper hinge bushing	89.8		±0.1		—	
21	Standard thickness of shim between upper hinge and retainer	2.4					Adjustment
22	Standard thickness of shim between upper hinge and retainer	2.2					
23	Standard thickness of shim between lower hinge and retainer	1.0					
24	Tightening torque of upper hinge retainer mounting bolt	68.8 Nm {7 kgm} (When shim is adjusted)					
		279±29.4 Nm {28.5 ± 3 kgm} (Final value)					
25	Tightening torque of upper hinge retainer mounting bolt	279±29.4 Nm {28.5 ± 3 kgm} (When shim is adjusted)					
		279±29.4 Nm {28.5 ± 3 kgm} (Final value)					
26	Tightening torque of lower hinge pin mounting bolt	34.3 Nm {3.5 kgm} (When shim is adjusted)					
		279±29.4 Nm {28.5 ± 3 kgm} (Final value)					

WA600-6 Wheel loader

Form No. SEN00406-00

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Printed in Japan 11-05 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

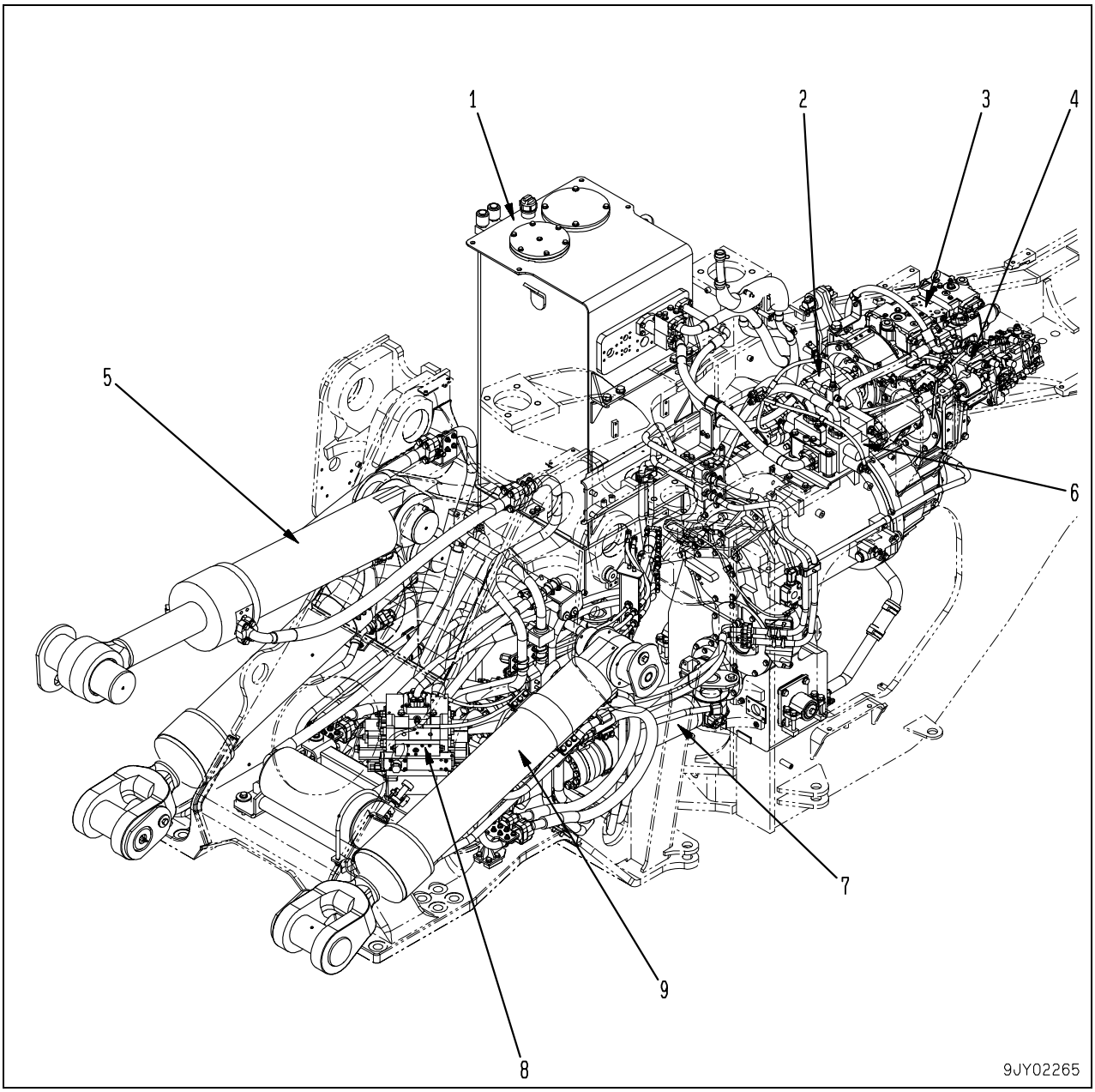
10 Structure, function and maintenance standard

Hydraulic system, Part 1

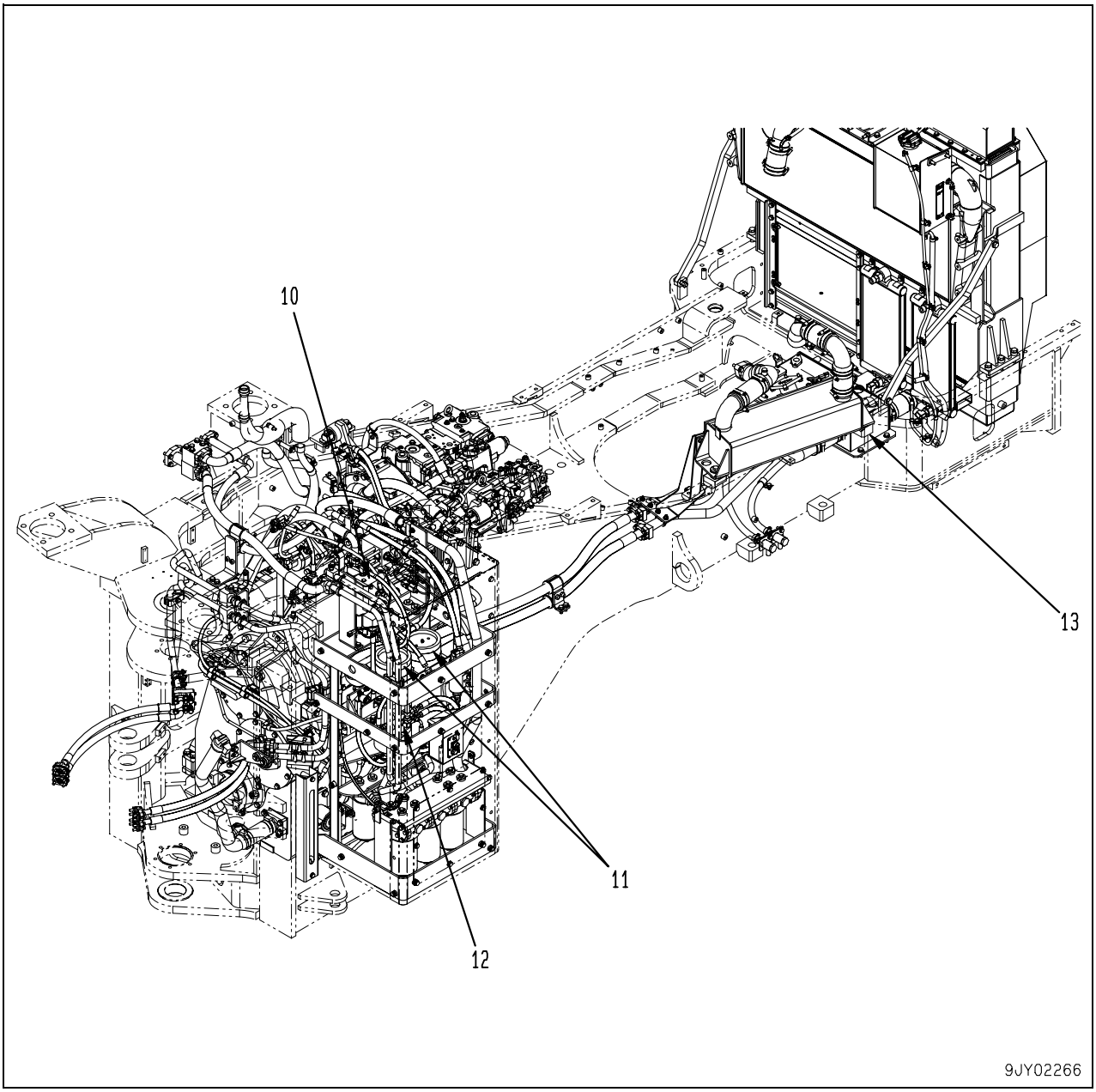
Hydraulic system, Part 1 2
Hydraulic piping diagram 2
Work equipment control lever linkage 4
Hydraulic tank 6
Work equipment hydraulic pump 8

Hydraulic system, Part 1

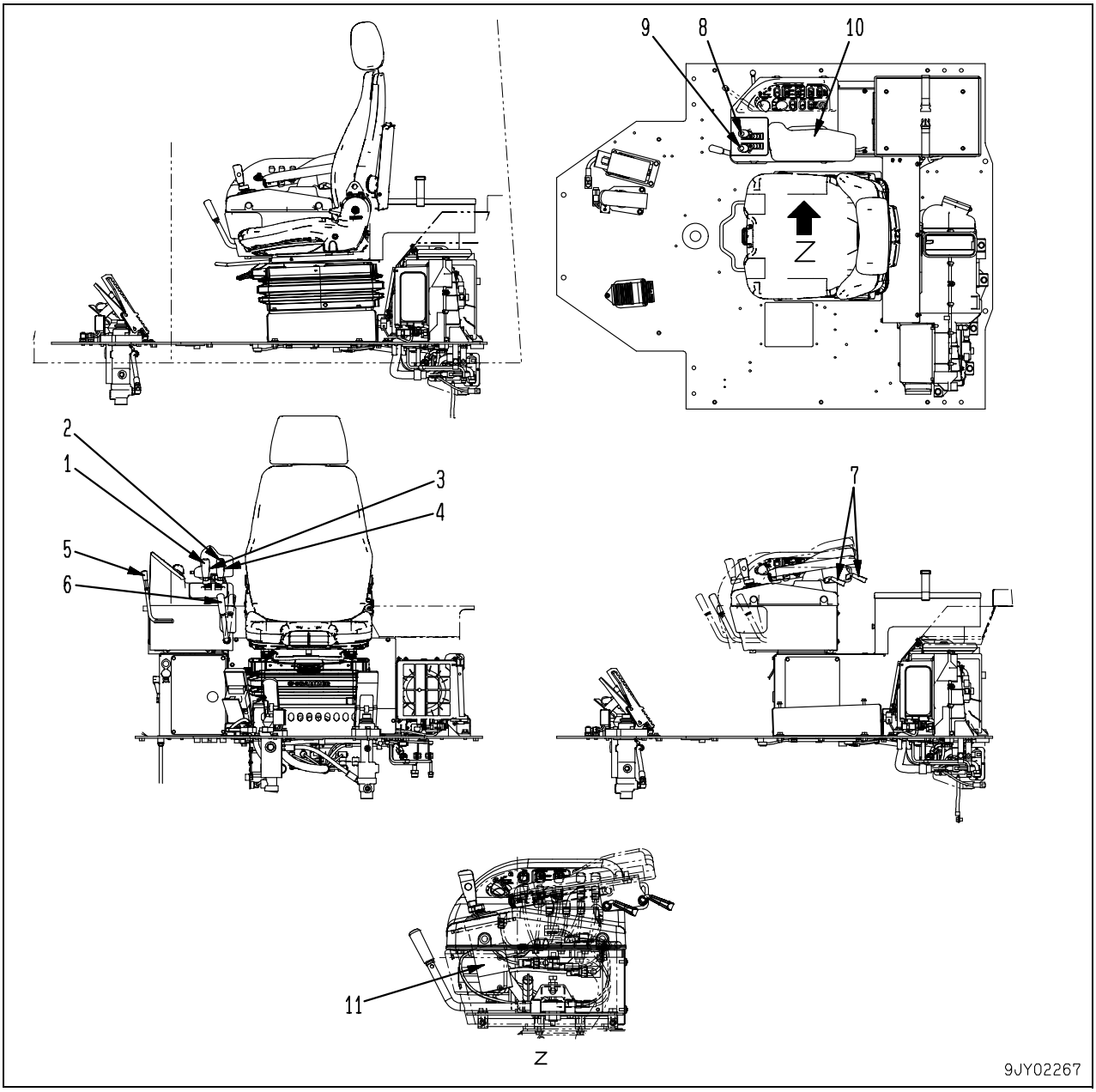
Hydraulic piping diagram



1. Hydraulic tank
2. Triple pump
   (Power train + Hydraulic oil cooling + Brake and EPC pump)
3. Tandem pump
   (Work equipment + Work equipment pump)
4. Tandem pump
   (Steering + Cooling fan pump)
5. Bucket cylinder
6. Steering control valve
7. Steering cylinder
8. Work equipment valve
9. Lift cylinder
10. EPC valve
11. Accumulator
12. Charge valve
    (Built-in EPC relief valve)
13. Oil cooler

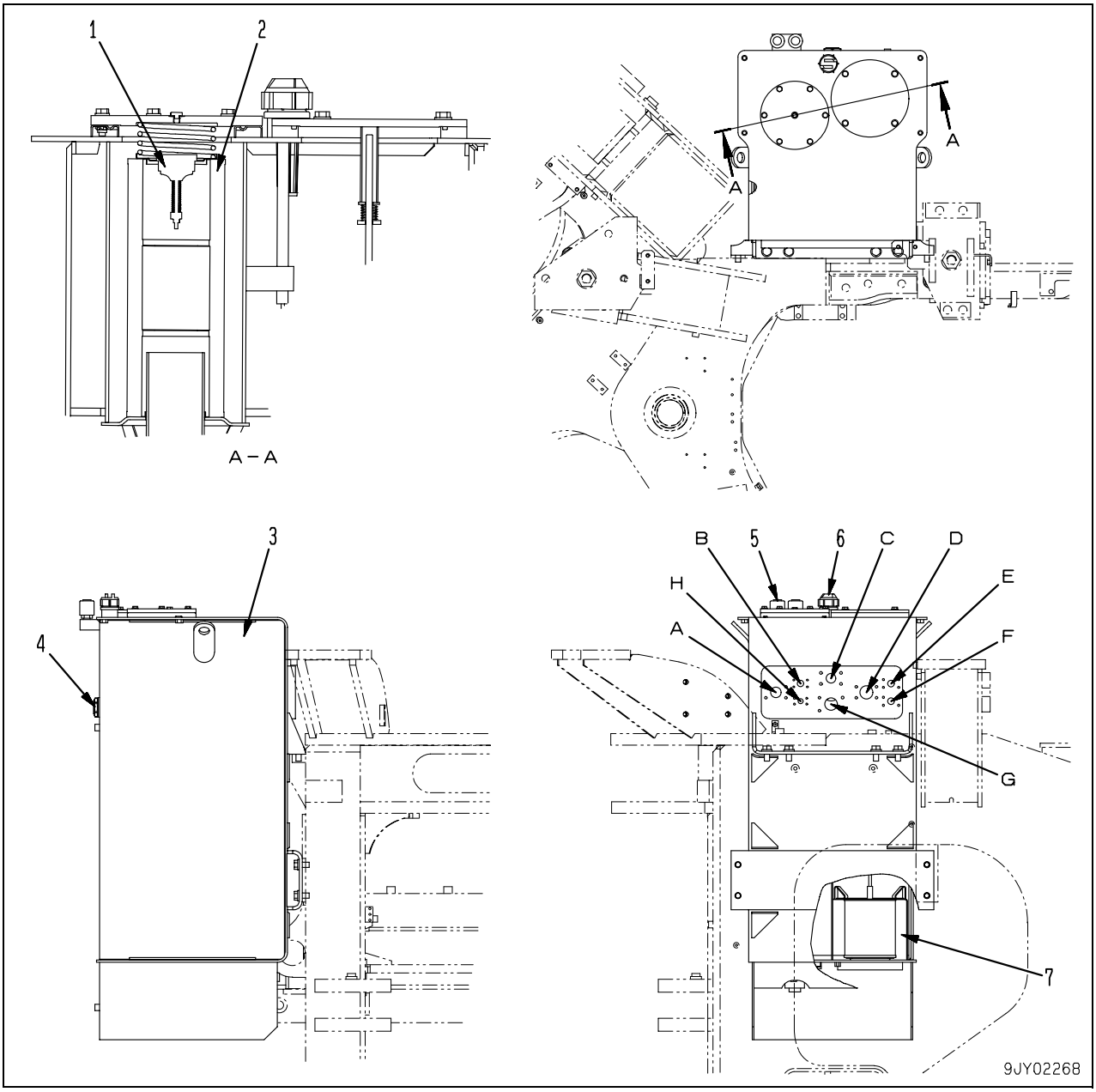

10
11
12
13
9JY02266

Work equipment control lever linkage



1. Lift arm control lever
2. Bucket control lever
3. Hold switch
4. Subtotal switch (Load meter specifications)
5. Work equipment lock lever
6. R.H. console forward-reverse slide lever
7. Armrest adjustment lever
8. Kickdown switch
9. Cancel switch (Load meter specifications)
10. Armrest
11. Work equipment EPC valve

Hydraulic tank

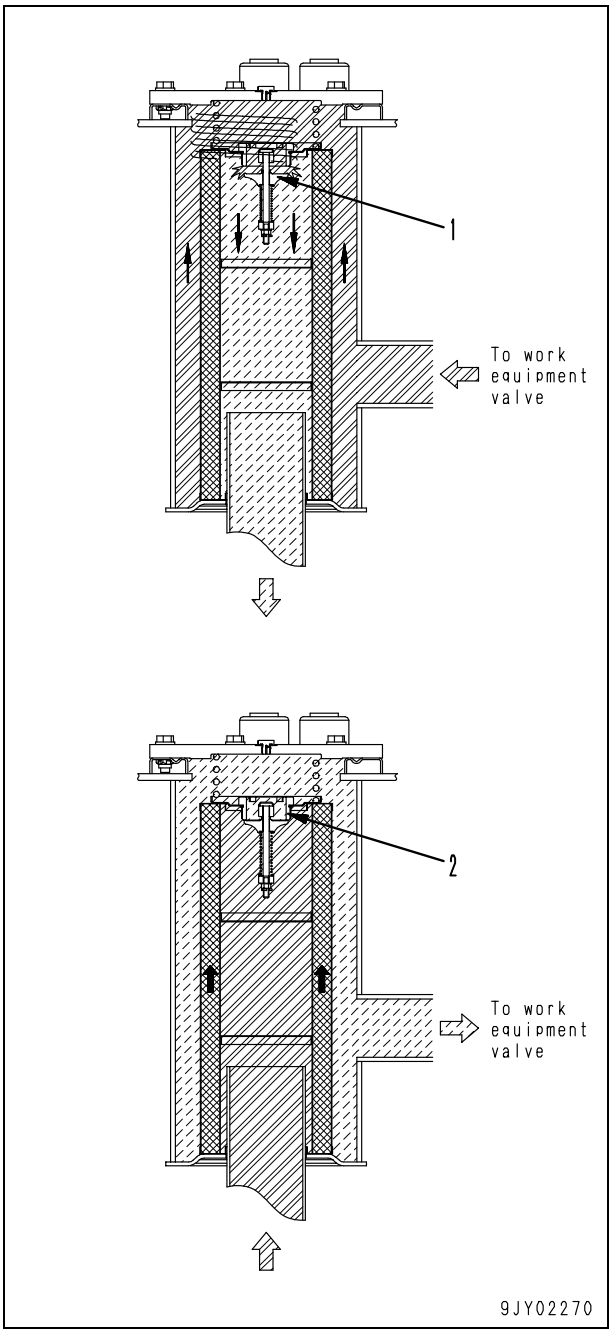


1. Filter bypass valve
2. Oil filter
3. Hydraulic tank
4. Oil level sight gauge
5. Breather
6. Oil filler point
7. Strainer

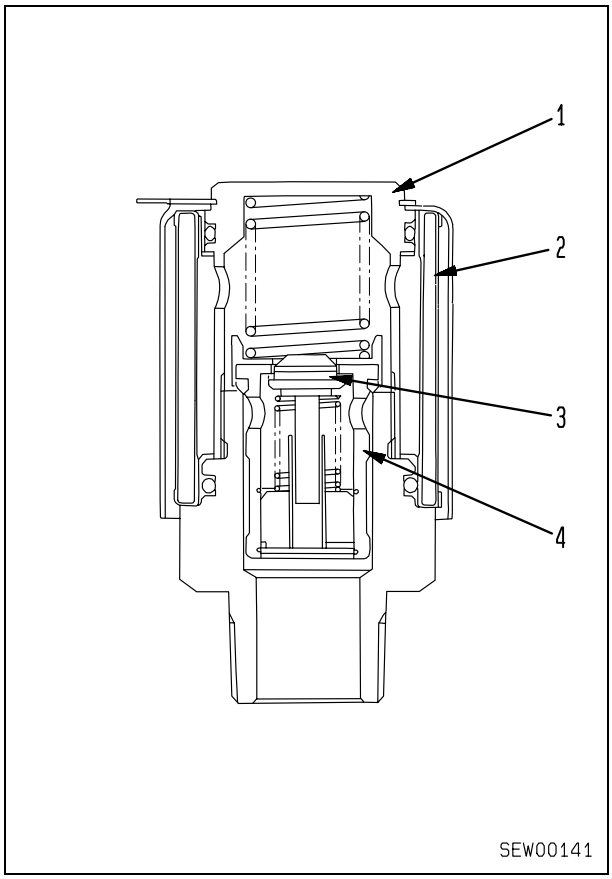
A: Emergency steering suction port
B: Emergency steering return port
C: Hydraulic oil cooler and steering return port
D: EPC pump suction port
E: Steering drain port
F: Pump case drain port
G: Main return port
H: Brake drain port

Operation of oil filter bypass valve

- In the case the filters are clogged
  Bypass valve (1) opens, and oil returns to the tank bypassing the filters.
  Bypass valve set pressure:
  0.15 MPa {1.5 kg/cm^2}
- In the case the return circuit turns negative pressure
  Whole valve (2) is held up to serve as the check valve.
  Check valve set pressure:
  2.36 MPa {24 kg/cm^2}



Breather



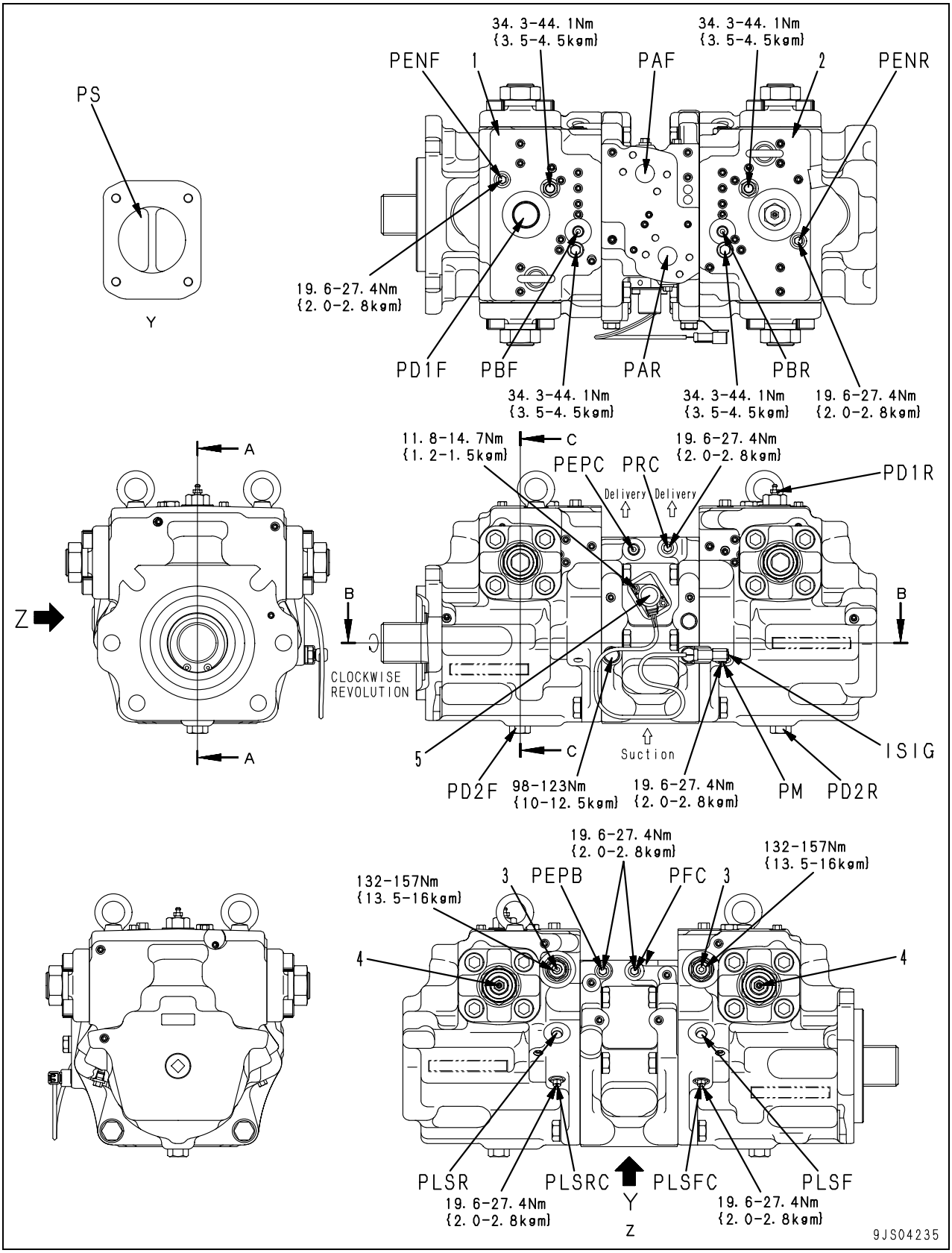
1. Body
2. Filter element
3. Poppet
4. Sleeve

Function

- Prevention of negative pressure in tank
  Since the tank is pressurized and enclosed, if the oil level in it lowers, negative pressure is generated. At this time, poppet (3) is opened by the differential pressure between the tank pressure and the atmosphere pressure to prevent generation of the negative pressure.
- Prevention of pressure rise in tank
  If the pressure rises to above a specified level while the circuit is in operation by an increase or decrease of oil level and the temperature rise, sleeve (4) is tripped to relieve pressure in the hydraulic tank.

Work equipment hydraulic pump

Type: HPV125+125

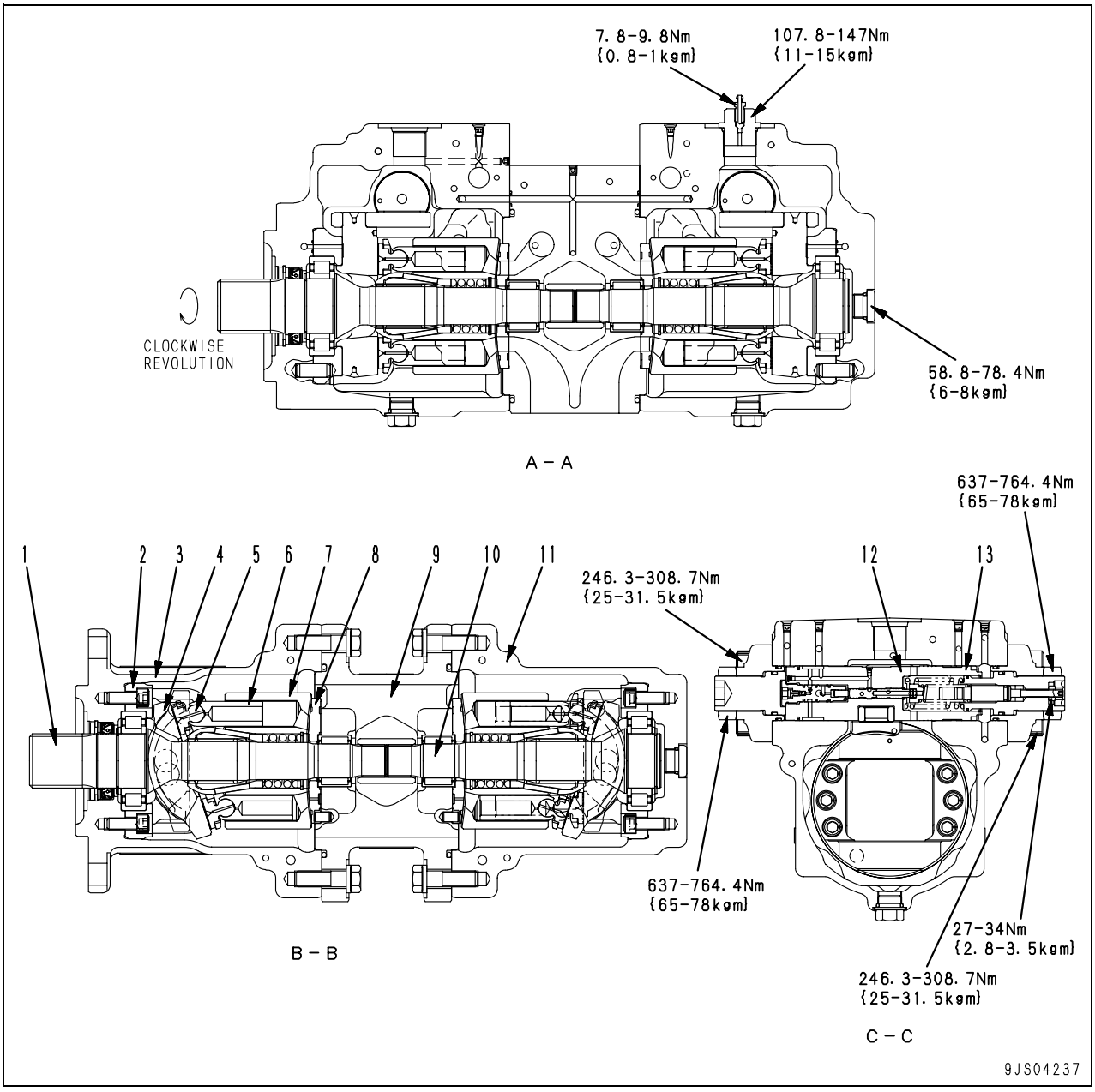


Outline

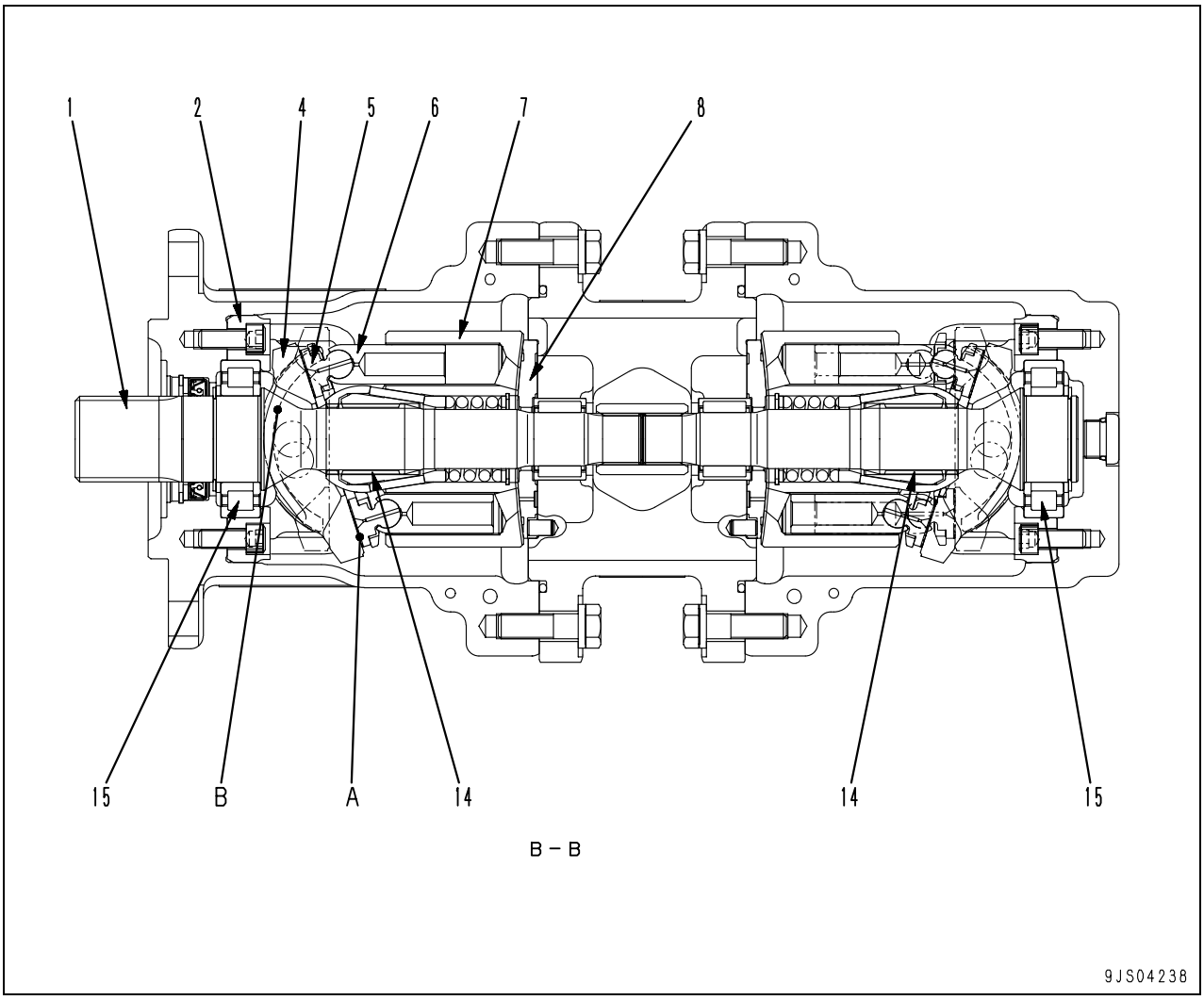
- This pump consists of 2 variable capacity swash plate piston pumps, PC valve, LS valve, and EPC valve.

ISIG : PC mode selector current
PAF : Front pump discharge port
PAR : Rear pump discharge port
PBF : Pump pressure input port
PBR : Pump pressure input port
PD1F : Case drain port
PD1R : Air bleeder
PD2F : Drain plug
PD2R : Drain plug
PENF : Front control pressure pick-up port
PENR : Rear control pressure pick-up port
PEPC : EPC basic pressure port
PEPB : EPC basic pressure pick-up port
PFC : Front pump discharge pressure pick-up port
PLSF : Front load pressure input port
PLSFC : Front load pressure pick-up port
PLSR : Rear load pressure input port
PLSRC : Rear load pressure pick-up port
PM : PC mode selector pressure pick-up port
PRC : Rear pump discharge pressure pick-up port
PS : Pump suction port

1. Front pump
2. Rear pump
3. LS valve
4. PC valve
5. PC-EPC valve



1. Front shaft
2. Cradle
3. Front case
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. End cap
10. Rear shaft
11. Rear case
12. Servo piston
13. PC valve



Function

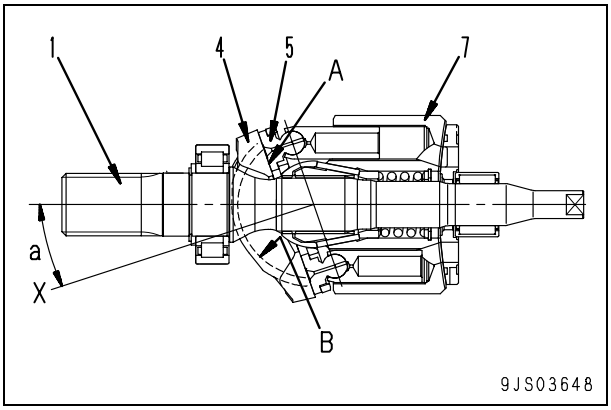
- The pump converts the engine rotation transmitted to its shaft to oil pressure and delivers pressurized oil corresponding to the load.
- It is possible to change the discharge amount by changing the swash plate angle.

Structure

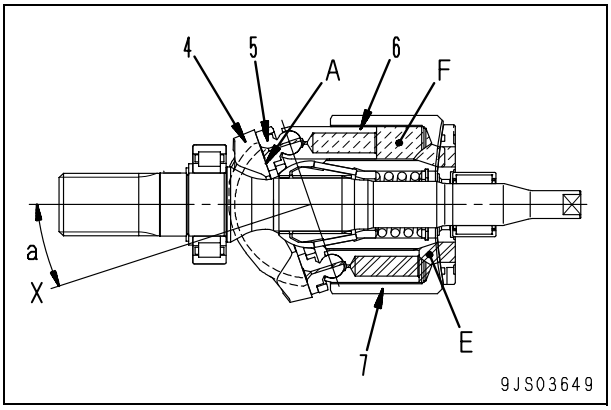
- Cylinder block (7) is supported to shaft (1) by spline (14).
- Shaft (1) is supported by front and rear bearings (15).
- Tip of piston (6) is shaped as a concave ball and shoe (5) is caulked to it to form one unit.
- Piston (6) and shoe (5) form a spherical bearing.
- Rocker cam (4) has flat surface (A), and shoe (5) is always pressed against this surface while sliding in a circular movement.
- Rocker cam (4) conducts high pressure oil to cylinder surface (B) with cradle (2), which is secured to the case, and forms a static pressure bearing when it slides.
- Piston (6) carries out relative movement in the axial direction inside each cylinder chamber of cylinder block (7).
- Cylinder block (7) seals the pressurized oil to valve plate (8) and carries out relative rotation.
- This surface is designed so that the oil pressure balance is maintained at a suitable level.
- The oil inside each cylinder chamber of cylinder block (7) is suctioned and discharged through valve plate (8).

Operation of pump

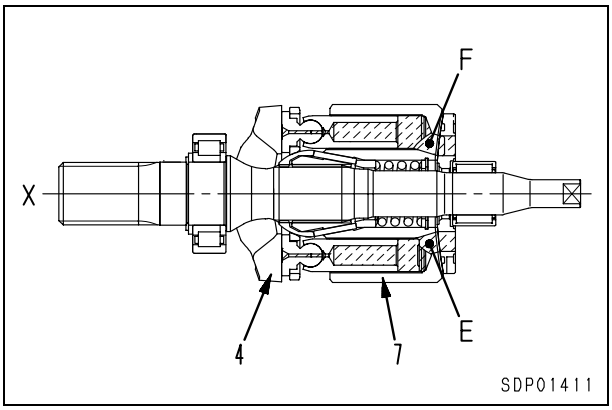
- Cylinder block (7) rotates together with shaft (1), and shoe (5) slides on flat surface (A).
- When this happens, rocker cam (4) moves along cylindrical surface (B), so angle (a) between center line (X) of rocker cam (4) and the axial direction of cylinder block (7) changes.
- Angle (a) is called the swash plate angle.



- With center line (X) of rocker cam (4) at swash plate angle (a) in relation to the axial direction of cylinder block (7), flat surface (A) acts as a cam in relation to shoe (5).
- In this way, piston (6) slides on the inside of cylinder block (7), so a difference between volumes (E) and (F) is created inside cylinder block (7).
- A single piston sucks and discharges the oil by the amount (F) – (E).
- As cylinder block (7) rotates and the volume of chamber (E) becomes smaller, the pressurized oil is discharged.
- On the other hand, the volume of chamber (F) grows larger and, in this process, the oil is suctioned.

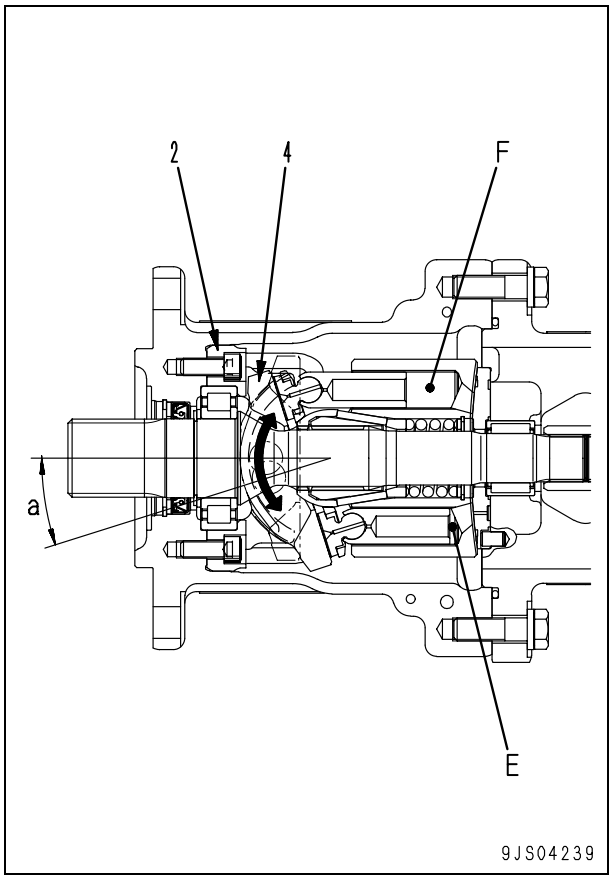


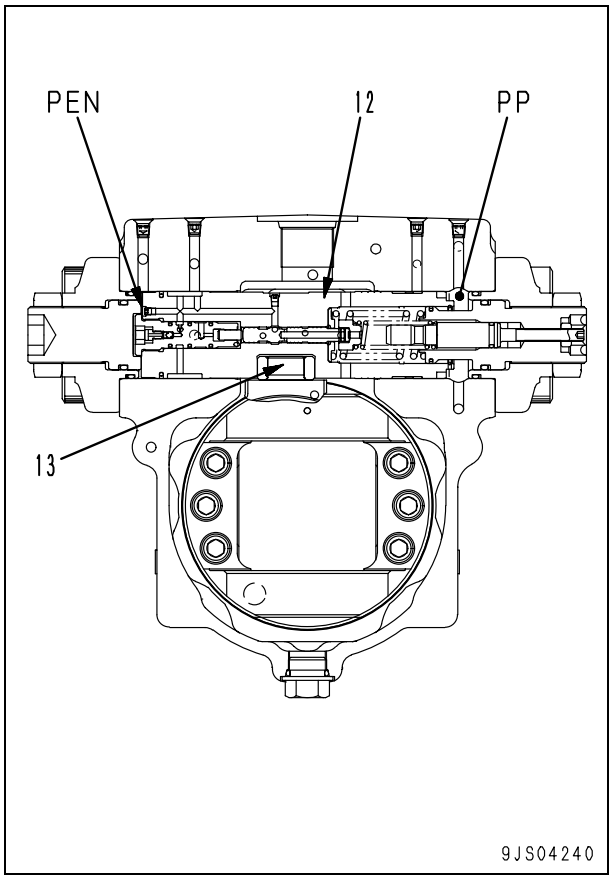
- As center line (X) of rocker cam (4) matches the axial direction of cylinder block (7) (swash plate angle (a) = 0), the difference between volumes (E) and (F) inside cylinder block (7) becomes 0.
- Suction and discharge of pressurized oil is not carried out in this state. Namely pumping action is not performed. (Actually, however, the swash plate angle is not set to 0)



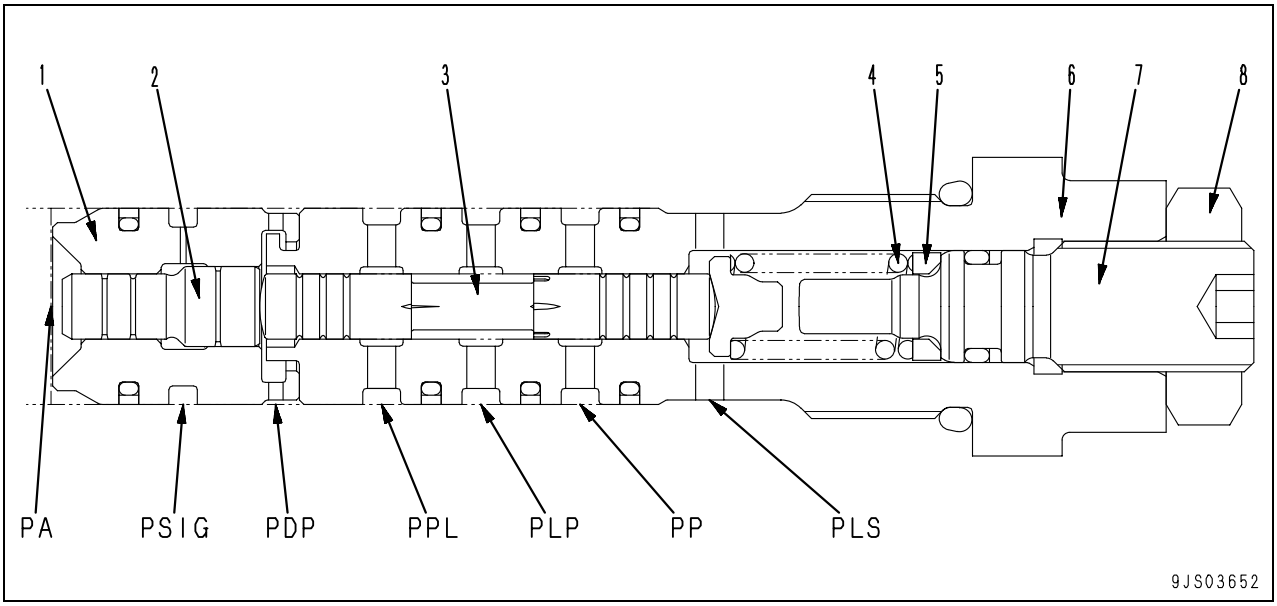
Control of pump delivery

- If the swash plate angle (a) becomes larger, the difference between volumes (E) and (F) becomes larger and pump delivery (Q) increases.
- Servo piston (12) is used for changing swash plate angle (a).
- Servo piston (12) carries out linear reciprocal movement according to the signal pressure from the PC and LS valves.
- This linear movement is transmitted to rocker cam (4) through slider (13).
- Being supported by cradle (2) on the cylindrical surface, rocker cam (4) slides on the surface while continuing revolving movement.
- Space of the pressure receiving area of servo piston (12) are not identical on the left side and right side. Main pump discharge pressure (self pressure) (PP) is always brought to the pressure chamber of the small diameter piston side.
- Output pressure (PEN) of the LS valve is brought to the chamber receiving the pressure at the large diameter piston end.
- The relationship in the size of pressure (PP) at the small diameter piston end and pressure (PEN) at the large diameter piston end, and the ratio between the area receiving the pressure of the small diameter piston and the large diameter piston controls the movement of servo piston (12).





1. LS valve

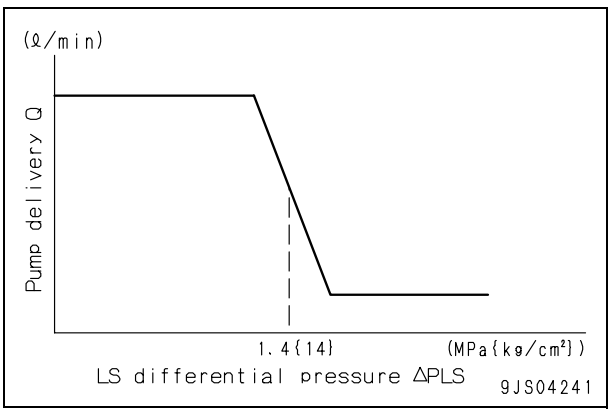


PA : Pump port
PDP : Drain port
PLP : LS control pressure output port
PLS : LS pressure input port
PP : Pump port
PPL : Control pressure input port
PSIG : Drain port

1. Sleeve
2. Piston
3. Spool
4. Spring
5. Seat
6. Sleeve
7. Plug
8. Locknut

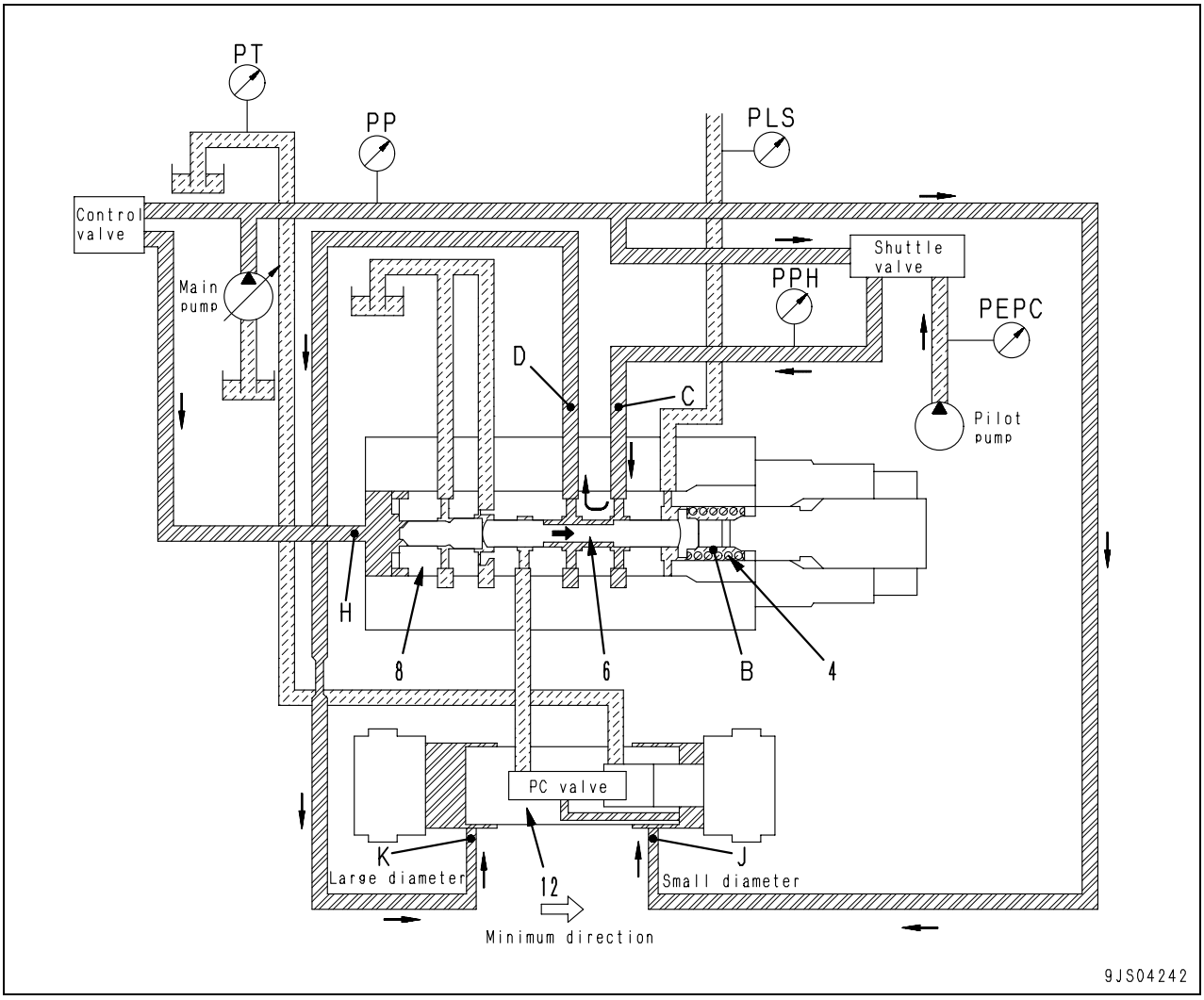
Function

- The LS (load sensing) valve detects the load and controls the discharge amount.
- This valve controls main pump delivery (Q) according to differential pressure (ΔPLS) [= PP – PLS], called the LS differential pressure (the difference between main pump pressure (PP) and control valve outlet port pressure (PLS)).
- Main pump pressure (PP), pressure (PLS) (called the LS pressure) coming from the control valve output, and pressure (PSIG) (called the LS selector pressure) from the proportional solenoid valve enter this valve.

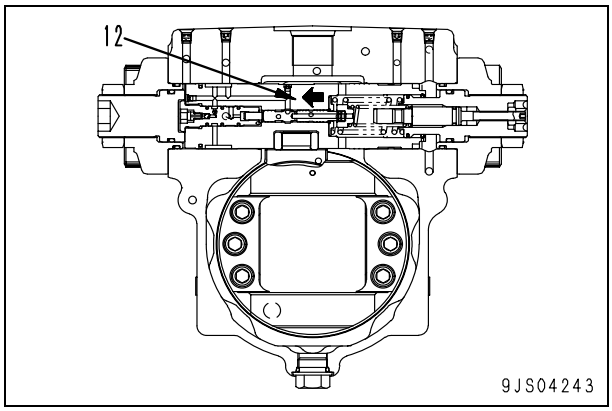


Operation

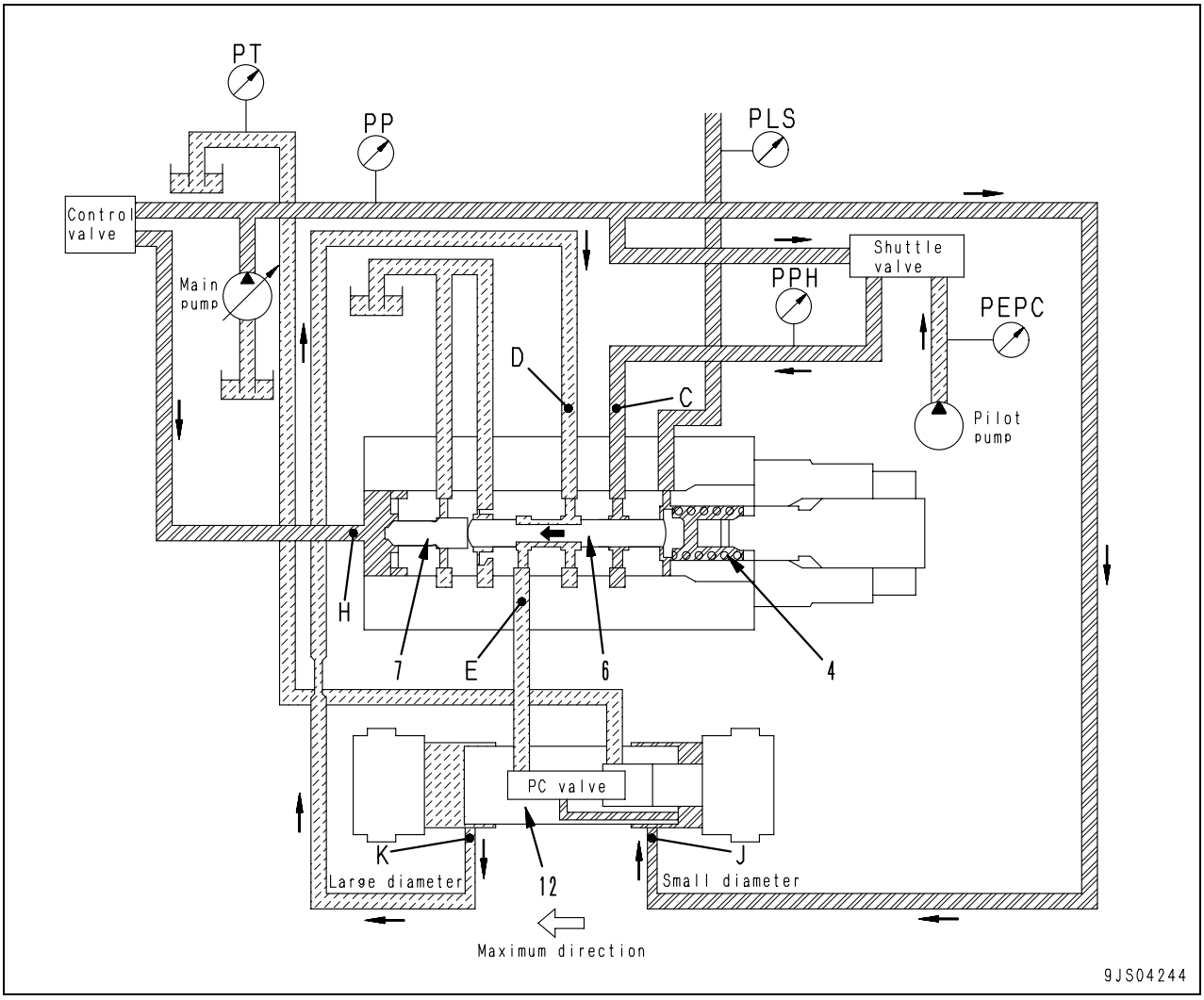
1) When the control valve is situated at neutral



- The LS valve is a 3-way selector valve, with pressure (PLS)(LS pressure) from the inlet port of the control valve brought to spring chamber (B), and pump discharge pressure (PP) brought to port (H) of sleeve (8).
- Magnitude of the force resulting from this LS pressure (PLS), force of spring (4) and the pump delivery pressure (self pressure) (PP) determine the position of spool (6).
- Before starting engine, servo piston (12) is pressed to the left. (See the figure to the right)
- If the control lever is at the neutral position when the engine is started, LS pressure (PLS) will be set to 0 MPa {0 kg/cm^2}. (It is interconnected to the drain circuit through the control valve spool)
- Spool (6) is pushed to the right, and port (C) and port (D) will be connected.
- Shuttle valve output pressure (PPH) enters the large diameter side of the piston from port (K).
- Pump pressure (PP) is present in port (J) on the small diameter side of the piston.
- According to the difference in the areas on servo piston (12), the pressure moves in to the direction of minimizing the swash plate angle.

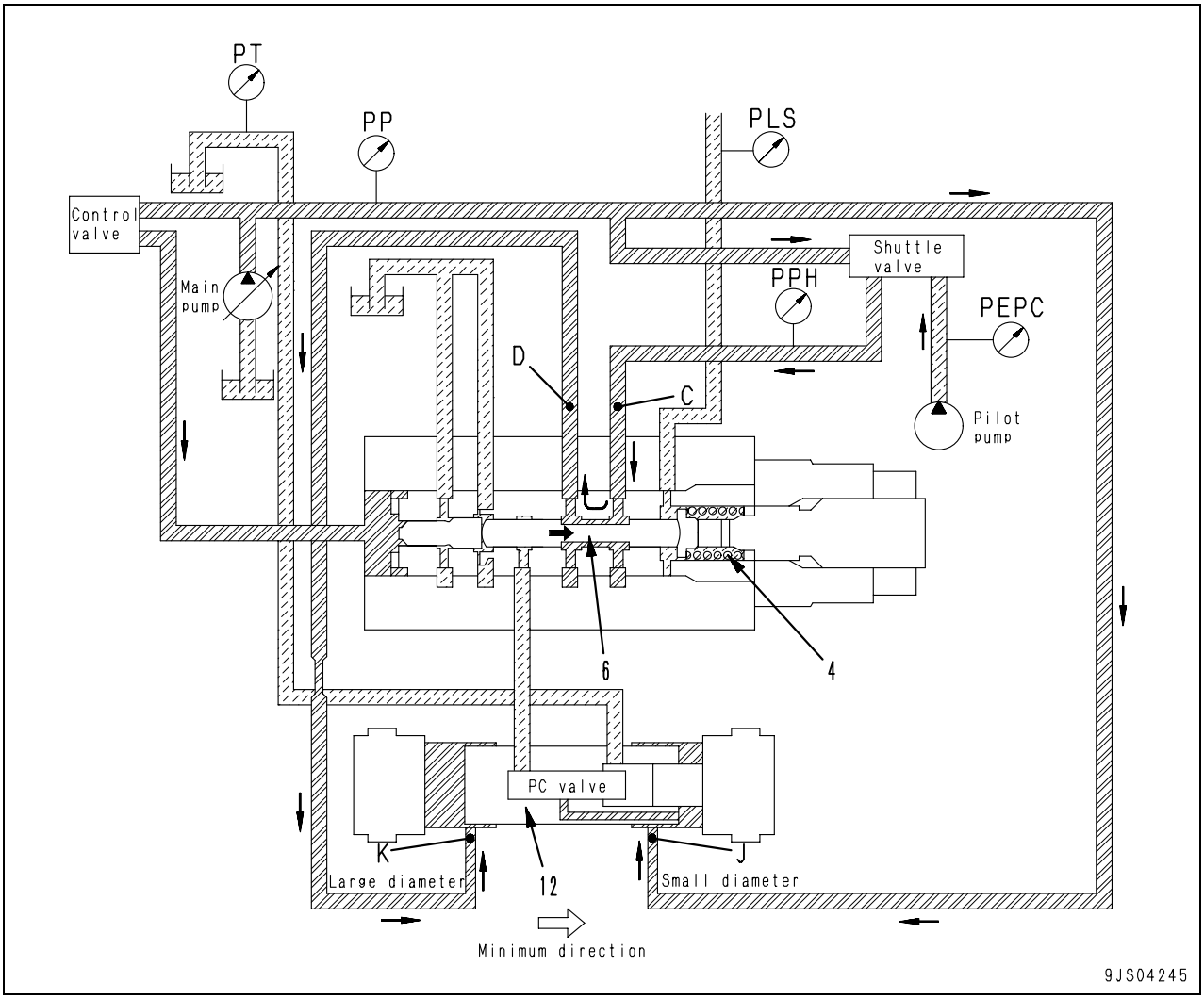


2) Action for the direction of maximizing the pump delivery



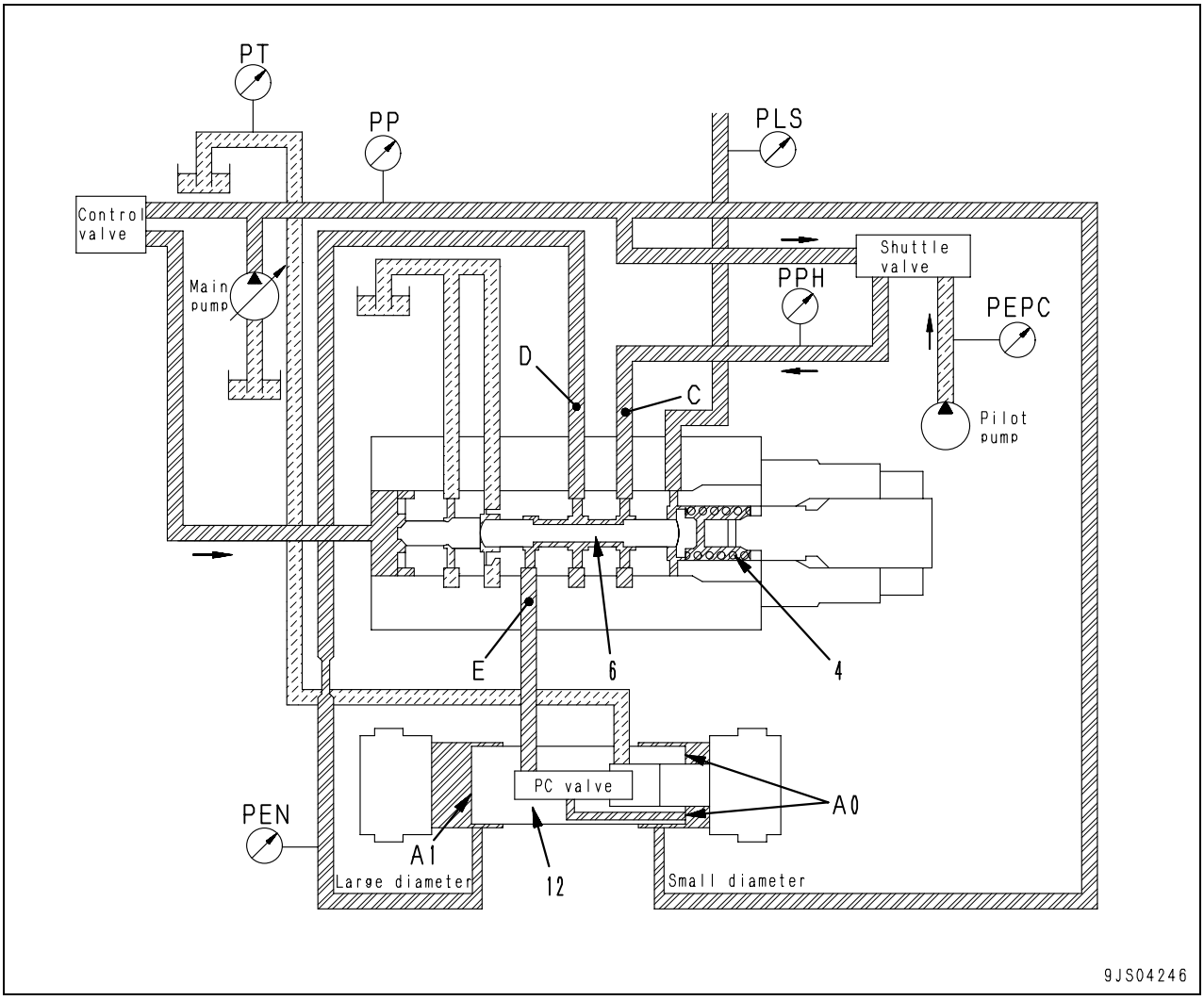
- When the difference between the main pump pressure (PP) and LS pressure (PLS), in other words, LS differential pressure (ΔPLS) becomes smaller (for example, when the area of opening of the control valve becomes larger and pump pressure (PP) drops), spool (6) is pushed to the left by the combined force of LS pressure (PLS) and the force of spring (4).
- When spool (6) moves, port (D) and port (E) are interconnected and connected to the PC valve.
- The PC valve is connected to the drain port, so the pressure across circuits (D) and (K) becomes drain pressure (PT). (The operation of the PC valve is explained later.)
- The pressure at the large diameter end of servo piston (12) becomes drain pressure (PT), and pump pressure (PP) enters port (J) at the small diameter end, so servo piston (12) is pushed to the left side. Therefore, the swash plate is moved in the direction to make the delivery larger.

3) Action for the direction of minimizing the pump delivery



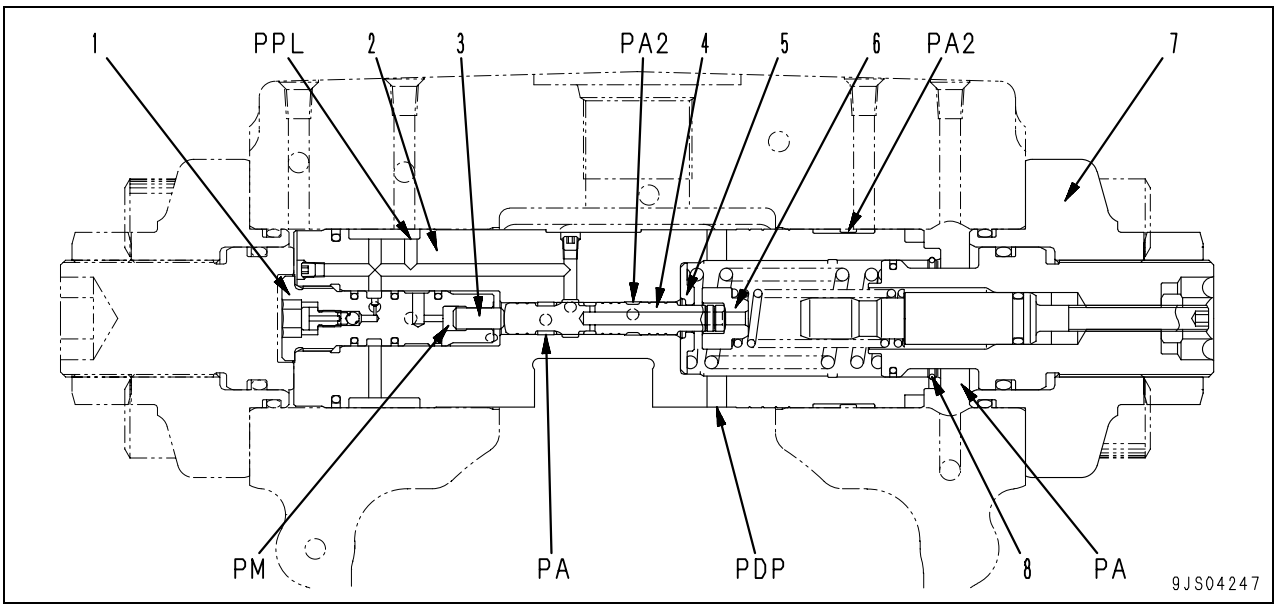
- If LS differential pressure (ΔPLS) becomes larger (for example, when the area of control valve opening becomes smaller and the pump pressure (PP) increases), spool (6) is pressed to the right by the force of pump pressure (PP).
- As a result of the movement of spool (6), shuttle valve output pressure (PPH) flows from port (C) to port (D), then from port (K) to the large diameter side of the piston.
- While main pump pressure (PP) is present in port (J) of the smaller diameter side of the piston, servo piston (12) is pressed to the right by its area difference between the larger and the smaller diameter sides. As the result, servo piston (12) moves in the direction to minimize the swash plate angle.

4) When servo piston is balanced



- Let us take the area receiving the pressure at the large diameter end of the piston as (A1), the area receiving the pressure at the small diameter end as (A0), and the pressure flowing into the large diameter end of the piston as (PEN).
- If the main pump pressure (PP) of the LS valve and the combined force of spring (4) and LS pressure (PLS) are balanced, and the relationship is (A0) x (PP) = (A1) x (PEN), servo piston (12) will stop in that position.
- And the swash plate of the pump will be held in an intermediate position. [Spool (6) will be stopped at a position where the distance of the opening from port (D) to port (E) and the distance from port (C) to port (D) is almost the same.]
- At this point, the relationship between the pressure receiving areas across servo piston (12) is (A0) : (A1) = 3 : 5, so the pressure applied across the piston when it is balanced becomes (PP) : (PEN) ≒ 5 : 3.
- The force of spring (4) is adjusted to determine the balanced stop position of this spool (6) at the center of the standard when (PP) – (PLS) = 1.4 MPa {14 kg/cm^2}.

2. PC valve

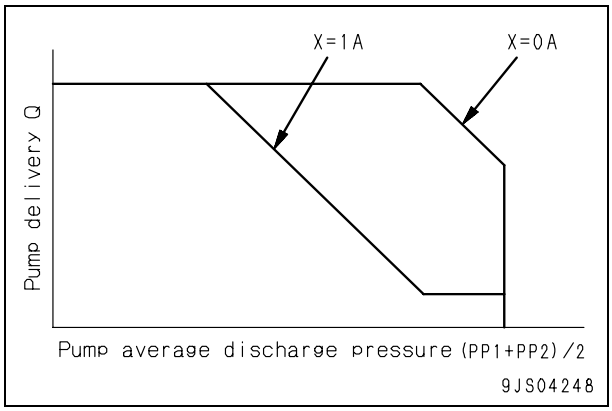


PA : Pump port
PA2 : Pump pressure pilot port
PDP : Drain port
PM : Mode selector pressure pilot port
PPL : Control pressure output port (to LS valve)

1. Plug
2. Servo piston assembly
3. Pin
4. Spool
5. Retainer
6. Seat
7. Cover
8. Wiring

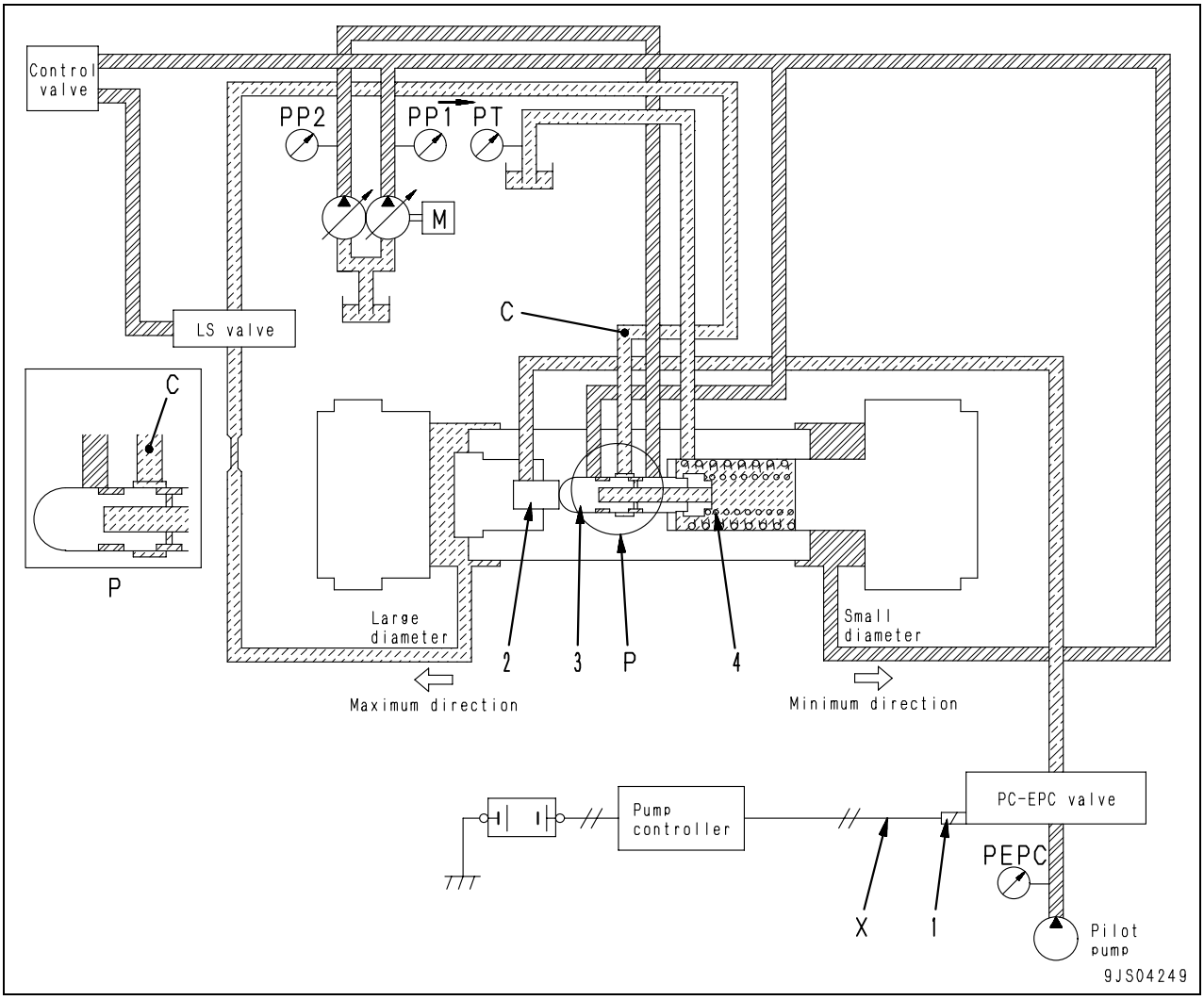
Function

- PC valve controls the flow to a certain rate corresponding to the discharge pressure irrespective of how much the control valve stroke is increased, when pump discharge pressure (PP1) (self pressure) and (PP2) (other pump pressure) are high.
- If the pump discharge pressure increases due to increased load during operation, this valve decreases the pump delivery.
- And if the pump discharge pressure goes low, it increases the pump delivery.
- In this case, relation between the mean discharge pressure of the front and rear pumps [(PP1) + (PP2)]/2 and pump delivery (Q) will become as shown below if the relation is represented as the parameter of the current value (X) to be given to PC-EPC valve solenoid.
- The controller continues counting the actual engine speed.
- During low speed, command current flows from the controller to PC-EPC valve solenoid according to the engine speed to reduce the pump delivery.



Operation

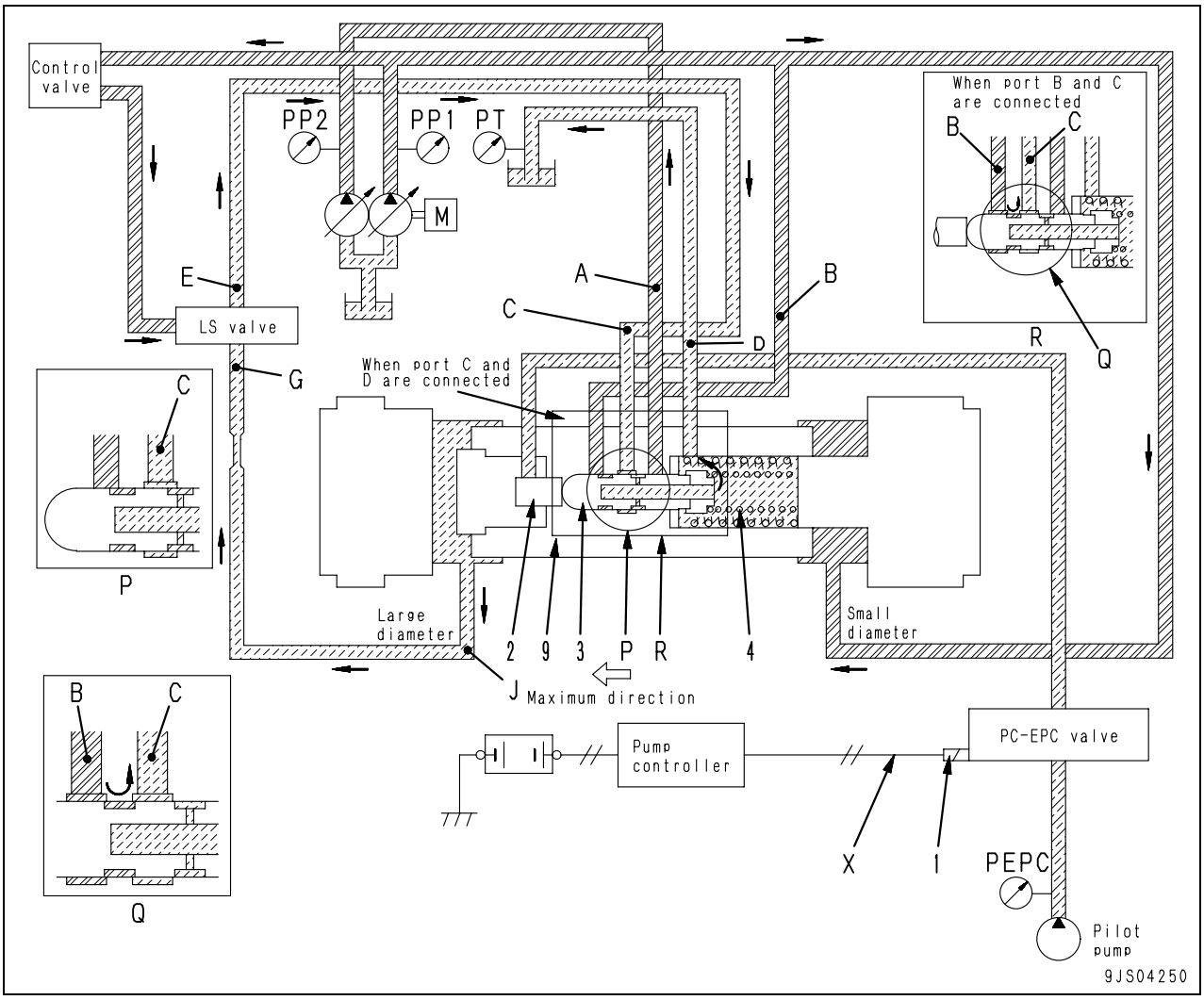
1) When the actuator load is small and pump pressure (PP1) and (PP2) are low



Action of PC-EPC valve solenoid (1)

- Command current (X) is being sent to PC-EPC valve solenoid (1) from the pump controller.
- This command current acts on PC-EPC valve to output the signal pressure in order to modify the force pushing piston (2).
- Spool (3) stops at a position where the combined force pressing spool (3) becomes balanced between a set force of spring (4) and pump pressure (PP1) (self pressure) and (PP2) (other pump pressure).
- The pressure [port (C) pressure] output from PC valve is changed depending on the above position.
- The size of command current (X) is determined by the nature of the operation (lever operation), the selected working mode, and the set value and actual value of the engine speed.

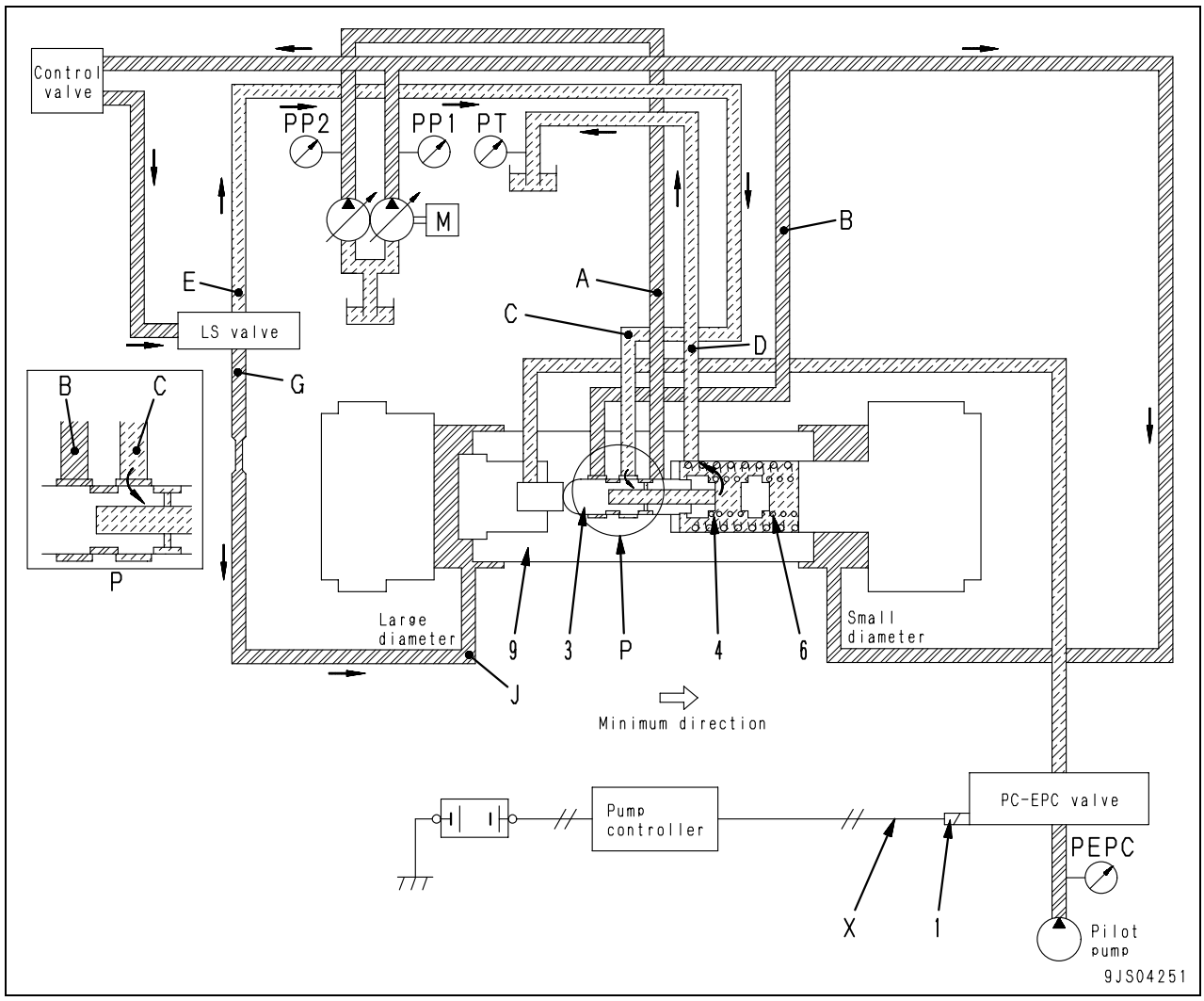
★ Other pump pressure denotes the pressure of the pump situated on the opposite side.
For the front pump pressure, the other pump pressure is that of the rear pump.
And for the rear pump pressure, the other pump pressure is that of the front pump.



Action of spring

- The load of spring (4) at the PC valve is determined by the position of the swash plate.
- Spring load changes as servo piston (9) makes spring (4) elongate or contract.
- If the command current (X) to PC-EPC valve solenoid (1) changes, so does the force pushing piston (2).
- The load of spring (4) also changes according to the PC-EPC valve solenoid command current (X).
- Port (C) of the PC valve is connected to port (E) of the LS valve.
- Self pressure (PP1) enters port (B) and the small diameter end of servo piston (9), and other pump pressure (PP2) enters port (A).
- When pump pressures (PP1) and (PP2) are small, spool (3) will be positioned in the left side.
- Ports (C) and (D) are connected, and the pressure entering the LS valve becomes drain pressure (PT).
- If port (E) and port (G) of the LS valve are connected, the pressure entering the large diameter end of the piston from port (J) becomes drain pressure (PT), and servo piston (9) moves to the left side.
- The pump delivery will be set to the increasing trend.
- Spring (4) extends as servo piston (9) moves and weakens the spring force.
- As the spring force is weakened, spool (3) moves to the right, the connecting between port (C) and port (D) is shut off and the pump discharge pressure ports (B) and (C) are connected.
- The pressure on port (C) rises and the pressure on the large diameter end of the piston also rises. Thus, the leftward move of servo piston (9) is stopped.
- Stop position of servo piston (9) (= pump delivery) is determined by a position where press force generated by pressure (PP1) and (PP2) on spool (3) and other press force by PC-EPC valve solenoid are balanced with the force of spring (4).

2) When the actuator load is large, and the pump discharge pressure is high



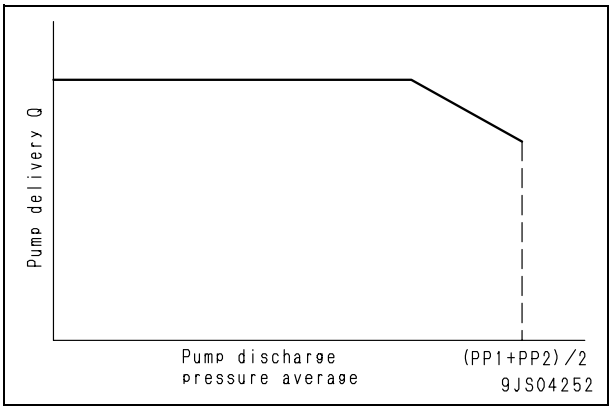
Outline

- When the load is large and pump discharge pressures (PP1) and (PP2) are high, the force pushing spool (3) to the right becomes larger and spool (3) will be moved to the position shown in above figure.
- Part of the pressure to be conducted from port (C) to LS valve flows from port (B) to port (C) and (D) through LS valve. At the end this flow, level of this pressure becomes approximately half of main pump pressure (PP2).

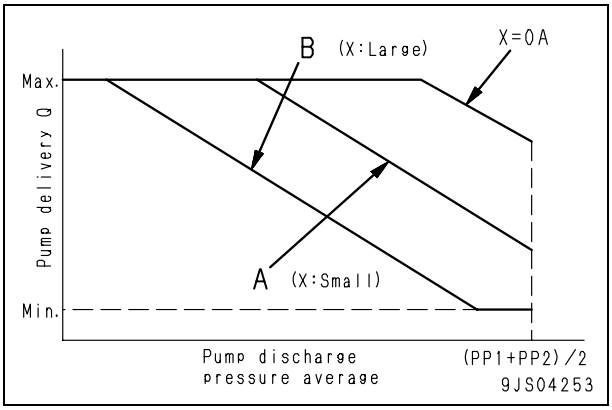
Operation

- When port (E) and port (G) of the LS valve are connected, this pressure from port (J) enters the large diameter end of servo piston (9), stopping servo piston (9).
- If main pump pressure (PP2) increases further and spool (3) moves further to the right, main pump pressure (PP1) flows to port (C) and acts to make the pump delivery the minimum.
- When servo piston (9) moves to the right, springs (4) and (6) are compressed and push back spool (3).
- When spool (3) moves to the left, the openings of port (C) and port (D) become larger.
- The pressure on port (C) (= J) is decreased and the rightward move of servo piston (9) is stopped.
- The position in which servo piston (9) stops at this time is further to the right than the position when pump pressures (PP1) and (PP2) are low.

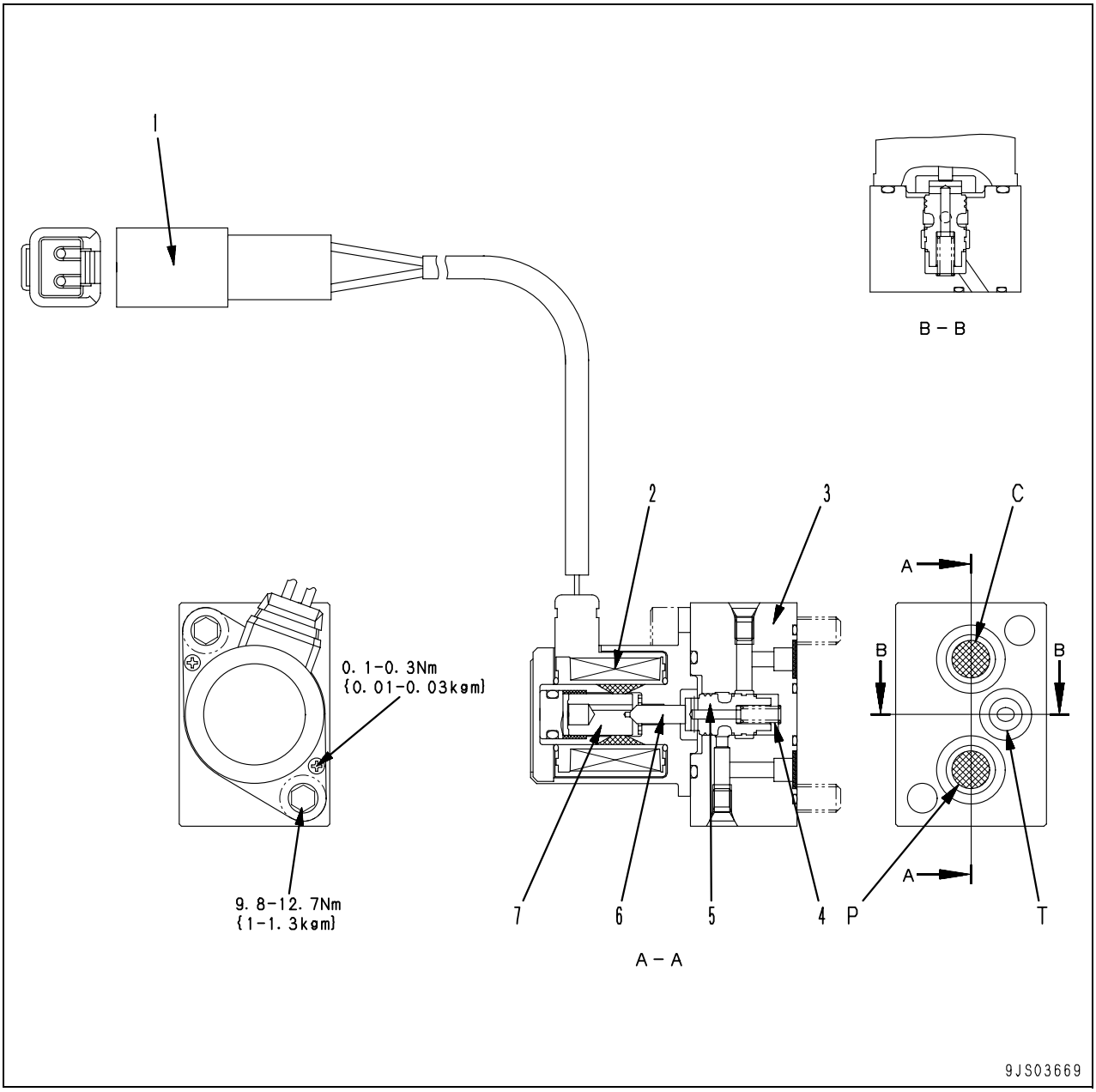
- The relationship between the average pump pressure (PP1 + PP2)/2 and average pump delivery (Q) becomes as shown below.



- If command voltage (X) sent to PC-EPC valve solenoid (1) increases further, the relationship between average pump pressure (PP1 + PP2)/2, and pump delivery (Q) is proportional to the force of the PC-EPC valve solenoid and moves in parallel.
- Namely, the force of PC-EPC valve solenoid (1) is added to the pushing force to the right because of the pump pressure applied to spool (3), so the relationship between the average pump pressure (PP1 + PP2)/2 and pump delivery (Q) moves from (A) to (B) as command current (X) is increased.



3. PC-EPC valve

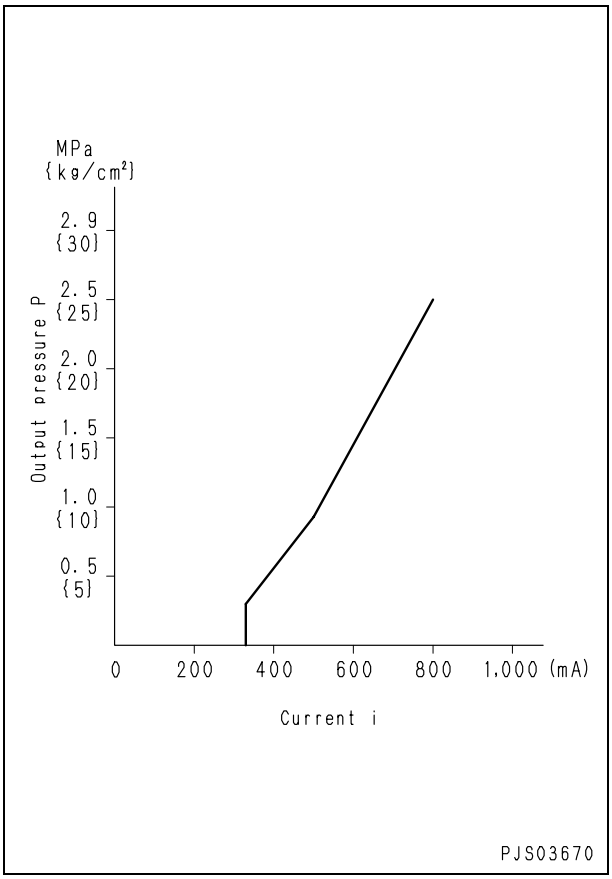


C : To PC valve
P : From pilot pump
T : To tank

1. Connector
2. Coil
3. Body
4. Spring
5. Spool
6. Rod
7. Plunger

Function

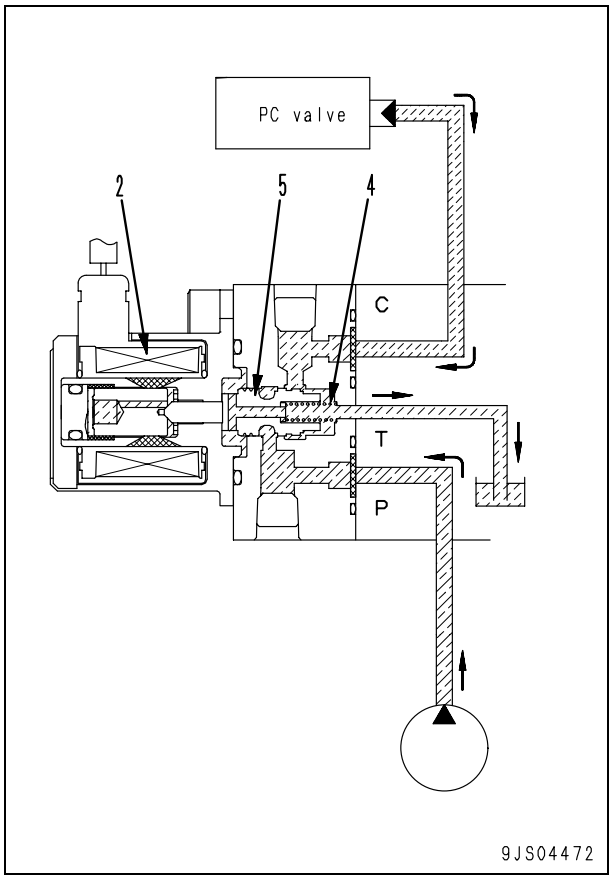
- The EPC valve consists of the proportional solenoid portion and the hydraulic valve portion.
- On receiving signal current (i) from the controller, the EPC valve generates EPC output pressure in proportion to the signal current and outputs it to the PC valve.



Operation

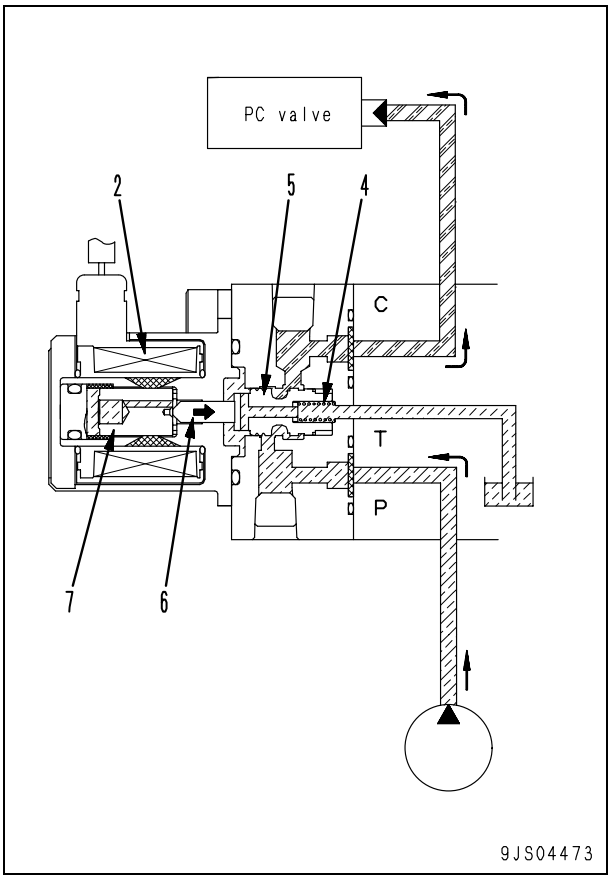
1) When signal current is 0 (coil is de-energized)

- When there is no signal current flowing from the controller to coil (2), coil (2) is de-energized.
- Spool (5) is pushed to the left by spring (4).
- Port (P) is closed and the oil from the pilot pump does not flow to the PC valve.
- The oil from the PC valve is drained through ports (C) and (T) to the tank.



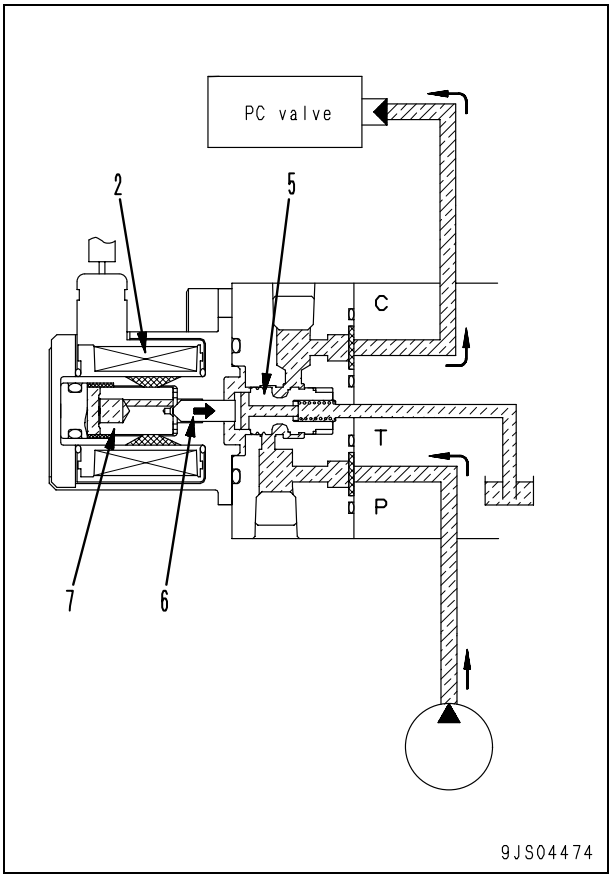
2) When signal current is very small (coil is energized)

- When a very small signal current flows to coil (2), coil (2) is energized, and a propulsion force is generated on the right side of plunger (7).
- Rod (6) pushes spool (5) to the right, and pressurized oil flows from port (P) to port (C).
- Pressures on port (C) increases and the force to act on spool (5) surface and the spring load on spring (4) become larger than the propulsion force of plunger (7).
- Spool (5) is pushed to the left, and port (P) is shut off from port (C).
- Port (C) and port (T) are connected.
- Spool (5) moves up and down so that the propulsion force of plunger (7) may be in balance with pressure of port (C) + spring load of spring (4).
- Circuit pressure between the EPC valve and PC valve is controlled in proportion to the size of the signal current.



3) When signal current is maximum (coil is energized)

- As the signal current flows to coil (2), coil (2) is energized.
- When this happens, the signal current is at its maximum, so the propulsion force of plunger (7) is also at its maximum.
- Spool (5) is pushed toward the right side by rod (6).
- Hydraulic oil from port (P) flows to port (C) with maximum flow rate. As the result, the circuit pressure between the EPC and PC valves becomes maximum.
- Since port (T) is closed, pressurized oil does not flow to the tank.



WA600-6 Wheel loader

Form No. SEN00407-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

10 Structure, function and maintenance standard

Hydraulic system, Part 2

Hydraulic system, Part 2 2
Control valve 2
CLSS 16
Each function and operation of each valve 21
Accumulator (for PPC circuit) 36
Triple pump 37

Hydraulic system, Part 2

Control valve

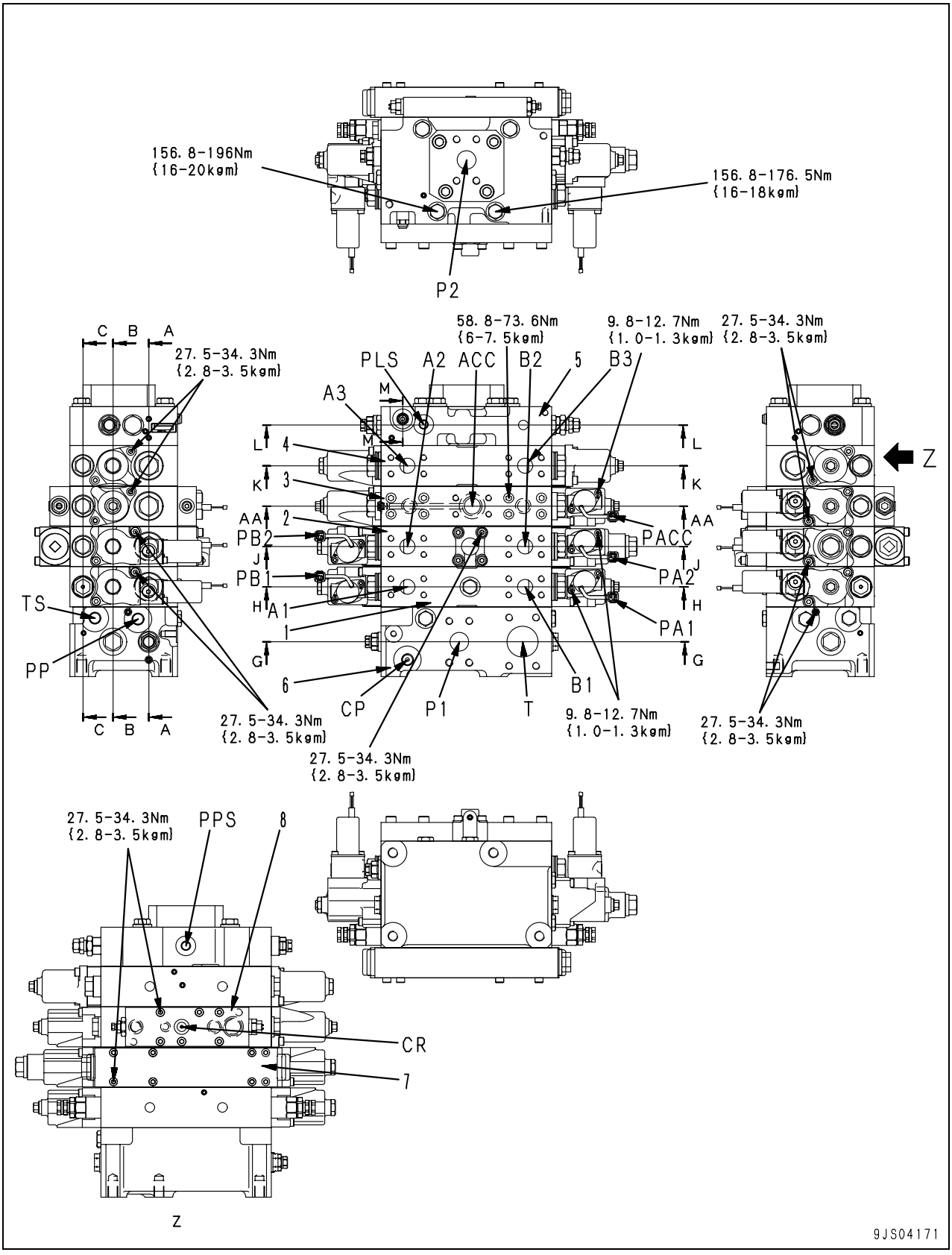
Outline

As for outside views and sectional views, only the 4-spool valve (with ECSS control valve) is shown.

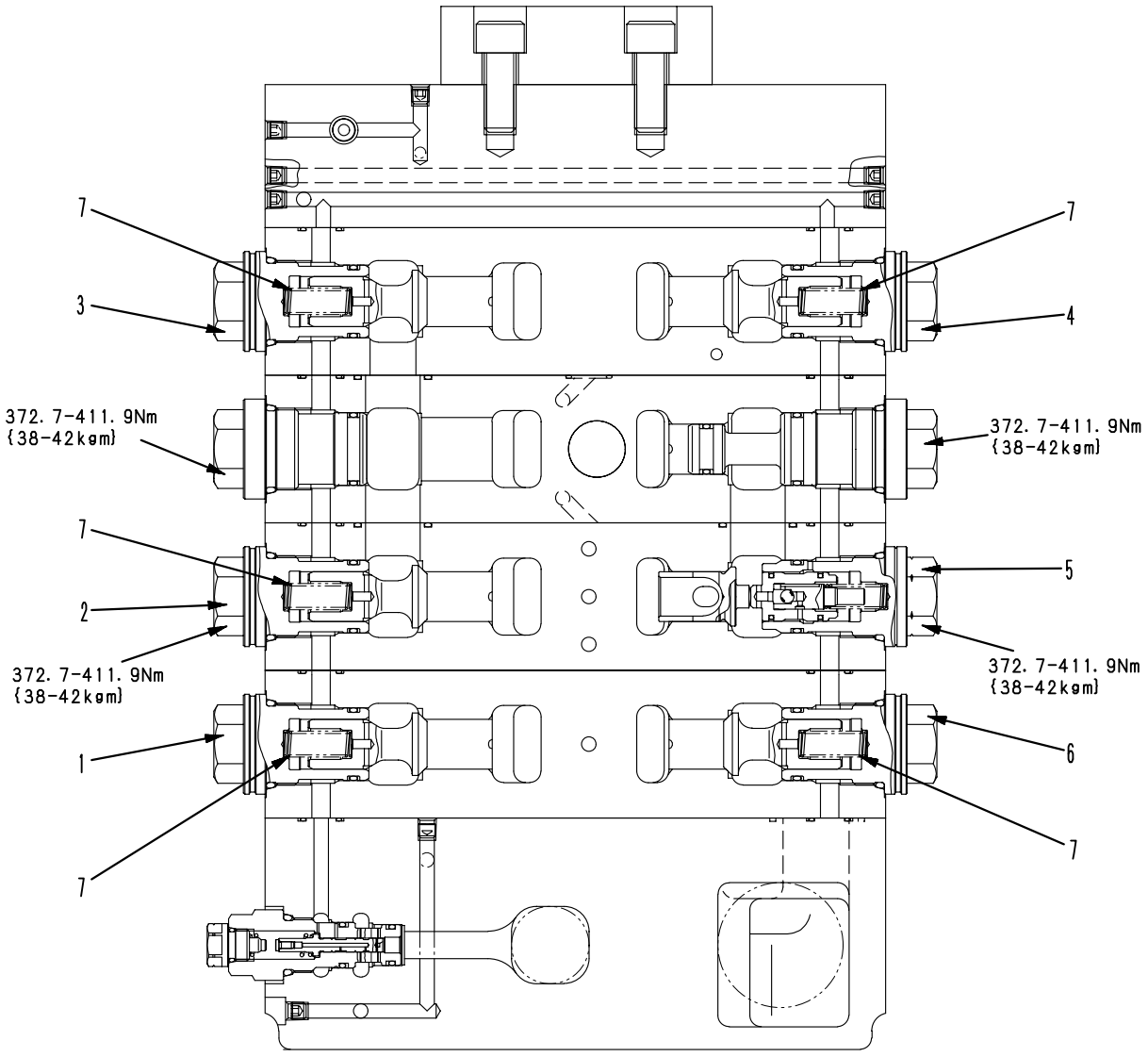
A1 : To bucket cylinder head
A2 : To lift arm cylinder bottom
A3 : To lift arm cylinder bottom
ACC : To ECSS accumulator
B1 : To bucket cylinder bottom
B2 : To lift arm cylinder head
B3 : To bucket cylinder bottom
CP : Pressure sensor installation port
CR : Pressure pick-up port
P1 : From front work equipment hydraulic pump
P2 : From rear work equipment hydraulic pump
PA1 : From bucket dump controller
PA2 : From lift arm raise controller
PACC : From ECSS controller
PB1 : From bucket tilt controller
PB2 : From lift arm lower controller
PLS : To work equipment hydraulic pump LS port
PP : From pilot pump
PPS : To work equipment hydraulic pump
T : To tank
TS : To tank

1. Bucket valve
2. Lift arm valve
3. ECSS control valve
4. Lift arm Hi and bucket Hi valves
5. Cover 1
6. Cover 2
7. Lift arm suction valve
8. Accumulator charge valve

Outside view



Sectional view
(1/6)

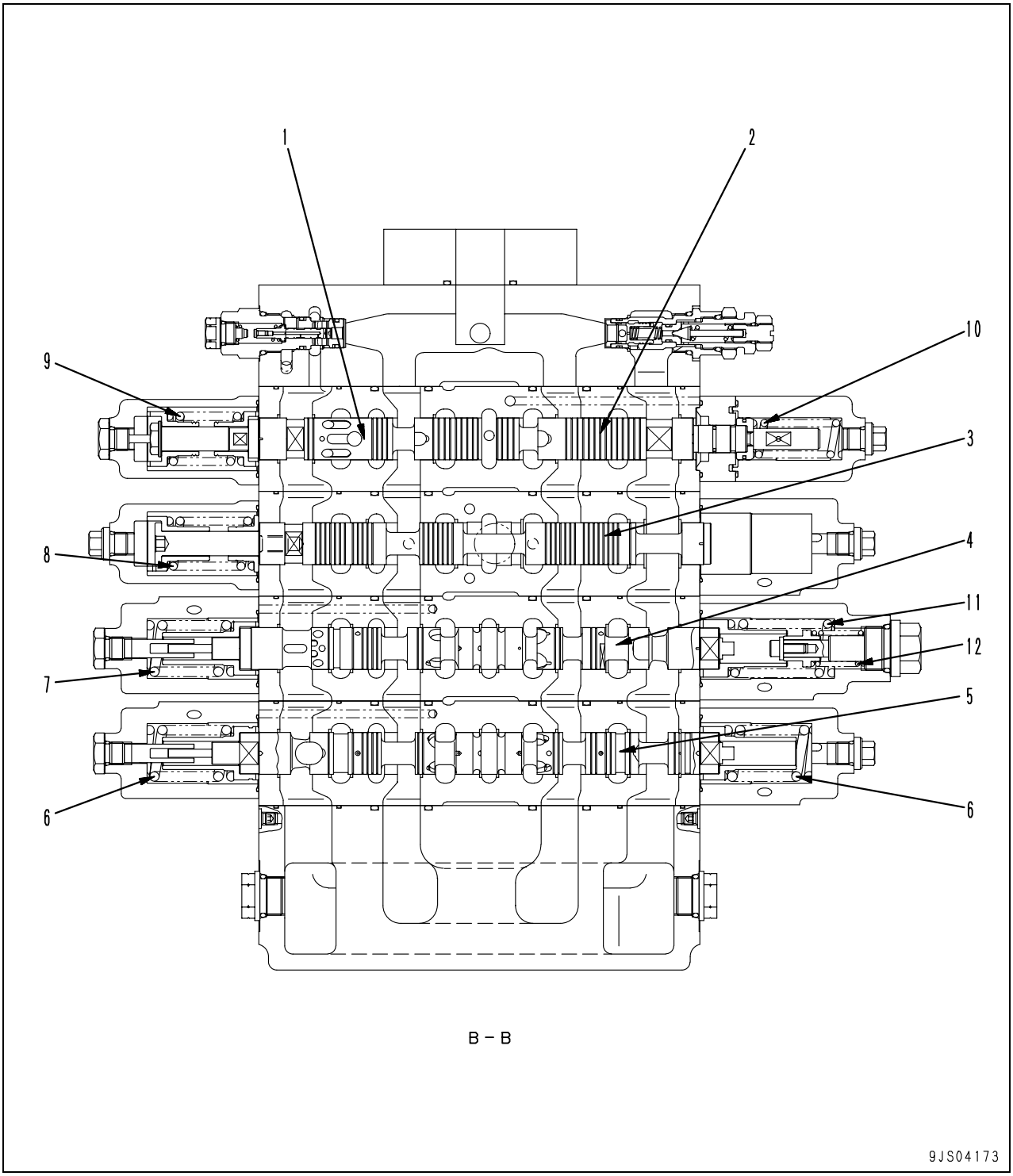


1. Load check valve (Bucket head)
2. Load check valve (Lift arm bottom)
3. Load check valve (Lift arm Hi) and (Lift arm bottom)
4. Load check valve (Bucket Hi) and (Bucket bottom)
5. Pressure compensation valve (Lift arm head)
6. Load check valve (Bucket bottom)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
7	Check valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		38.9 x 11.5	30.0	29.4 N {3.0 kg}	—	23.5 N {2.4 kg}	

(2/6)

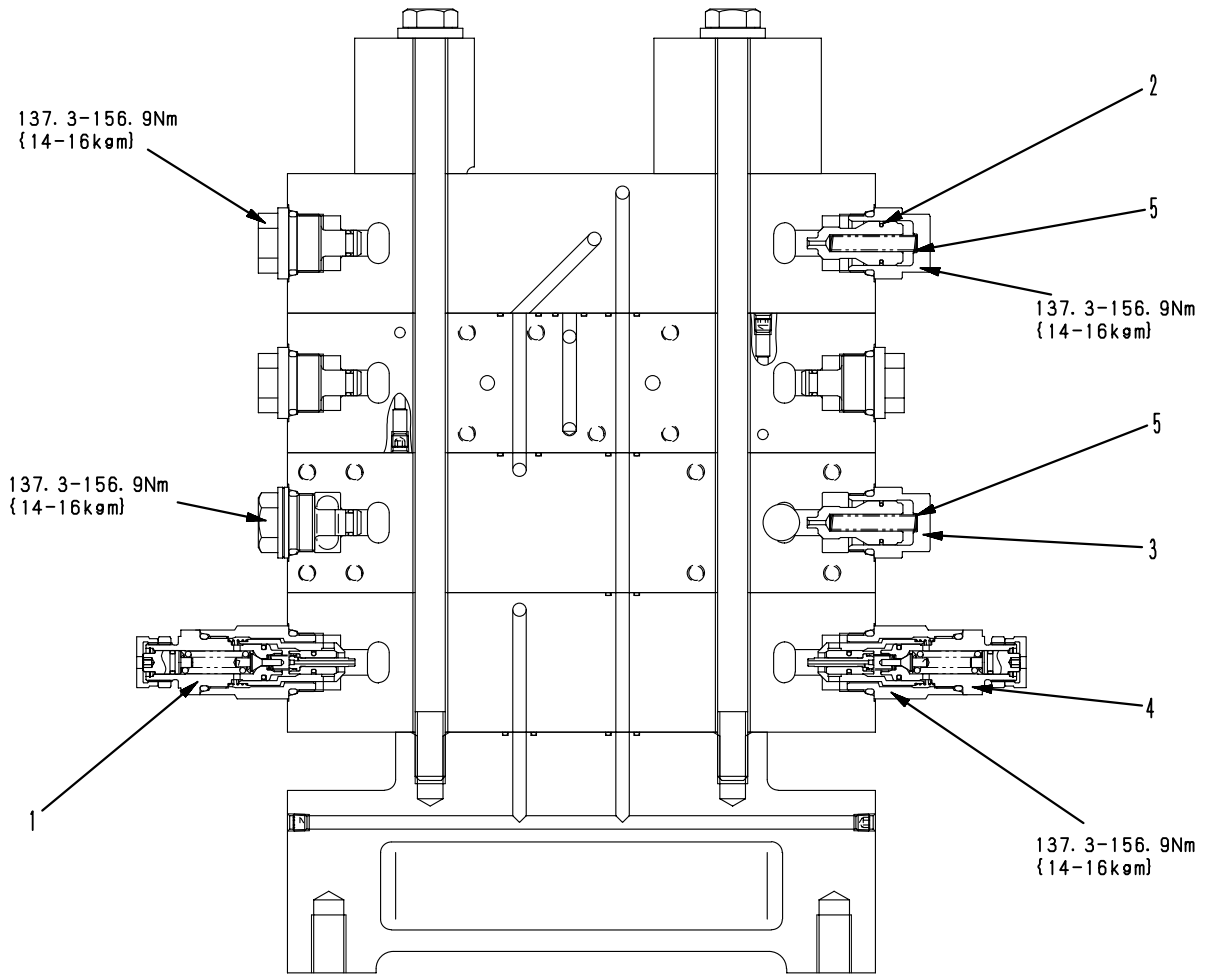


1. Spool (Boom Hi)
2. Spool (Bucket Hi)
3. Spool (ECSS control)
4. Spool (Lift arm)
5. Spool (Bucket)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
6	Spool return spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		54.5 x 34.8	51.2	393 N {40.1 kg}	—	315 N {32.1 kg}	
7	Spool return spring	54.2 x 34.8	51.2	417 N {42.5 kg}	—	333 N {34.0 kg}	
8	Spool return spring	58.1 x 33.0	51.5	351 N {35.8 kg}	—	280 N {28.6 kg}	
9	Spool return spring	51.6 x 33.0	45.0	351 N {35.8 kg}	—	280 N {28.6 kg}	
10	Spool return spring	54.9 x 24.2	52.0	251 N {25.6 kg}	—	201 N {20.5 kg}	
11	Spool return spring	66.9 x 36.1	63.5	263 N {26.8 kg}	—	210 N {21.4 kg}	
12	Spool return spring	53.2 x 22.3	33.0	274 N {27.9 kg}	—	219 N {22.3 kg}	

(3/6)

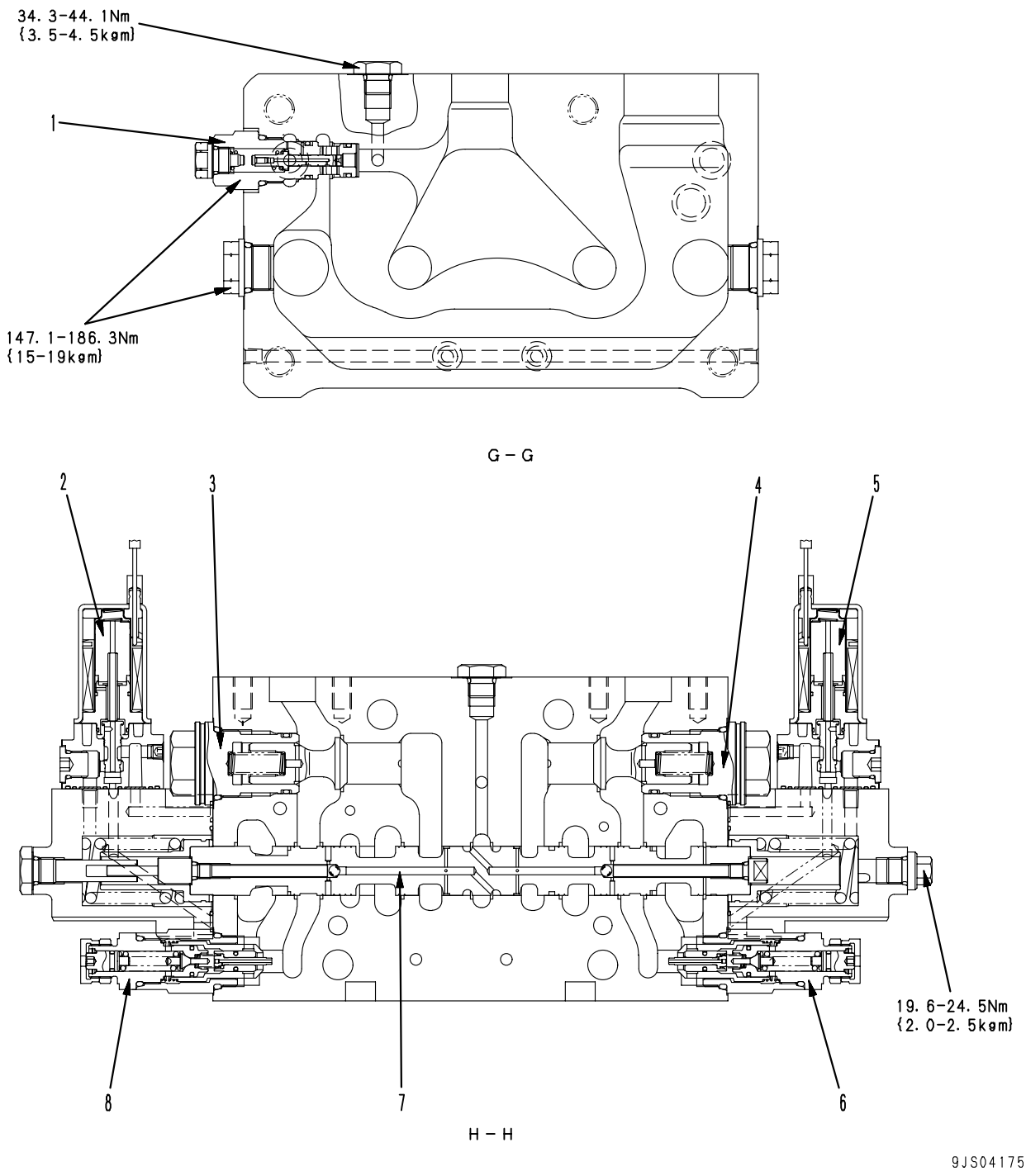

137. 3-156. 9Nm
{14-16kgm}
2
5
137. 3-156. 9Nm
{14-16kgm}
137. 3-156. 9Nm
{14-16kgm}
5
3
4
1
137. 3-156. 9Nm
{14-16kgm}
C - C
9JS04174

1. Safety-suction valve (Bucket head)
2. Suction valve (Bucket Hi) and (Bucket bottom)
3. Suction valve (Lift arm head)
4. Safety-suction valve (Bucket bottom)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
5	Suction valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		46.8 x 7.5	40.6	5.5 N {0.56 kg}	—	4.4 N {0.45 kg}	

(4/6)

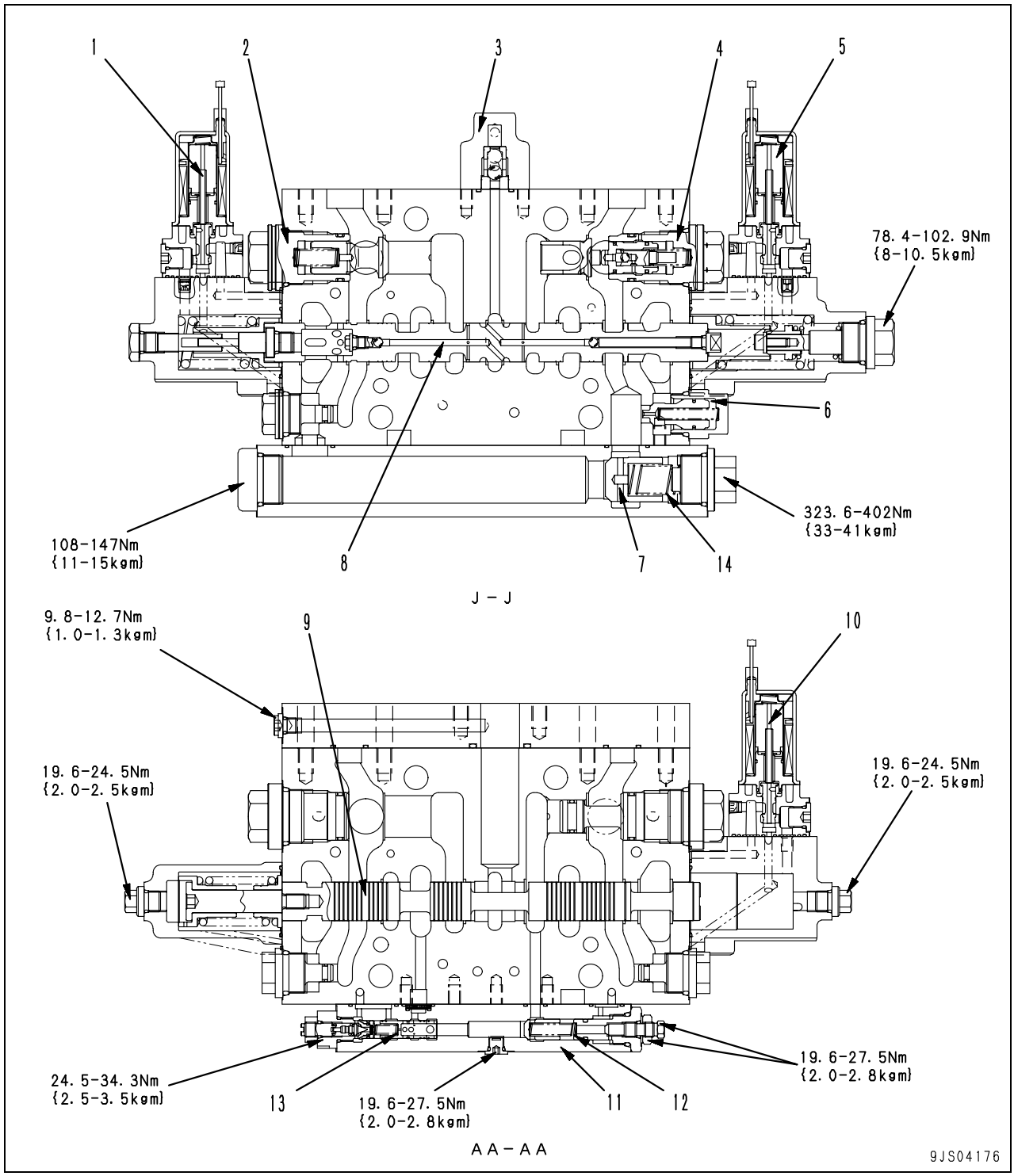


1. Unload valve

Bucket valve

2. EPC valve (Tilt)
3. Load check valve (Dump)
4. Load check valve (Tilt)
5. EPC valve (Dump)
6. Safety-suction valve (Tilt)
7. Spool
8. Safety-suction valve (Dump)

(5/6)


1
2
3
4
5
78.4-102.9Nm
{8-10.5kgm}
6
323.6-402Nm
{33-41kgm}
108-147Nm
{11-15kgm}
8
7
14
J-J
9.8-12.7Nm
{1.0-1.3kgm}
9
10
19.6-24.5Nm
{2.0-2.5kgm}
19.6-24.5Nm
{2.0-2.5kgm}
19.6-27.5Nm
{2.0-2.8kgm}
24.5-34.3Nm
{2.5-3.5kgm}
13
19.6-27.5Nm
{2.0-2.8kgm}
11
12
A A-A A
9JS04176

Lift arm valve

1. EPC valve (Lower and float)
2. Load check valve (Lift)
3. LS shuttle valve
4. Pressure compensation valve (Lower)
5. EPC valve (Raise)
6. Suction valve (Lower and float)
7. Suction valve (Lower and float)
8. Spool

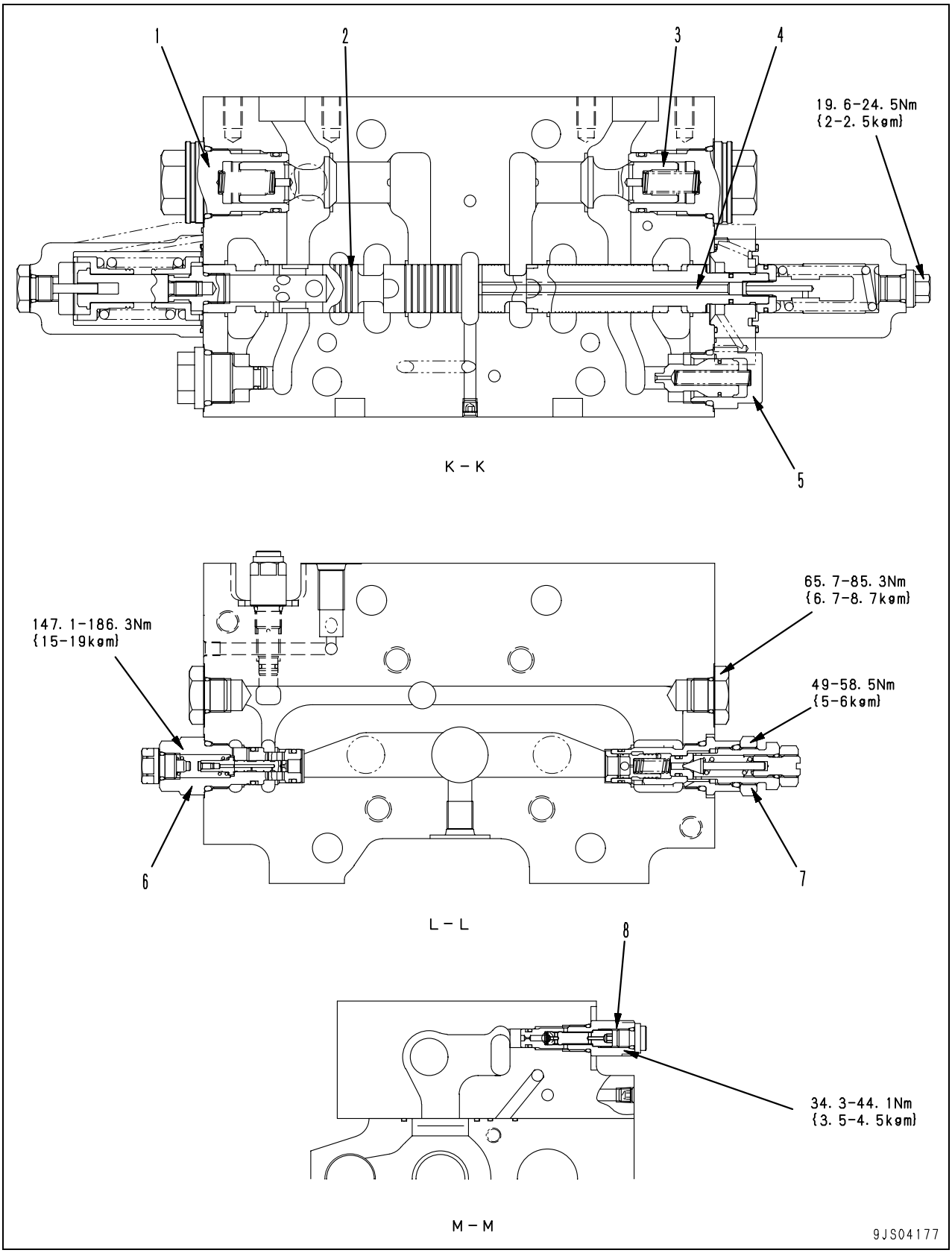
ECSS valve

9. Spool
10. EPC valve
11. Accumulator charge valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
12	Check valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		41.5 x 8.5	31.5	5.9 N {0.6 kg}	—	4.72 N {0.48 kg}	
13	Valve spring	19.2 x 7.2	16.1	19.6 N {2.0 kg}	—	15.7 N {1.6 kg}	
14	Suction valve spring	62.5 x 20.0	39.0	3.04 N {0.31 kg}	—	2.43 N {0.25 kg}	

(6/6)

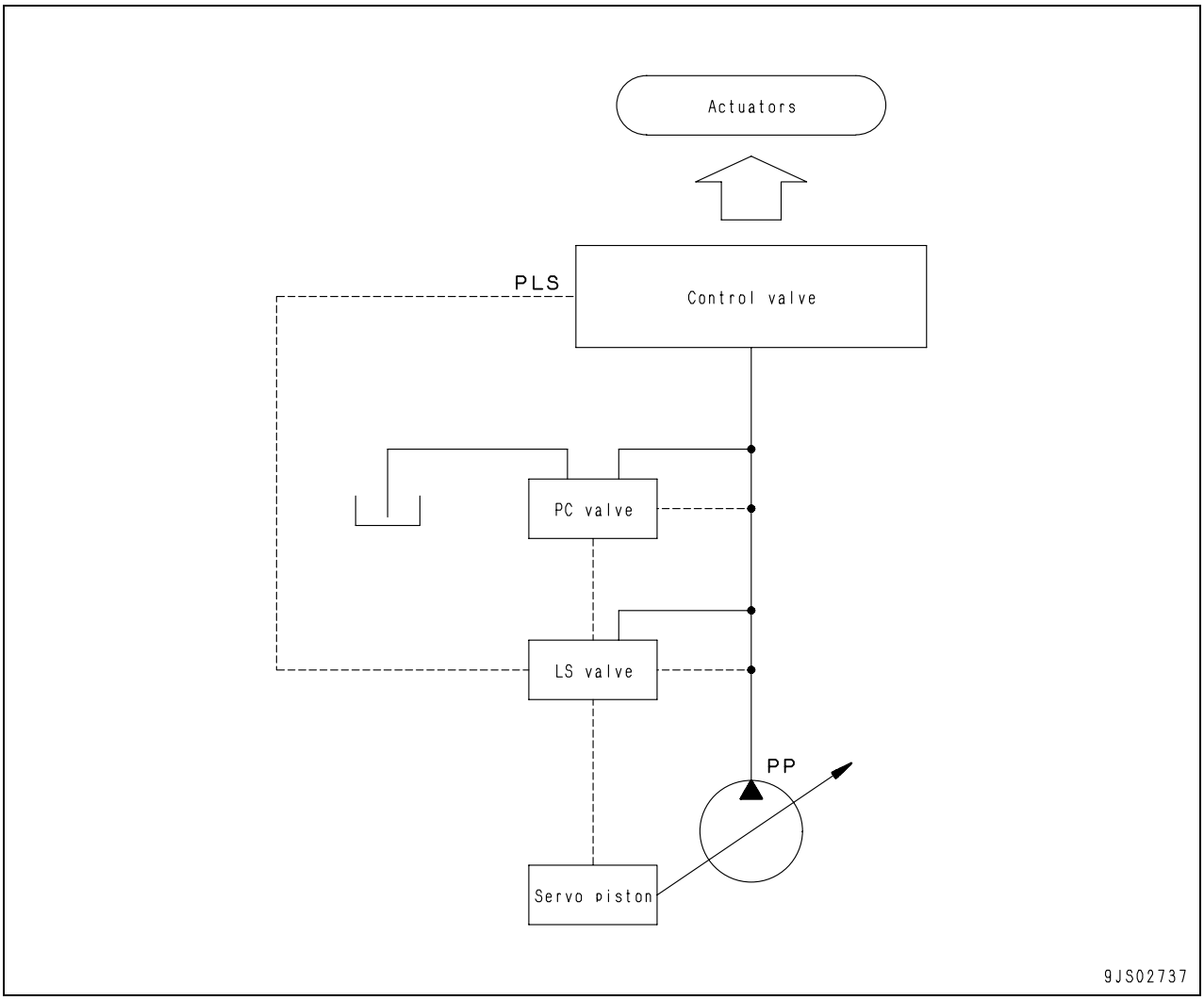

1
2
3
4
19. 6-24. 5Nm
{2-2. 5kgm}
5
K - K
65. 7-85. 3Nm
{6. 7-8. 7kgm}
147. 1-186. 3Nm
{15-19kgm}
49-58. 5Nm
{5-6kgm}
6
7
L - L
8
34. 3-44. 1Nm
{3. 5-4. 5kgm}
M - M
9JS04177

Lift arm Hi and bucket Hi valves

1. Load check valve (Lift arm Hi)
2. Spool (Lift arm Hi)
3. Load check valve (Bucket Hi)
4. Spool (Bucket Hi)
5. Suction valve (Bucket Hi)
6. Unload valve
7. Main relief valve
8. LS bypass plug

CLSS

Outline of CLSS



Features

CLSS stands for Closed center Load Sensing System, and has the following features:

- Fine control not influenced by load
- Controllability enabling digging even with fine control
- Ease of compound operation ensured by flow divider function using area of opening of spool during compound operations
- Energy saving using variable pump control

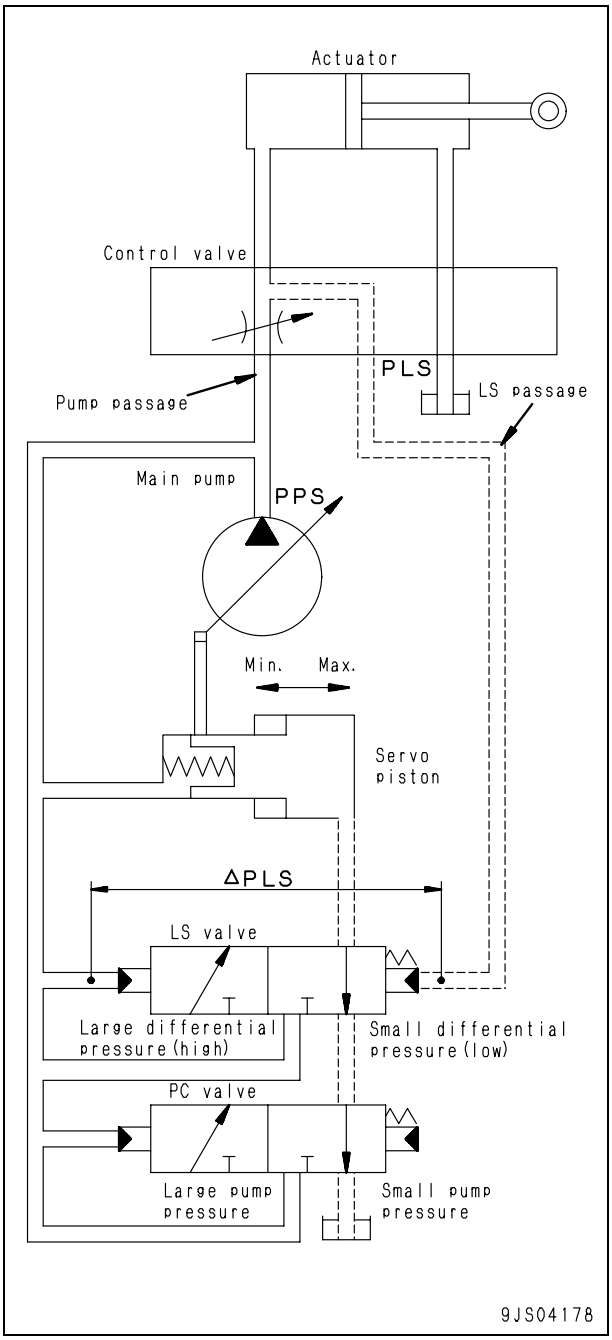
Structure

- CLSS is configured with a variable capacity piston pump, control valves, and respective actuators.
- The hydraulic pump is configured with pump body, PC valve and LS valve.

Basic principle

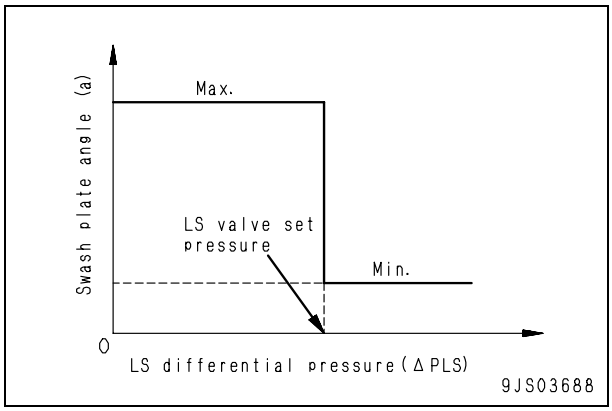
1. Pump swash plate angle control

- The pump swash plate angle (pump delivery) is so controlled that the LS differential pressure (ΔPLS), which is the differential pressure between the pump discharge pressure (PPS) and LS pressure (PLS) (the actuator load pressure) at the control valve outlet, will be constant.
- [LS differential pressure (ΔPLS) = Pump discharge pressure (PPS) – LS pressure (PLS)]



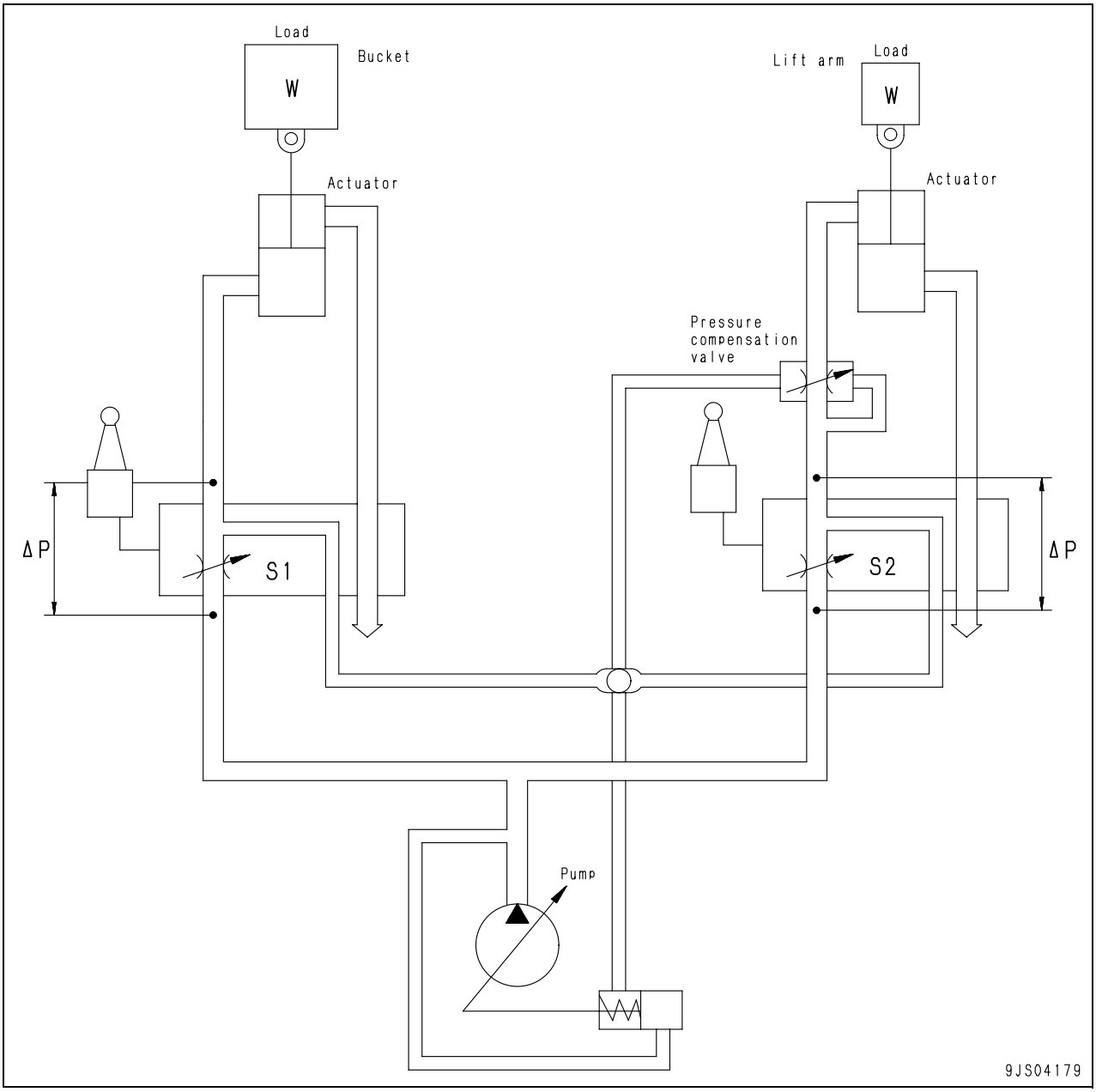
- The pump swash plate angle shifts toward the maximum position if LS differential pressure (ΔPLS) is lower than the set pressure of the LS valve (when the actuator load pressure is high).
- If it becomes higher than the set pressure (when the actuator load pressure is low), the pump swash plate angle shifts toward the minimum position.

LS differential pressure (ΔPLS) and pump swash plate angle

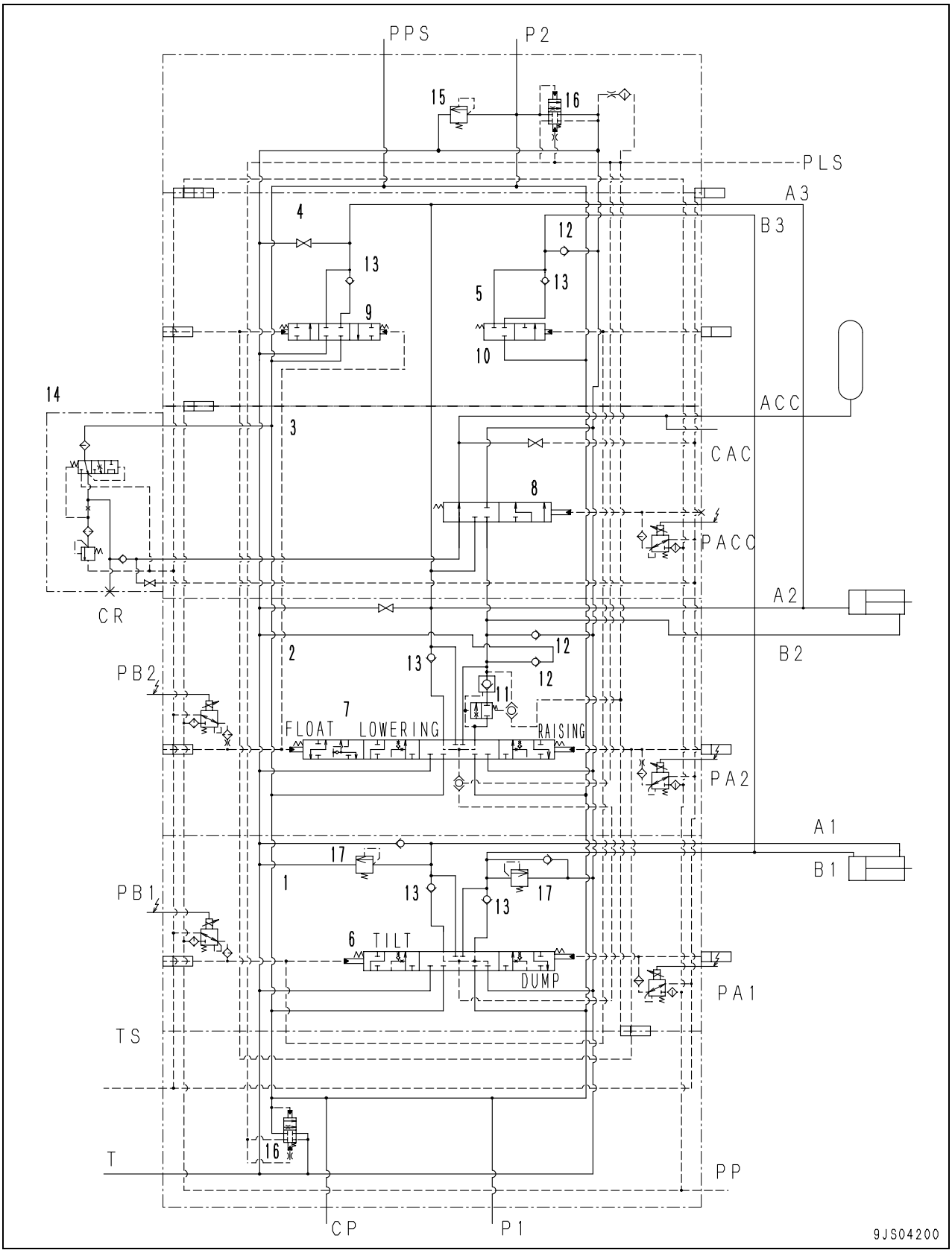


★ For details of functions, see the “Hydraulic pump” paragraph.

2. Pressure compensation control



- The valve (pressure compensation valve) to balance the load is installed to the lift arm head outlet side of the control valve.
- When actuators are operated simultaneously, the pressure difference (ΔP) between the upstream (inlet port) and downstream (outlet port) of the spool of each valve becomes the same regardless the size of the load (pressure).
- The flow of oil from the pump is divided (compensated) in proportion to the area of openings (S1) and (S2) of each valve.
- This prevents the bucket from becoming inoperable because of excessive oil flow to the lift arm head due to the lowering of lift arm under its own weight and compound operation of the bucket.

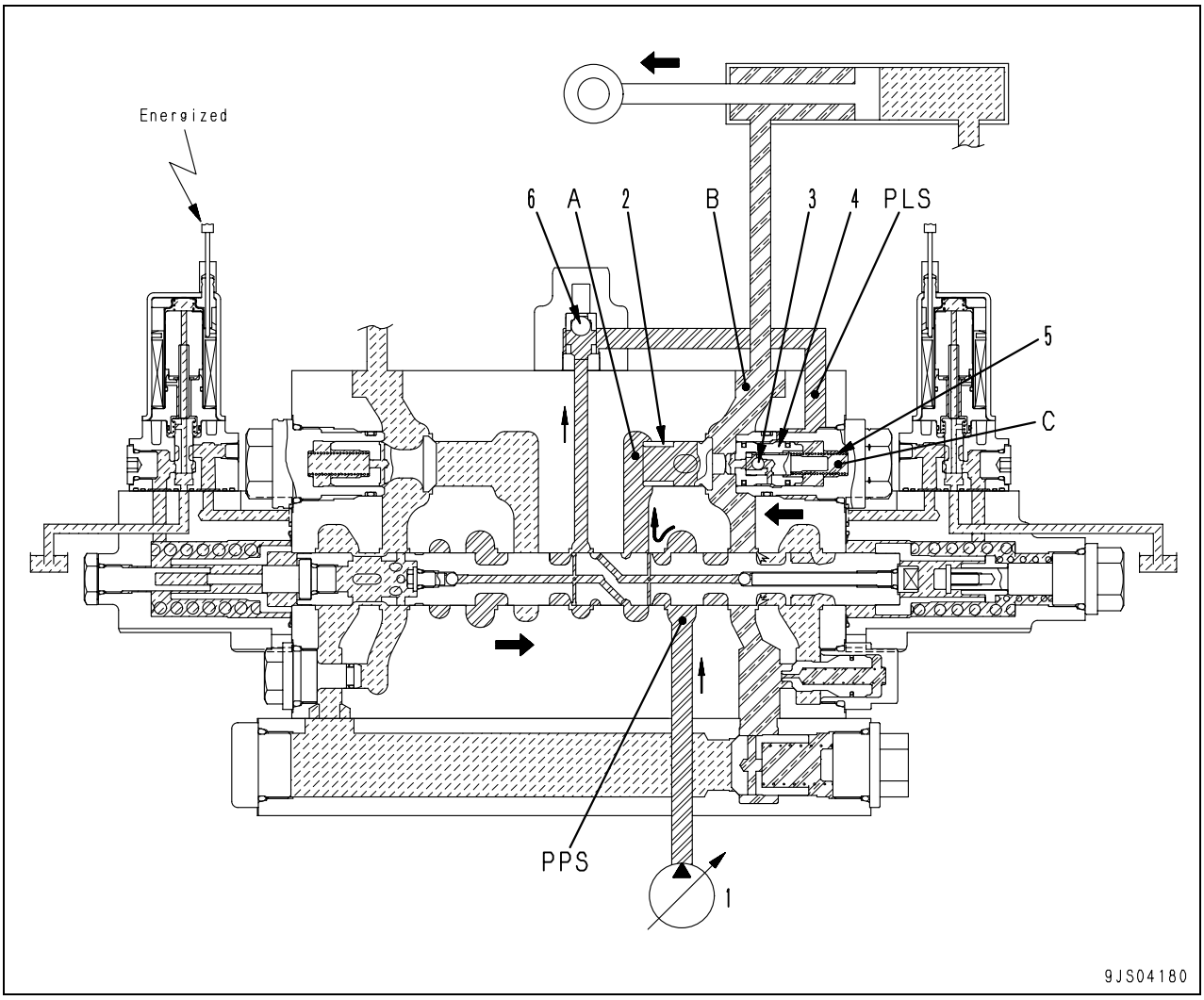

PPS
P2
15
16
PLS
A3
B3
4
12
13
13
5
9
10
14
ACC
3
CAC
8
PACC
CR
A2
B2
2
13
12
12
PB2
11
7
FLOAT
LOWERING
RAISING
PA2
A1
17
B1
1
13
13
17
PB1
6
TILT
DUMP
PA1
TS
16
T
PP
CP
P1
9JS04200

1. Bucket valve
2. Lift arm valve
3. ECSS valve
4. Lift arm Hi valve
5. Bucket Hi valve
6. Bucket spool
7. Lift arm spool
8. ECSS spool
9. Lift arm spool
10. Bucket spool
11. Pressure compensation valve
12. Suction valve
13. Load check valve
14. Accumulator charge valve
15. Main relief valve
    Set pressure: 34.3 ± 0.5 MPa {350 ± 5 kg/cm^2}
16. Unload valve
    Cracking pressure: 1.96 ± 0.2 MPa {20 ± 2 kg/cm^2}
17. Safety-suction valve
    Set pressure: 36.2 ± 0.5 MPa {370 ± 5 kg/cm^2}

Each function and operation of each valve

Pressure compensation valve
(Installed on the cylinder head side of the lift arm valve)

1) When a high load is applied to the lift arm

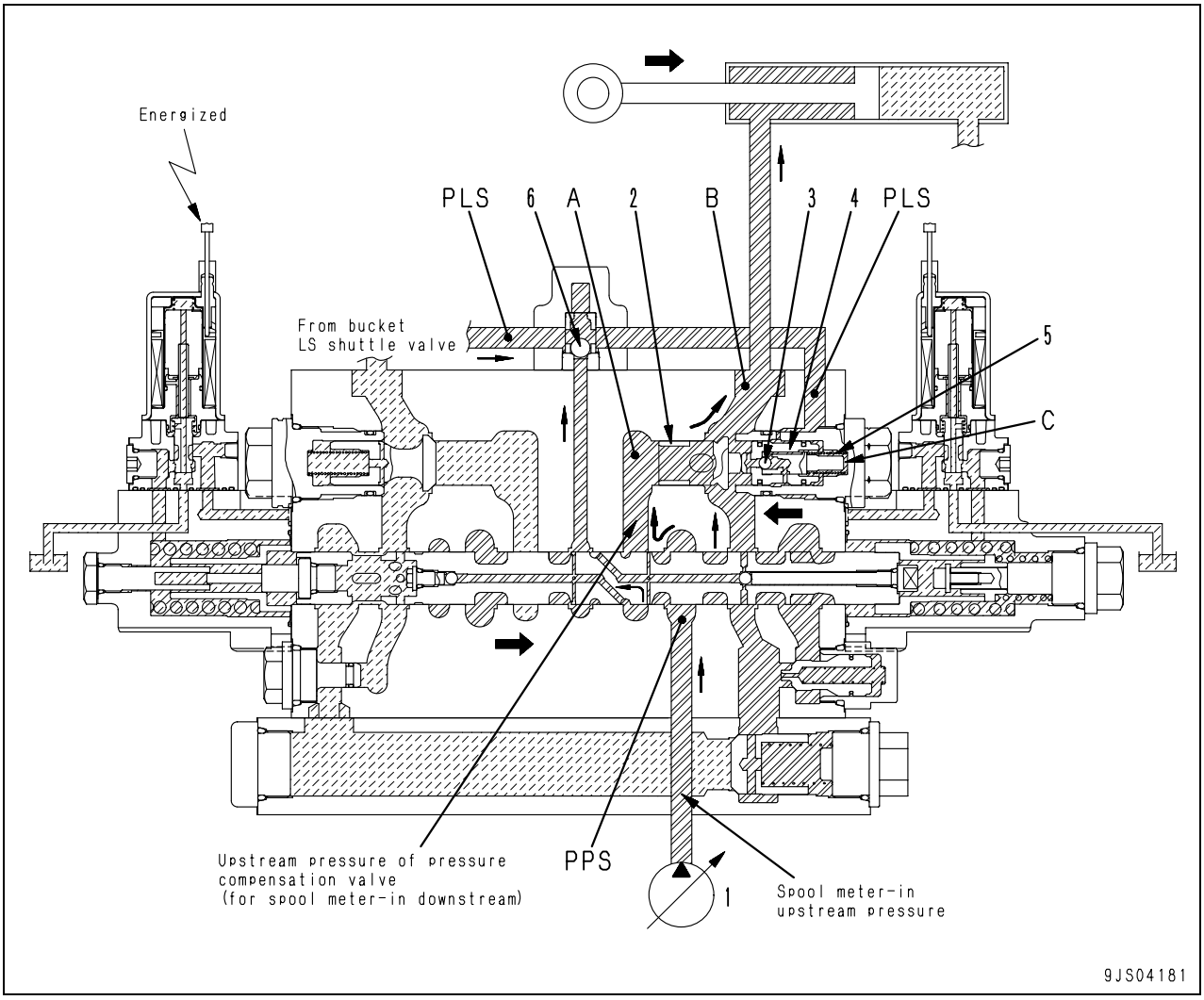


1. Main pump
2. Valve
3. Shuttle valve
4. Piston
5. Spring
6. LS shuttle valve

Function
- High load pressure is generated during independent operation of the lift arm and compound operation with the bucket.
- When the lift arm load pressure becomes higher than the bucket, the pressure compensation valve operates as a load check valve to prevent reverse oil flow in the circuit.

Operation
- Actuator circuit pressure (B) becomes higher than pump discharge pressure (PPS) and LS pressure (PLS).
- Shuttle valve (3) of the pressure compensation valve moves to the right.
- Actuator circuit pressure (B) and spring chamber (C) is connected.
- Accordingly, piston (4) is pressed by spring (5) to the left.
- Also valve (2) is pressed by piston (4) to the left and pump outlet circuit (A) is closed. This prevents reverse flow of oil from actuator circuit (B) to pump outlet circuit (A).

2) Compound operation (Lift arm lower + bucket tilt)



Function

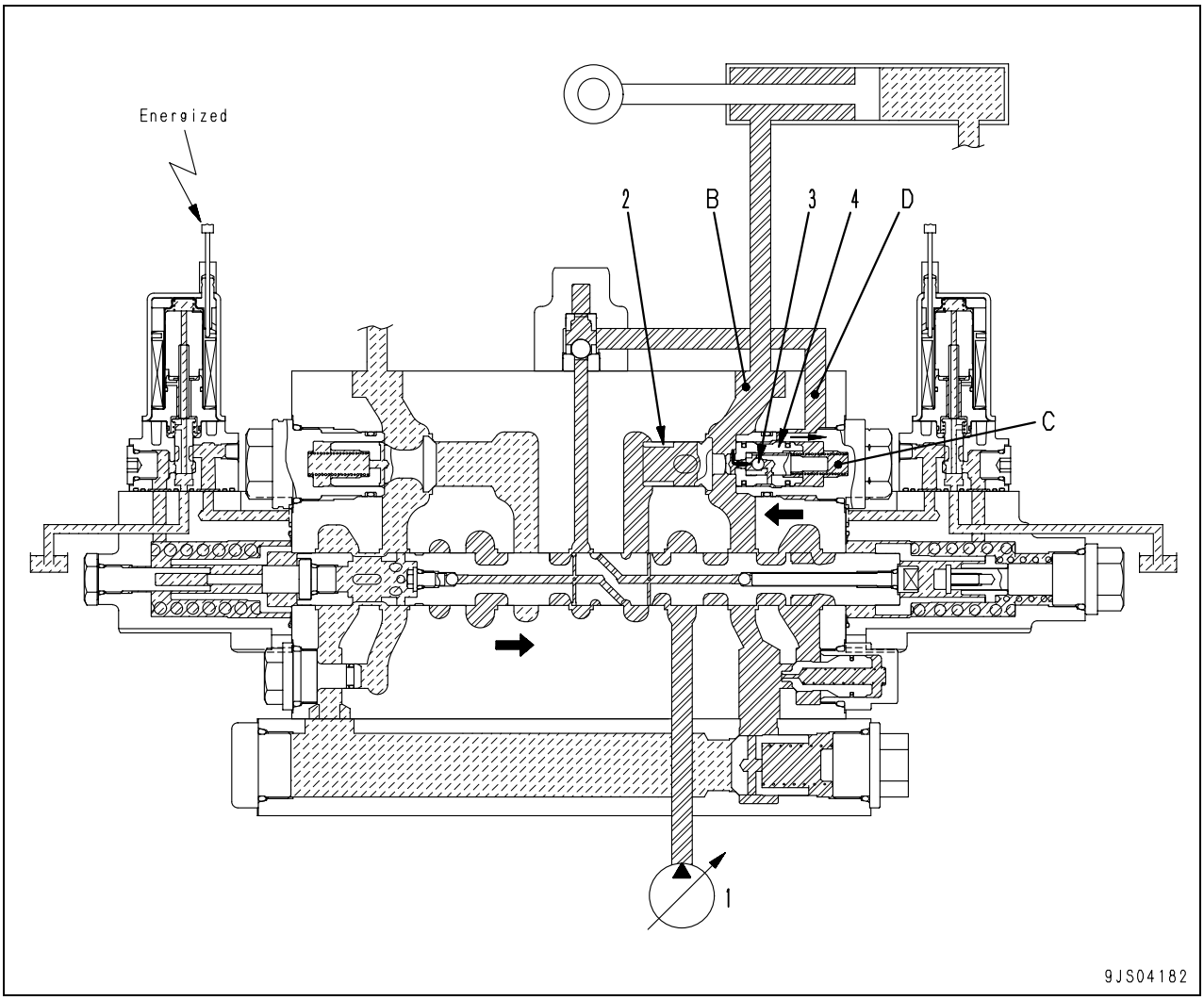
- If the load pressure is lower than the bucket and the flow rate starts increasing during compound operation, the pressure compensation valve compensates the pressure.
- On the bucket side, the load pressure is higher and the flow rate starts to decrease.

Operation

- If the load pressure on the bucket side rises during compound operation, the flow rate of actuator circuit pressure (B) starts to increase.
- As LS pressure (PLS) rises on the bucket side, shuttle valve (3) of the pressure compensation valve is pressed to the left.
- Hydraulic oil flows through the internal passage of piston (4) to spring chamber (C).
- Piston (4) and valve (2) are pressed to the left and the outlet side of pump circuit (PPS) is cut off.
- Outlet pressure (A) (spool meter-in downstream pressure) becomes equal to the bucket outlet pressure.
- Pump pressure (PPS) (spool meter-in upstream pressure) becomes equal for all actuators.
- Pump pressure (PPS) and outlet pressure (A) becomes equal for all spools.
- Pump flow rate is distributed in proportion to the opening area of respective spools.

Shuttle valve in the pressure compensation valve

1. If holding pressure of port (B) > LS pressure in spring chamber (C)

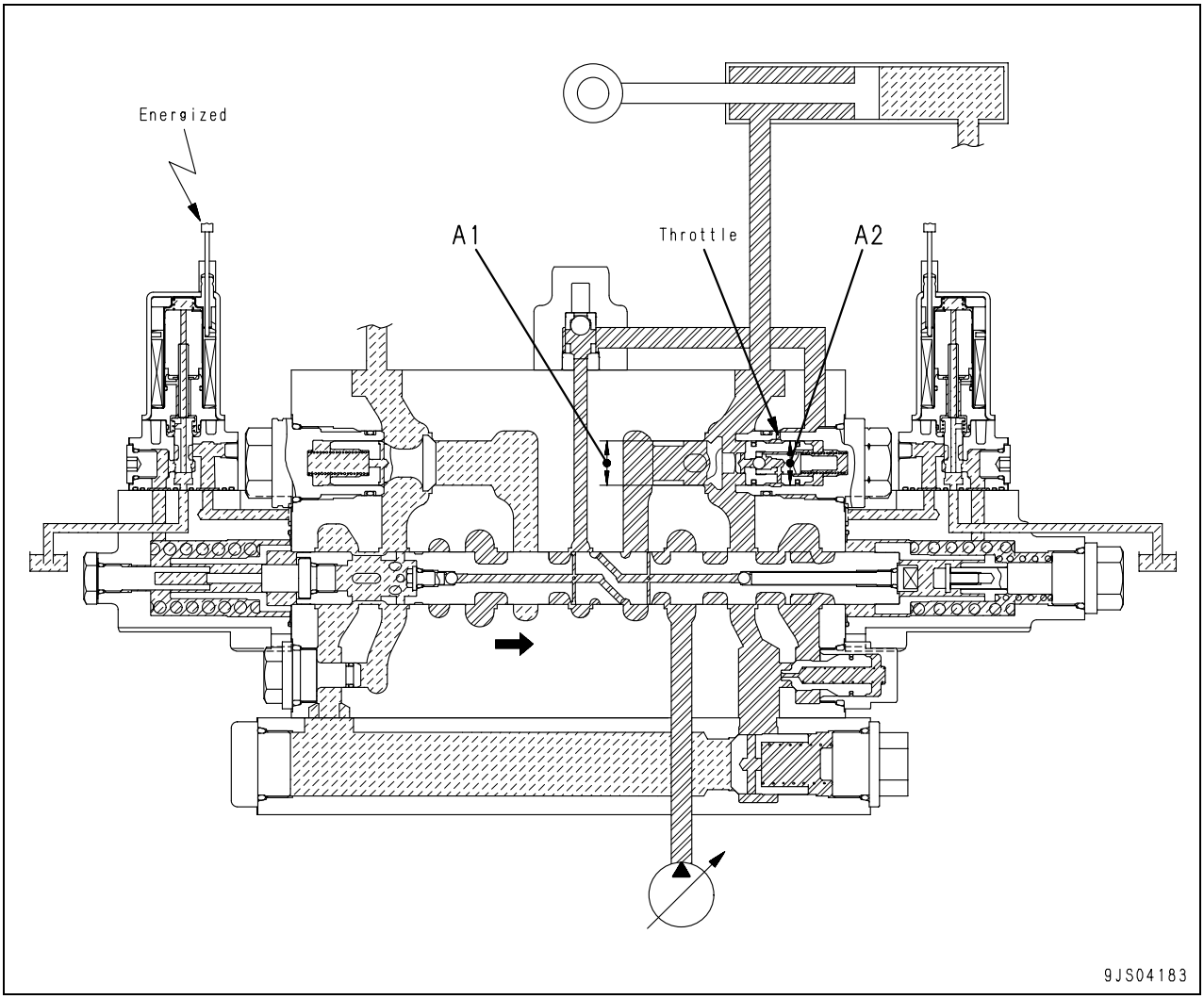


1. Hydraulic pump
2. Valve
3. Shuttle valve
4. Piston

Function

- Shuttle valve (3) is pressed to the right by port (B) pressure and ports (B) and (D) are cut off.
- Holding pressure of port (B) is led to spring chamber (C) and piston (4) is pressed to the left to prevent it from being separated from valve (2).

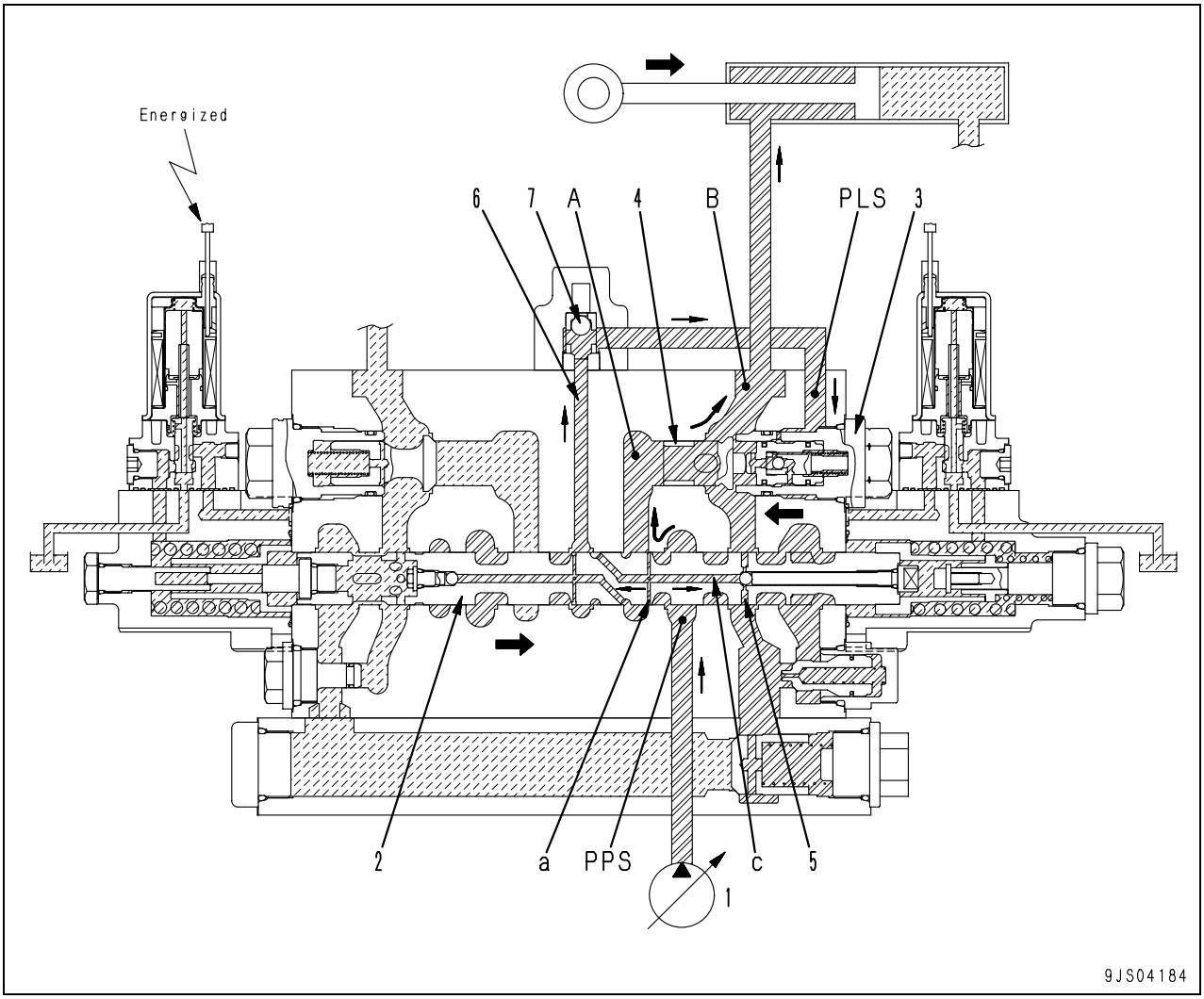
Area ratio of pressure compensation valve



Function

- The state of division changes according to the area ratio of pressure compensation portions (A1) and (A2). Area ratio = (A2)/(A1)
- Since the area ratio is less than 1, spool meter-in downstream pressure < maximum load pressure, and the oil flow is divided greater than by the area ratio of the opening.

Supply of LS pressure
(LS shuttle valve)



1. Hydraulic pump
2. Main spool
3. Pressure compensation valve
4. Valve
5. Check valve
6. LS circuit
7. LS shuttle valve

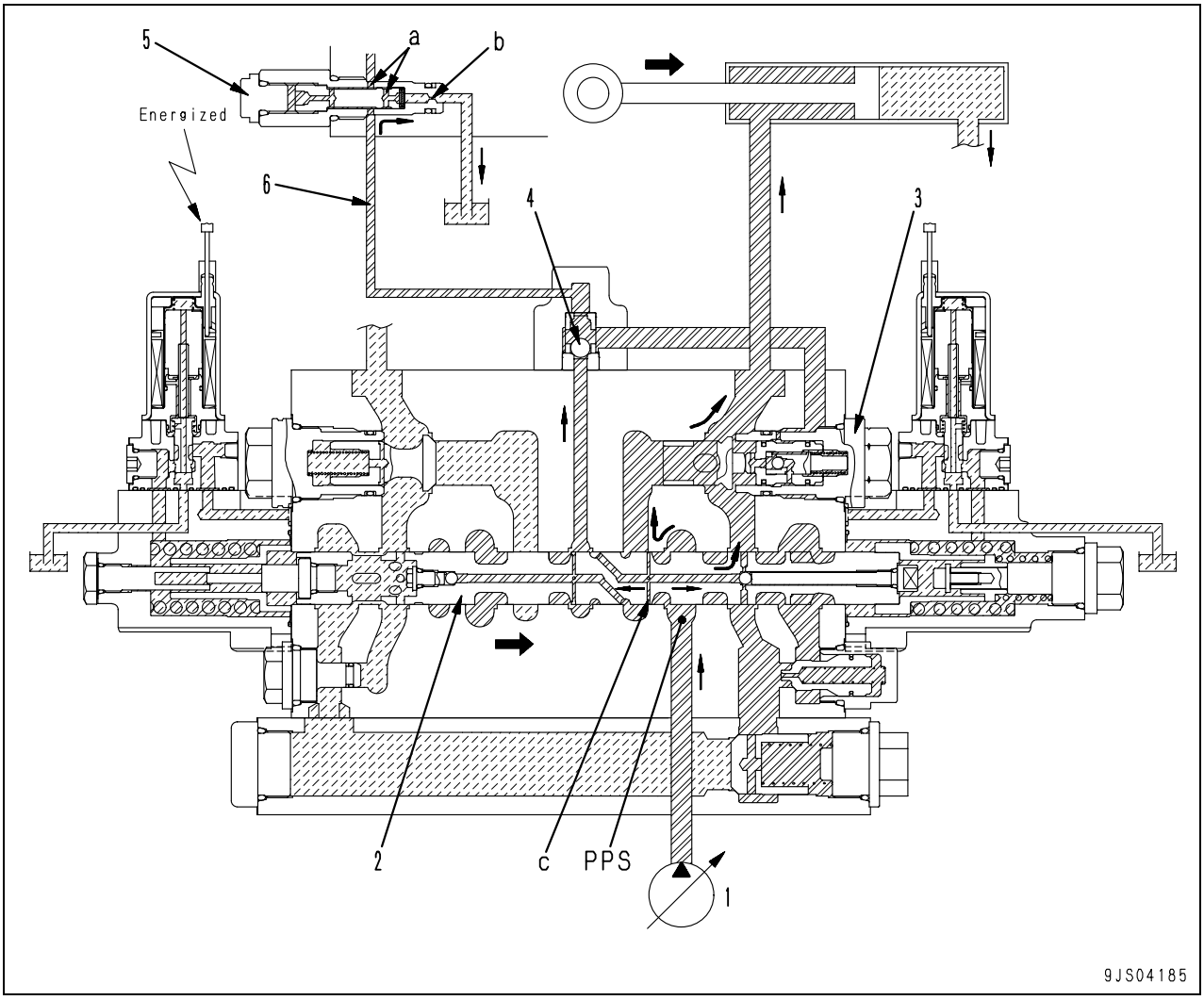
Function

- The LS pressure (PLS) means the actuator load pressure on the outlet side of the control valve.
- Pressure compensation valve (3) upstream pressure (spool meter-in downstream pressure) is led through main spool (2) to LS shuttle valve (7).
- Connected to actuator port (B) through valve (4), and makes LS pressure ≒ actuator load pressure.
- Inlet pore (a) inside main spool (2) has a small diameter concurrently serving as a throttle.

Operation

- If main spool (2) is operated, pump discharge pressure (PPS) flows to actuator circuit (B).
- Pump discharge pressure (PPS) is led through orifice (a) of main spool (2) to LS circuit (PLS).
- When actuator circuit (B) rises to necessary pressure level, pump discharge pressure (PPS) rises.
- Check valve (5) in main spool (2) opens and the high pressure in LS circuit (PLS) flows out to actuator circuit (B).
- Pressure in LS circuit (PLS) becomes approximately equal to that of actuator circuit pressure (B).

LS bypass plug

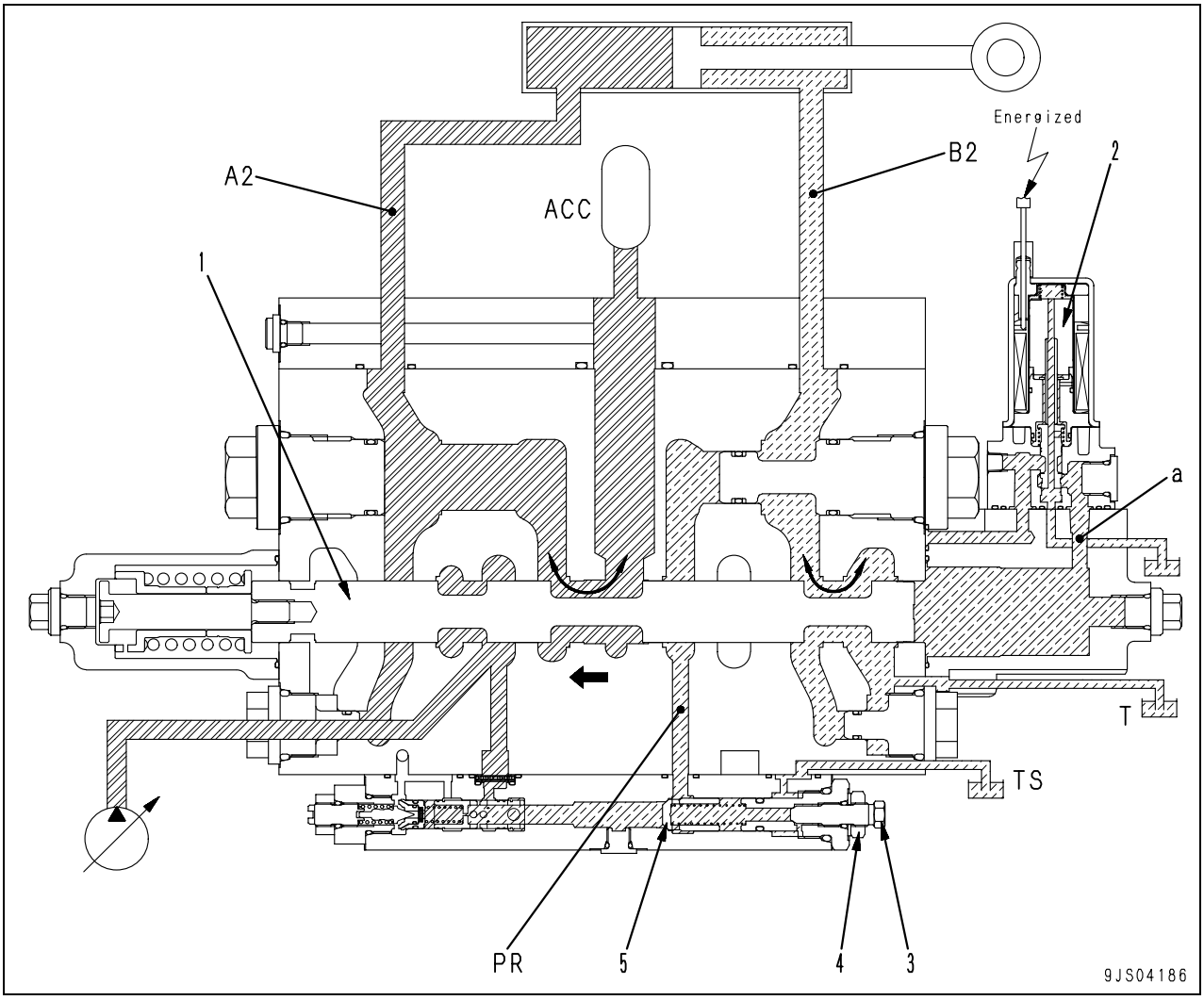


1. Hydraulic pump
2. Main spool
3. Pressure compensation valve
4. LS shuttle valve
5. LS bypass plug
6. LS circuit

Function

- Releases the residual pressure in LS pressure circuit (6) from orifices (a) and (b).
- Slows down the rising rate of LS pressure to prevent a sudden change of hydraulic pressure.
- Bypass flow from LS bypass plug (5) causes a pressure loss to be generated due to the circuit resistance between throttle (c) of main spool (2) and LS shuttle valve (4).
- Effective LS differential pressure drops to improve a dynamic stability of the actuator.

ECSS control valve



Function

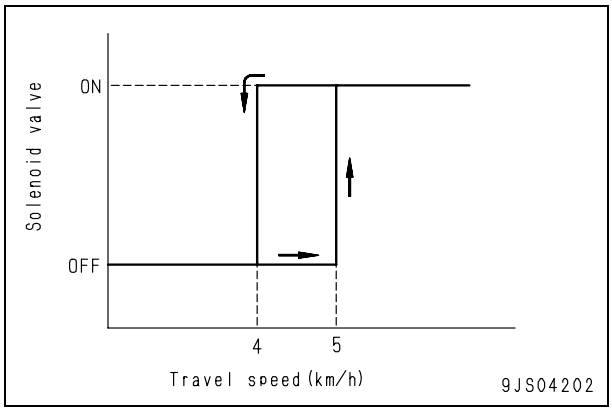
- The controller automatically turns on and off the accumulator charged with high-pressure gas according to the travel condition.
- The ECSS control valve gives elasticity to the vertical movement of the work equipment and reduces rocking of the machine body during high-speed travel to improve the operator comfort and prevent spillage of material for higher working efficiency.

Operation

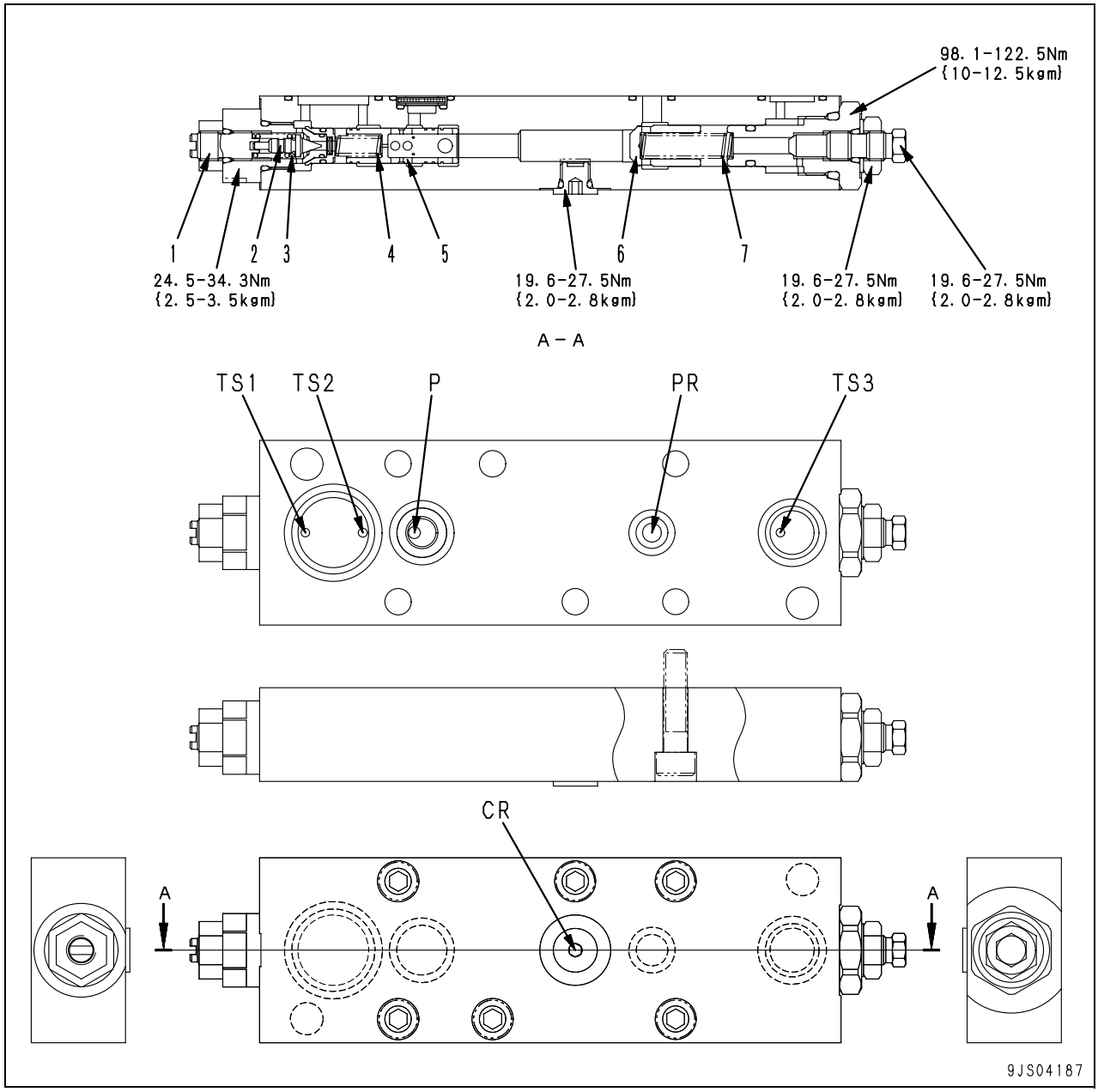
- If the travel speed exceeds 5 km/h, the signal is sent to solenoid valve (2) and the pressure is applied to (a).
- Spool (1) moves to the right.
- As spool (1) moves, the line from (PR) to accumulator (ACC) is closed and the lines from (A2) to accumulator (ACC) and from (B2) to (T) are opened. As a result, the ECSS is turned ON.
- While the travel speed is below 4 km/h, the signal is not sent to solenoid valve (2) and spool (1) is in neutral. At this time, the line from (PR) to accumulator (ACC) is opened and accumulator (ACC) is charged.
- If accumulator (ACC) is charged up to the set pressure, check valve (5) is closed and the pressure in accumulator (ACC) does not rise any more.

Accumulator pressure relief valve

- If the pressure in accumulator (ACC) needs to be relieved, loosen plug (3) and nut (4) to open circuits (PR) and (TS).

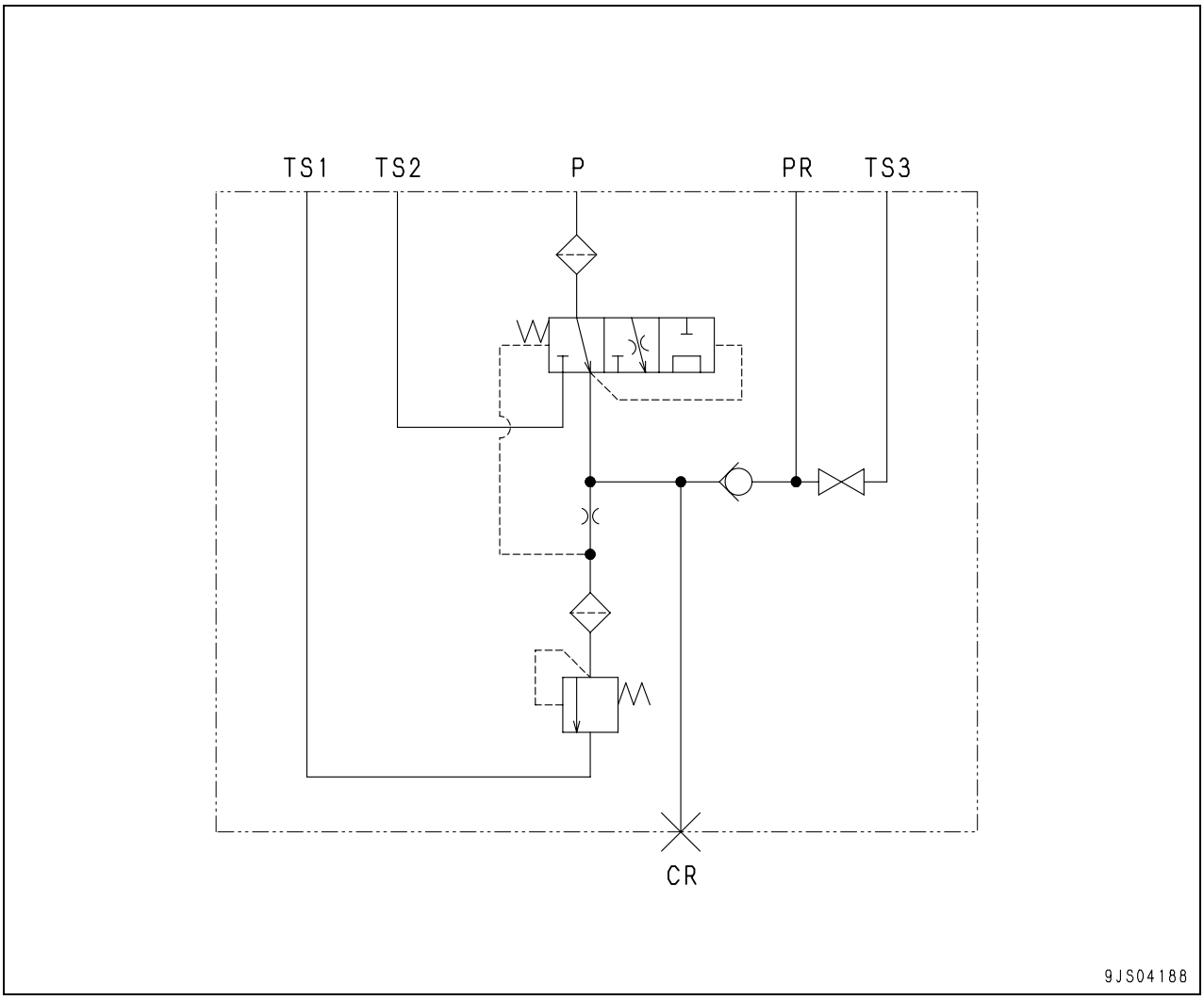


Accumulator charge valve

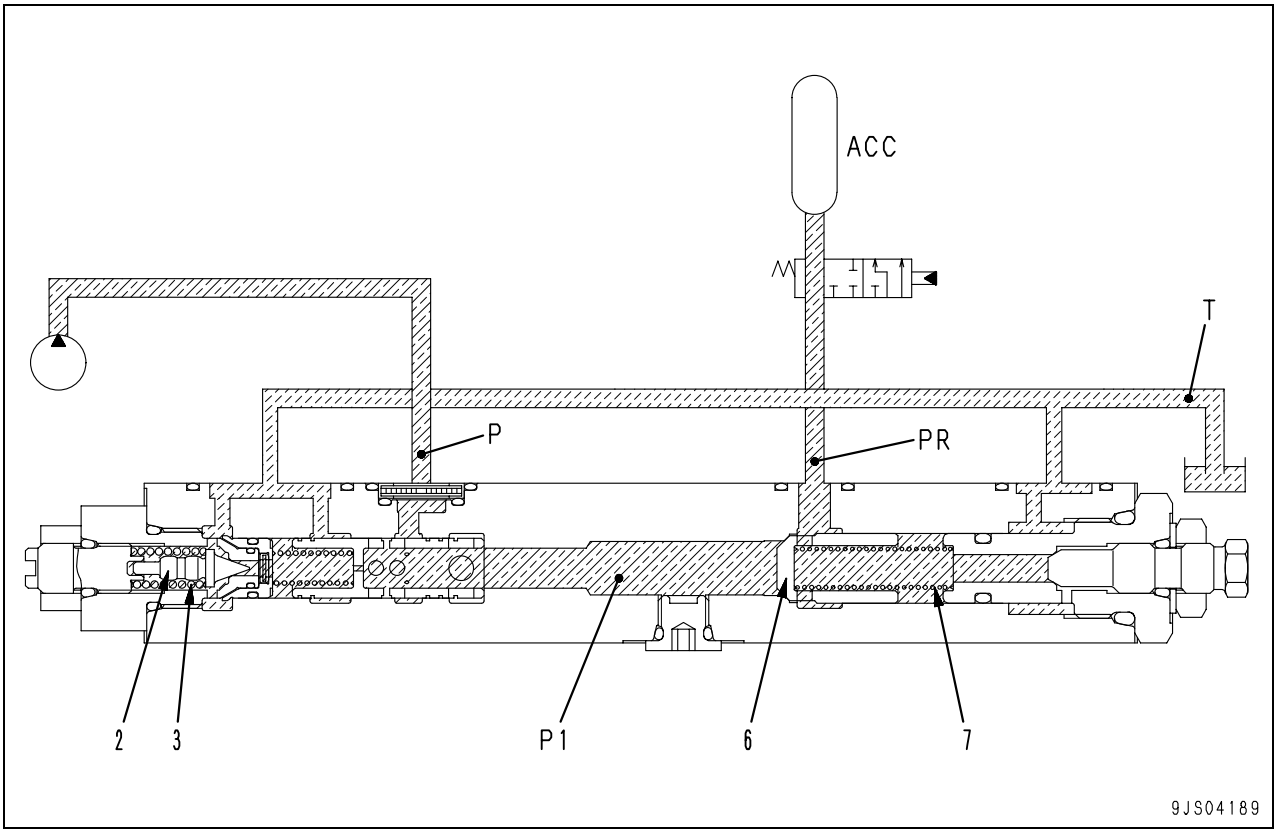


CR : Pressure pickup port
P : From main pump
PP : To the accumulator through ECSS spool
TS1 : To tank
TS2 : To tank
TS3 : To tank

1. Screw
2. Poppet (Safety valve)
3. Spring (Safety valve)
4. Spring (Main pressure reducing valve)
5. Pressure reducing valve spool
6. Poppet (Check valve)
7. Spring (Check valve)


TS1
TS2
P
PR
TS3
CR
9JS04188

1. When valve is in neutral and (P) is low



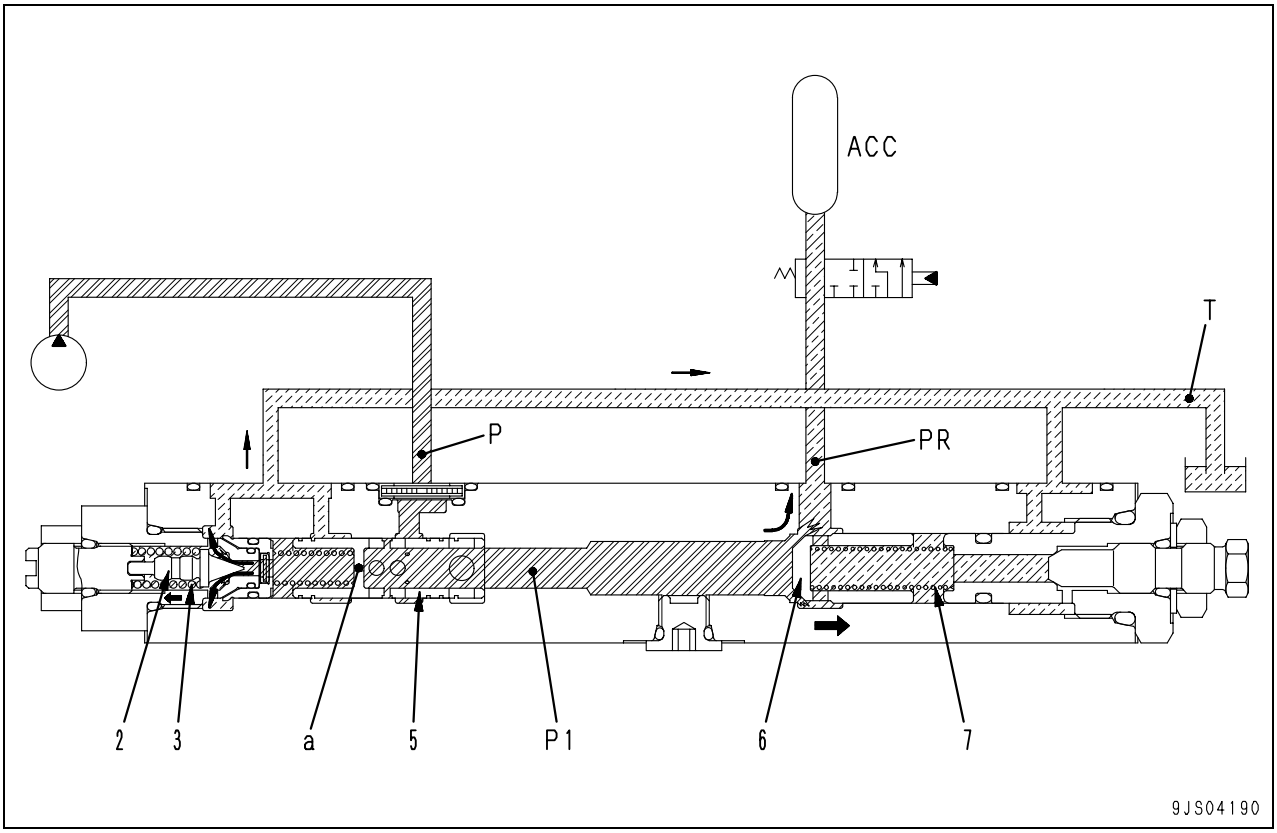
Function

- The discharge pressure of the hydraulic pump is reduced and the oil is supplied to the ECSS accumulator.

Operation

- Poppet (2) is pressed by spring (3) against the seat and the line from port (P1) to port (T) is closed.
- Poppet (6) is pressed to the left and the line from port (P1) to port (PR) is closed.
- Poppet (6) is moved to the right by pressure (P1) and the line from (P1) to (PR) is opened. If (P1) < (PR), poppet (6) is pressed to the left by spring (7) and the line from (P1) to (PR) is closed.

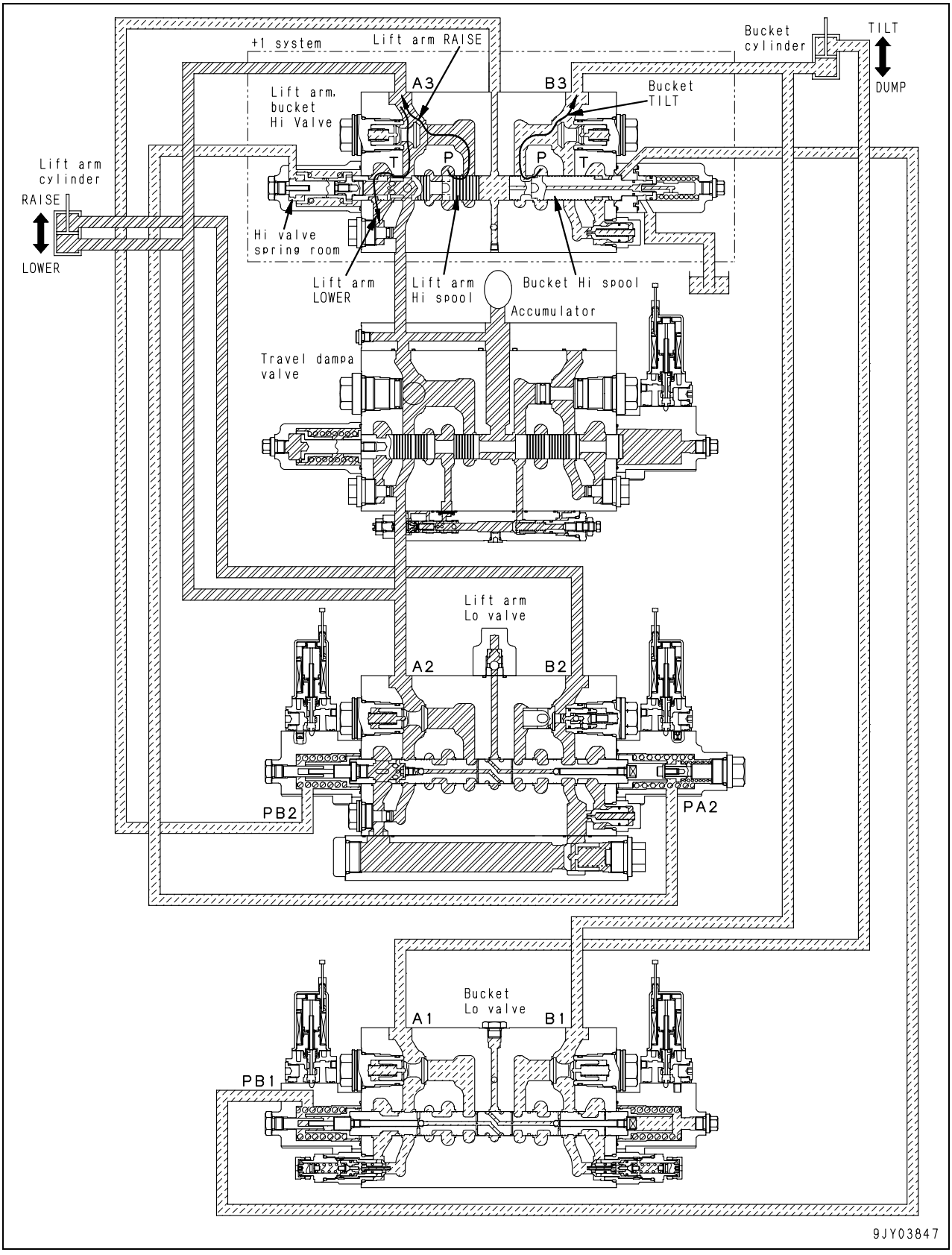
2. When load pressure (P) is high



Operation

- If pressure (P) rises above the set pressure, poppet (3) opens and the hydraulic oil flows through port (P1), hole (a) in spool (5), opening of poppet (2), and tank port (T).
- Accordingly, differential pressure is made before and after hole (a) in spool (5) and spool (5) moves to close the opening between ports (P) and (P1). Pressure (P) is reduced to a certain pressure (the set pressure) by the open area at this time and supplied as pressure (P1).

Explanation of operation of Hi valve



Operation

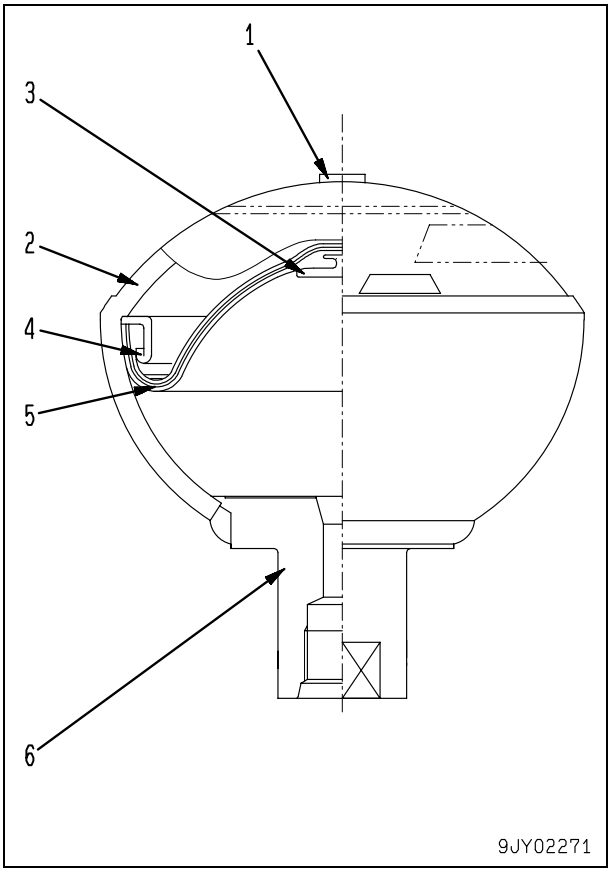
1. When lift arm is raised
   Pilot pressure (EPC valve output) is applied to Lo valve (PA2).
   Since this pressure is also applied to Hi valve spring chamber in parallel, lift arm Hi valve moves to right and oil from pump flows through port (P) to port (A).

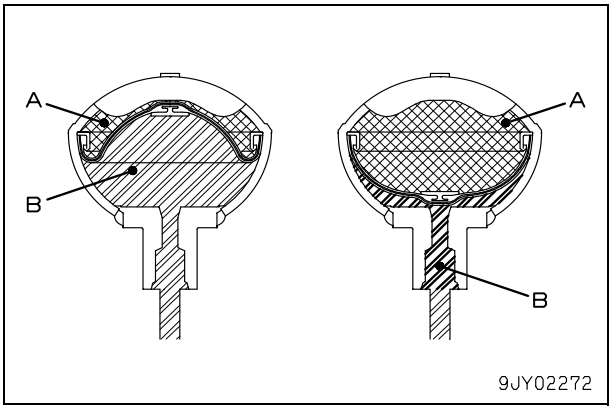
2. When lift arm is lowered
   Pilot pressure (EPC valve output) is applied to Lo valve (PB2).
   Since this pressure is also applied to chamber on opposite side of Hi valve spring chamber in parallel, lift arm Hi valve moves to left and (meter-out) oil flows through port (A3) to port (T).
   When pilot pressure is applied to Lo valve (PB2), bucket Hi valve is also pressurized. Since bucket Hi valve has a hole at center of its spool and chambers on right and left chambers of spool are connected, however, pressure is applied to both of those chambers simultaneously, thus spool does not move.

3. When bucket is tilted
   Pilot pressure (EPC valve output) is applied to Lo valve (PB1).
   Bucket Hi valve has piston, unlike lift arm Hi valve.
   Piston chamber is pressurized and spool moves to right, thus oil from pump flows through port (P) to port (B3).

		Lo valve	Hi valve
Lift arm	Raise	○	○
	Lower	○	○
Bucket	Tilt	○	○
	Dump	○	—

Accumulator (for PPC circuit)





1. Gas plug
2. Shell
3. Poppet
4. Holder
5. Bladder
6. Oil port

Specifications

Type of gas : Nitrogen gas
Amount of gas : 500 cc
Max. operating pressure : 3.92 MPa {40 kg/cm^2}
Min. operating pressure : 0 MPa {0 kg/cm^2}

Function

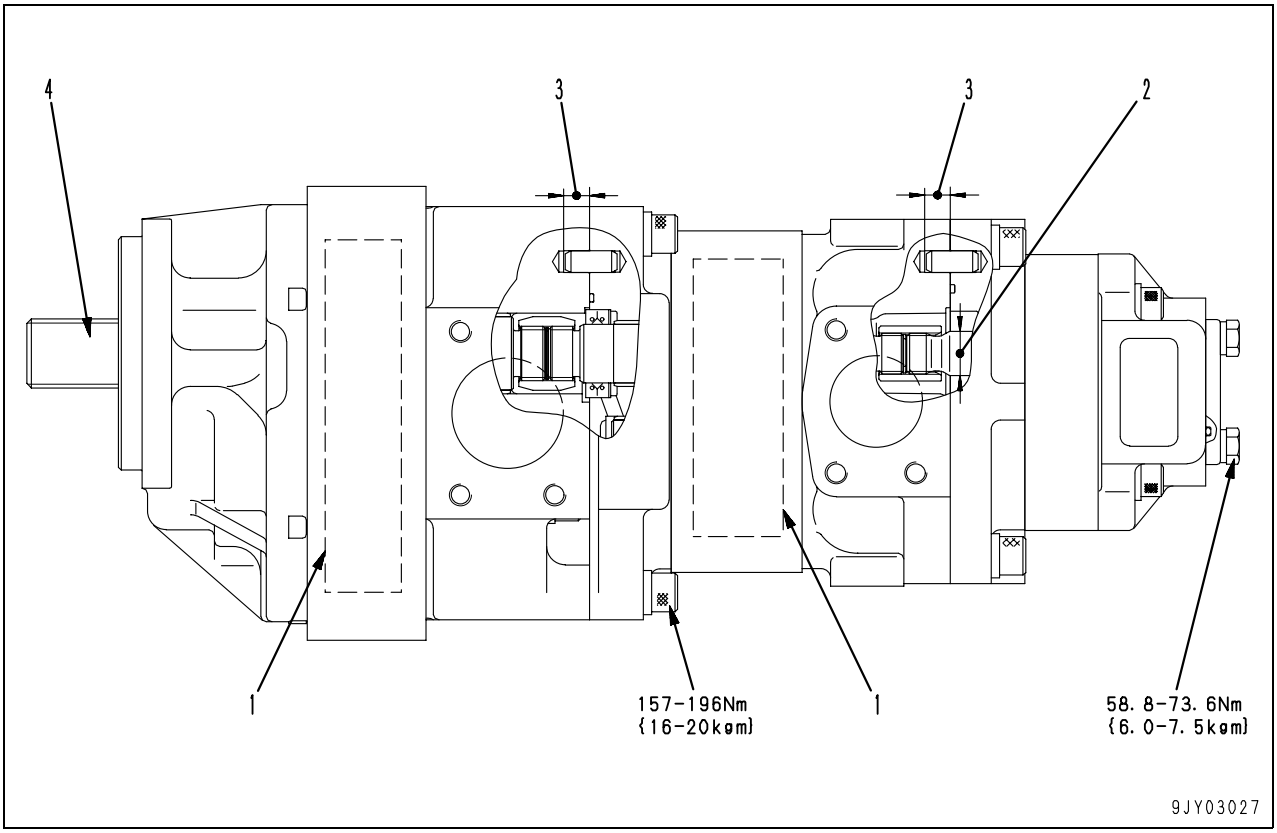
- Accumulator is installed between the charge valve and work equipment valve. In the case the engine is stopped with the lift arm lifted up, compressed nitrogen gas pressure in the accumulator feeds the pilot oil pressure to the work equipment valve for operation. Thus the lift arm and bucket are enabled to descend under own weight.

Operation

- After engine is stopped, chamber (A) in the bladder is compressed by oil pressure in chamber (B).
- When work equipment EPC solenoid is tripped by operating the work equipment EPC lever, pressure inside nitrogen gas chamber (A) expands the bladder, and the oil in chamber (B) operates the work equipment valve as the pilot pressure.

Triple pump

Power train, Hydraulic oil cooling, brake and EPC pump
SAL(4)160+(3)100+(2)32



Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between body and spool	Type	Tolerance		Repair limit		Replace
		SAL(4)-160	0.11 – 0.16		0.20		
		SAL(3)-100	0.10 – 0.15		0.19		
		SAL(2)-32					
2	Clearance between inside diameters of plain bearing and gear shaft	SAL(4)-160	0.06 – 0.14		0.20		
		SAL(3)-100	0.06 – 0.149				
		SAL(2)-32	0.06 – 0.125				
3	Driven depth of pin	Type	Standard size	Tolerance		Repair limit	
		SAL(4)-160	21	0 –0.5		—	
		SAL(3)-100	14				
		SAL(2)-32	12				
4	Rotation torque of spline shaft	19.6 – 33.3 Nm {2.0 – 3.4 kgm}					
—	Discharge oil: EO10-CD Oil temperature: 45 – 55°C	Type	Speed (rpm)	Discharge pressure (MPa {kg/cm^2})	Standard discharge (ℓ/min)	Allowable discharge (ℓ/min)	—
		SAL(4)-160	2,200	20.6 {210}	328.3	303.3	
		SAL(3)-100		30 {2.9}	210	183.5	
		SAL(2)-32		20.6 {210}	62.7	56.0	

WA600-6 Wheel loader

Form No. SEN02456-00

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

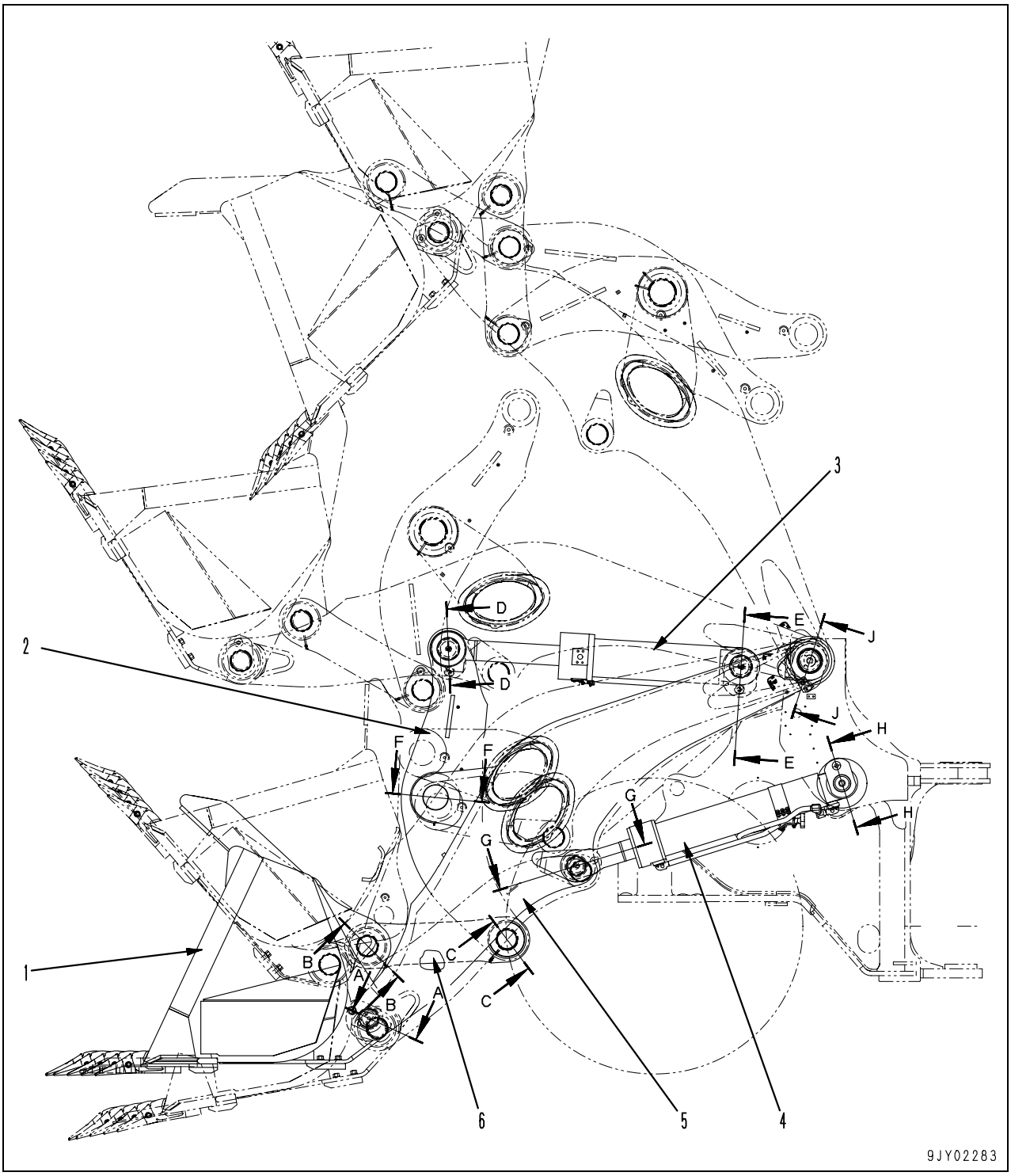
10 Structure, function and maintenance standard

Work equipment

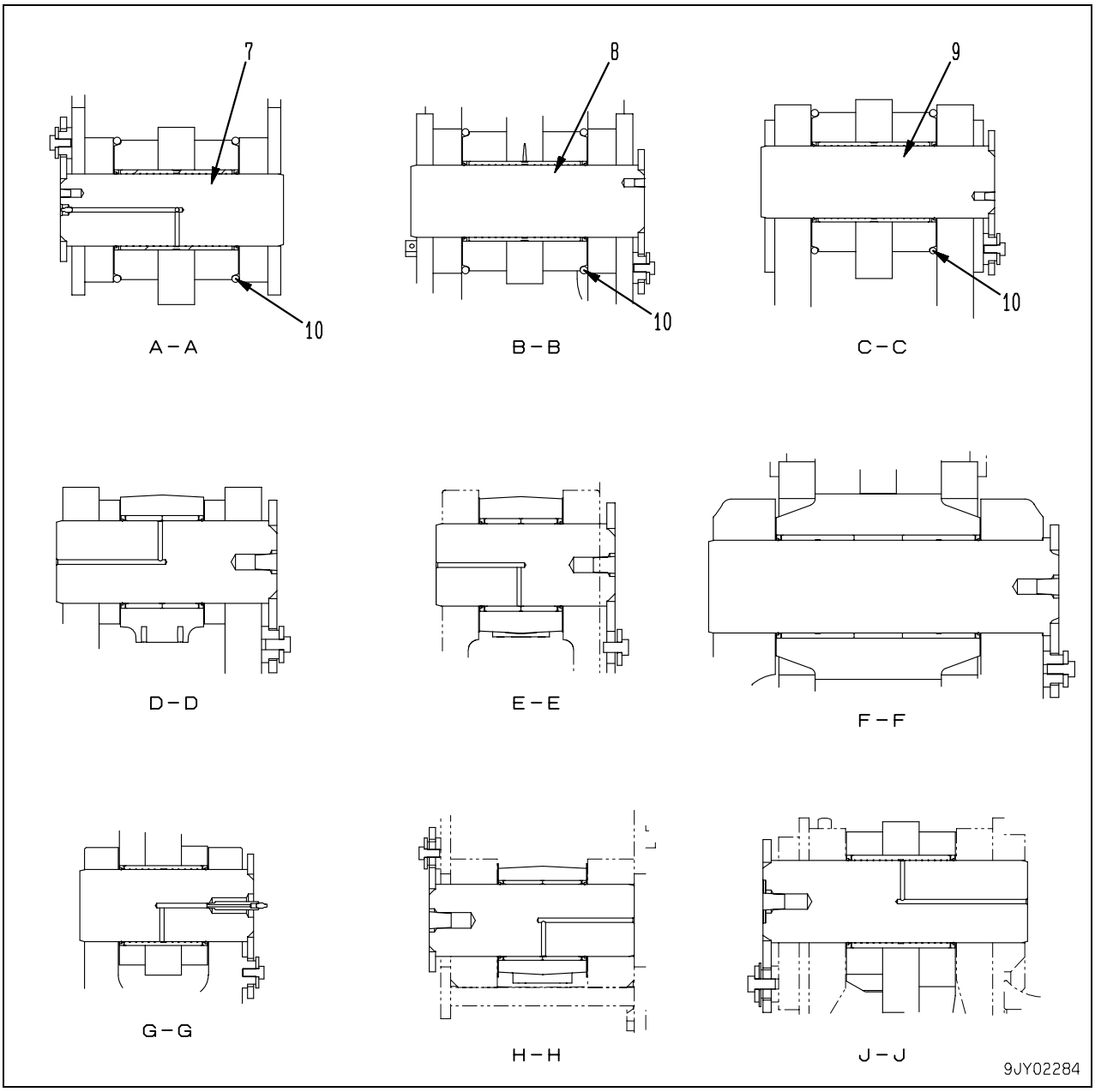
Work equipment 2
Work equipment linkage 2
Bucket 6
Bucket positioner and boom kick-out 8
Work equipment lubrication 9

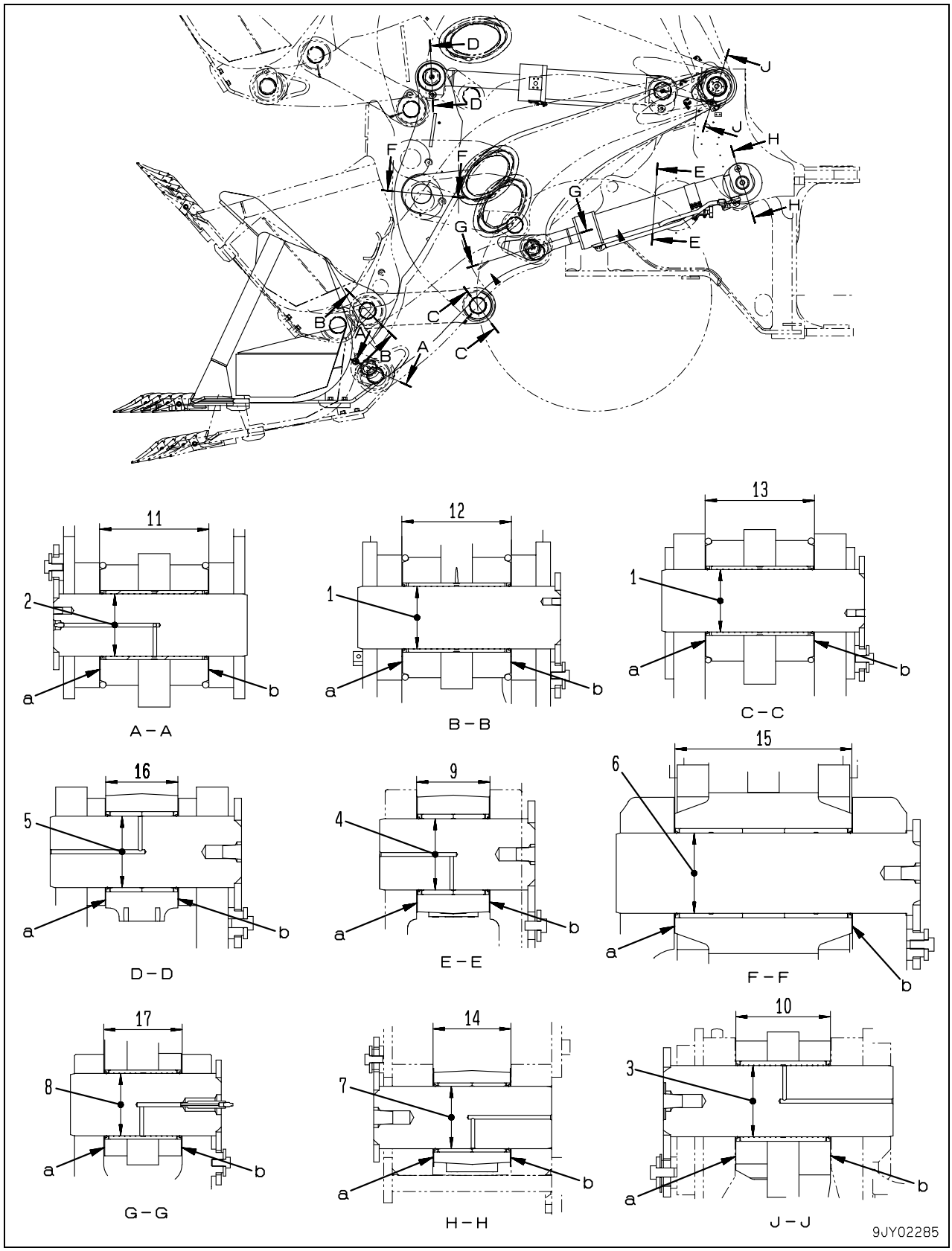
Work equipment

Work equipment linkage



1. Bucket
2. Bell crank
3. Bucket cylinder
4. Lift arm cylinder
5. Lift arm
6. Bucket link
7. Bucket hinge pin
8. Bucket hinge pin
9. Bell crank pin
10. Cord ring

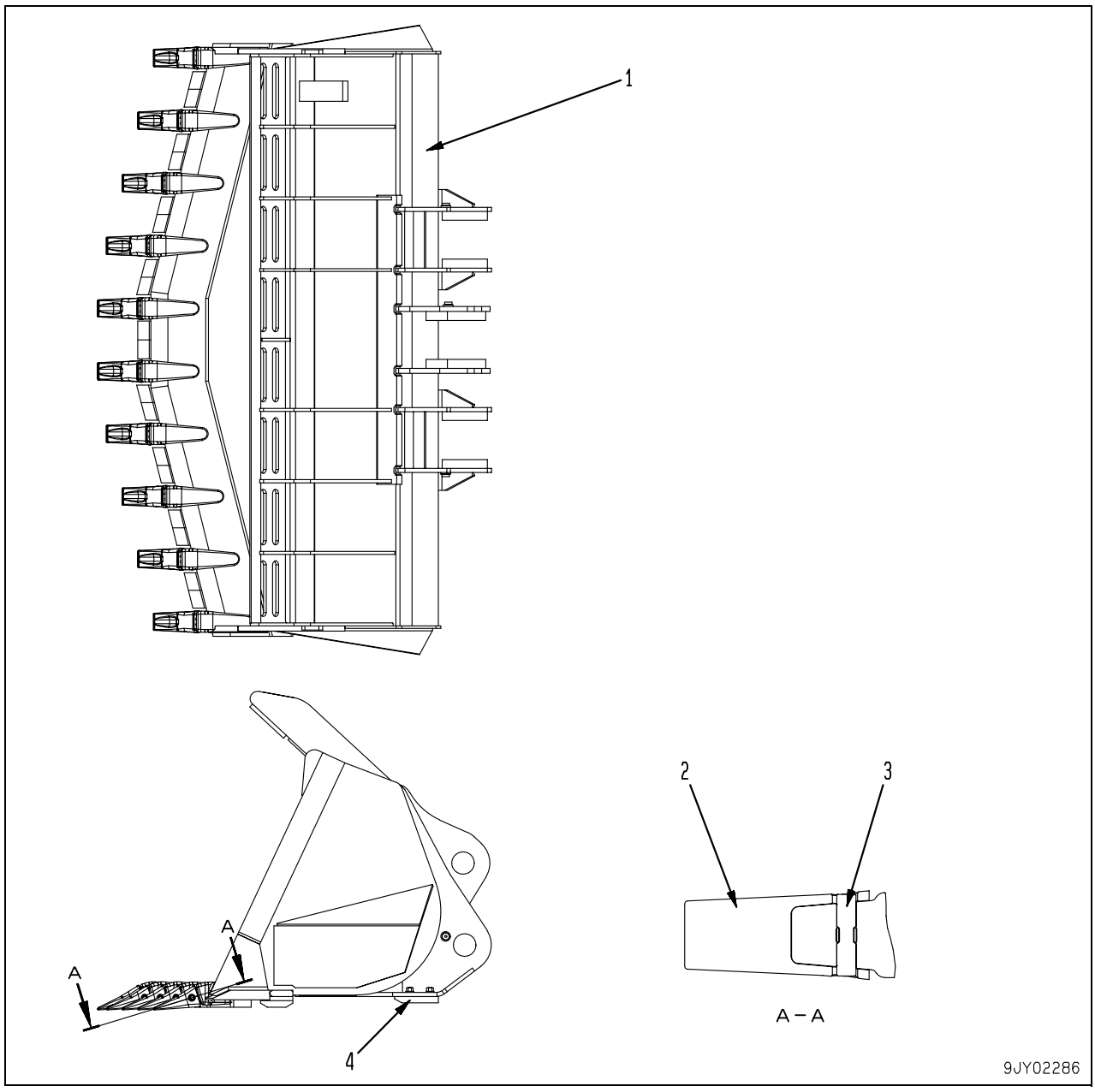

7
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C – C
D – D
E – E
F – F
G – G
H – H
J – J
9JY02284


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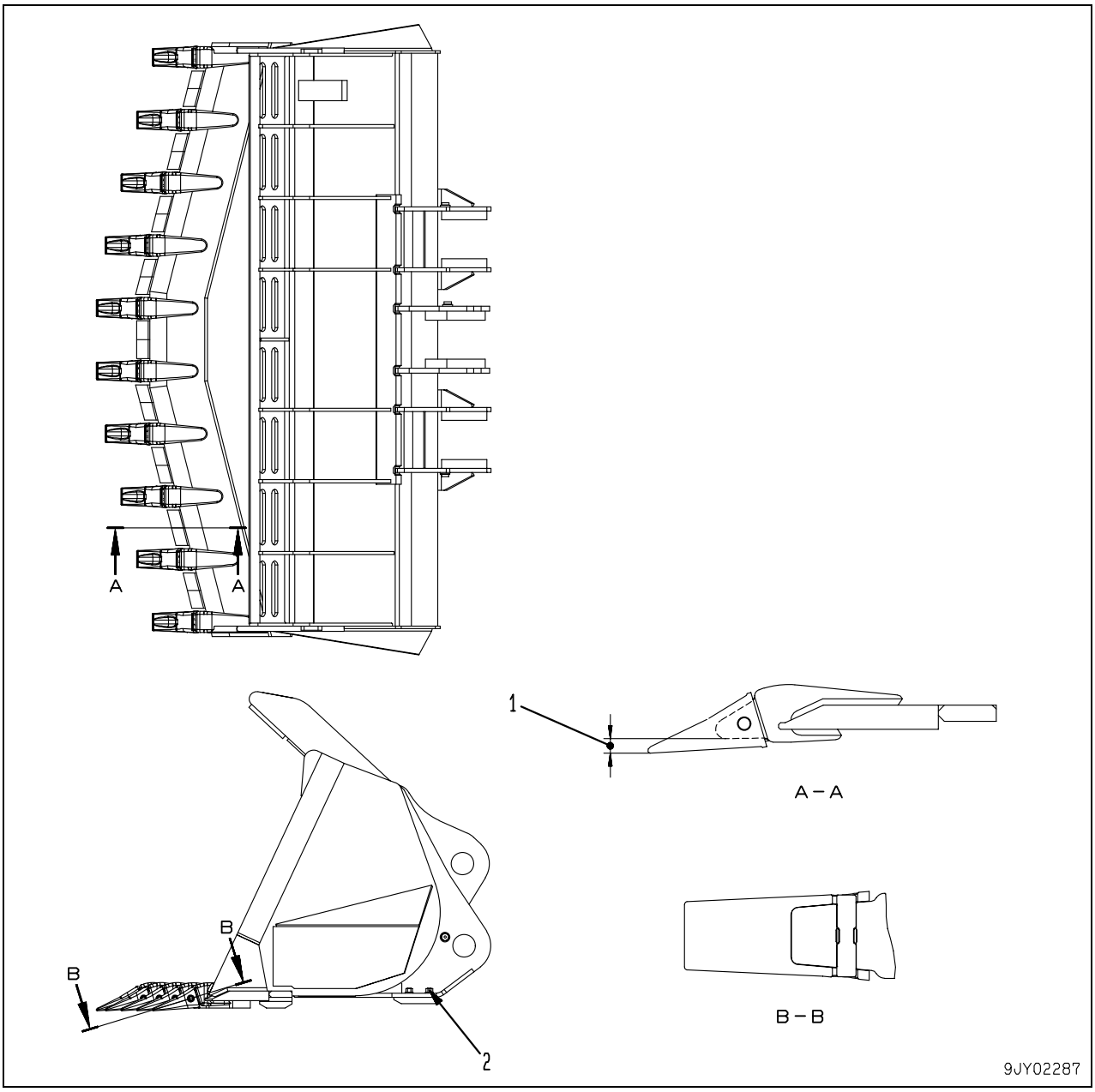
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between bushing and pin at each end of bucket link	140	–0.043 –0.106	+0.215 +0.115	0.158 – 0.321	1.0	Replace
2	Clearance between bushing and pin connecting lift arm and bucket	140	–0.043 –0.106	+0.215 +0.115	0.158 – 0.321	1.0	
3	Clearance between bushing and pin connecting lift arm and frame	160	–0.043 –0.106	+0.215 +0.115	0.158 – 0.321	1.0	
4	Clearance between bushing and pin connecting bucket cylinder bottom and frame	160	–0.043 –0.106	+0.215 +0.115	0.158 – 0.321	1.0	
5	Clearance between bushing and pin connecting bucket cylinder rod and bell crank	160	–0.043 –0.106	+0.215 +0.115	0.158 – 0.321	1.0	
6	Clearance between bushing and pin connecting bell crank and lift arm	180	–0.043 –0.106	+0.215 +0.115	0.158 – 0.321	1.0	
7	Clearance between bushing and pin connecting lift cylinder bottom and frame	140	–0.043 –0.106	+0.215 +0.115	0.158 – 0.321	1.0	
8	Clearance between bushing and pin connecting lift cylinder rod and lift arm	140	–0.043 –0.106	+0.215 +0.115	0.158 – 0.321	1.0	
9	Connecting part of bucket cylinder and frame	Boss to boss width		Width of hinge		Standard (a+b) clearance	Insert shims to both sides so that clearance will be below 1.5 mm on each side.
		163 ± 0.8		160±1.2		1.0 – 5.0	
10	Connecting part of lift arm and frame	214 ± 1.5		210(+1/–2)		1.5 – 7.5	
11	Connecting part of lift arm and bucket	243(+1.5/0)		240(+1/–2)		2.0 – 6.5	—
12	Connecting part of bucket link and bucket	243(+1.5/0)		240(+1/–2)		2.0 – 6.5	
13	Connecting part of bell crank and bucket link	243 ± 2		240(+1/–2)		0 – 7.0	Insert shims to both sides so that clearance will be below 1.5 mm on each side.
14	Connecting part of lift cylinder and frame	174 ± 1.5		170±1.2		1.3 – 6.7	
15	Connecting part of bell crank and lift arm	396 ± 0.5		393±0.5		2.0 – 4.0	
16	Connecting part of bucket cylinder and bell crank	163 ± 2		160±1.2		0.2 – 6.2	
17	Connecting part of lift arm and lift cylinder	174 ± 1.5		170(+1/–2)		2.5 ± 7.5	

Bucket



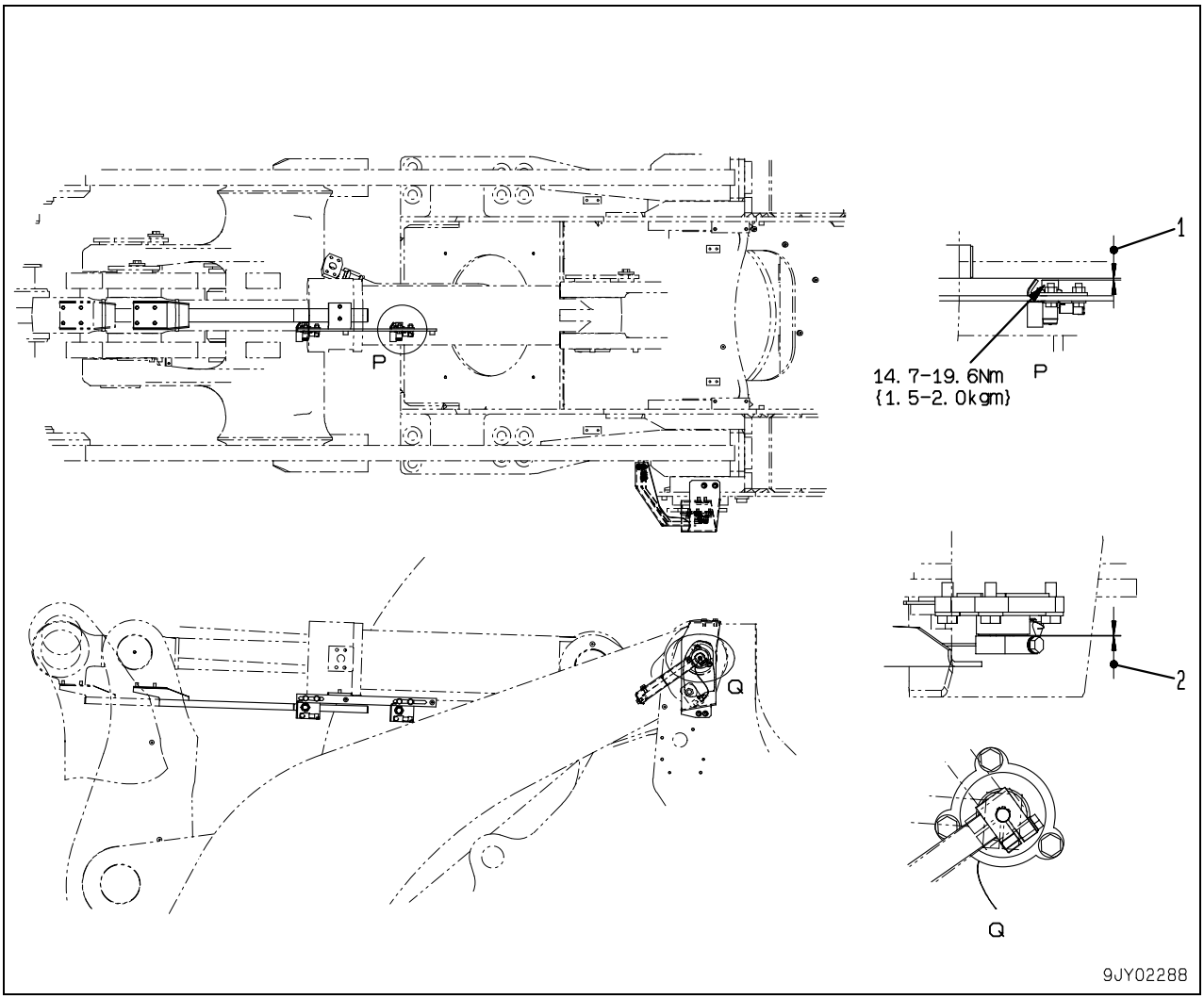
1. Bucket
2. Tip tooth
3. Pin
4. Wear plate



Unit: mm

No.	Check item	Criteria		Remedy
1	Wear of bucket tooth, tip type	Standard size	Repair limit	Replace
		35	0	
2	Tightening torque of bucket wear plate mounting bolt	745 ± 108 Nm {76 ± 11 kgm}		Retighten

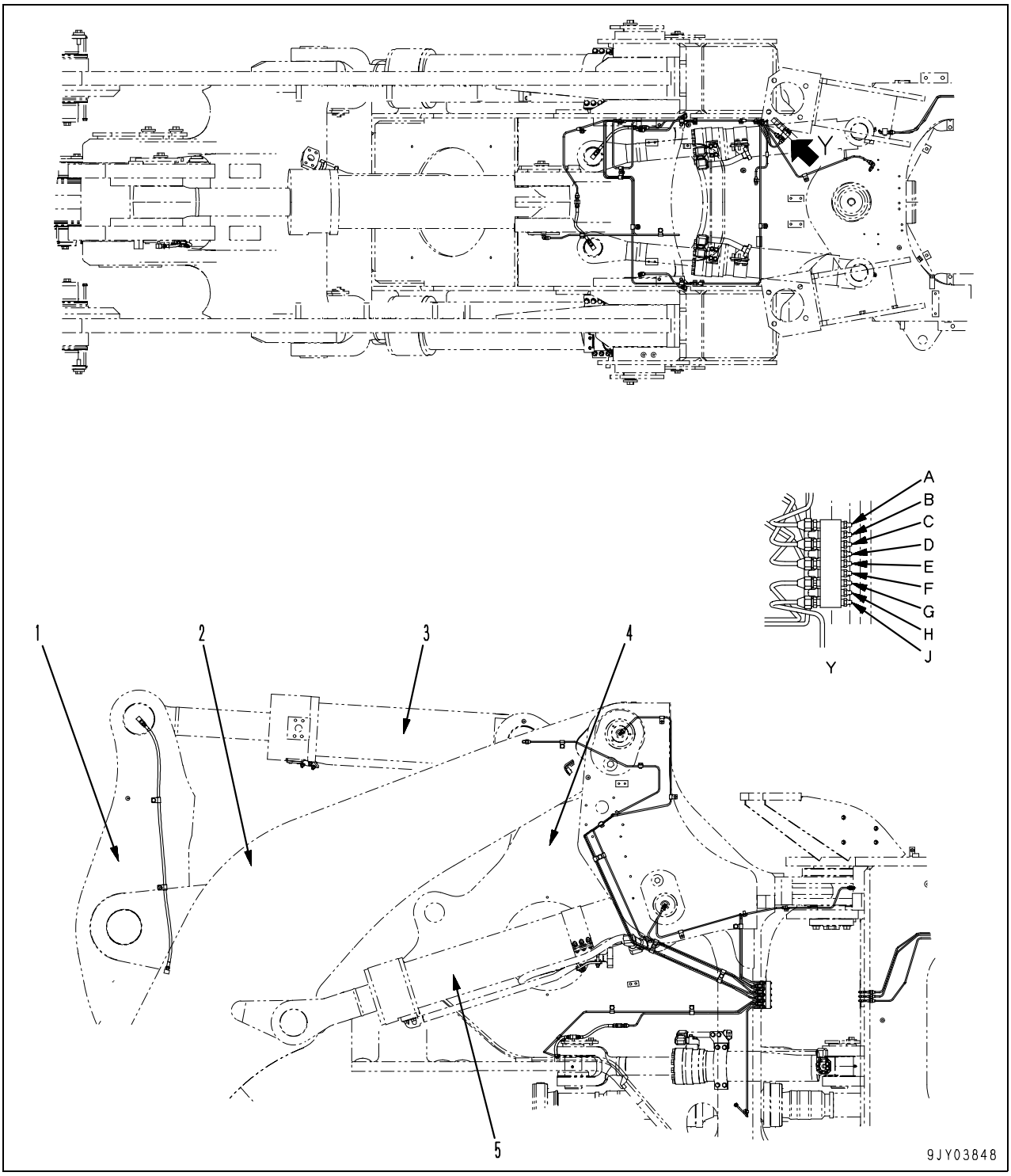
Bucket positioner and boom kick-out



Unit: mm

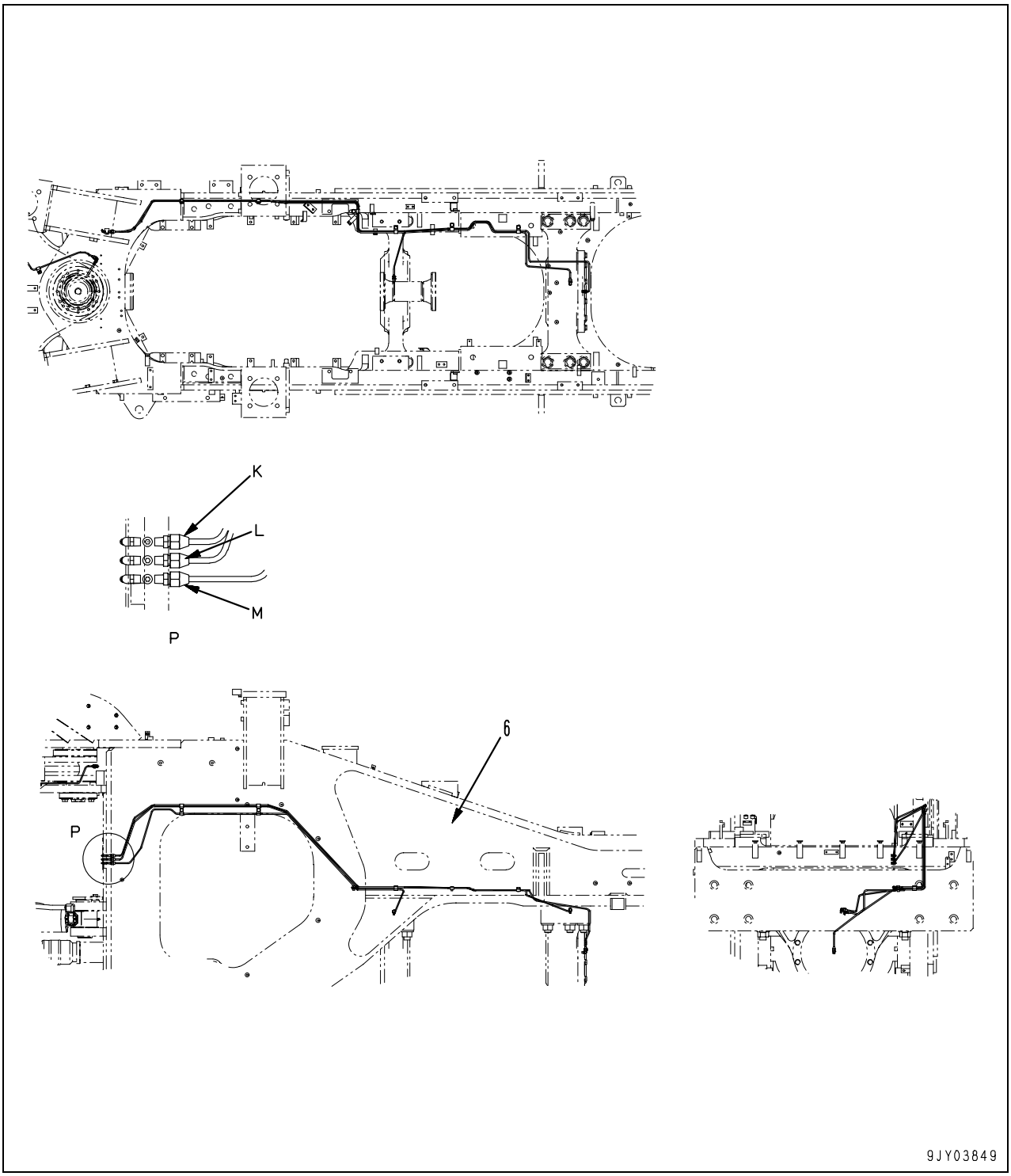
No.	Check item	Criteria	Remedy
1	Clearance of bucket positioner switch	3 – 5	Adjust
2	Clearance in lift arm position detector sensor	0.5 – 1	

Work equipment lubrication



1. Bell crank
2. Lift arm
3. Bucket cylinder
4. Front frame
5. Lift cylinder
6. Rear frame

A: Center hinge, upper side
B: Lift arm cylinder, left side
C: Lift arm cylinder, right side
D: Lift arm pin, right side
E: Bucket cylinder, bottom side
F: Lift arm pin, left side
G: Steering cylinder head, left side
H: Steering cylinder head, right side
J: Center support



K: Rear axle, rear side
L: Rear axle, top side
M: Rear axle, front side

WA600-6 Wheel loader

Form No. SEN00408-01

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

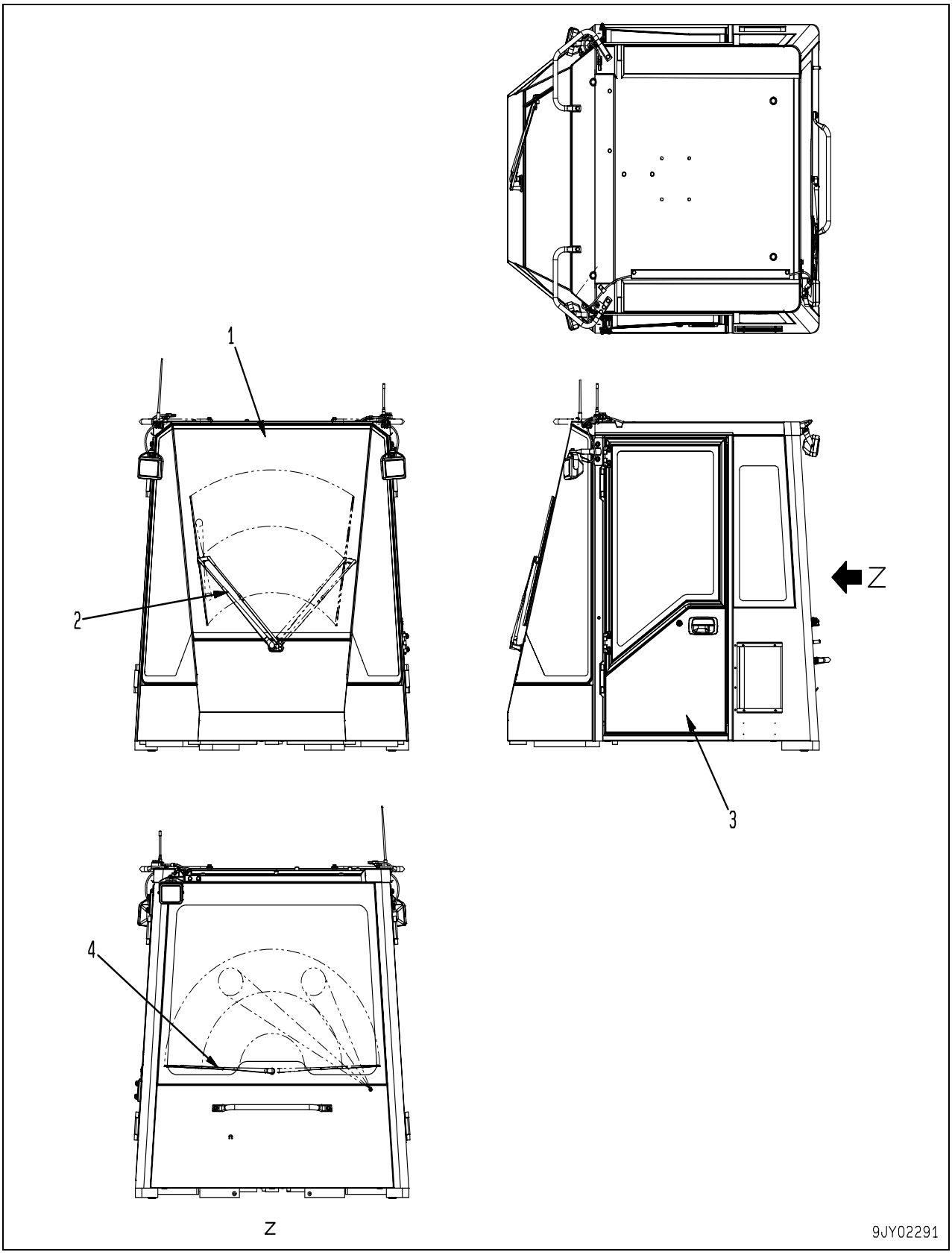
10 Structure, function and maintenance standard

Cab and its attachments

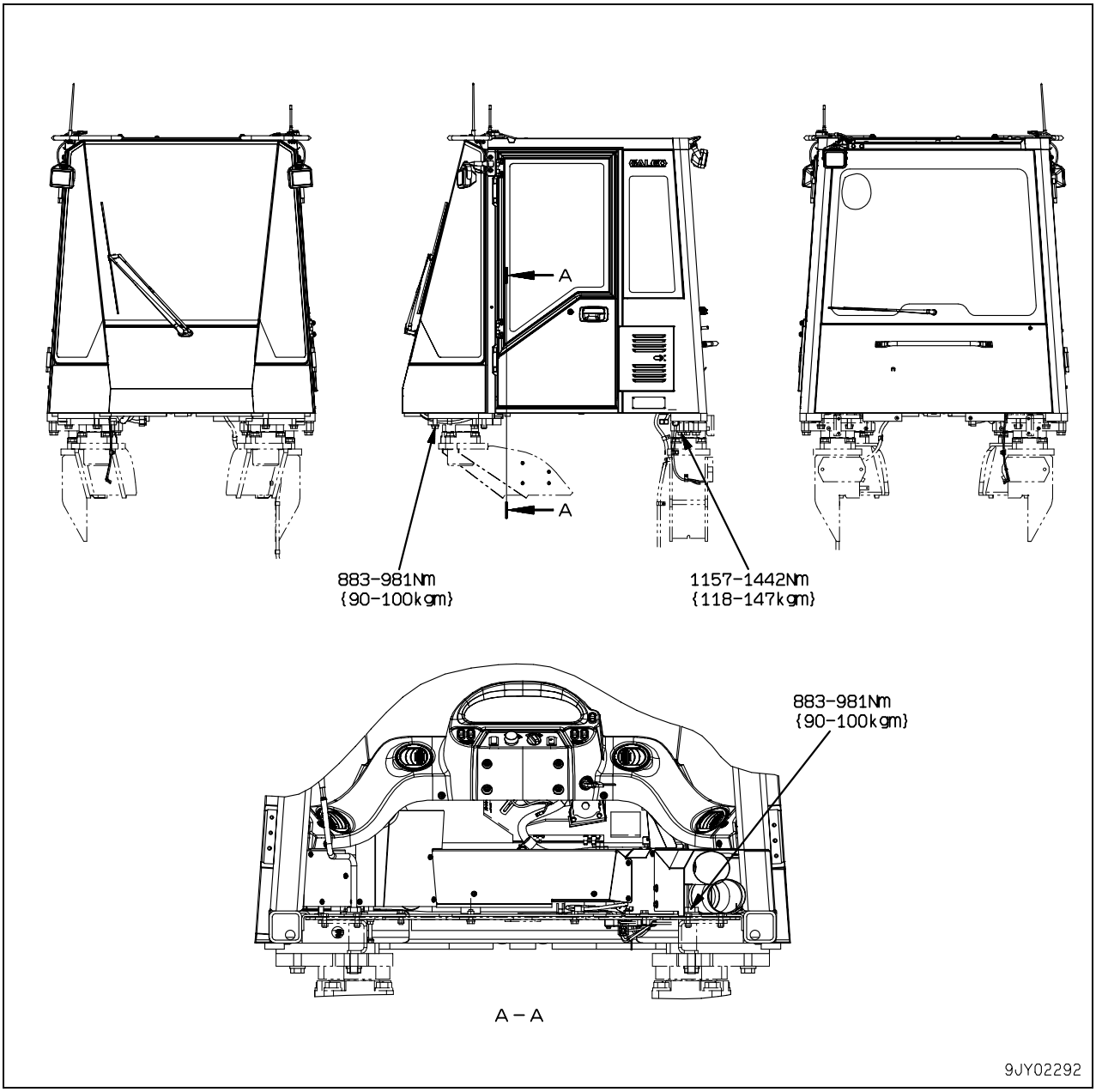
Cab and its attachments 2
ROPS cab 2
Air conditioner 4

Cab and its attachments

ROPS cab

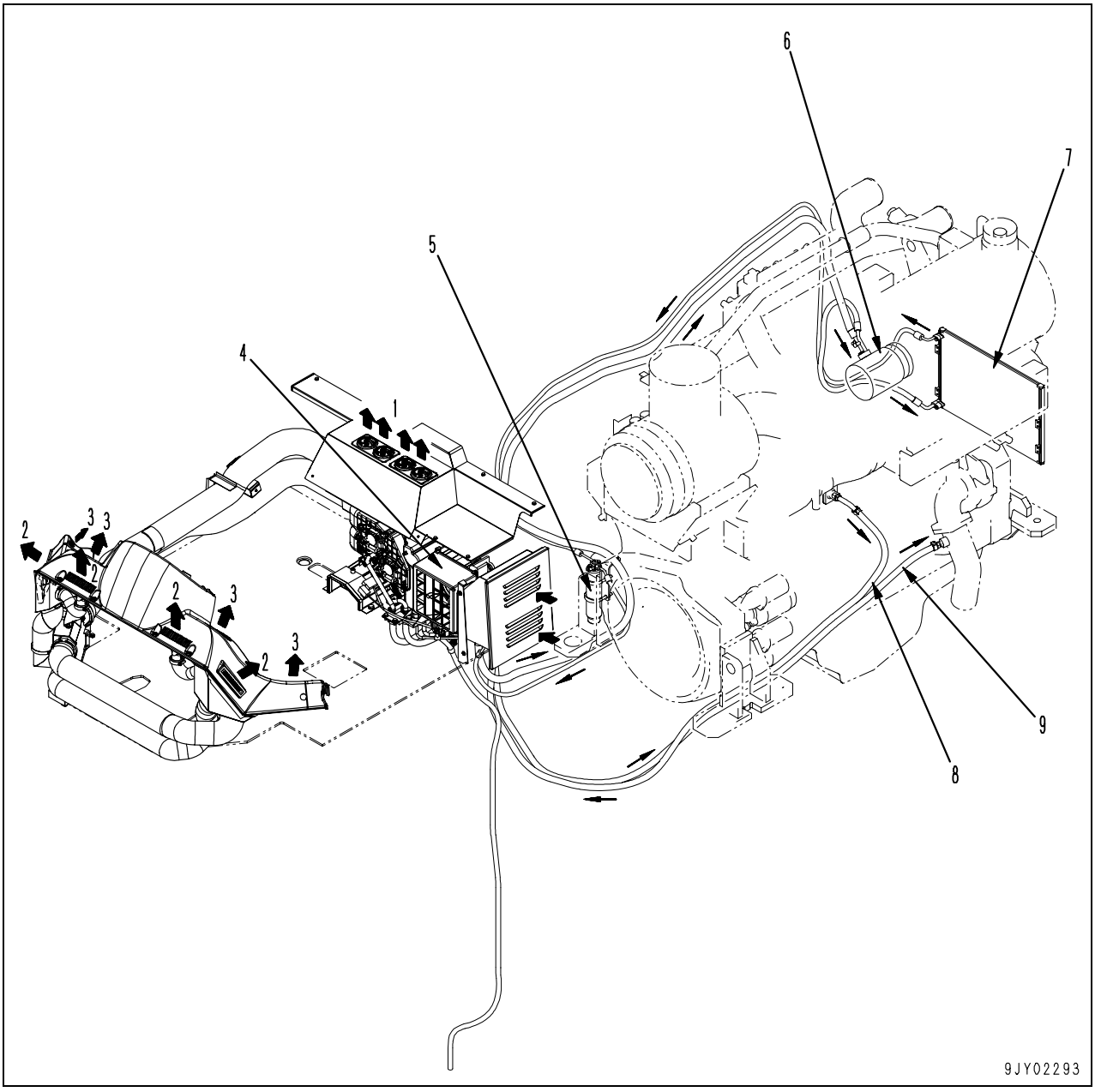


1. Front glass
2. Front wiper
3. Door
4. Rear wiper


A
A
883-981Nm
{90-100kgm}
1157-1442Nm
{118-147kgm}
883-981Nm
{90-100kgm}
A – A
9JY02292

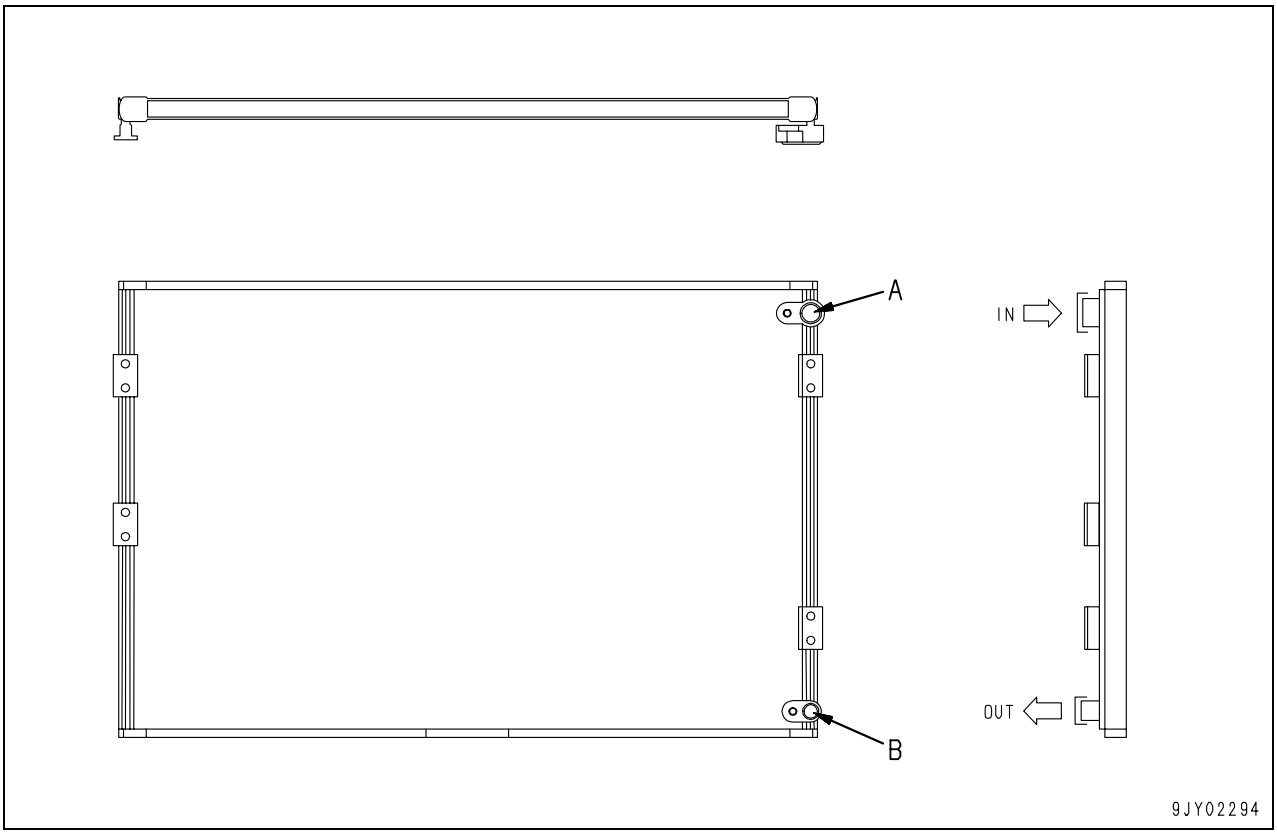
Air conditioner

Air conditioner piping



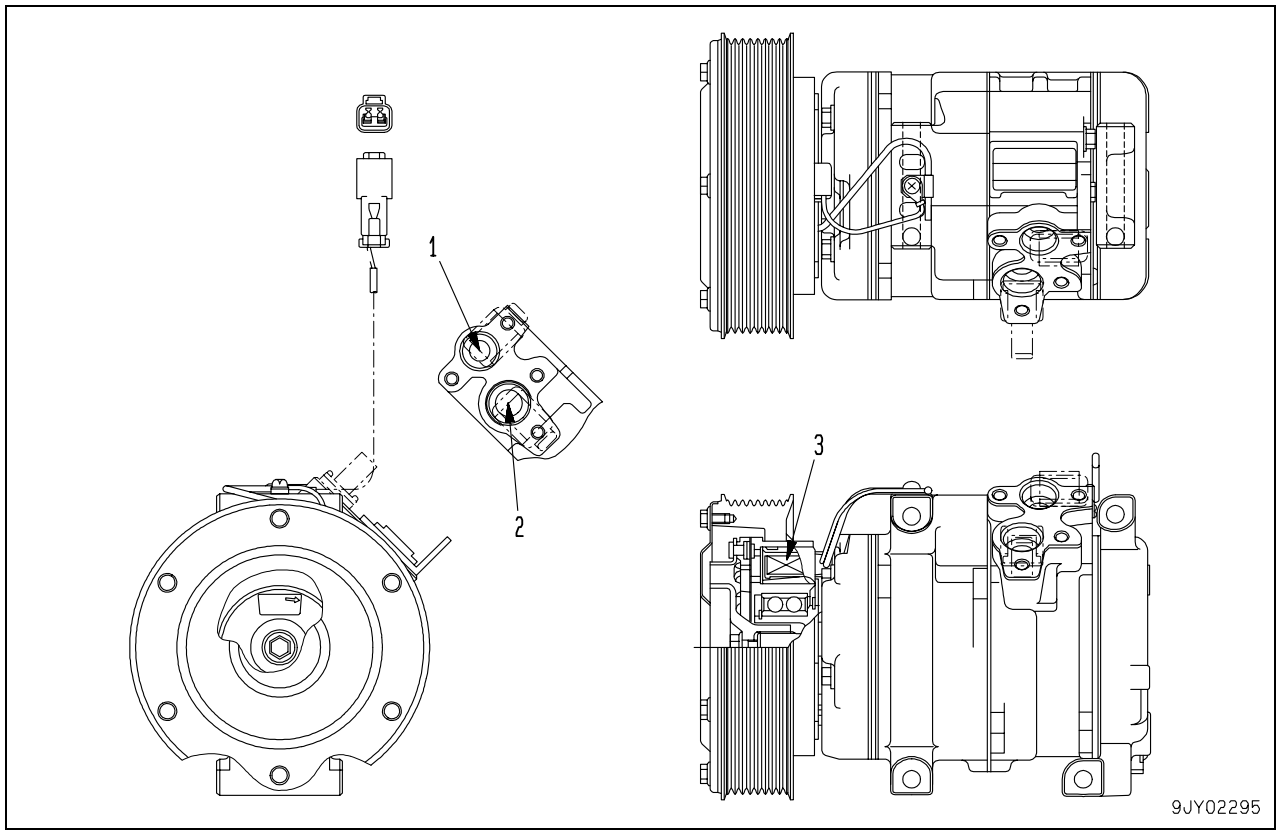
1. Air outlet duct
2. Defroster window
3. Air outlet duct
4. Air conditioner unit
5. Dry receiver
6. Compressor
7. Air conditioner condenser
8. Hot water take-out port
9. Hot water return port

Air conditioner condenser



A: Refrigerant gas inlet port
B: Refrigerant gas outlet port

Air conditioner compressor

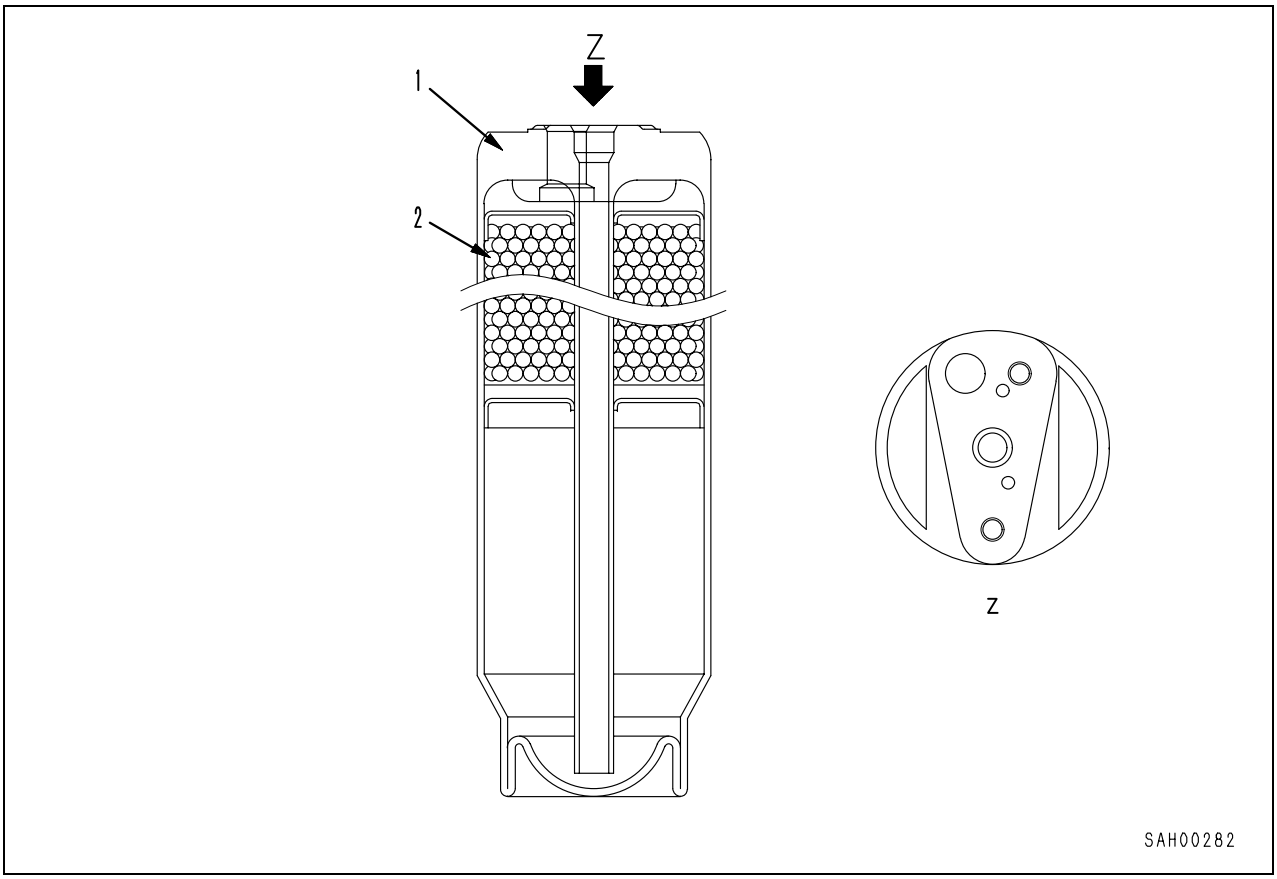


1. Refrigerant gas outlet port
2. Refrigerant gas inlet port
3. Clutch

Specifications

Type : Piston pump type
Specified refrigerant : R134a

Air conditioner dry receiver



1. Body
2. Dryer

WA600-6 Wheel loader

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

10 Structure, function and maintenance standard

Electrical system, Part 1

Electrical system, Part 1 2
Machine monitor system 2
Machine monitor 8

Electrical system, Part 1

Machine monitor system

Outline

- In the machine monitor system, each monitor on the network monitors and controls the vehicle condition with the sensors installed to various parts of the vehicle, and then sends the result as network information to the machine monitor, which displays the information to notify the operator of the vehicle condition.

- The machine monitor displays the information in the normal mode or service mode.

- The normal mode is used to display the information to the operator normally. The major items displayed in this mode are as follows.

1. Items always displayed
   - Meters (Speedometer or engine tachometer)
   - Gauges (Engine coolant temperature gauge, torque converter oil temperature gauge, hydraulic oil temperature gauge, and fuel level gauge)
   - Pilot indicators
   - Service meter

   The following is displayed according to setting condition of optional device.
   - Load meter calculated weight
   - Hours
   - Display of travel speed/engine speed on the character display

2. Items displayed when abnormality is detected
   - Caution lamps
   - Action code (While an action code is displayed, if the monitor panel mode selector switch (>) is pressed and released, the failure code (6 digits) is displayed.))

3. At the replacement period of a filter or oil, the character display displays that filter or oil. (Maintenance monitoring function)

4. In addition to the above, the following can be displayed, set, and adjusted by using the character display and the machine monitor mode selector switch which is the operation switch of the character display.

   1) Load meter (If equipped)
      - Loaded/no loaded calibration
      - Reset of calibration
      - Display/non-display of load meter
      - Printer output format (printer (if equipped))
   2) Display of odometer
   3) Reset of filter oil replacement time
   4) Input of telephone number
   5) Selection of language
   6) Adjustment of brightness of the night lighting for the machine monitor
   7) Adjustment of time of clock (Load meter (if equipped))
   8) Selection of travel speed and engine speed display
   9) Function to display/non-display of travel speed and engine speed on the character display

- The service mode function is used for the ease of troubleshooting for the controllers on the network (including the machine monitor itself). The major functions used in the service mode are as follows.

1. Display of electrical system failure history
   The electrical system failures of each controller saved in the machine monitor are displayed. The information of those failures is deleted with this function, too.

2. Display of mechanical system failure history
   The mechanical system failures of each controller saved in the machine monitor are displayed.

3. Real-time monitor
   The input and output values recognized by each controller on the network are displayed in real time.

4. Reduced-cylinder mode
   This function is used to stop fuel injection by cylinder and specify the cylinder having defective fuel by shutting off fuel injected from the fuel injector.

5. No injection cranking
   This function is used when lubricating the engine with the engine stopped when restarting it after a long time of non-operation.

6. Adjustment function
   The installation errors and manufacturing dispersion of the sensors, solenoid valves, etc. are corrected and adjusted, and control characteristic data is changed upon request of the user.

7. Maintenance monitor
   The filter and oil replacement period is changed and its function is stopped.

8. Operating information display function
   Fuel consumption per operating hours is displayed.

9. Manual snap shot (if equipped)
   The direction to take in the snap shot data is given to the VHMS.

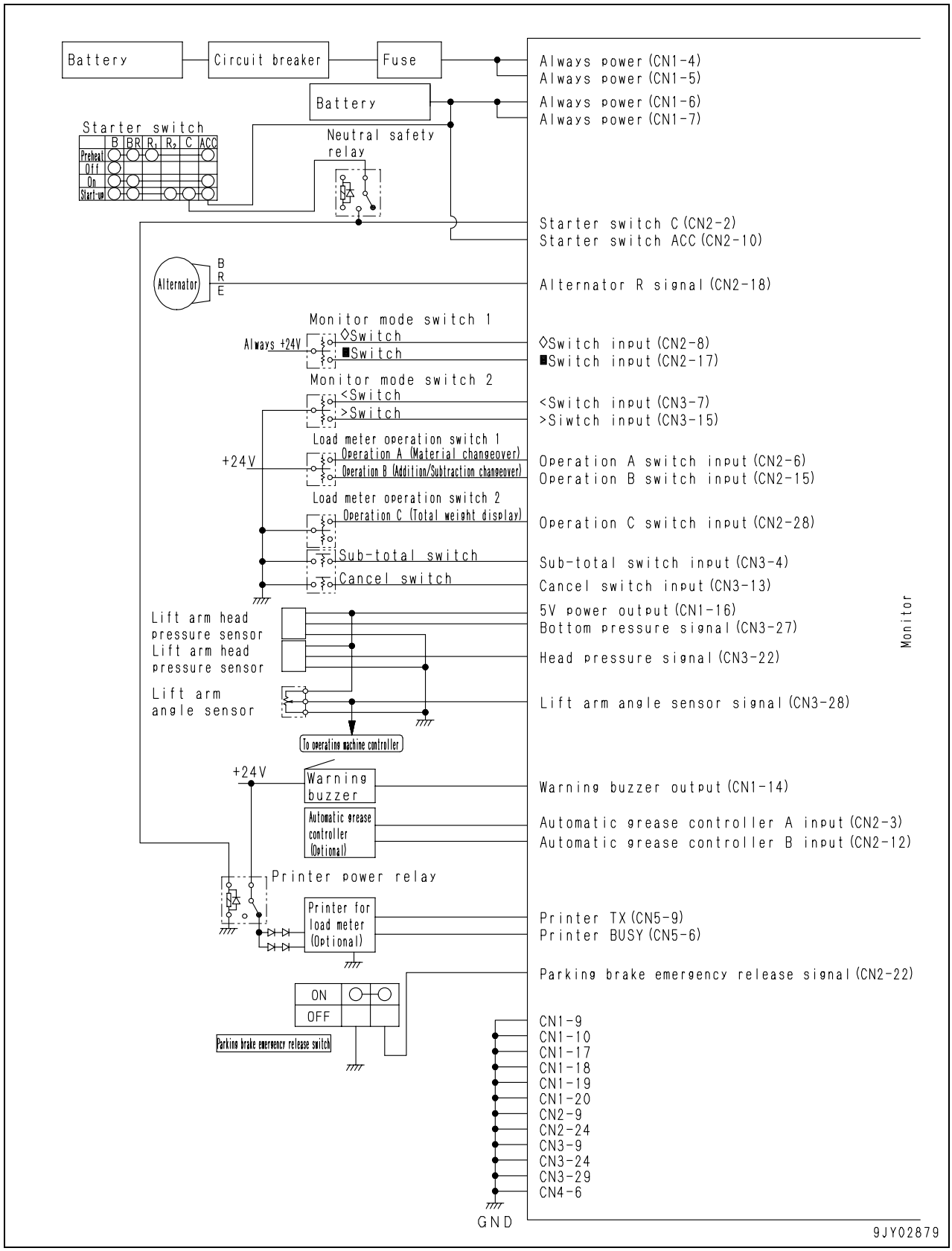
10. Function of selecting optional device
    Information of the controller to be used and optional device are selected.

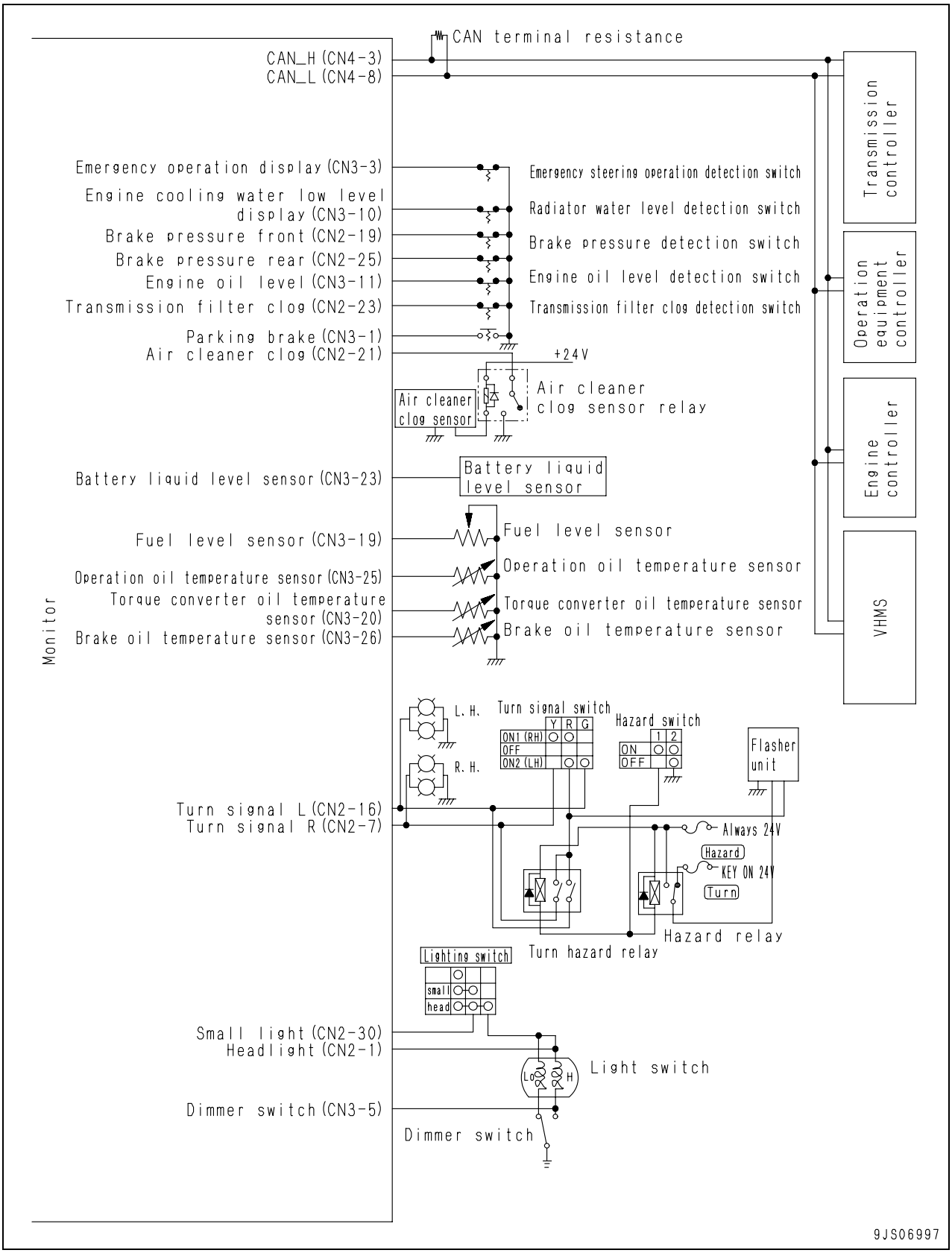
11. Input of machine serial number (No.)
    Enter the machine serial number to specify the machine.

12. Model selection function
    Enter the information of applicable model.

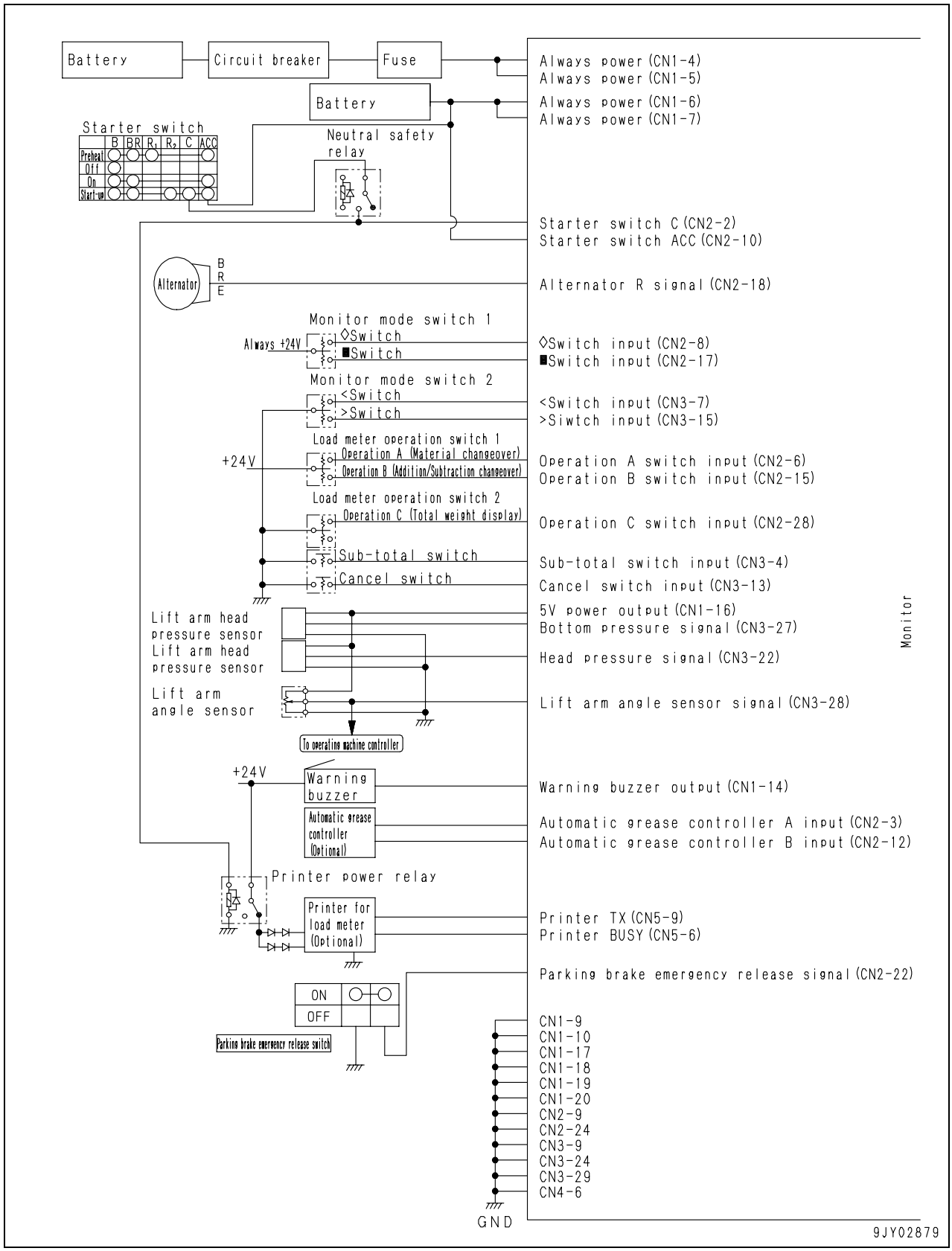
13. Initialize
    This function is used to set the machine monitor to the state set when delivered.

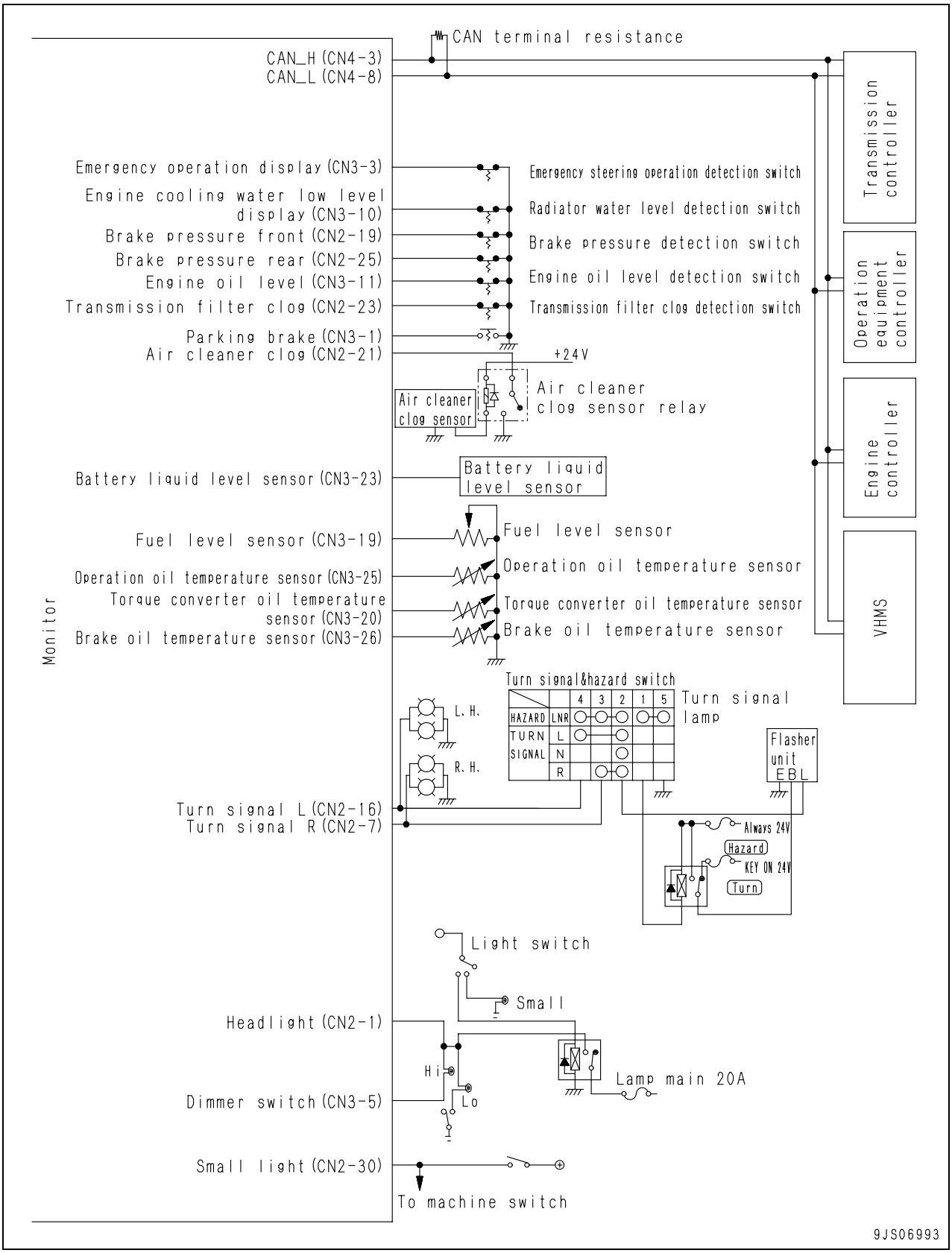
Machine monitor electrical circuit diagram (AJSS specification)



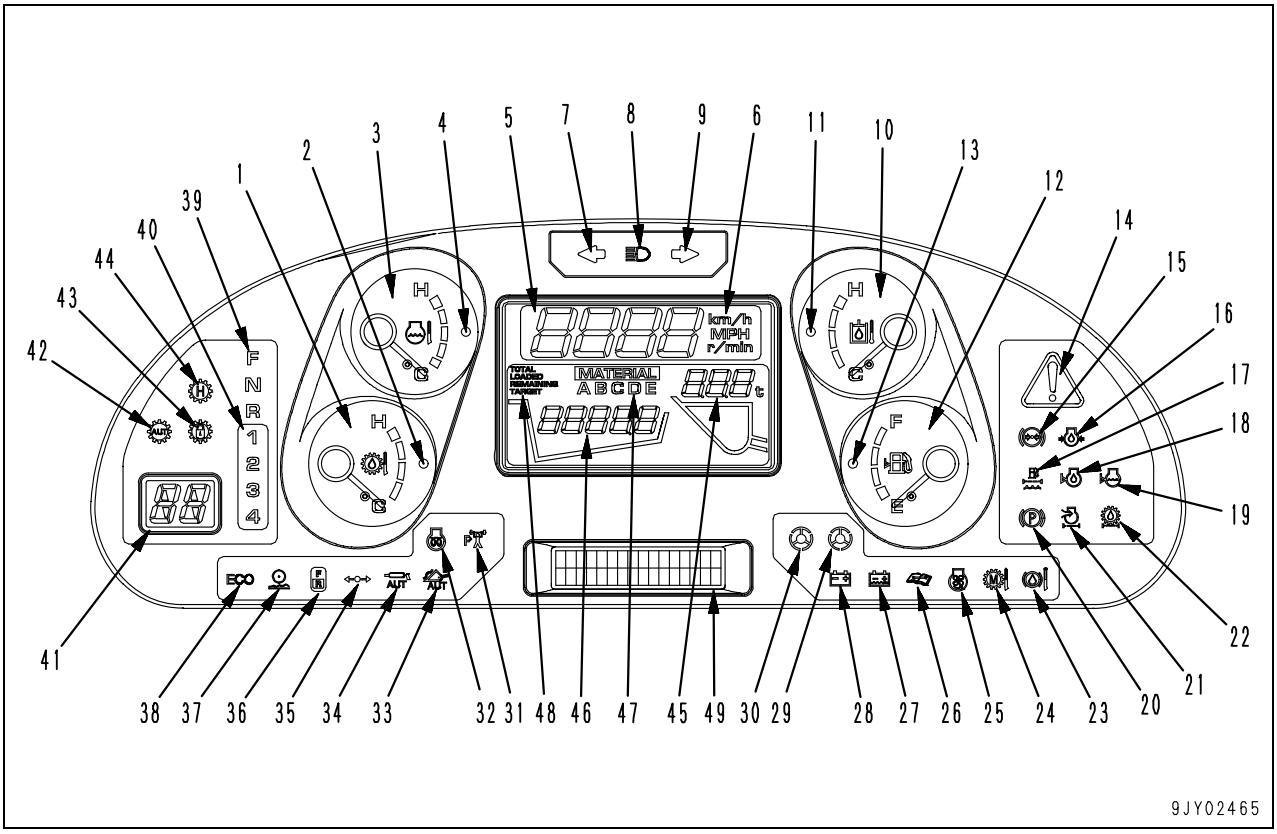

CAN terminal resistance
CAN_H (CN4-3)
CAN_L (CN4-8)
Transmission controller
Emergency operation display (CN3-3)
Emergency steering operation detection switch
Engine cooling water low level display (CN3-10)
Radiator water level detection switch
Brake pressure front (CN2-19)
Brake pressure detection switch
Brake pressure rear (CN2-25)
Engine oil level (CN3-11)
Engine oil level detection switch
Transmission filter clog (CN2-23)
Transmission filter clog detection switch
Operation equipment controller
Parking brake (CN3-1)
Air cleaner clog (CN2-21)
+24V
Air cleaner clog sensor
Air cleaner clog sensor relay
Engine controller
Battery liquid level sensor (CN3-23)
Battery liquid level sensor
Fuel level sensor (CN3-19)
Fuel level sensor
Operation oil temperature sensor (CN3-25)
Operation oil temperature sensor
Torque converter oil temperature sensor (CN3-20)
Torque converter oil temperature sensor
Brake oil temperature sensor (CN3-26)
Brake oil temperature sensor
VHMS
Monitor
L.H.
R.H.
Turn signal switch
Y R G
ON1 (RH)
OFF
ON2 (LH)
Hazard switch
1 2
ON
OFF
Flasher unit
Turn signal L (CN2-16)
Turn signal R (CN2-7)
Always 24V
Hazard
KEY ON 24V
Turn
Hazard relay
Turn hazard relay
Lighting switch
small
head
Small light (CN2-30)
Headlight (CN2-1)
Light switch
LO
H
Dimmer switch (CN3-5)
Dimmer switch
9JS06997

Machine monitor electrical circuit diagram (Steering wheel specification)

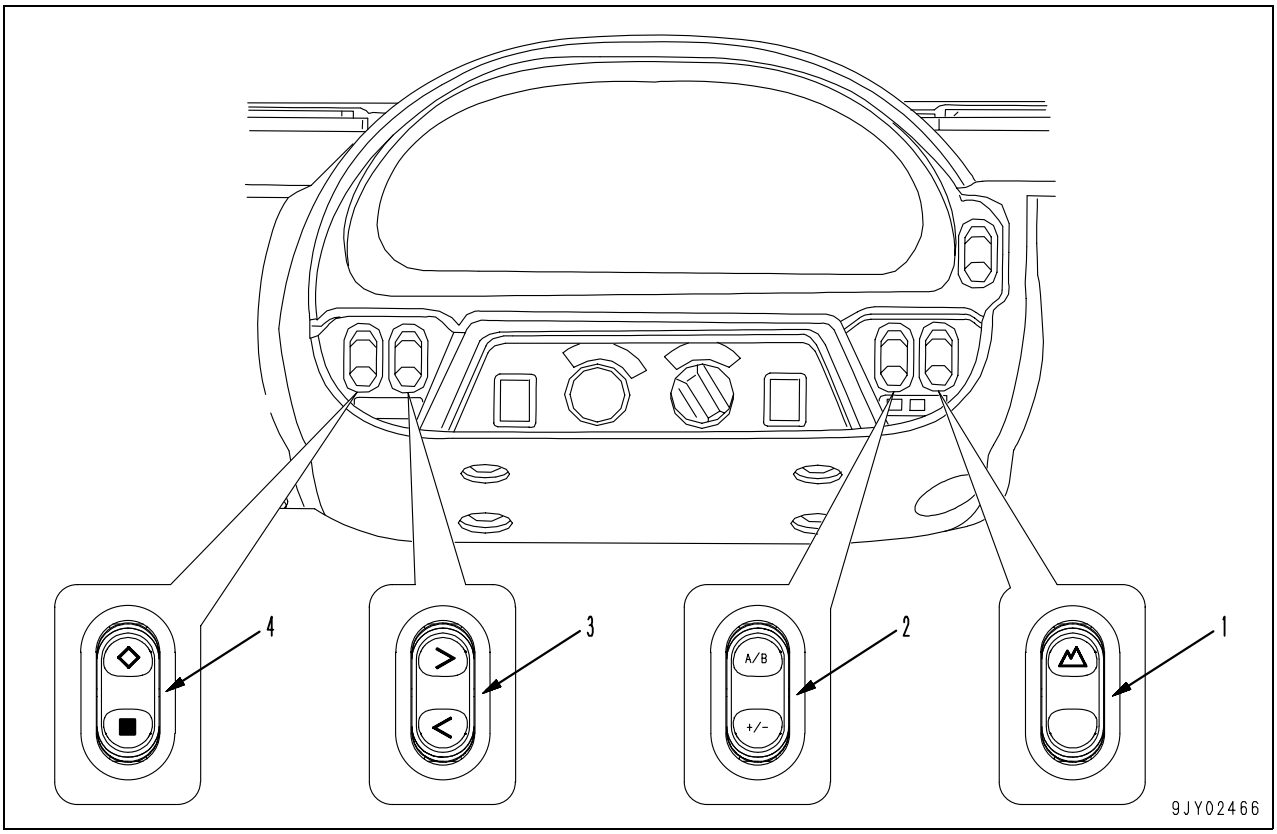



CAN terminal resistance
CAN_H (CN4-3)
CAN_L (CN4-8)
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Emergency operation display (CN3-3)
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Battery liquid level sensor
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Fuel level sensor
Operation oil temperature sensor (CN3-25)
Operation oil temperature sensor
Torque converter oil temperature sensor (CN3-20)
Torque converter oil temperature sensor
Brake oil temperature sensor (CN3-26)
Brake oil temperature sensor
VHMS
Monitor
Turn signal&hazard switch
4 3 2 1 5
HAZARD LNR
TURN L
SIGNAL N
R
Turn signal lamp
L.H.
R.H.
Flasher unit EBL
Turn signal L (CN2-16)
Turn signal R (CN2-7)
Always 24V
Hazard
KEY ON 24V
Turn
Light switch
Small
Headlight (CN2-1)
Hi
Lo
Lamp main 20A
Dimmer switch (CN3-5)
Small light (CN2-30)
To machine switch
9JS06993

Machine monitor



1. Torque converter oil temperature gauge
2. Torque converter oil temperature caution lamp
3. Engine coolant temperature gauge
4. Engine coolant temperature caution lamp
5. Speedometer or engine tachometer
6. Display of the unit of speedometer or engine tachometer
7. Turn signal pilot lamp (Left)
8. Head lamp high beam pilot lamp
9. Turn signal pilot lamp (Right)
10. Hydraulic oil temperature gauge
11. Hydraulic oil temperature caution lamp
12. Fuel level gauge
13. Fuel level caution lamp
14. Central warning lamp
15. Brake oil pressure caution lamp
16. Engine oil pressure caution lamp
17. Fuel filter coolant level caution lamp (Not used)
18. Engine oil level caution lamp
19. Radiator coolant level caution lamp
20. Parking brake pilot lamp
21. Air cleaner clogging caution lamp
22. Transmission oil filter clogging caution lamp
23. Brake oil temperature caution lamp
24. Modulation clutch temperature caution lamp
25. Cooling fan reverse rotation pilot lamp
26. Maintenance caution lamp
27. Battery electrolyte level caution lamp
28. Battery charge circuit caution lamp
29. Steering oil pressure caution lamp (If equipped)
30. Emergency steering pilot lamp (If equipped)
31. Output mode pilot lamp (Power mode)
32. Preheater pilot lamp
33. Semi auto digging pilot lamp (If equipped)
34. Auto-grease pilot lamp (If equipped)
35. Joystick operation pilot lamp
36. Directional selector pilot lamp (Not used)
37. ECSS pilot lamp (If equipped)
38. Economy operation indicator lamp
39. Shift position pilot lamp (Forward/reverse)
40. Shift position pilot lamp (Gear speed)
41. Shift indicator
42. Auto-shift pilot lamp
43. Lockup pilot lamp
44. Shift hold pilot lamp
45. Display of bucket loading (If equipped)
46. Addition mode: Total loading display/Reduction mode: Display of level (If equipped)
47. Working object display (If equipped)
48. Addition/reduction mode display (If equipped)
49. Character display



1. Load meter display selector switch (if equipped)
   - Total mass display
2. Load meter mode selector switch (if equipped)
   - Material selection
   - Addition/reduction selection
3. Character display mode selector switch
4. Character display item selector switch

List of items displayed on monitor

During starting the engine, the monitor checks if:
1. Starting motor switch ON has been recorded.
2. Charge level is min. the specified value or more.
3. Engine speed is the specified value (500 rpm) or more

At least two items above are satisfied, or CAN communication error (transmission controller: DAQRKR) or (engine controller: DB2RKR) and charge level are the specified values or more.

○: Lighting
◎: Flashing (1.6 sec., 50% duty)
☆: Intermittent (Period: 240 msec., “ON“: 80 msec., “OFF“: 160 msec.)
△: As per separate setting condition

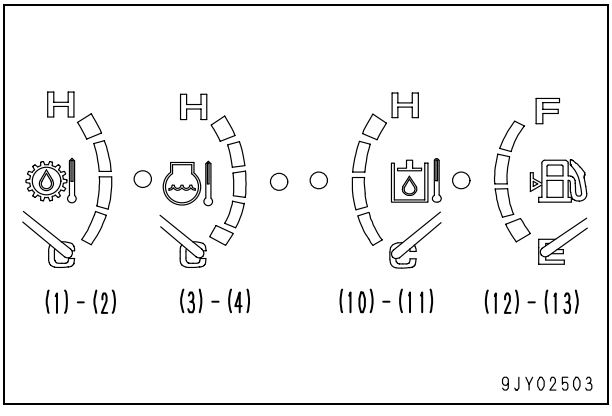
Category	No.	Item	Device	Operating condition: Engine operating condition included, error detection time counted (As indicated at right)	Operating state (Starting switch ON)									Display color	Signal detection controller	Remarks
					Detection time (SEC)		Engine: Stopped				Engine is running						
					Detection	Reset	Alarm buzzer	Individual display	Central warning	Display of message	Alarm buzzer	Individual display	Central warning	Display of message			
Central warning lamp	14	Central warning lamp	LED	When error is made			△	△	△	△	△	△	△	△	Red	△	Lights when error (E03, E02) occurs on each controller and at the same time displays message.
				Other than above, see “Operating condition – Central warning lamp” column of relevant items.			—	—	—		—	—	—		—	—	
Back light	—	Back light (various back lights)	For night lighting of LED	Back light: When small lamp is turned ON			—	—	—		—	—	—		White	Monitor	
Gauges and meters	5	Engine speed	Fixed LCD	Indicates “0” if error is made in communication other than when engine speed is selected or tilt positioner set angle is displayed.			—	—	—		—	—	—		—	Engine	Switchable to speedmeter The first digit is fixed at 0. Number of display digits (4-digits): 0 – 3990
		Speedometer	Fixed LCD	Other than when engine speed is not selected and tilt positioner set angle is displayed			—	—	—		—	—	—		—	Transmission	Switchable to tachometer Number of display digits (4-digits): 0 – 99 (middle 2 out of 4 digits are used.)
		Tilt positioner set position display	Fixed LCD	When tilt positioner set angle is displayed. Lamp does not light up when error is made in communication.			—	—	—		—	—	—		—	Work equipment	Switching between speedometer/tachometer Displayed just 3 seconds when instruction is given from work equipment controller. Number of display digits is 1-digit (–5 to 5) (middle 2 out of 4-digits are used, unit is not displayed). Operation completion sound (short beep) and cancel sound (long beep sound) are given simultaneously.
		Overrun prevention (when lockup release → torque converter mode) alarm notice	Fixed LCD	Alarm is issued when information of “Overrun prevention (in lockup release → torque converter mode) alarm notice” is obtained from transmission controller, and is kept at least 3 minutes.			◎	◎ Remarks	○		◎	◎ Remarks	○		—	Transmission	Note)
		Overrun prevention (in lockup release → torque converter mode) alarm	Fixed LCD	Alarm is issued when information of “Overrun prevention (in lockup release → torque converter mode) alarm detecting” is obtained from transmission controller, and is continued at least 3 minutes.			◎	◎ Remarks	○		◎	◎ Remarks	○		—	Transmission	
Unit	6	Unit display	LCD	When engine speed is selected	—	—	—	r/min	—		—	r/min	—		—	Monitor	
				When speed [km/H] is selected	—	—	—	km/h	—		—	km/h	—		—		
				When speed [MPH] is selected	—	—	—	MPH	—		—	MPH	—		—		
				When tilt positioner set angle is displayed			—	—	—		—	—	—		—	Work equipment	

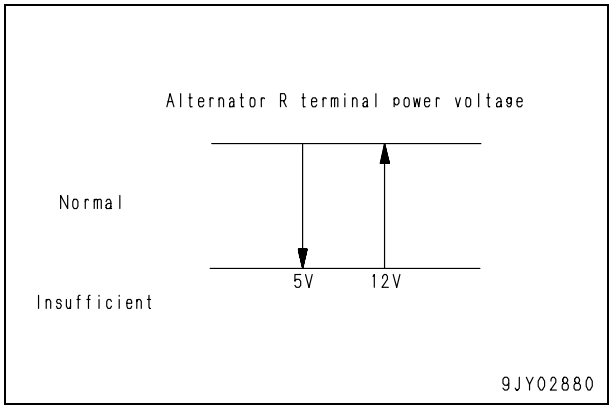
Note)

	Central warning lamp	Buzzer	Main part (*1)	Message
Overrun notice	○	◎	◎ (flashing)	—
Overrun	○	◎	◎ (flashing)	Overrun prevention

(*1) When the engine speed is displayed on the center LCD, the display flashes. When the travel speed is displayed, it is switched to the engine speed and the display flashes.

Category	No.	Item	Device	Operating condition: Engine operating condition included, error detection time counted (As indicated at right)	Detection time (SEC)		Operating state (Starting switch ON)								Display color	Signal detection controller	Remarks
							Engine: Stopped				Engine is running						
					Detection	Reset	Alarm buzzer	Individual display	Central warning	Display of message	Alarm buzzer	Individual display	Central warning	Display of message			
Operation of gauges and meters	1	Torque converter oil temperature gauge	Pointer: Movement				—	—	—	—	—	—	—	—	—	Monitor	(See figures below.) MAX position: 135°C Red zone start point: 120°C Level: 110°C 1/4 of full scale: 80°C Min. position 50°C When sensor is grounded: Max. of gauge When sensor is disconnected or hot shorted: Min. of gauge
	2	Torque converter oil temperature caution lamp	Indicator: LED	Alarm: Min. 120°C and [No abnormality is detected (DGT1KX is not generated)]	10	1	—	○	—	(b@CENS)	—	○	—	(b@CENS)	Red		
				Alarm: Min. 130°C and [No abnormality is detected (DGT1KX is not generated)]	10	1	◎	○	○	B@CENS	◎	○	○	B@CENS	Red		
				When abnormality is detected	20	5	—	—	—	DGT1KX	—	—	—	DGT1KX	Red		b@CENS does not display character message.
	3	Engine coolant temperature gauge	Pointer: Movement				—	—	—	—	—	—	—	—	—	Engine monitor	(See figures below.) MAX position: 135°C Level: 85°C 1/4 of full scale: 65°C Min. position: 50°C
	4	Engine coolant temperature caution lamp	Indicator: LED	Alarm: Min. 102°C and [No abnormality is detected (CA144 and CA145 are not generated)]	3		—	○	—	—	—	○	—	—	Red		
				Alarm: Min. 105°C			◎	○	○	B@BCNS	◎	○	○	B@BCNS	Red		
				When abnormality is detected			—	—	—	CA144	—	—	—	CA144			
				When abnormality is detected			—	—	—	CA145	—	—	—	CA145			
	10	Hydraulic oil temperature gauge	Pointer: Movement				—	—	—	—	—	—	—	—	—	Monitor	(See figures below.) Max. position: 125°C Red zone start point: 100°C Level: 85°C (green graduations only) 1/4 of full scale: 65°C (green graduations only) Min. position: 50°C When sensor is grounded: Max. of gauge When sensor is disconnected or hot shorted: Min. of gauge
	11	Hydraulic oil temperature caution lamp	Indicator: LED	Alarm: Min. 100°C and [No abnormality is detected (DGH2KX is not generated)]	10	1	◎	○	○	B@HANS	◎	○	○	B@HANS	Red		
				When abnormality is detected	20	5	—	—	—	DGH2KX	—	—	—	DGH2KX	—		
	12	Fuel level gauge	Pointer: Movement				—	—	—		—	—	—		—	Monitor	(See figures below.) MAX position: 100%: 10Ω 3/4 of full scale: 75%: Level: 50%: 32Ω 1/4 of full scale: 25%: 49.5Ω Red zone start point: See specified LED lighting percent or resistance. Min. position: 0%: 85Ω When sensor is disconnected or hot shorted: Gauge EMPTY When sensor is grounded: Gauge FULL
	13	Fuel level caution lamp	Indicator: LED	Min. 61.3 Ω	10	1	—	○	—		—	○	—		Red		





Category	No.	Item	Device	Operating condition: Engine operating condition included, error detection time counted (As indicated at right)	Detection time (SEC)		Operating state (Starting switch ON)								Display color	Signal detection controller	Remarks
							Engine: Stopped				Engine is running						
					Detection	Reset	Alarm buzzer	Individual display	Central warning	Display of message	Alarm buzzer	Individual display	Central warning	Display of message			
Actual gear speed	39 40	Shift position pilot lamp	LED	[When F is selected] and [Engine is stopped]	1	0	☆	○	○		—	—	—		Green	Monitor Transmission	
				[When R is selected] and [Engine is stopped]	1	0	☆	○	○		—	—	—		Green		
				When F is selected	0	0	—	○	—		—	○	—		Green		
				When N is selected	0	0	—	○	—		—	○	—		Green		
				When R is selected	0	0	—	○	—		—	○	—		Green		
				When 4th gear speed is selected	0	0	—	○	—		—	○	—		Green		
				When 3rd gear speed is selected	0	0	—	○	—		—	○	—		Green		
				When 2nd gear speed is selected	0	0	—	○	—		—	○	—		Green		
				When 1st gear speed is selected	0	0	—	○	—		—	○	—		Green		
				If error is made in communication, display is held until key is turned OFF.			—	—	—		—	—	—		—		
	41	Shift indicator	9-segment LCD	Upper line: F, N, R Lower line: 1, 2, 3, 4 If error is made in communication, display is held until key is turned OFF.	0	0	—	—	—		—	—	—		—	Transmission	Displayed on right of [Gear speed display]. Interlocked with shift valve. In neutral, however, gear speed is not displayed. Displayed on left of [FNR display]. N when F or R solenoid vale is OFF.
	42	Auto-shift pilot lamp	LED	When auto-shift is selected	0	0	—	○	—		—	○	—		Green		
				If error is made in communication, display is held until key is turned OFF.			—	—	—		—	—	—		Green		
	44	Shift hold pilot lamp	LED	When auto-shift and shift hold is selected	0	0	—	○	—		—	○	—		Green		
				If error is made in communication, display is held until key is turned OFF.			—	—	—		—	—	—		—		
	43	Lockup pilot lamp	LED	When lockup functions	0	0	—	—	—		—	○	—		Green		
				If error is made in communication, display is held until key is turned OFF.			—	—	—		—	—	—		—		
Others	7 9	Turn signal pilot lamp	LED	When turn signal switch is input (including when key is OFF)	0	0	—	○	—		—	○	—		Green	Monitor	Functions when key is OFF to provide hazard function interlocking with turn signal switch.
	8	Head lamp high beam pilot lamp	LED	When high beam is functioning: Head lamp ON and High beam ON	0	0	—	○	—		—	○	—		Blue	Monitor	
	15	Brake accumulator oil pressure caution lamp	LED	Normal oil pressure (CLOSED)			—	—	—		—	—	—		—	Monitor	
				Below specified value (F) (OPEN) (detection time is continued) and in 45 seconds after engine is started	5	1	—	○	—		◎	○	○	2G42ZG	Red		Front
				Below specified value (R) (OPEN) (detection time is continued) and in 45 seconds after engine is started (No detection time)	5	1	—	○	—		◎	○	○	2G43ZG	Red		Rear
				Below specified pressure (F) (OPEN) (detection time is continued) and 45 seconds after engine is started (No detection time) * When engine is stopped, condition of “45 seconds after engine is started” is not applied.	1	1	—	○	—		◎	○	○		Red		Front
				Below specified pressure (R) (OPEN) (detection time is continued) and 45 seconds after engine is started (No detection time) * When engine is stopped, condition of “45 seconds after engine is started” is not applied.	1	1	—	○	—		◎	○	○		Red		Rear
	16	Engine oil pressure caution lamp	LED	At normal operation			—	—	—	—	—	—	—		—	Engine	
				Engine oil pressure reduction error is received			◎	○	○	B@BAZG	◎	○	○	B@BAZG	Red		
	18	Engine oil level caution lamp	LED	Normal oil level (CLOSED)			—	—	—		—	—	—		—	Monitor	If alarm is detected when key is turned ON, first information is kept until engine oil reaches normal oil level even if engine is started.
				Low oil level (OPEN) continues 2 seconds. For 300 seconds after engine is stopped, however, no error is detected.	2	1	—	○	—	B@BAZK	—	—	—		Red		
	19	Radiator coolant level caution lamp	LED	Normal coolant level (CLOSED)			—	—	—		—	—	—		—	Monitor	
				Low coolant level (OPEN)	30	1	—	○	—	B@BCZK	—	○	—	B@BCZK	Red		
	20	Parking brake pilot lamp	LED	When parking brake is applied (OPEN)			—	○	—		—	○	—		Red	Monitor	
				When parking brake is not applied (CLOSED)			—	—	—		—	—	—		—		
				Other than when parking brake is applied and gear shift lever is at “N” position, and during starting engine	0	0					☆	○	○		Red		

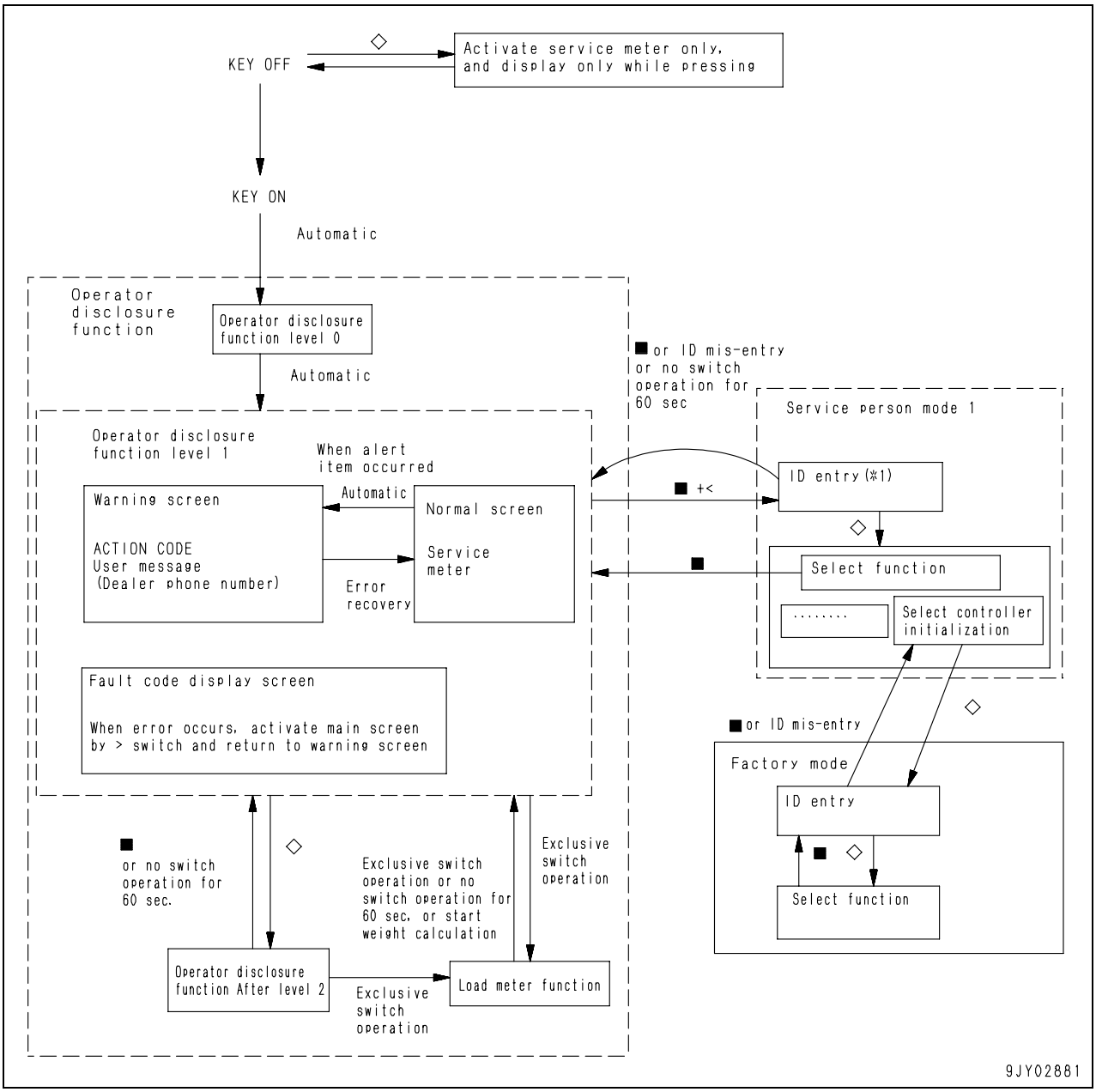
Category	No.	Item	Device	Operating condition: Engine operating condition included, error detection time counted (As indicated at right)	Detection time (SEC)		Operating state (Starting switch ON)								Display color	Signal detection controller	Remarks
							Engine: Stopped				Engine is running						
					Detection	Reset	Alarm buzzer	Individual display	Central warning	Display of message	Alarm buzzer	Individual display	Central warning	Display of message			
Others	21	Air cleaner clogging caution lamp	LED	Normal (CLOSED)			—	—	—		—	—	—		—	Monitor	
				Sensor detects clogging (OPEN)	2	1	—	—	—		—	○	—	AA1ANX	Red		
	22	Transmission oil filter clogging caution lamp	LED	Normal (CLOSED)			—	—	—		—	—	—		—	Monitor	If abnormality is detected while engine is stopped, alarm is continued even after engine is started.
				Clogging (OPEN) and torque converter oil temperature > 50°C	2	1	—	—	—		—	○	—	15BONX	Red		
				When abnormality is detected	3	OFF	—	—	—	DHT2L6	—	—	—		—		
							—	—	—		—	—	—		Red		
	23	Brake oil temperature caution lamp	LED	Other than below			—	—	—	—	—	—	—	—	—	Monitor	
				Temperature increase (Min. 120°C) (notice alarm)	5	5	—	○	—	—	—	○	—	—	Red		
				Temperature increase (1 or 2 below) 1. Oil temperature is above 130°C for 5 seconds. 2. When travel speed is above 35 km/h while brake oil temperature, 125°C and above, is detected continuously for 5 seconds. It is released when oil temperature, 125°C and below, is detected continuously for 5 seconds.	5	5	◎	○	○	B@C7NS	◎	○	○	B@C7NS	Red		
				When abnormality is detected			—	—	—	DGR2KA	—	—	—	DGR2KA	—		
				When abnormality is detected			—	—	—	DGR2KX	—	—	—	DGR2KX	—		
	24	Modulated clutch temperature caution lamp	LED	Other than following			—	—	—	—	—	—	—	—	—		
				Temperature rise (Forecast alarm)	0	0	—	○	—	—	—	○	—	—	Red		
				Temperature rise	0	0	◎	○	○	15W0NT	◎	○	○	15W0NT	Red		
	25	Cooling fan reverse rotation pilot lamp	LED	Cooling fan forward drive	0	0	—	—	—	—	—	—	—	—		Transmission	
				Cooling fan reverse rotation	0	0	—	○	—	As indicated at right	—	○	—	As indicated at right	Orange		Cooling fan reverse rotation state is displayed. While fan is reversed, message is displayed on character display. COOLING FAN REVERSE ROTATION
				Fan switch and solenoid disagree.	0	0	—	◎	—	—	—	◎	—	—	Orange		
	26	Maintenance caution lamp	LED	Ordinary			—	—	—		—	—	—		—	Monitor	Simultaneously displays contents on message display.
				30 h or less before maintenance or maintenance time			—	○	—	△	—	○	—	△	Red		
	27	Battery electrolyte level caution lamp	LED	Normal			—	—	—		—	—	—		—	Monitor	If abnormality is detected while engine is stopped, alarm is continued even after engine is started. See figures on alternator terminal R voltage.
				Sensors: Less than 2 V	10	1	—	○	—	B@GAZK	—		—	B@GAZK	Red		
				Option is not applied			—	—	—		—	—	—				
	28	Battery charge circuit caution lamp	LED	Normal voltage (hysteresis on the right figure)			—	—	—		—	—	—		—	Monitor	
				Insufficient alternator voltage (Hysteresis on the right figure), no starting motor C signal input, and during running of engine	30	1	—	—	—		◎	○	○	AB00MA	Red		
				When abnormality is detected	3	1	◎	○	○	AB00L6	—	—	—		Red		
	29	Steering oil pressure caution lamp	LED	Not in operation	—		—	—	—		—	—	—	—	—	Monitor	Implemented only when “Emergency steering enabled” is specified on optional setting on monitor panel.
				In operation (CN3-3 = OPEN)	—		—	○	—		—	○	—		Red		
				When abnormality is detected			—	—	—	DDE5MA	—	—	—	DDE5MA	—		

Category	No.	Item	Device	Operating condition: Engine operating condition included, error detection time counted (As indicated at right)	Detection time (SEC)		Operating state (Starting switch ON)								Display color	Signal detection controller	Remarks
							Engine: Stopped				Engine is running						
					Detection	Reset	Alarm buzzer	Individual display	Central warning	Display of message	Alarm buzzer	Individual display	Central warning	Display of message			
Others	30	Emergency steering pilot lamp	LED	Normal operation [Operation of divider (= Below S/T pressure CN3-3=OPEN)] and [Travel speed, min. 1 km/h]	1	1	—	○	—		—	○	—		Green	Monitor	
				Holds in position			—	—	—		—	—	—				
	31	Output mode pilot lamp (power mode)	LED	Power mode = P	0	0	—	○	—		—	○	—		Green	Transmission	Selection of power mode is displayed.
				Power mode = Other than P			—	—	—	—	—	—	—	—			
	32	Preheating pilot lamp	LED	Other than below			—	—	—		—	—	—		—	Engine	
				In preheating (with signal)	0	0	—	○	—		—	○	—		Red		
	33	Semi auto digging pilot lamp	LED	When auto digging switch is OFF			—	—	—		—	—	—		—	Work equipment	
				When auto digging switch is ON	0	0	—	○	—		—	○	—		Green		
				When error is made in communication			—	—	—		—	—	—		—		
	34	Auto grease pilot lamp	LED	Not in operation and not installed			—	—	—		—	—	—		—	Monitor	Status: Port A: Port B: Panel display Operation: 0 V: 24 V: Lighting Abnormality: 0 V: 0 V: Flashing, 2 Hz Empty tank: 24 V: 0 V: Flashing, 1 Hz Abnormality: 24 V: 24 V: OFF
				Operation	1	1	—	○	—		—	○	—		Green		
				Empty tank	3	1	—	◎ 1 Hz	—		—	◎ 1 Hz	—		Green		
				Abnormal	3	1	—	◎ 2 Hz	—		—	◎ 2 Hz	—		Green		
	35	AJSS operation pilot lamp	LED	Option is not applied			—	—	—	—	—	—	—	—	—		
				Operation of wheel steering system			—	—	—	—	—	—	—	—	—	Monitor	When steering wheel option is selected
				Operation of AJSS system only when joystick optional setting is made.	0	0	—	○	—	—	—	○	—	—	Green	Transmission	CAN input signal from transmission controller
				AJSS lever neutral lock (Output from work equipment controller)	0	0	☆	◎	○	—	☆	◎	○	—	Green	Work equipment	CAN input signal from work equipment controller
				Operation of FR prohibition function during locking of AJSS steering only when AJSS optional setting is made.	0	0	☆	◎	○	—	☆	◎	○	—	Green	Transmission	CAN input signal from transmission controller
				When error is made in communication			—	—	—		—	—	—		—		
	37	ECSS pilot lamp	LED	Not operated			—	—	—		—	—	—		—	Transmission	
				Operating	0	0	—	○	—		—	○	—		Green		
				When error is made in communication			—	—	—		—	—	—		—		
	38	Economy operation indicator lamp	LED	Economy mode	0	0	—	○	—		—	○	—		Green	Transmission	
				Other than above	0	0	—	—	—		—	—	—		—		

Priority of sounding of buzzer: Continual (◎) > Intermittent (☆) > Cancellation of operation > Check of acceptance of operation.

Character display function

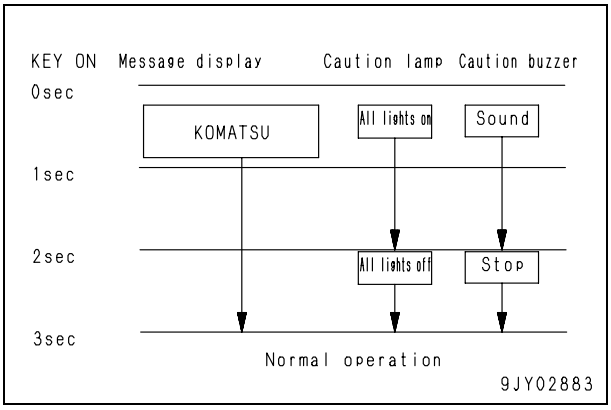
Using the character display function, you can change the display and settings on the machine monitor.
For usage of functions for the operator, see the Operation and Maintenance Manual.
The operator can operate the part “Operator disclosure function” below.

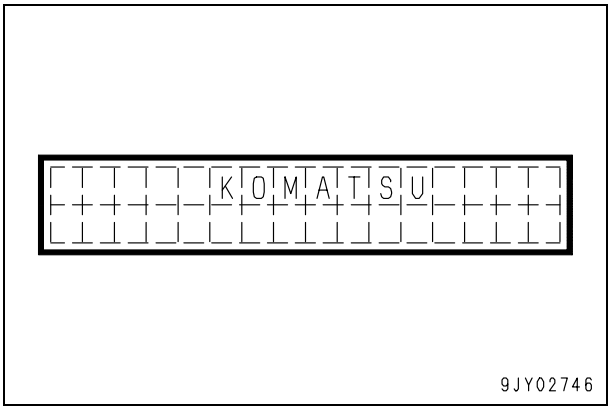


(*1) Once you pass on the ID input screen, you can directly move to the function selection screen without displaying this screen until the starting switch is turned OFF.

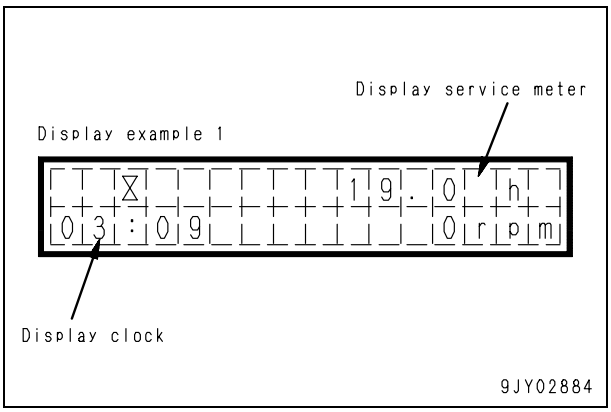
Operator mode self-check function

Self-check (0th layer)
The self-check function operates 3 seconds after the key is turned ON.
After the key ON, it automatically starts and ends the self-check function operation.
After 3 seconds, you are brought to the 2nd layer automatically.
In self-check mode, the mode switch is disabled.



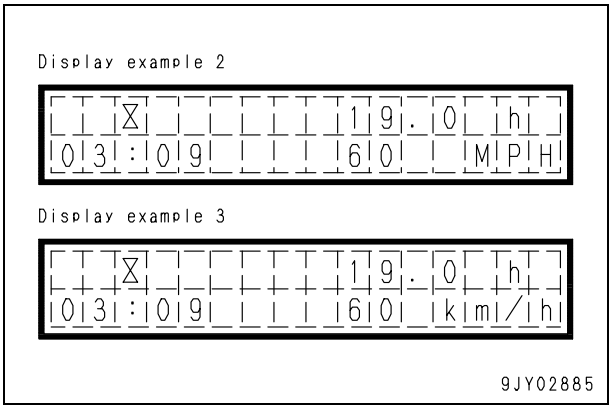


Normal screen (1st layer)
After the self-check, the following screen is automatically displayed.
Press the ◇ switch to move to the 2nd layer.



* The clock is displayed only for the load meter.

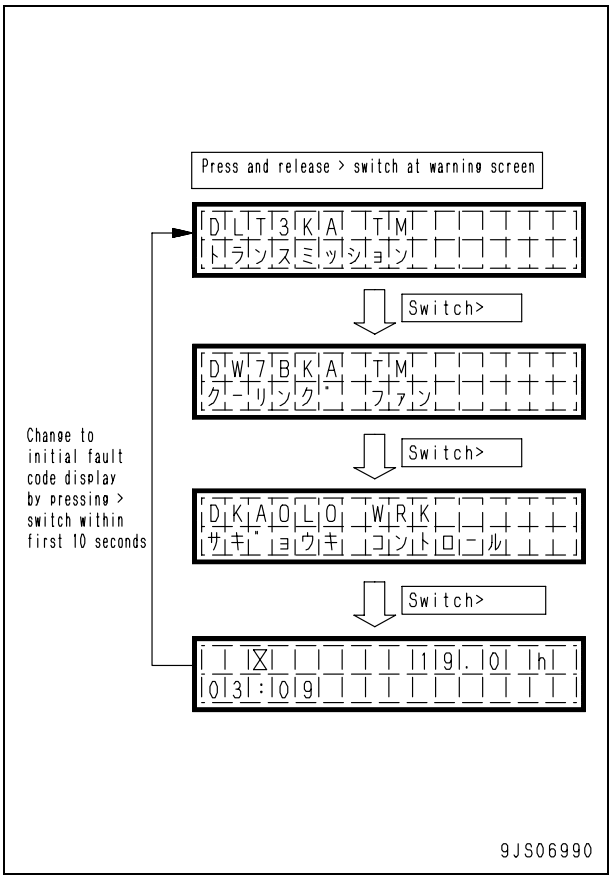
Select “Displayed” for “10. Engine speed or travel speed display on character display and normal screen” in the optional setting. Then, when the travel speed is displayed on the LCD at the center of the monitor, the engine speed is displayed on the character display.
when the engine speed is displayed on the LCD, the travel speed is displayed on the character display.
For machines of SI specification, the travel speed unit is km/h and for ones of non-SI specification, the service optional setting is conformed to.



Failure code display screen (1st layer)

- Pressing the > switch while the alarm screen is displayed changes to the failure code display screen.
- Pressing the > switch again displays the service meter for 10 seconds, and automatically returns to the alarm screen.
- If you do not perform any switch input for 30 seconds with the failure code display screen displayed or a new error occurs, you are returned to the alarm screen.
- When multiple errors occur, every pressing of the > switch displays items in descending order of priority. Items of the same priority is displayed in reverse chronological order of occurrence.

- Example of failure code display screen (When DLT3KA, DW7BKA and DKA0L0 occur simultaneously))



The upper column displays failure code (6-digits) so that the ECM CODE and space are sandwiched. The lower column displays the message 2.

For information on the failure code (6-digits), ECM CODE, and message 2, see the message list.

The example shows the failure code of WA600-6.

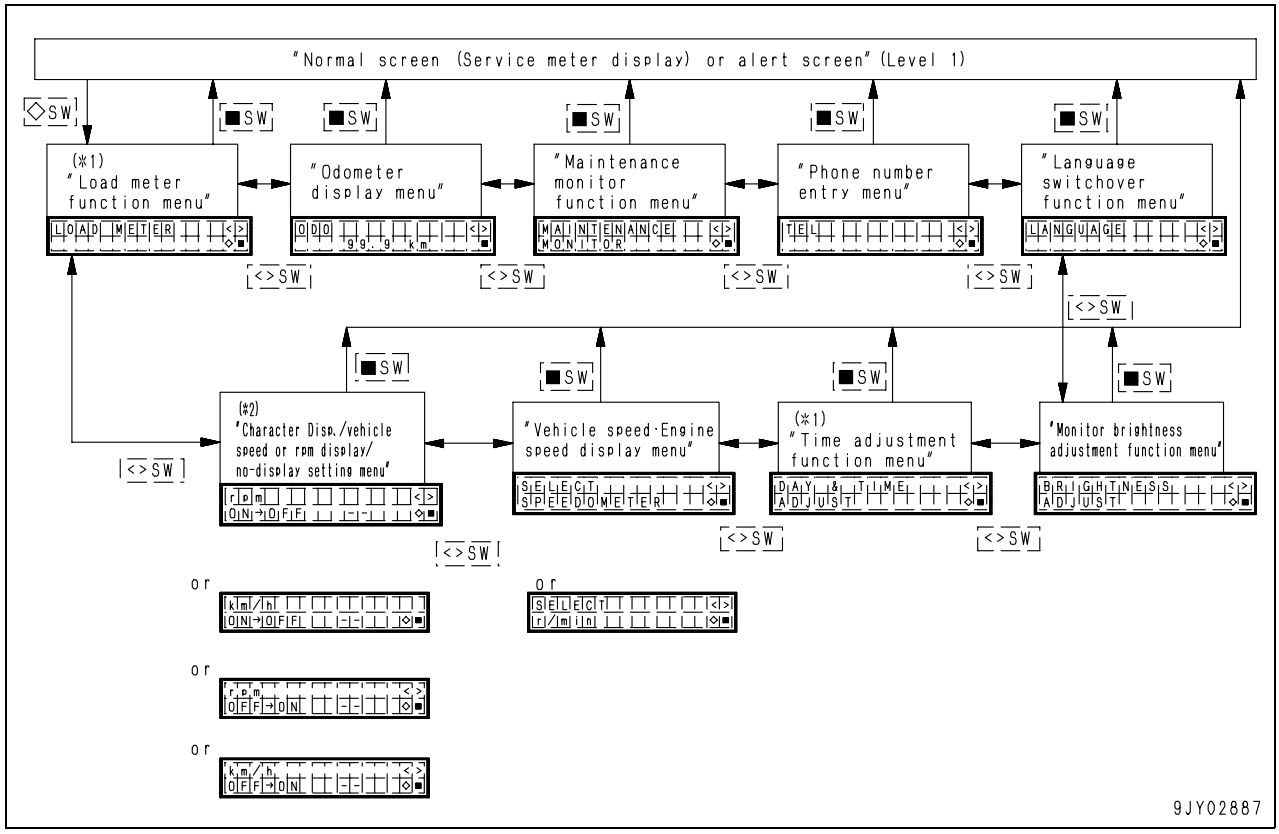
In 10 seconds, you are automatically brought to the alarm screen.

Operator disclosure function

Function opened to the operator (2nd layer and lower)

- If any switch operation is not done at least 60 seconds on the 2nd layer or lower, you are brought to the 1st layer automatically.
- Optional items are not displayed if not selected.
- The language selected by the language selection function is displayed.
- For operation after selecting each menu, see the corresponding menu item.
  (Select each menu using the ◇ switch.)

Function opened to the operator (2nd layer and lower)



(*1) This display is not available when the load meter function was turned off through OPT selection of Service Mode.

(*2) This menu is not available when the function to display the travel speed or rpm on the character display is turned OFF through the option selection of service mode.

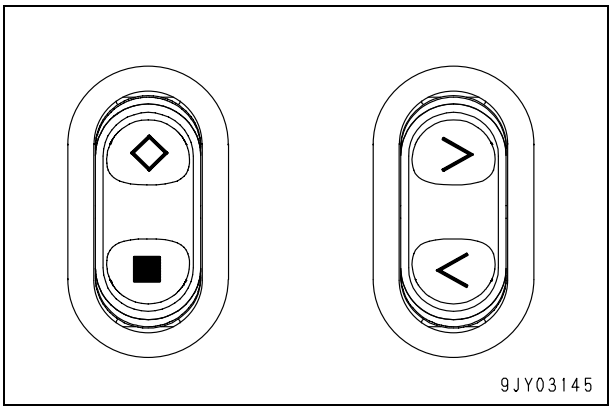
Outline of service mode

The service mode function is used for the ease of troubleshooting for the controllers on the network (including the machine monitor itself).
When making initial settings and optional settings for the sensors, enter the service mode of the machine monitor.

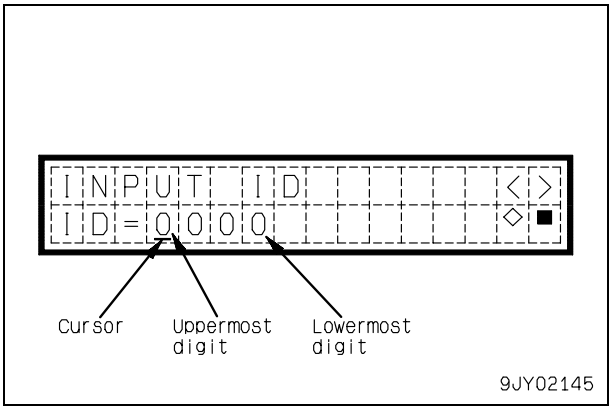
Operating method of machine monitor

1. Entering the service mode
   1) Operating method
      1] Turn the starting switch of the machine ON.
      2] When the normal service meter screen or alarm screen is on the character display of the machine monitor, press the machine monitor mode selector switches 1 (■) and 2 (<) simultaneously for 5 seconds. Then, the INPUT ID screen is displayed.

Machine monitor mode display selector switch 1 and 2



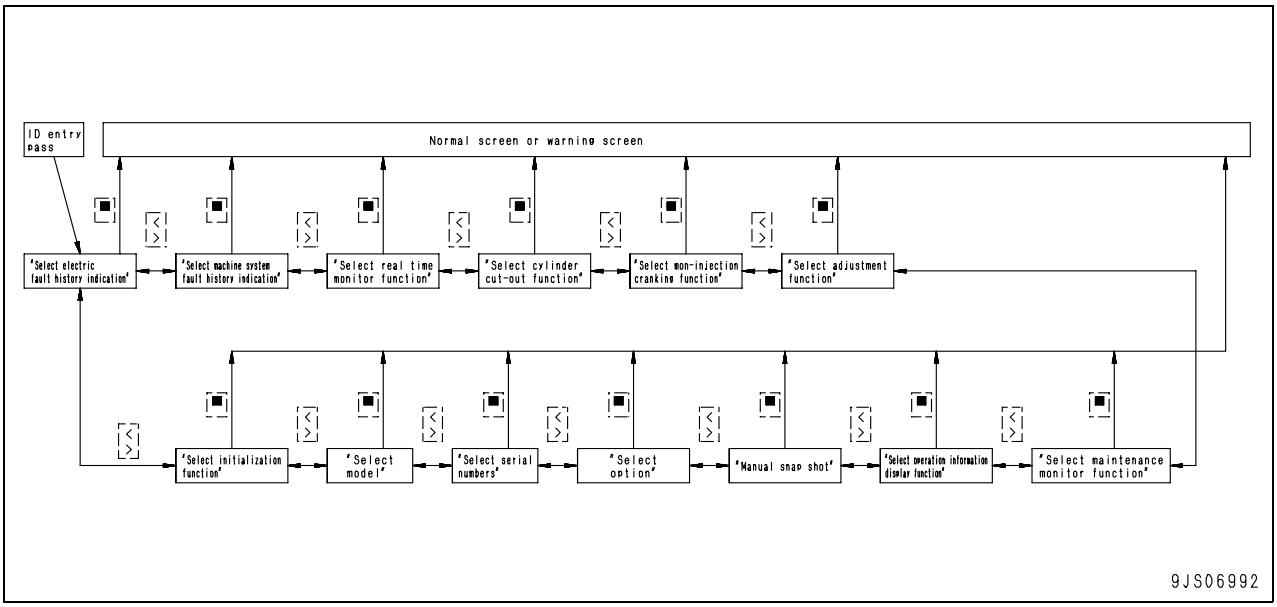
INPUT ID screen



   2) How to input ID
      1] Press the < or > switch. Then, the value at the cursor position increases or decreases at the cursor position. Select a desired value using the ◇ switch.
      2] Completing operations equivalent to 4 digits (1) brings you to the ELECTRIC FAULT screen.
         ★ If you input an incorrect value, press ■ switch to return the cursor to the highest-order digit, and re-enter values from there.
         ★ If you press the ■ switch while the cursor is at the highest-order digit, the normal service meter screen or alarm screen is returned.
         ★ If any switch operation is done at least 60 seconds during the ID input, the normal service meter screen or alarm screen is returned.

         ID to enter the service mode is “6491”.
         Remarks: If the starting switch is turned OFF in the service mode, the normal service meter screen or alarm screen is returned at the next starting switch ON.

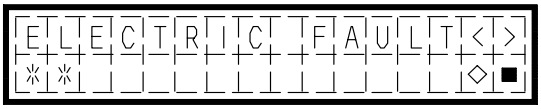
2. Service mode menu



★ The service mode menu shows a different screen by operating the < or >switch. Select a target operation menu screen with the switch.
★ If you press the ◇ when the following screen (selection screen) is displayed, the menu screen/operation screen of each function appears.
★ If you press the ■ when the following screen (selection screen) is displayed, the normal service meter screen or alarm screen is returned at the next starting switch ON.

Operation menu screen (character display)

1) ELECTRIC FAULT screen

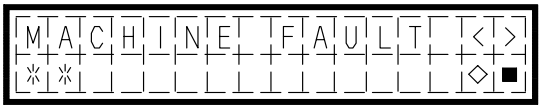


[※※] field displays number of the failure history currently recorded (up to 20 cases).

Outline

This function is used to check the electrical system failure history of each controller saved in the machine monitor. For the failure codes displayed in the electrical system failure history, see “Troubleshooting”. After each failure is repaired and the normal operation is confirmed, delete the failure history.

2) MACHINE FAULT screen

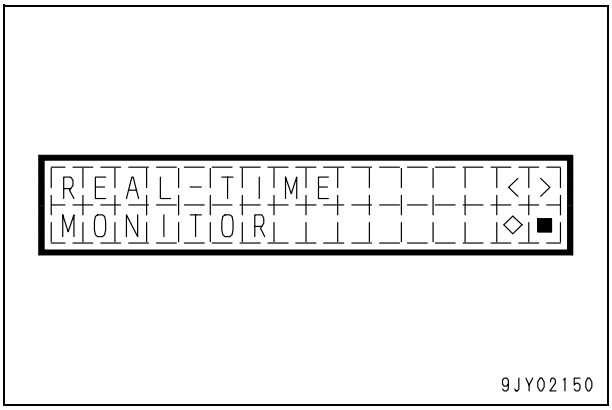


[※※] field displays number of the failure history currently recorded (up to 20 cases).

Outline

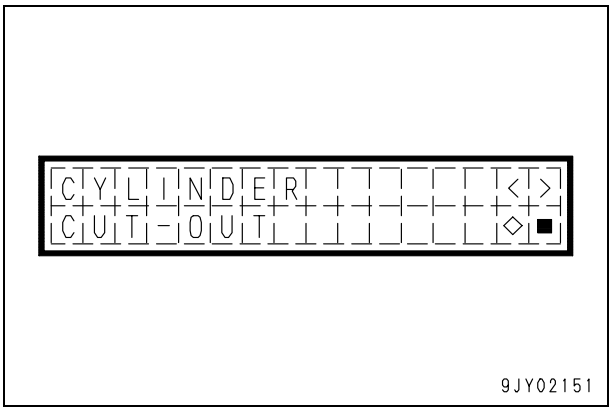
This function is used to check the mechanical system failure history of each controller saved in the machine monitor. For the failure codes displayed in the mechanical system failure history, see “Troubleshooting”.

3) REAL-TIME MONITOR screen



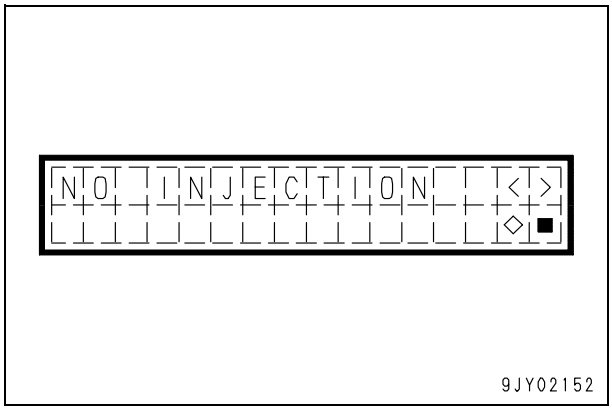
Outline
This function is used to check the input and output signals, etc. recognized by each controller on the network.

4) CYLINDER CUT-OUT screen



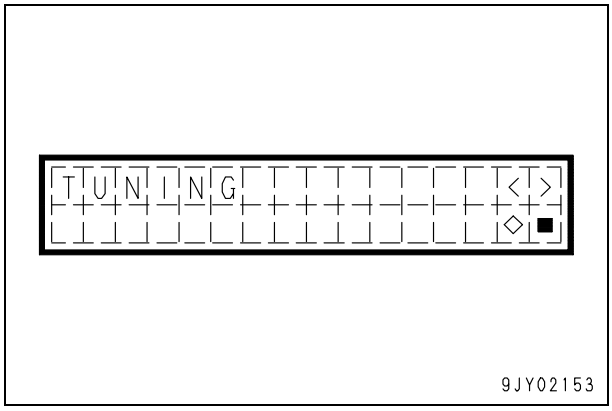
Outline
This function is used to stop fuel injection by cylinder and specify the cylinder having defective combustion by shutting off fuel injected from the fuel injector.
For the method of checking using this function, see “Testing and adjusting: Operating engine in reduce cylinder mode”.

5) NO INJECTION screen



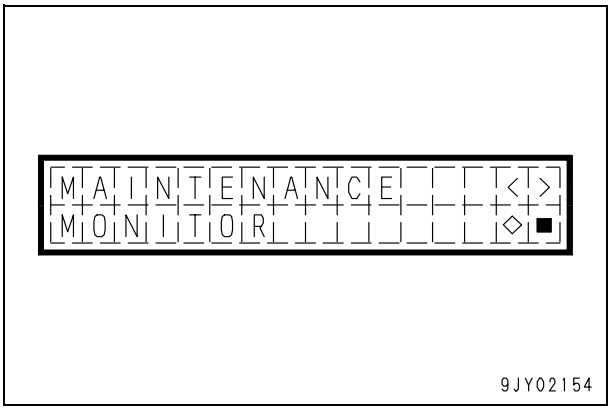
Outline
This function is used when lubricating the engine with the engine stopped when restarting it after a long time of non-operation.
For the starting method of engine using this function, see “Testing and adjusting: No injection cranking operation of engine”.

6) TUNING screen



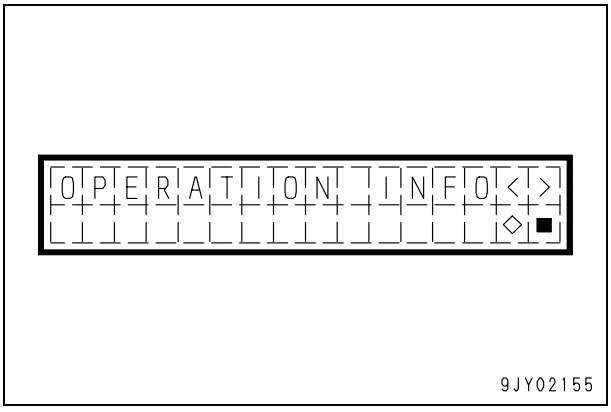
Outline
The installation errors and manufacturing dispersion of the sensors, solenoid valves, etc. are corrected and adjusted, and control characteristic data is changed upon request of the user. Use this function if you have changed or added sensors, valves or controllers. For adjustment using this function, see “Testing and adjusting: Adjustment performed on the monitor”.

7) MAINTENANCE MONITOR screen



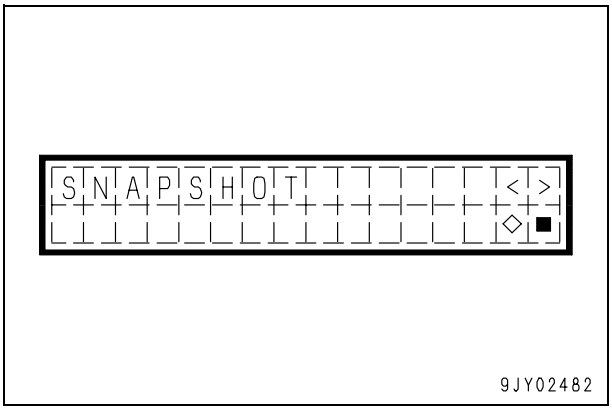
Outline
This function is explained in “Operation and Maintenance Manual, Operation, Character display, Display of replacement periods of filters and oils”. The set replacement periods of a filter and oil are changed and their functions are stopped.

8) OPERATION INFO screen



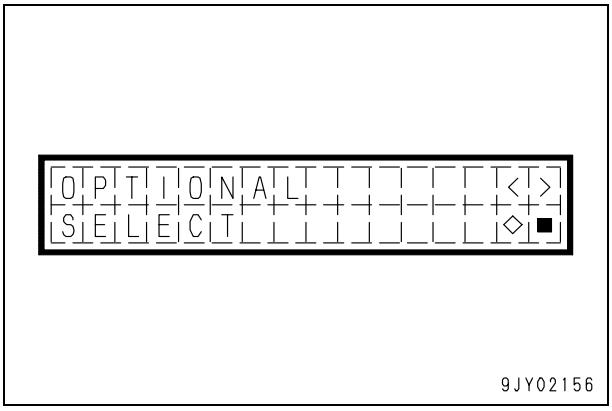
Outline
Fuel consumption per operating hours is displayed.

9) MANUAL SNAP SHOT screen



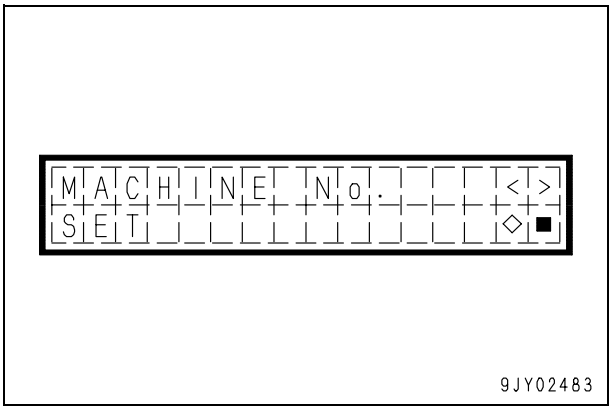
Outline
The direction to take in the snap shot data is given to the VHMS.
This function is used only when the VHMS is installed.
For inspection with this function, see “Testing and adjusting volume, Inspection with VHMS”.

10) OPTIONAL SELECT screen



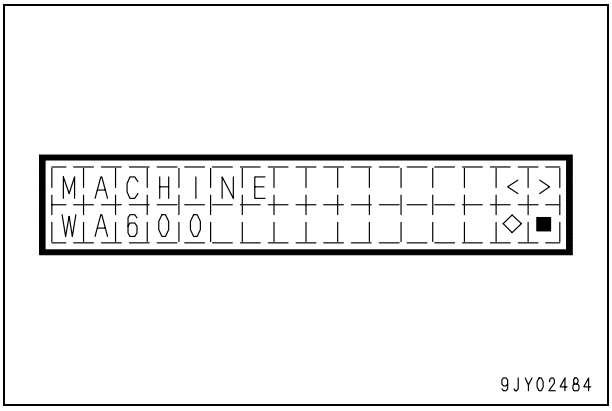
Outline
With this function, you can display installation of an optional device and change the setting of that device. Use this function after any optional device is installed or removed. For the method of setting and changing this function, see “Testing and adjusting: Adjustment performed on the monitor”.

11) Machine serial No. input function screen



Outline
The machine serial No. is displayed and set.
This screen is used for machine management etc.

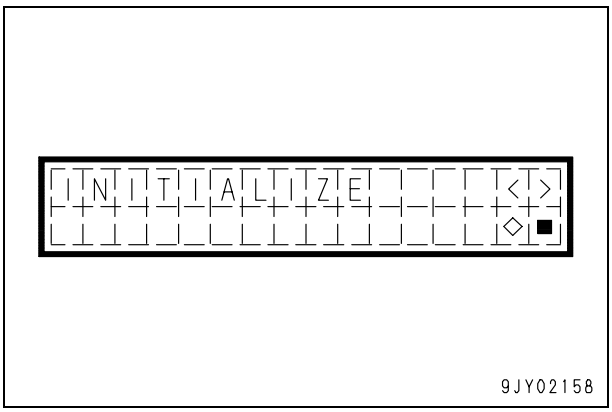
12) MACHINE screen



★ The lower column displays the currently selected model.

Outline
This function is used to display or select the machine model.

13) INITIALIZE screen

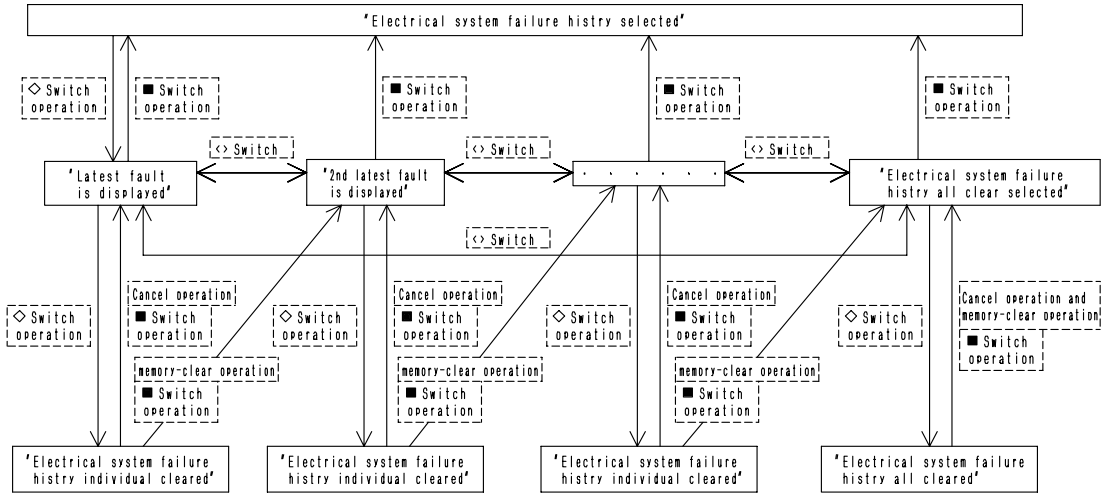


Outline
This function is used only in the factory. Do not use it.

Function of displaying electrical system failure history

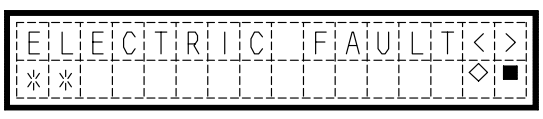
1) Display of electrical system failure history and selection of clearing entirely the electrical system failure history

The items are displayed in the sequential order by the latest occurrence time from the latest one.
The items which have not been reset are displayed before the items which have been reset.
Pressing the > switch scrolls the items from the newer ones to the older ones.
Pressing the < switch scrolls the items from the newer ones to the older ones.
After the oldest saved item, the “Electrical system failure history all clear selected” screen is displayed.
Pressing the ■ switch changes the screen to the “Electrical system failure history selected” screen.
Pressing the ◇ switch changes the screen to the “Electrical system failure history individual cleared” screen or the “Electrical system failure history all cleared” screen.



2) Selection of electrical system failure history (1st layer)

Pressing the < switch changes the screen to the “Select initialization” screen.
Pressing the > switch changes the screen to the “Select display of mechanical system failure history” screen.
Pressing the ■ switch changes the screen to the normal screen or alarm screen.
Pressing the ◇ switch changes the screen to the “Display electrical system failure history” screen.



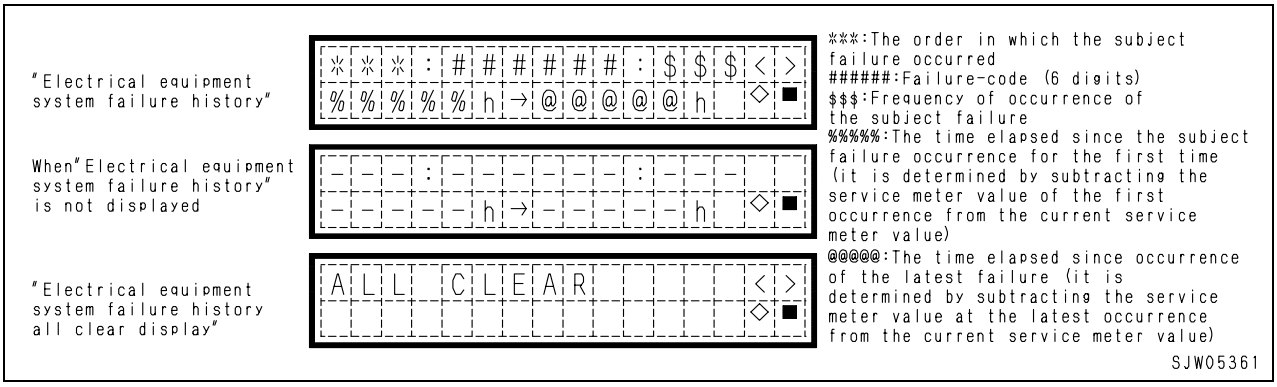
The portion indicated with ** displays number of failures being stored (up to 20 incidences are storable)

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3) Display of electrical system failure history and the electrical system failure history all clear selected (2nd layer)

The items are displayed in the sequential order by the latest occurrence time from the latest one.
The items which have not been reset are displayed before the items which have been reset.
Pressing the > switch scrolls the items from the newer ones to the older ones.
Pressing the < switch scrolls the items from the newer ones to the older ones.
Pressing the ■ switch changes the screen to the “Display electrical system failure history” screen.
Pressing the ◇ switch changes the screen to the “Display electrical system failure history” screen.

- If there is only 1 history, the current screen does not change to the “Electrical system failure history all clear” screen (Only the “Electrical system failure history individual clear” screen is displayed).
- If the number of the histories exceeds 20, they are deleted in order from the oldest one.

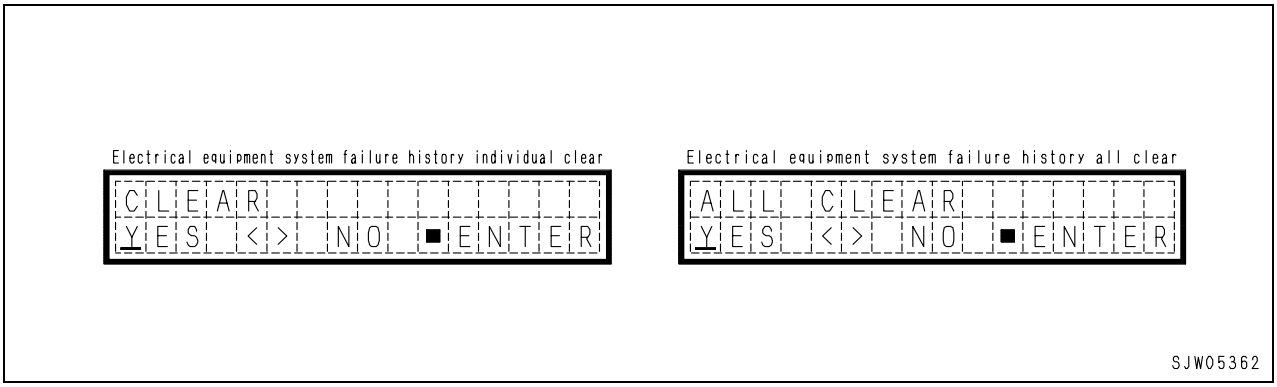


4) Electrical system failure history individual clear and Electrical system failure history all clear (3rd layer)

Select “YES” or “NO” with the < or > switch.
The cursor “_” blinks on the selected item. If “YES” is selected and the ■ switch is pressed, clearing is executed. If “NO” is selected and the ■ switch is pressed, clearing is cancelled and the display changes as shown below.

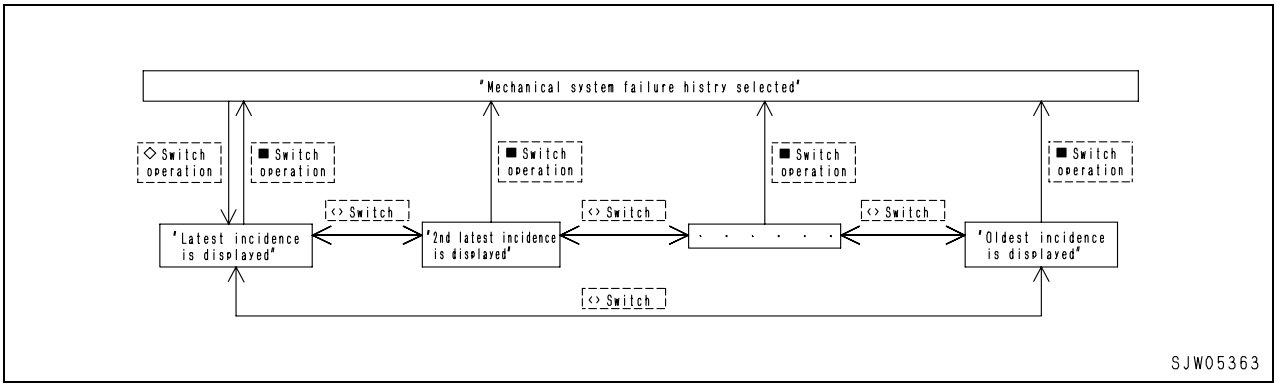
- If clearing is cancelled (NO), the current screen returns to the “Display electrical system failure history” screen of the corresponding failure.
  (Returns to the screen before the “Electrical system failure history individual clear” (Electrical system failure history all clear) screen).)
- If clearing is executed (YES), the current screen returns to the “Display electrical system failure history” screen of the corresponding next failure.
  After all the failure histories are cleared, the current screen returns to the “Select electrical system failure history” screen.

By default, the cursor is on NO (cancel) to prevent resetting by an error.
You cannot delete a failure which has not been reset. At this time, the operation cancel peep (for 1 sec) is heard.
If any failure history is cleared, the operation acceptance peeps (“ON” for 0.1 sec, “OFF” for 0.1 sec, “ON” for 0.1 sec) are heard.
When clearing of all the histories is selected, if there is any history to be cleared, clearing is assumed to be completed.

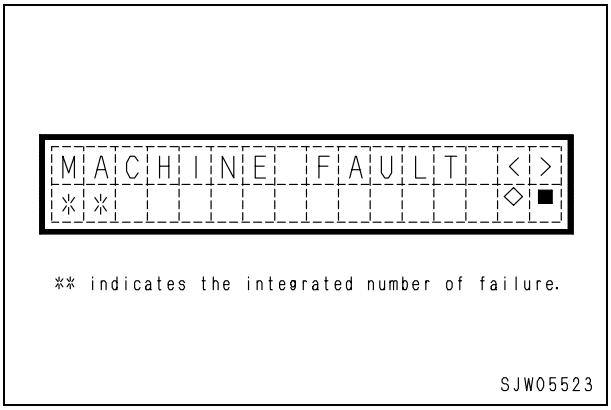


Function of displaying mechanical system failure history

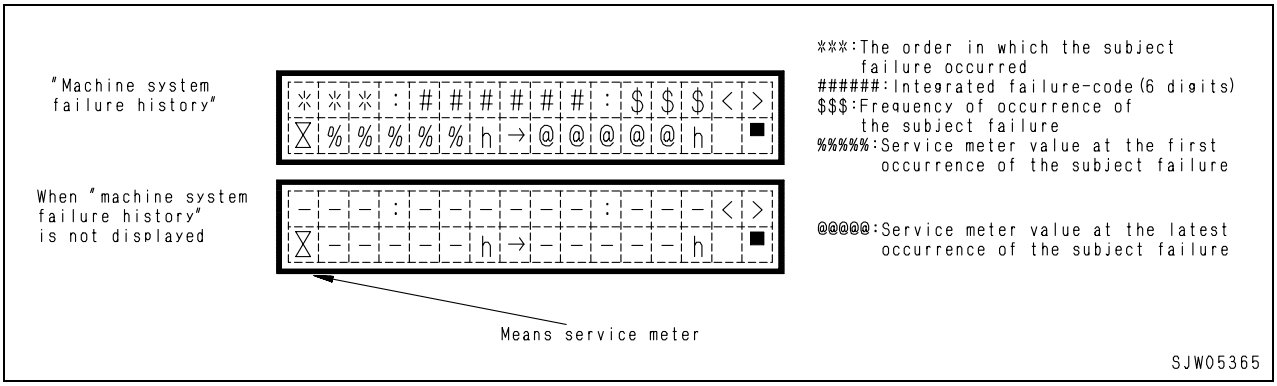
1) Display of mechanical system failure history
The items are displayed in the sequential order by the latest occurrence time from the latest one.
The items which have not been reset are displayed before the items which have been reset.
Pressing the > switch scrolls the items from the newer ones to the older ones.
Pressing the < switch scrolls the items from the newer ones to the older ones.
Pressing the ■ switch changes the screen to the “Mechanical system failure history selected” screen.
- The mechanical system fault histories cannot be deleted.



2) Selection of mechanical system failure history (1st layer)
Pressing the > switch changes the screen to the “Select real-time monitor” screen.
Pressing the < switch changes the screen to the “Select display of electrical system failure history” screen.
Pressing the ■ switch changes the screen to the normal screen or alarm screen.
Pressing the ◇ switch changes the screen to the “Mechanical system failure history selected” screen.



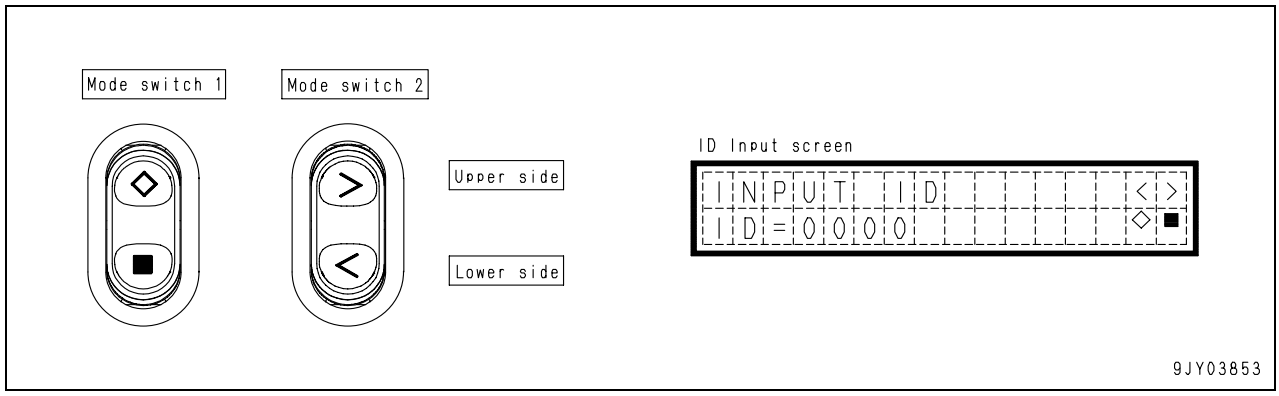
3) Display of mechanical system failure history (2nd layer)
The items are displayed in the sequential order by the latest occurrence time from the latest one.
The items which have not been reset are displayed before the items which have been reset.
Pressing the > switch scrolls the items from the older ones to the newer ones.
Pressing the < switch scrolls the items from the newer ones to the older ones.
Pressing the ■ switch changes the screen to the “Mechanical system failure history selected” screen.



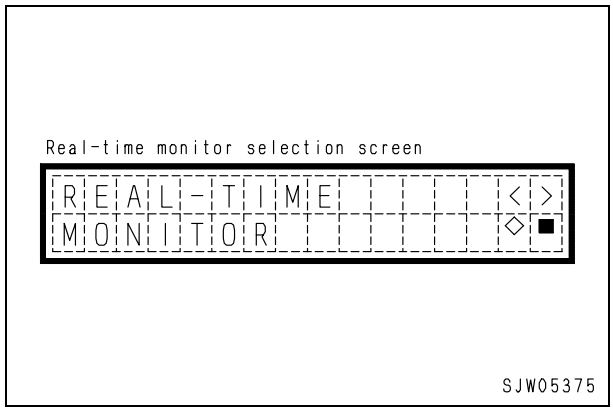
Function of real-time monitor

The real-time monitor function displays the information saved in the controllers mounted on the machine in real time.
This function is used for testing, adjusting, or troubleshooting the machine.
This function classifies the items and data by the controllers having them, and then displays the results. It has 2 display modes of the normal display mode and the 2-item display mode for displaying 2 data simultaneously.

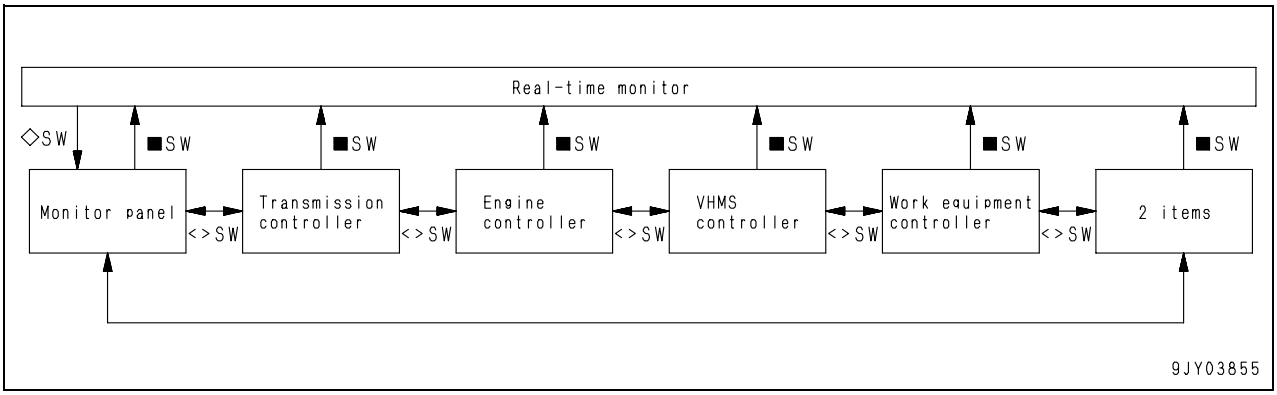
Operating procedure
1. Hold the ■ switch and < switch simultaneously for at least 5 seconds to change the screen to the ID inputting screen.

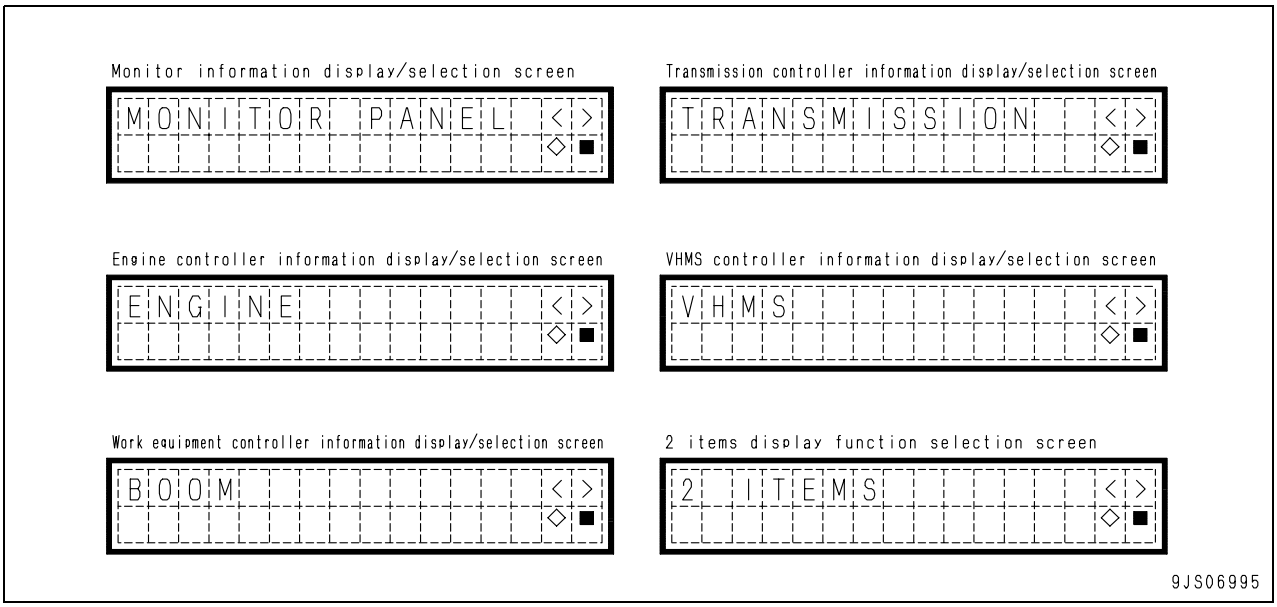


2. Input the ID with the < and > switches, and then press the ◇ switch to enter the screen for the service mode.
3. Using the < and > switches, display “Real-time monitor selection” screen, and then press the ◇ switch.

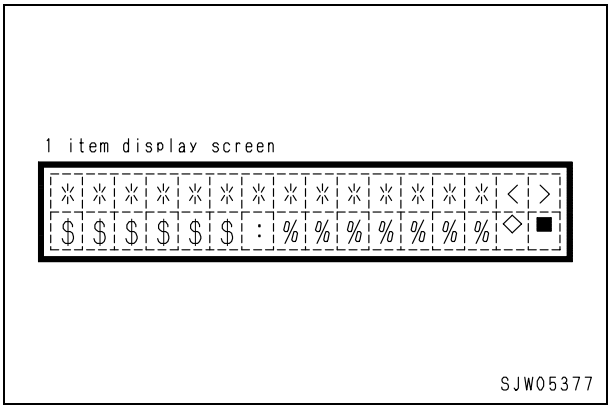


4. Press the ◇ switch, and the “Monitor panel information display select screen”.
   Each time the < switch or > switch is pressed, the screens to select the following information or function are displayed in order; the transmission controller information, engine controller information, VHMS controller information, work equipment controller information and 2-item display function.





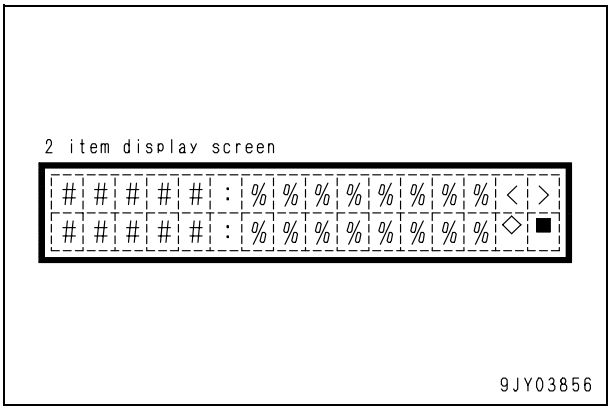
5. Press the ◇ switch while a selection screen is displayed, and the screen to select the “1 item display” function or “2 item display” function is displayed.
   1) 1 item display screen
      The screen to select display of the information of the monitor panel, transmission controller, engine controller, VHMS controller or work equipment controller or the “2 item display” function are displayed.



***: tem name
%%%%% : Data and unit (Unit: SI unit)
$$$$: ID number

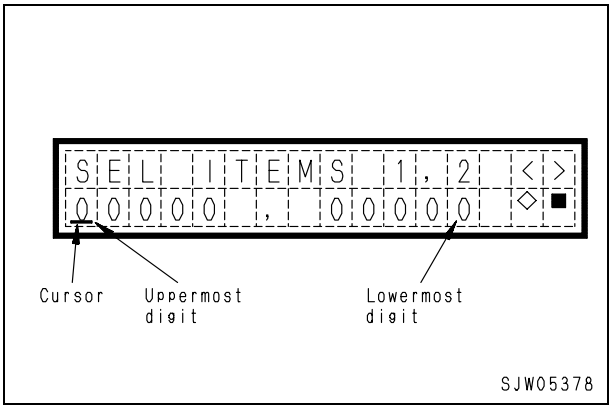
- Items displayed on the “Display 1 item” screen change in order by pressing < and > switches, displaying information held by the controller.

   2) 2 item display function
      If the “2 item display function” is selected, 2 items are displayed simultaneously.



      1] How to input ID
      “00000” is displayed during screen transition.
      Input a value between 0 and 9 at the cursor (_) position.
      First, the cursor appears at the highest-order digit. Each time the > or < switch is pressed, the digit changes by 1 between 0 and 9.
      2] Select a desired digit and press the ◇ switch.
      The cursor moves to the 2nd position. Select the digits for the all positions in the same manner as the previous steps.
      3] Input a value at the lowest-order digit and press the ◇ switch to move to the screen to select the display of 2nd item.

- If you press the ■ switch during the processing, the screen returns to the “Select 2 items display information” screen.



- In display of 2 items mode, input the ID of necessary information and press the ◇ switch to display 2 items simultaneously.
- The ID displayed is the same as the ID number displayed on the “Display 1 item” screen.

List of display contents of the real-time monitor

The state of the controller input and output signals can be checked using the real-time monitor function of the monitor.
The following table shows the display items and display contents in normal operation of the real-time monitor in relation to the machine monitor:

No.	Item	ID No.	Display of item	Contents of display data	Display contents in normal operation	Remarks
1	Monitor software part No.	20200	VERSION	Part No. of software is displayed	Depends on the software part number	
2	Application version	20221	VERSION (APP)	Application version number is displayed	Depends on application version number	
3	Data version	20222	VERSION (DATA)	Data version number is displayed	Depends on data version	
4	Engine Speed	01001	ENG SPEED	Engine speed is displayed	Li: 800 ± 25 rpm Hi: 2000 ± 50 rpm (P-mode) 1900 ± 50 rpm (E-mode) T/C stall: 1800 ± 100 rpm (P-mode) 1730 ± 100 rpm (E-mode)	
5	Travel speed	40000	SPEED	Travel speed is displayed	F1/R1: 6.7/7.3 km/h ± 5% (P-mode, T/C) F2/R2: 11.7/12.8 km/h ± 5% (P-mode, T/C) F3/R3: 20.3/22.0 km/h ± 5% (P-mode, T/C) F4/R4: 33.8/37.0 km/h ± 5%(P-mode, T/C)	
6	Fuel level	04202	FUEL SENSOR	Fuel level is displayed	0 – 100%	
7	Fuel level	04207	FUEL SENSOR	Fuel level is displayed	Gauge FULL (100%,10 Ω): 0.32 V Gauge 1/2 (50%, 32 Ω): 0.88 V Caution (61.3 Ω): 1.45 V Gauge EMPTY (0%, 85 Ω): 1.81 V	When sensor is disconnected or hot shorted: gauge EMPTY When sensor is grounded: gauge FULL
8	Engine coolant temperature	04103	COOLANT TEMP	Coolant temperature is displayed	Depends on machine status (°C)	Coolant temperature, max. 100°C Data is obtained from engine controller.
9	Torque converter oil temperature	40100	TC OIL TEMP	Torque converter oil temperature is displayed	Depends on machine status (°C)	Overheat: 120°C
10	Torque converter oil temperature	40101	TC OIL TEMP	Torque converter oil temperature is displayed	Gauge red zone start point (120°C): 1.62 V (80°C): 2.91 V	When sensor is disconnected or hot shorted: Min. of gauge When sensor is grounded: Max. of gauge
11	Hydraulic oil temperature	04401	HYD TEMP	Hydraulic oil temperature is displayed	Depends on machine status (°C)	Hydraulic tank oil temperature: Max. 100°C
12	Hydraulic oil temperature	04404	HYD TEMP	Hydraulic oil temperature is displayed	Gauge red zone start point (120°C): 1.62 V (80°C): 2.91 V	When sensor is disconnected or hot shorted: Min. of gauge When sensor is grounded: Max. of gauge
13	Brake oil temperature	30202	R BRAKE OIL	Brake oil temperature is displayed	Depends on machine status (°C)	
14	Brake oil temperature	30205	R BRAKE OIL	Brake oil temperature is displayed	(120°C): 1.62 V (80°C) : 2.91 V	
15	Charge level	04302	ALTERNATOR R	Charge level is displayed	Depends on machine status (0.0 – 30 V)	
16	Small lamp voltage	40200	SMALL LAMP	Small lamp voltage is displayed	Depends on machine status (0.0 – 30 V)	
17	Battery electrolyte level A	40300	BATTERY A	Battery electrolyte level is displayed	Min. 2 V	Only when optional setting is made
18	Battery electrolyte level B	40301	BATTERY B	—	—	Not used.
19	Lift arm angle	06001	BOOM ANG	Calculation results of lift arm angle is displayed	Standard lift arm Lift arm top: 46.8 ± 2.0deg Lift arm bottom: –42.3 ± 3.0deg Hi lift arm Lift arm top: 49.3 ± 2.0deg Lift arm bottom: –40.5 ± 3.0deg	
20	Lift arm angle	06003	BOOM ANG	Input voltage value to lift arm angle sensor potentiometer is displayed	Standard lift arm Lift arm top: 3.80 ± 0.3 V Lift arm bottom: 1.33 ± 0.5 V Hi lift arm Lift arm top: 3.87 ± 0.3 V Lift arm bottom: 1.38 ± 0.5 V	
21	Lift arm bottom pressure	40400	BOOM BTM PRESS	Lift arm bottom pressure is displayed	Depends on status	(When arm is placed horizontally at rated loading and Hi lift arm operation lever at FULL): Approx. 18 MPa
22	Lift arm bottom pressure	40402	BOOM BTM PRESS	Lift arm bottom pressure is displayed	(0MPa) : 0.5V (10MPa): 1.3V (20MPa): 2.1V (50MPa): 4.5V	
23	Lift arm head pressure	40500	BOOM HEAD PRESS	Lift arm head pressure is displayed	Depends on status	Only when optional setting is made in load meter (When arm is placed horizontally at rated loading and Hi lift arm operation lever at FULL): Approx. 0.5 MPa
24	Lift arm head pressure	40501	BOOM HEAD PRESS	Lift arm head pressure is displayed	(0MPa) : 0.5V (10MPa): 1.3V (20MPa): 2.1V (50MPa): 4.5V	Only when optional setting is made in load meter
25	Calibration pressure	40600	CAL PRESS	Lift arm differential pressure corresponding to no load around level position at load meter calibration	—	Not used.

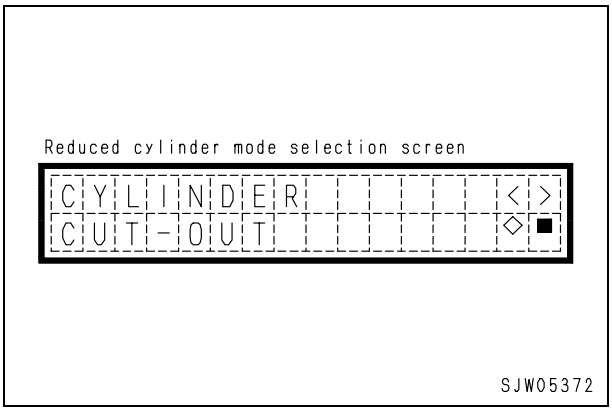
No.	Item	ID No.	Display of item	Contents of display data	Display contents in normal operation	Remarks
26	Classified weight	40800	MES LOAD	Load meter calculated weight is displayed	Load weight [t]	Only when optional setting is made in load meter
27	Position of rotary switch	30802	SW1, SW2, SW3	—	—	Not used.
28	Position of DIP switch	30904	SW5-1, SW5-2	—	—	Not used.
29	Position of DIP switch	30905	SW5-3, SW5-4	—	—	Not used.
30	Position of DIP switch	30906	SW6-1, SW6-2	—	—	Not used.
31	Position of DIP switch	30907	SW6-3. SW6-4	—	—	Not used.
32	Input signal D_IN_0-7	40900	D-IN--0------7	The state of input signal is displayed	10000000 (Head lamp = on) 00000000 (Not used) 00100000 (Starting motor C = on) 00000000 (Not used) 00001000 (Auto grease: Empty) 00000100 (Auto grease: Operation) 00000000 (Auto grease: Abnormal) 00001100 (Auto grease: Abnormal) 00000000 (Not used) 00000000 (Not used)	D-IN-0: Head lamp D-IN-1: Not used D-IN-2: Starting motor C D-IN-3: Not used D-IN-4: Auto grease A (Only when optional setting is made in auto grease) D-IN-5: Auto grease B (Only when optional setting is made in auto grease) D-IN-6: Not used D-IN-7: Not used
33	Input signal D_IN_8-15	40901	D-IN- 8-----15	The state of input signal is displayed	00000000 (Not used) 00000000 (Not used) 00100000 (Load meter material selector SW = on) 00010000 (Load meter addition/reduction selector SW = on) 00001000 (Right winker on) 00000100 (Left winker on) 00000010 (Monitor mode SW (◇) = on) 00000001 (Monitor mode SW (■) = on)	D-IN-8: Not used D-IN-9: Not used D-IN-10: Load meter material selector SW input (Only when optional setting is made in load meter) D-IN-11: Load meter addition/reduction selector SW input (Only when optional setting is made in load meter) D-IN-12: Winker right D-IN-13: Winker left D-IN-14: Monitor mode SW (◇) D-IN-15: Monitor mode SW (■)
34	Input signal D_IN_16-23	40902	D-IN-16-----23	The state of input signal is displayed	10000000 (Front brake oil pressure SW = on = low level) 01000000 (Rear brake oil pressure SW = on = low level) 00000000 (Not used) 00000000 (Not used) 00001000 (Air cleaner clogging SW = on) 00000000 (Not used) 00000010 (Parking brake emergency release SW = on) 00000001 (Load meter total weight display SW = on)	D-IN-16: Brake oil pressure (Front) D-IN-17: Brake oil pressure (Rear) D-IN-18: Not used D-IN-19: Not used D-IN-20: Air cleaner clogging D-IN-21: Not used D-IN-22: Parking brake emergency release SW D-IN-23: Load meter total weight display SW (Only when optional setting is made in load meter)
35	Input signal D_IN_24-31	40903	D-IN-24-----31	The state of input signal is displayed	10000000 (T/M filter clogging SW = on) 00000000 (Not used) 00100000 (Parking brake = on) 00010000 (Coolant level SW = on = low level) 00000000 (Not used) 00000100 (Engine oil level SW = on = low level) 00000010 (Emergency steering operation SW = on) 00000000 (Not used)	D-IN-24: T/M filter clogging (Only when optional setting is made) D-IN-25: Not used D-IN-26: Parking brake D-IN-27: Coolant level D-IN-28: Not used D-IN-29: Engine oil level D-IN-30: Emergency steering operation (Low S/T pressure) D-IN-31: Not used
36	Input signal D_IN_32-39	40904	D-IN-32-----39	The state of input signal is displayed	10000000 (Subtotal SW = on) 01000000 (Cancel SW = on) 00100000 (High beam = on) 00000000 (Not used) 00001000 (SW for servicing = on) 00000100 (Monitor mode SW (>) = on) 00000010 (Monitor mode SW (<) = on) 00000000 (Not used)	D-IN-32: Subtotal SW (Only when optional setting is made in auto grease) D-IN-33: Cancel SW (Only when optional setting is made in auto grease) D-IN-34: High beam D-IN-35: Not used D-IN-36: SW for servicing D-IN-37: Monitor mode SW (>) D-IN-38: Monitor mode SW (<) D-IN-39: Not used
37	Output signal D_OUT_0-3	40952	D-OUT-0--3	The state of output signal is displayed	1000 (Buzzer = on) 0000 (Not used) 0000 (Not used) 0000 (Not used)	D-OUT-0: Buzzer D-OUT-1: Not used D-OUT-2: Not used D-OUT-3: Not used

The following table shows the display items and display contents in normal operation of the real-time monitor in relation to the VHMS.

No.	Item	ID No.	Display of item	Contents of display data	Display contents in normal operation	Remarks
1	Ambient temperature	37501	AIR TEMP	Ambient temperature	–30 – +100°C, depending on ambient temperature	
2	Blow-by pressure	42801	BLOWBY PRESS	Blow-by pressure	0.0 – 20.0 kPa See Pm-clinic check sheet.	
3	Engine oil temperature	42703	ENG OIL TEMP	Engine oil temperature	0 – 180°C, depending on engine oil temperature	
4	Exhaust temperature (F)	42610	EXHAUST TEMP F	Exhaust temperature (F)	Check after machine is warmed up. 200 – 950°C See Pm-clinic check sheet.	
5	Exhaust temperature (R)	42611	EXHAUST TEMP R	Exhaust temperature (R)	Check after machine is warmed up. 200 – 950°C See Pm-clinic check sheet.	
6	Brake oil pressure (F)	92800	BRAKE PRESS F	Brake oil pressure (F)	0.00 – 50.00 MPa See Pm-clinic check sheet.	
7	Brake oil pressure (R)	92801	BRAKE PRESS R	Brake oil pressure (R)	0.00 – 50.00 MPa See Pm-clinic check sheet.	
8	Brake signal	92900	BRAKE SIG	Brake signal	Brake operation = ON	
9	Steering oil pressure	93000	S/T OIL PRESS	Steering oil pressure	0.00 – 50.00 MPa See Pm-clinic check sheet.	
10	Start signal	93100	START SIG	Start signal	Starting switch ON = ON	
11	Input signal D_IN_0-7	40944	D-IN--0------7	Input signal state	00000000 (Unused) 01000000 (Download switch under cab ON = on) 00000000 (Unused) 00000000 (Unused) 00000000 (Unused) 00000000 (Unused) 00000000 (ORBCOMM connection = on) 00000000 (Brake operation = on)	D-IN-0: Unused D-IN-1: Download switch under cab D-IN-2: Unused D-IN-3: Unused D-IN-4: Unused D-IN-5: Unused D-IN-6: ORBCOMM connection D-IN-7: Brake operation signal
12	Output signal D_OUT_0-3	40948	D-OUT--0--3	Output signal state	0000 (Unused) 0000 (Unused) 0010 (During VHMS operation = on) 0000 (Unused)	D_OUT_0: Unused D_OUT_1: Unused D_OUT_2: VHMS operation D_OUT_3: Unused
13	SEL signal 0-3	00248	D-SEL-0--3	SEL signal state	0000 (Kept at 0) 0000 (Kept at 0) 0010 (Kept at 1) 0000 (Kept at 0)	SEL-0: Kept at 0 SEL-1: Kept at 0 SEL-2: Kept at 1 SEL-3: Kept at 0

Engine reduced-cylinder function

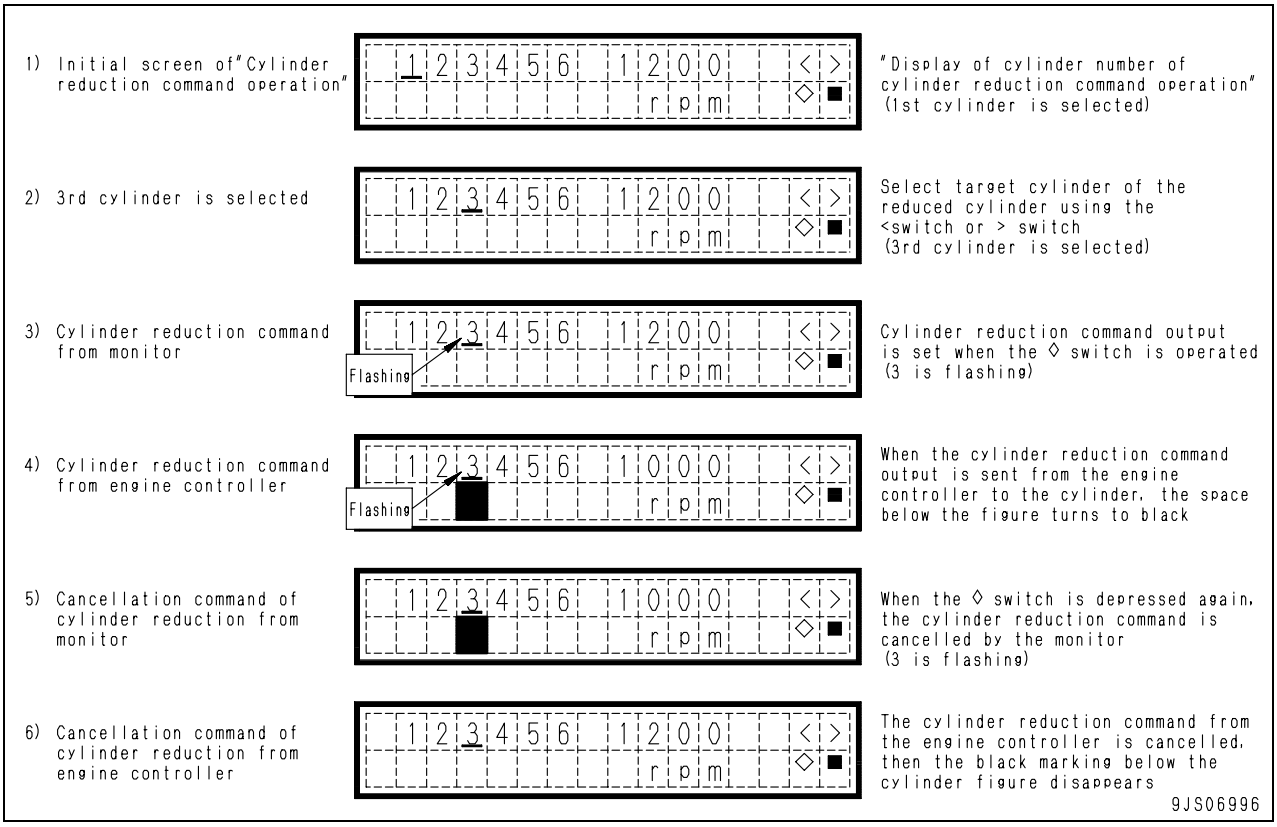
1. Using the < and > switches, display “Reduced cylinder mode selection (CYLINDER CUT-OUT)” screen, and then press the ◇ switch.



2. Operating method of reduced-cylinder function

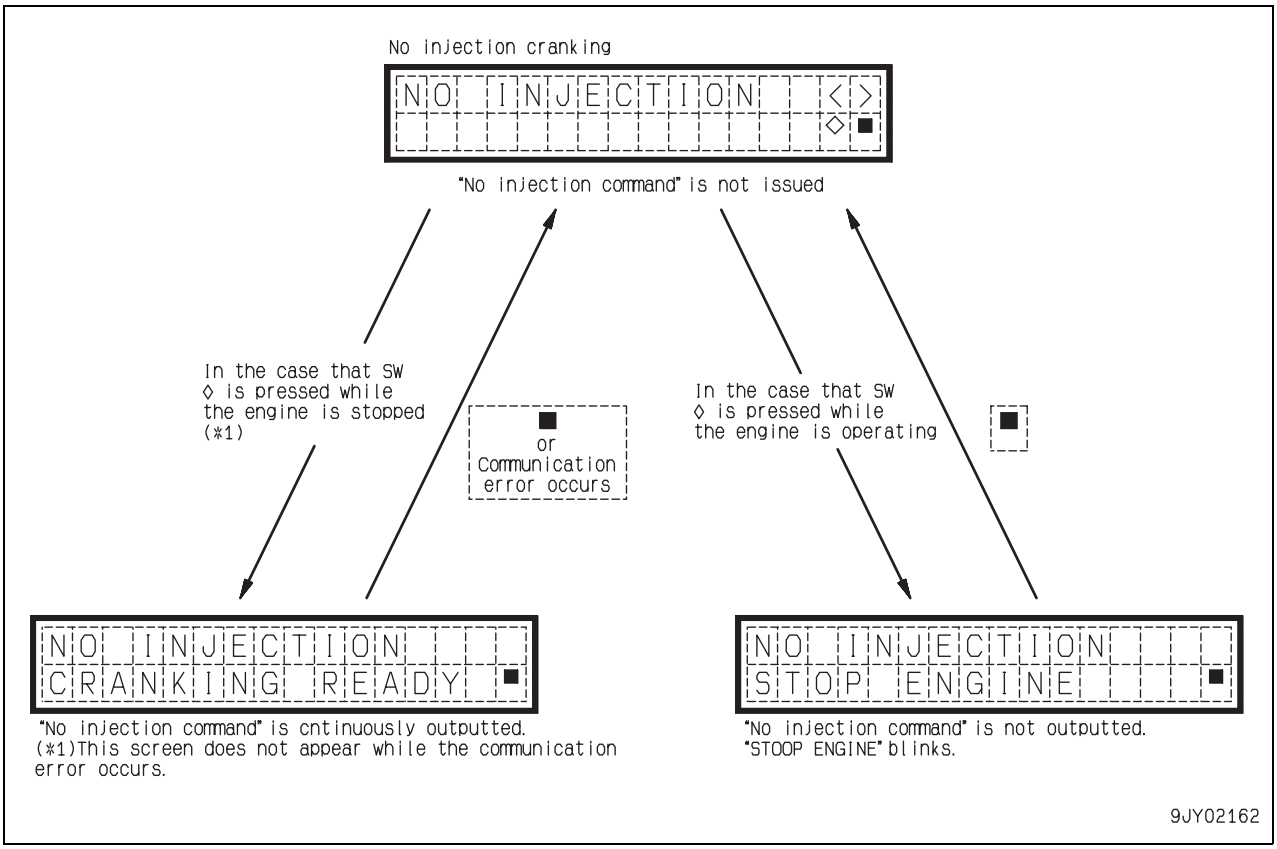
Every pressing the > switch moves the cursor to the right (select a cylinder to issue the reduced-cylinder command).
Every pressing the < switch moves the cursor to the left (select a cylinder to issue the reduced-cylinder command).
Press the ◇ switch to issue the monitor reduced-cylinder command. Every pressing this switch repeats output/release of the command.
Press the ■ switch to return to the “Reduced cylinder mode selection (CYLINDER CUT-OUT)” screen and the reduced-cylinder commands from the monitor are all released.

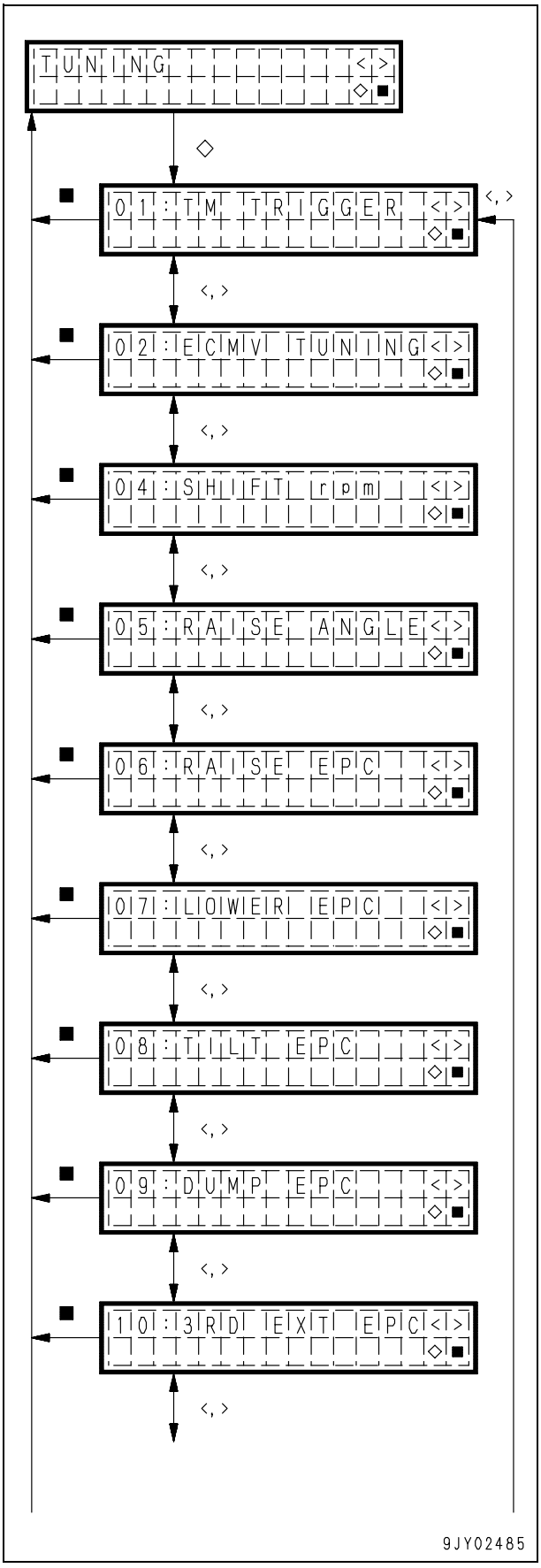
Operation example: When the 3rd cylinder stop command is issued



No injection cranking

For the starting method of engine using this function, see “Testing and adjusting: No injection cranking operation of engine”.
This section describes only the operating method.





Adjustment function

For adjustment using this function, see “Testing and adjusting: Adjustment performed on the monitor”. This section describes its outline only.

01: Reset of transmission initial learning
See “Testing and adjusting: Setting of transmission initial learning”.
See “Testing and adjusting: Reset of initial learning”.
See “Testing and adjusting: Setting of transmission initial learning”.

02: ECMV compensation
See “Testing and adjusting: Adjustment of transmission ECMV current”.

04: Adjustment of transmission shift point
See “Testing and adjusting: Adjusting a shift point”.

05: Lift arm angle adjustment of work equipment controller
See “Testing and adjusting: Adjustment of lift arm angle sensor (Raise) (for EPC lever)”.

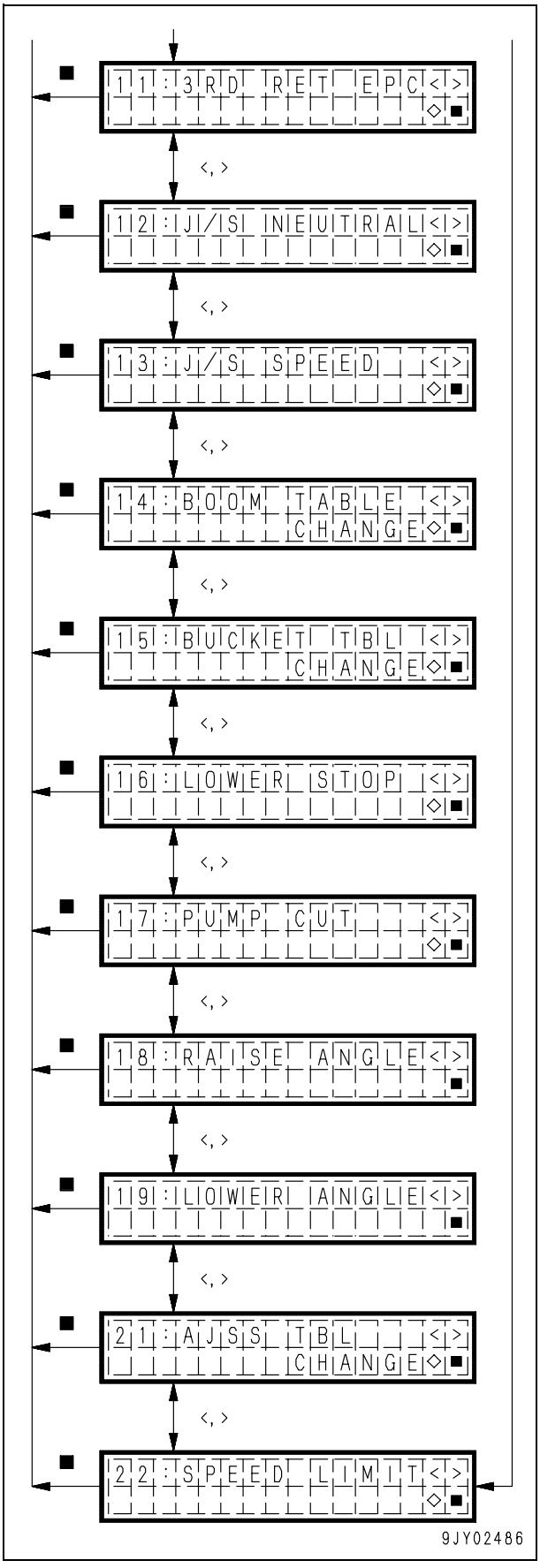
06: Adjustment of lift arm raise lever position before detent and variations in the dead zone of EPC
See “Testing and adjusting: Adjusting variation correcting calibration of lift arm raise lever before detent”.
See “Testing and adjusting: Adjusting lift arm raise EPC starting current”.

07: Adjustment of lift arm lower (float) lever and variations in the dead zone of EPC
See “Testing and adjusting: Adjusting variation correcting calibration of lift arm lower (float) EPC lever”.
See “Testing and adjusting: Adjusting lift arm lower EPC starting current”.

08: Adjustment of bucket tilt lever position before detent and variations in the dead zone
See “Testing and adjusting: Adjusting variation correcting calibration of bucket tilt lever position before detent”.
See “Testing and adjusting: Adjusting bucket tilt EPC starting current”.

09: Adjustment of bucket dump EPC starting current
See “Testing and adjusting: Adjustment of bucket dump EPC starting current”.

10: Adjustment of 3-spool valve EPC cylinder extraction lever and variations in the dead zone of EPC
★ This item shall not be operated.



11: Adjustment of 3-spool valve EPC cylinder retraction lever and variations in the dead zone of EPC
★ This item shall not be operated.

12: Adjustment of AJSS neutral position (AJSS specification)
See “Testing and adjusting: Adjustment of AJSS neutral position”.

13: Adjustment of AJSS EPC output current (AJSS specification)
See “Testing and adjusting: Adjustment of AJSS EPC output current”.

14: Modification of lift arm (boom) lever pattern
See “Testing and adjusting: Modification of lift arm (boom) lever pattern”.

15: Modification of bucket lever pattern
See “Testing and adjusting: Modification of bucket lever pattern”.

16: Adjustment of lift arm (boom) raise/lower stop modulation
See “Testing and adjusting: Adjustment of lift arm (boom) raise/lower stop modulation”.

17: Adjustment of pump cut-off pressure in lift arm (boom) raise
See “Testing and adjusting: Adjustment of pump cut-off pressure in lift arm (boom) raise”

18: Adjustment of lift arm (boom) angle sensor (raise) (For load meter)
See “Testing and adjusting: Adjustment of lift arm (boom) angle sensor (raise) (For load meter)”.

19: Adjustment of lift arm (boom) angle sensor (lower) (For load meter)
See “Testing and adjusting: Adjustment of lift arm (boom) angle sensor (lower) (For load meter)”.

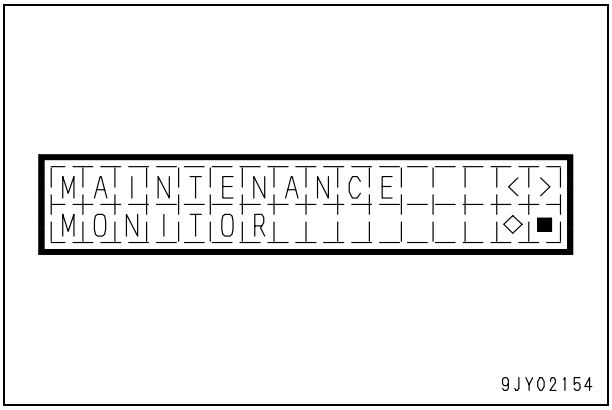
21: Modification of AJSS oil pressure command table pattern
See “Testing and adjusting: Modification of AJSS oil pressure command table pattern”.

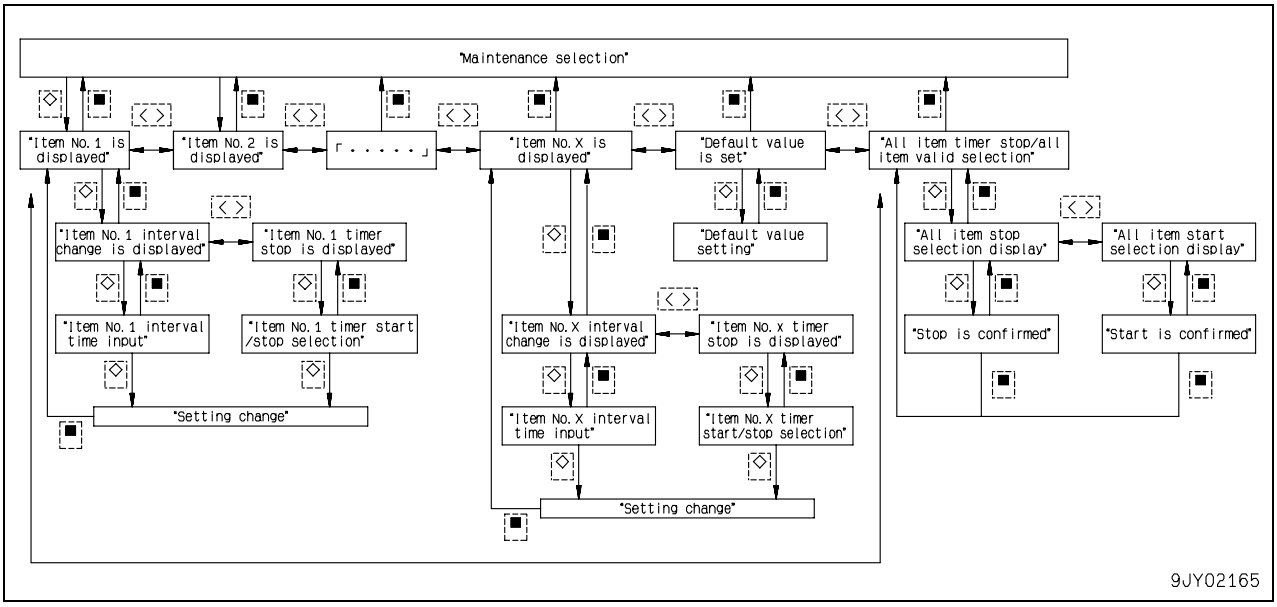
22: Adjustment of maximum speed limit
See “Testing and adjusting: Adjustment of maximum speed limit”.

Maintenance monitoring function

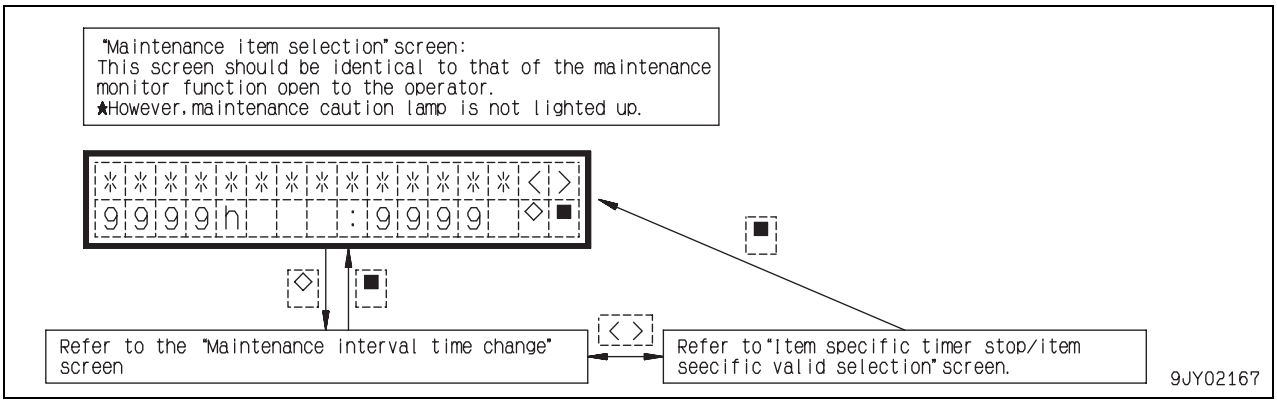
1. Selection of display of maintenance monitor function (1st layer)
   For the destination you can go to using <, >, and ■ switches, see “Function 1 for the service person: 2nd layer transition diagram”.

Pressing the ◇ switch changes the screen to the “Item NO. 1 is displayed” screen.

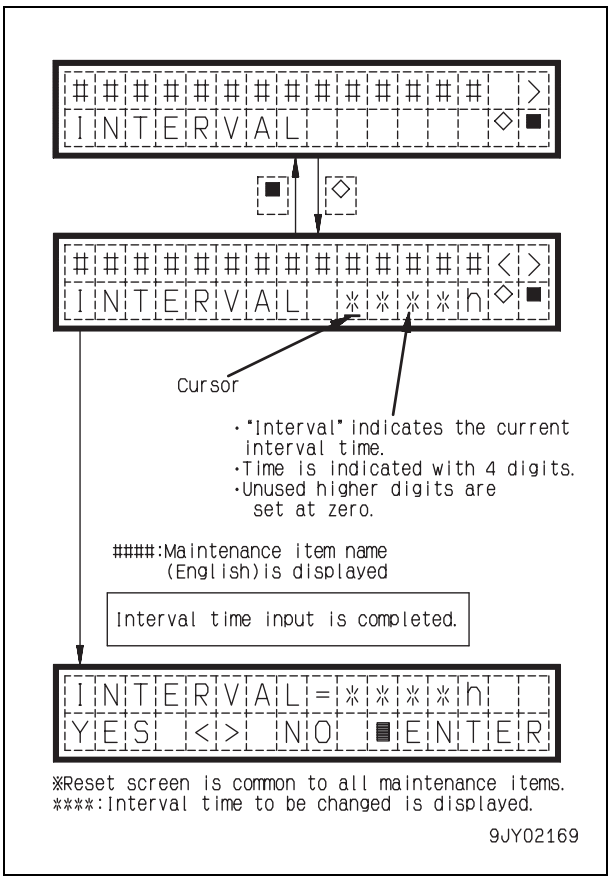




2. “Select maintenance item” screen
   (1) Using the > switch, display items in ascending order of numbers.
   ★ When the last item is selected, the screen is changed to the “Default value is set” screen.
   (2) Using the < switch, display items in descending order of numbers.
   ★ When the last item is selected, the screen is changed to the “All item timer stop/all item valid selector” screen.

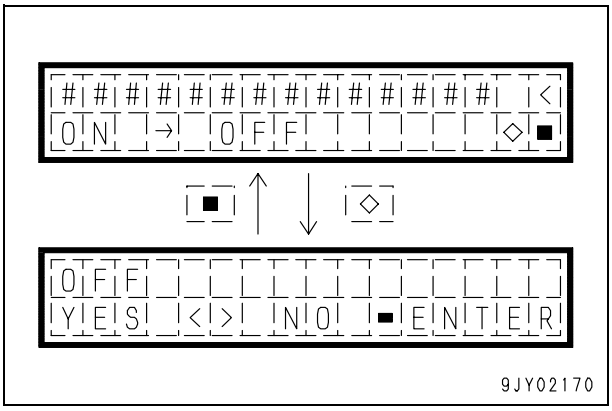


a. Change of maintenance interval time



How to input interval
(1) Input a value between 0 and 9 at the cursor position.
(2) The cursor is positioned at the highest-order digit. Pressing the > or < switch increases or decreases the value between 0 and 9.
(3) Input a desired value and press the ◇ switch.
(4) The cursor moves to the 2nd position. Select the digits for the all positions by performing steps (2) and (3) above.
(5) After selecting the digit for the lowest position, press the ◇ switch.
★ If the input interval time is acceptable, the screen changes to the check screen.
★ If the input interval time is not acceptable, the time does not change.
(6) Return the cursor to the highest-order digit.
★ The lower limit of set value is 50h.
(7) When you have entered a wrong value to a position succeeding to the highest-order digit, move to the highest-order digit using ■ switch and repeat the procedure from the first.
★ In this case, values that had been entered remain as they are until modified.
(8) When the cursor is at the highest-order digit, move to the higher layer using ■ switch.
● Select YES or NO with the < or > switch.
● The cursor (_) is blinking at the selected item. If you have selected “YES”, press the ■ switch to execute the change. If you have selected “NO”, press it to return to the “Select maintenance item” screen without executing the change.
★ By default, the cursor is set to NO (cancel) to prevent resetting error.
● When an interval time is changed, the remaining timer time is changed as shown below.
(Interval time being set – Elapsed time from the last replacement)

b. Selection between enabling or disabling timer by item



- When “Timer by item” is enabled at present, “ON → OFF” is displayed at the lower column.
- When “Timer by item” is disabled at present, “OFF → ON” is displayed at the lower column.

★ By default, it is “ON” and the timer function is enabled.

- When you disable “Timer by item”, “OFF” is displayed at the upper column.
- When you enable “Timer by item”, “ON” is displayed at the upper column.

- Select YES or NO with the < or > switch.
- The cursor (_) blinks on the selected item. If “YES” is selected with the ■ switch, the change is executed. If “NO” is selected, the change is cancelled and the “Select maintenance item” screen is returned.

★ By default, the cursor is set to NO (cancel) to prevent resetting error.

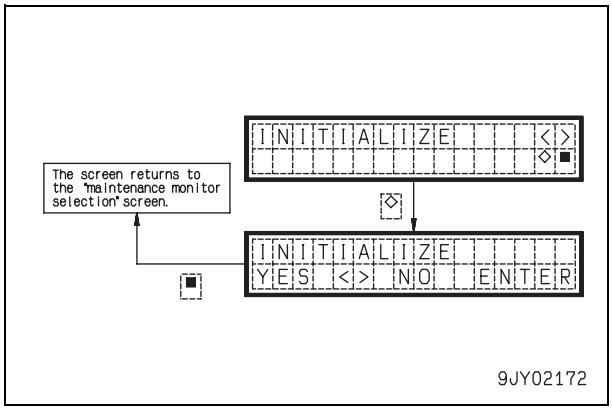
- Specify disabling the timer or releasing the disabling by maintenance item.

- If you cancel the timer disabled, interval time before having been disabled is used as the set value.

- The timer remaining time is reset.

★ The reset frequency is not incremented and remains the same as before the resetting.

3. Setting of a default value



- Select YES or NO with the < or > switch.
- The cursor (_) blinks on the selected item. If “YES” is selected with the ■ switch, the change is executed. If “NO” is selected, the change is cancelled and the “Select maintenance item” screen is returned.

★ By default, the cursor is set to NO (cancel) to prevent resetting error.

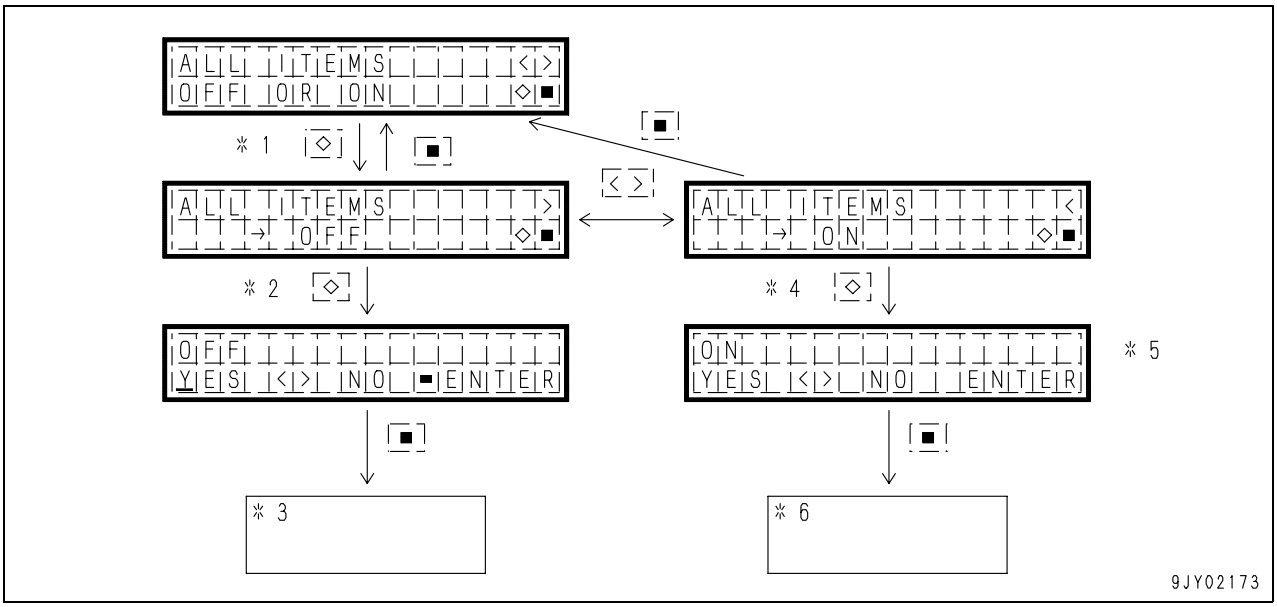
- If the default value is executed, all the currently changed interval times are returned to the default values. It is executed on every item independent of whether or not the function is enabled for a specific item.

- Timer remaining time shall be Default value – Elapsed time since the last replacement.

★ The reset frequency is not incremented and remains the same as before the resetting.

★ Set enable for enable or disable of individual items.

4. Selection between timer stop for all items and enable by item

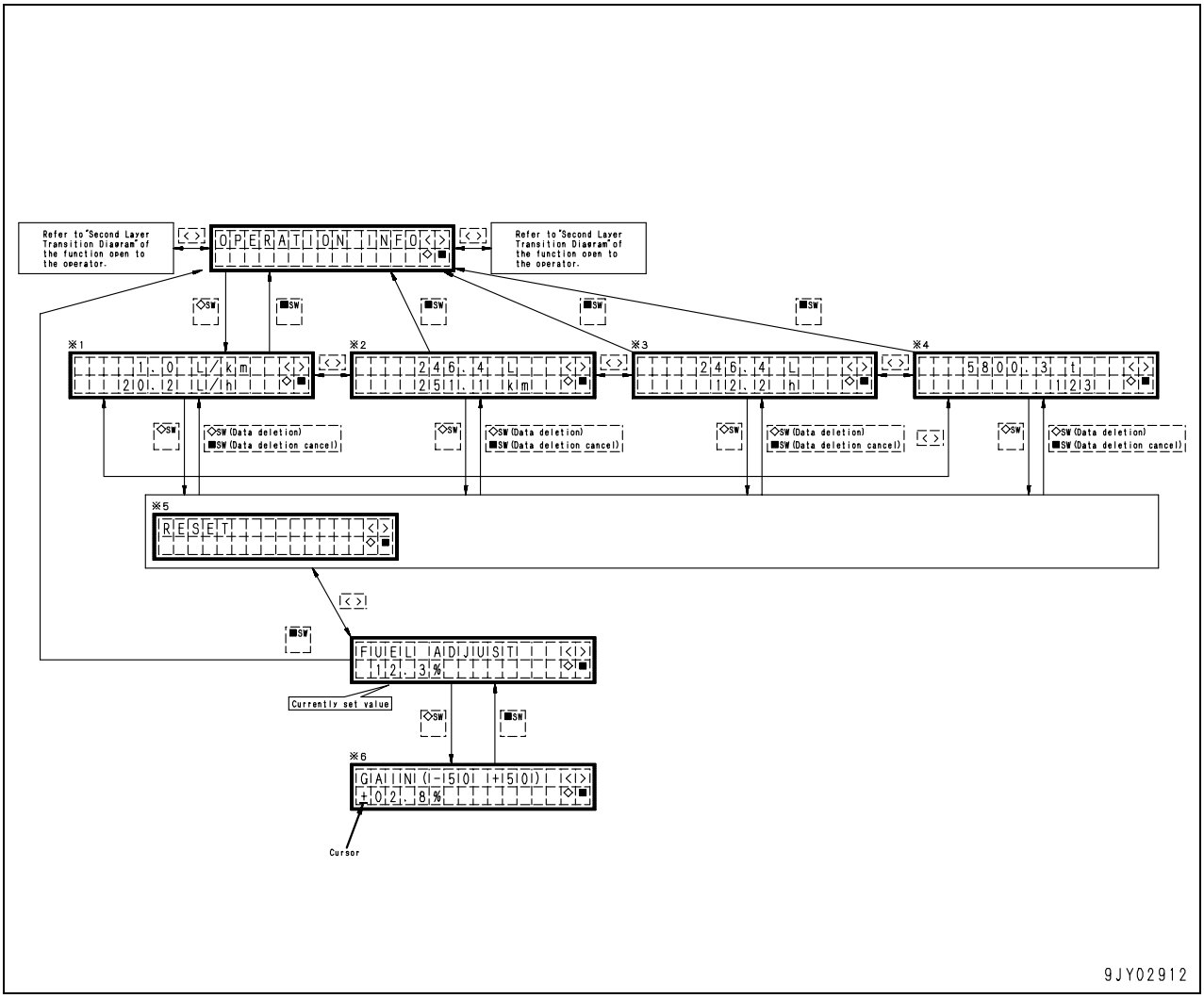


*1 Press the ◇ switch to go to the “ALL ITEMS OFF” screen.
*2 When “ALL ITEMS OFF” is selected
*3 When ALL ITEMS OFF is executed:
The timer function for all items is stopped and the “Select maintenance monitor” screen is restored.
Setting for individual items is also disabled.
When ALL ITEMS OFF is canceled:
The operation is cancelled and the MAINTENANCE MONITOR screen is restored.
*4 When “ALL ITEMS ON” is selected
*5 Select YES or NO with the < or > switch.
The cursor (_) is blinking at the selected item.
★ By default, the cursor is set to NO (cancel) to prevent resetting error.
*6 When ALL ITEMS ON is executed:
Interval time being set for all items is disabled independent of whether or not it is enabled or disabled for a specific item.
The timer remaining time is reset.
The reset frequency is not incremented and remains the same as before the resetting.
The “Select maintenance monitor” screen is restored. Setting for individual items is also enabled.
When ALL ITEMS OFF is canceled:
The operation is canceled and the “Select maintenance monitor” screen is restored.

Operating information display function

Outline

- The value of fuel consumption is obtained by adding the target injection amount sent from the engine controller.
- It is not measured but calculated fuel consumption. Use it as a rough standard.



*1 The upper column displays fuel consumption [L/km or L/mile] per 1 km (or 1 mile) from the last resetting.
It is calculated from the fuel consumption and travel distance above.
The unit km or mile shall be selected depending on that used on the odometer.
The counting is stopped at 99999.9, the upper limit.
The lower column displays the average fuel consumption [L/h] from the last resetting.
The counting is stopped at 99999.9, the upper limit.

*2 The upper column displays the cumulative fuel consumption [L] from the last resetting.
The counting is stopped at 9999999.9, the upper limit.
The lower column displays the travel distance [km or mile] from the last resetting.
The unit km or mile shall be selected depending on that used on the odometer.
The counting is stopped at 9999999.9, the upper limit.

*3 The upper column displays the cumulative fuel consumption [L] from the last resetting.
The counting is stopped at 9999999.9, the upper limit.
The lower column displays the elapsed time [h] from the last resetting.
The counting is stopped at 9999999.9, the upper limit.

*4 Calculation of (*4) is executed when the load meter is installed. (The screen is not available when the load meter is not installed.)
The upper column displays the loaded volume [ton] from the last resetting.
The counting is stopped at 199999999.9, the upper limit.
Short ton or metric ton depends on optional setting.
The lower column displays the loading frequency from the last resetting.
The counting is stopped at 65000, the upper limit.
(*1 – *4)
Calculation is done only for the duration in which the engine is run.

*5 Using the ◇ switch, clear data of (*1), (*2), (*3), and (*4) to return to the previous screen.
Using the ■ switch, return to the previous screen without resetting.
Note: Other than the reset operation above, you can reset data by initializing the monitor panel or specifying optional setting to OFF.

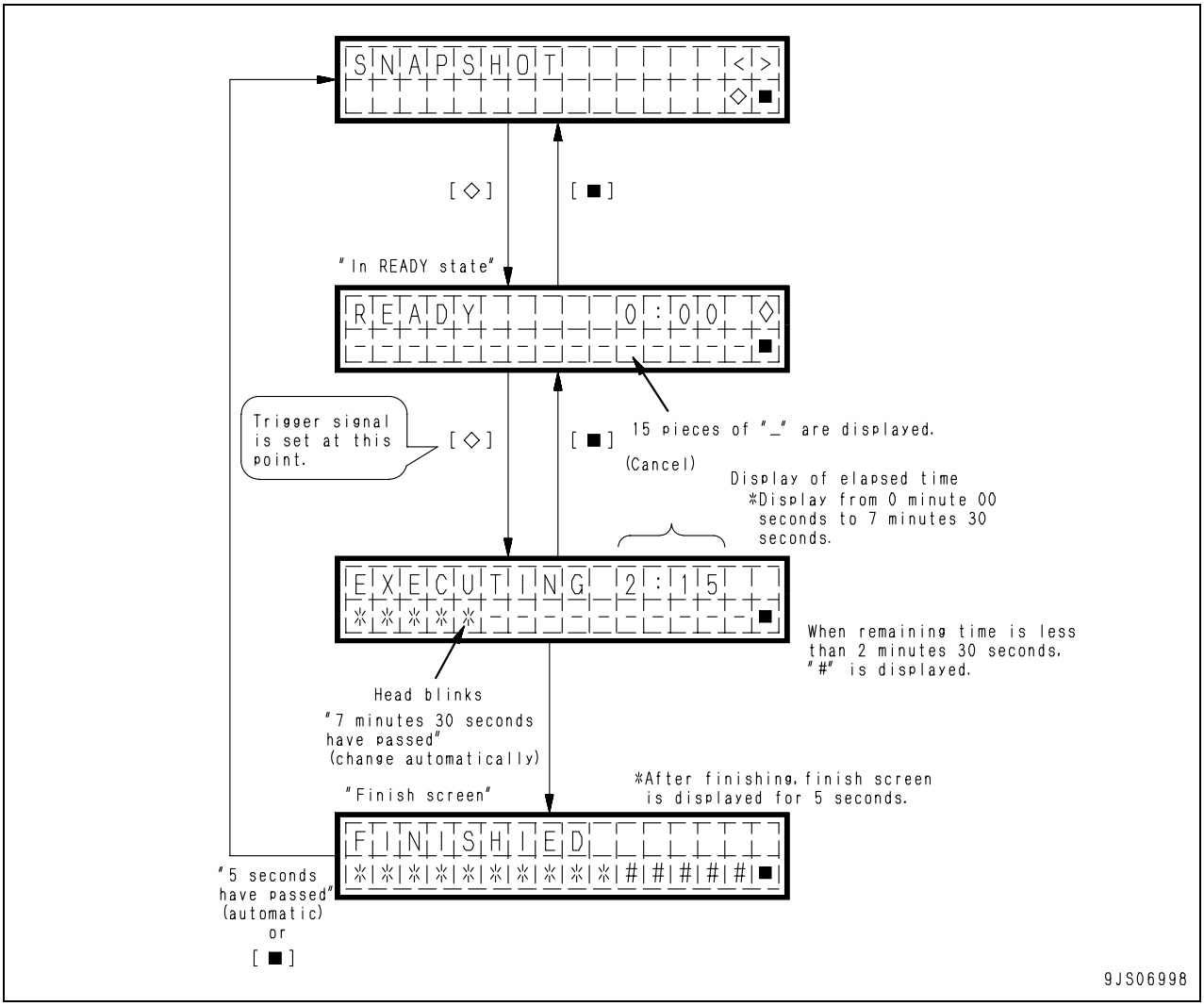
Acquisition of fuel consumption (L)
- The monitor panel calculates the cumulative fuel consumption (L) based on the momentary fuel consumption (L/h) from the engine controller.

*6 Setting gain correction
1) When the screen appears, the current set value is displayed and the cursor is placed on the sign (+/–).
2) When the cursor is placed on the sign, every pressing the > or < switch displays "+" ⟷ "–" in order.
3) Press the ◇ switch to confirm the sign.
→ Cursor moves to the highest-order digit.
4) First, the cursor appears at the highest-order digit. Each time the > or < switch is pressed, the value at the digit increases or decreases between 0 and 9. (The highest-order digit is between 0 and 2.)
5) Input a desired value and press the ◇ switch to confirm the entry.
6) The cursor moves to the lowest-order digit. Select a value in the same manner as step 4).
7) Input a value at the lowest-order digit and press the ◇ switch. (The screen returns to the previous one when the entry is confirmed.)
8) If ■ switch is pressed before finishing entering, the cursor moves to the sign position. In this case, the value remains unchanged. Using the ■ switch, return to the previous screen.
9) If the value confirmed for the lowest-order digit is outside the range from –50.0 to +50.0, the cursor moves to the sign position with the value unchanged as with when the ■ switch is pressed.

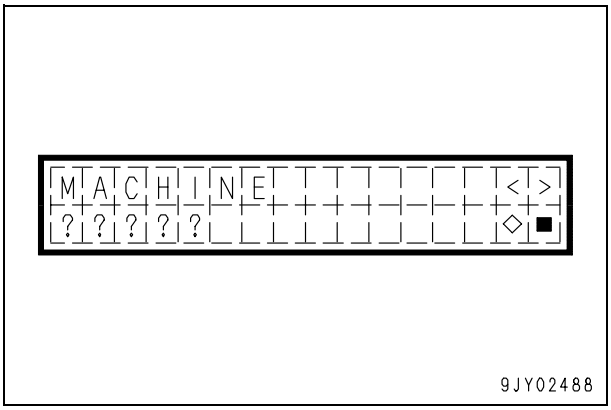
Processing on the monitor panel:
- Default value: 0.0%
- This setting allows correcting the cumulative fuel consumption (L) in the range of –50.0 to +50.0%.

Snap shot function

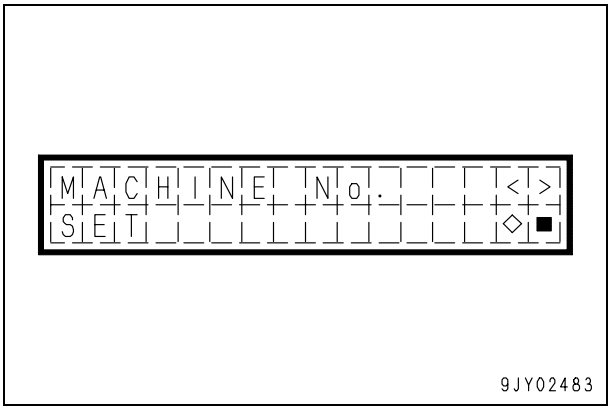
For this function, see the section of “Testing and adjusting: Manual snapshot function”.



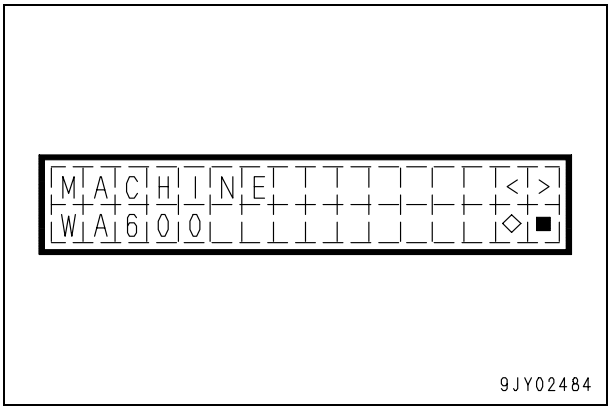
Function of selecting optional device
For setting using this function, see “Testing and adjusting: Adjustment performed on the monitor”.



Input of machine serial number (No.)
For setting using this function, see “Testing and adjusting: Adjustment performed on the monitor”.



Model selection function
For setting using this function, see “Testing and adjusting: Adjustment performed on the monitor”.



Load meter function

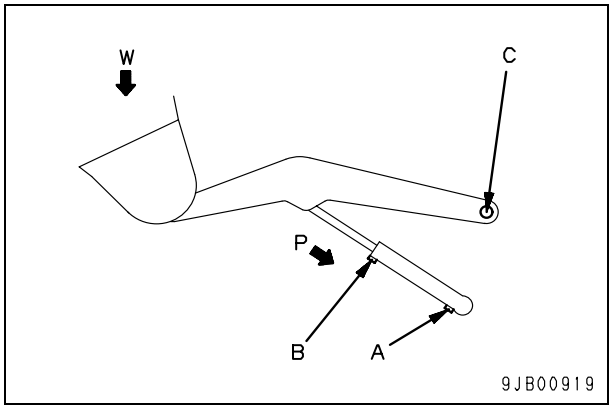
★ Machine equipped with load meter

1. Outline

- The load meter displays the remaining amount of total or target loaded volume by classifying working objects into five types and measuring the bucket-loaded volume.
- It is provided with the functions to switch between reduction mode and addition mode, and between working objects, and the function to display and clear total loaded volume. To operate these functions, use the load meter mode selector switch and monitor panel mode selector switch.
- It is also equipped with calibration mode, calibration clear mode, and load meter calculation stop mode. To operate these modes, use the monitor panel mode selector switch.
- Installing a printer (if equipped) allows printing of measured data.
- For usage of the functions, see Operation and Maintenance Manual.

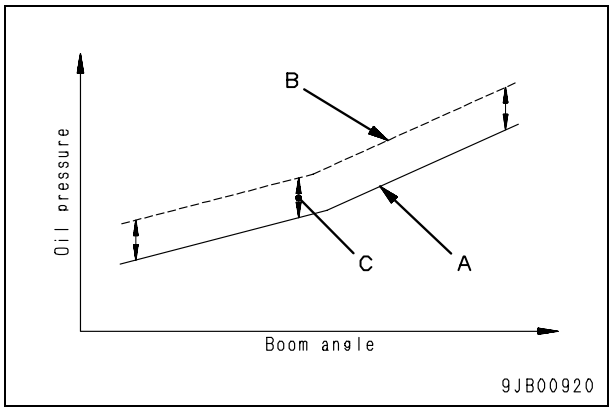
2. Weight calculation

The load meter calculates weight (W) by detecting the lift arm operating pressure (P) by the pressure sensor (A) installed at the lift arm cylinder bottom and pressure sensor (B) installed at its head and calculating the center of gravity by the lift arm angle sensor (C).

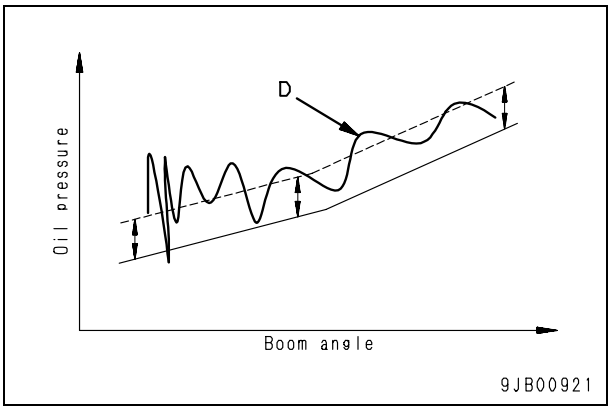


Weight calculation is done based on the differential pressure (C) between the reference value (A) where the lift arm pressure with no load is saved (corrected by calibration) and the calculated lift arm pressure (B) with load.

In addition, to improve its precision, the detection function calculates weight during lift arm raise operation.

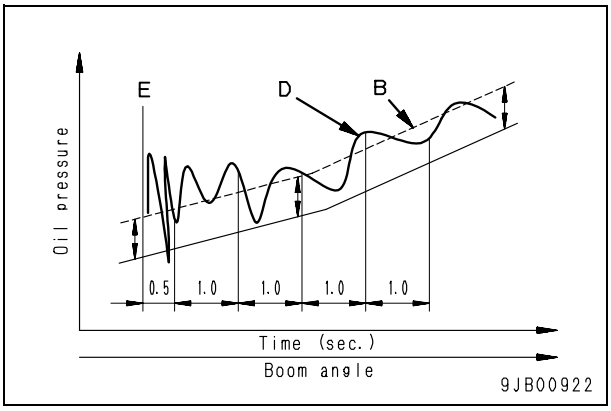


Operation of tires and work equipment generates spring effect on the machine, however, the measured lift arm pressure (D) is provided with the characteristic shown in the figure below.



The value (D) measured by lift arm raise operation is calculated based on the value obtained as the calculated value (B) according to the following calculation criteria.

- For 0.5 seconds after lift arm raise operation start (E), the lift arm state changes from the static state to operating state and the pressure largely fluctuates and is not stable. Therefore, it is not used for calculation of the calculated value (B).
- The spring effect of the machine is generated at interval of approx. 1 second. Therefore, the calculated value (B) is obtained based on the mean every 1 second during the period between the lift arm raise operation start and the operation end.



Determination of lift arm raise operation start
The load meter determines that the lift arm starts moving and starts weight calculation when all the following conditions are satisfied.

Condition 1	The lift arm angle is between –10 and –30°. (The range between the horizontal position and position immediately before it contacts the ground)
Condition 2	The lift arm angle changes at least 0.1° for 0.1 second. (The lift arm starts moving with min. specified speed in raising direction.)

Determination of lift arm raise operation stop
The load meter determines that the lift arm stops moving and ends weight calculation when one of the following conditions is satisfied.

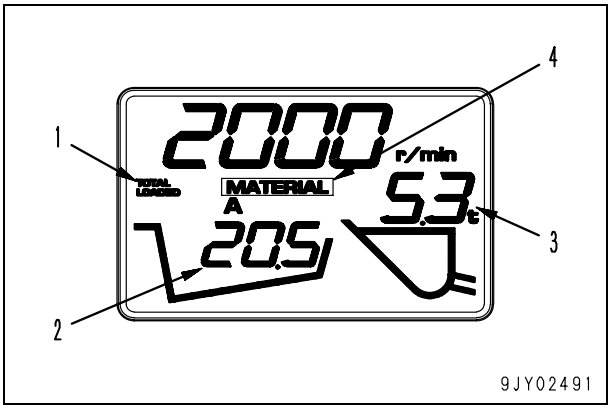
Condition 1	The lift arm angle changes to under 0.5° for 0.5 second. (The lift arm speed in raise direction is reduced below the specified speed.)
Condition 2	The lift arm angle changes to lowering direction. (When the lift arm is lowered, weight calculation finishes.)
Condition 3	The lift arm angle changes to above +20°. (At a high position, weight calculation stops.)
Condition 4	The lift arm raise speed suddenly changed. (The current angular velocity is decreased 70% or more of the previous one.)
Condition 5	Weight calculation was performed 7 times.

Display of calculated weight
The average of calculated weight values are displayed.

Number of calculations	Calculation time (sec)	Weight calculation and display method
Only 1 time	1.5 – 2.5	Displays weight based on a single calculation result. In this case, however, the weight display blinks to inform the operator that the precision is unstable due to short calculation time.
2 times	2.5 – 3.5	Displays weight based on the mean value of 2 calculation results.
Min. 3 times	3.5 –	Displays weight based on the mean value of latest 3 calculation results.

3. Reduction/addition mode

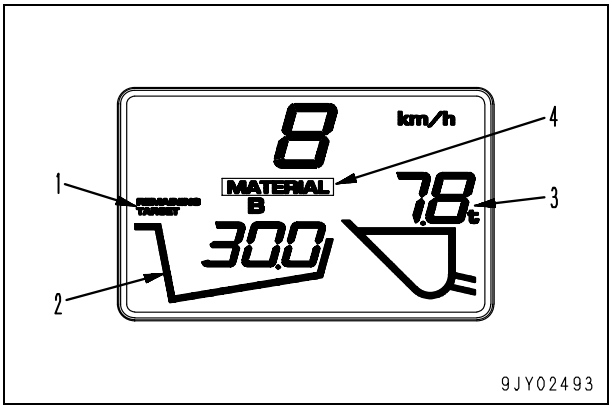
Monitor display in addition mode
This is the mode to display the bucket-loaded volume every time.
Use this mode for grasping the work rate.



- When addition mode is selected, “TOTAL LOADED” is displayed at the display of addition mode (1), which indicates the value obtained by adding the value at the display of calculated bucket-loaded volume (3) to the value at the total loaded volume (2).
- Weight calculation can be displayed by cumulating up to any 5 working objects independently.
  Working objects can be selected from types A to E at the working object display (4) in mode selection.
- The display of total loaded volume (2) indicates up to 9,999 t unless data is cleared by the load meter subtotal switch.
  The display indicates a value to one decimal place (in 100 kg) in the case of max. 999.9 t. When it exceeds 1000 t, the decimal point display disappears and switches to the display in 1 t.

★ For details of the display of total loaded volume, see “Display of total loaded volume and display of remaining volume”.

Monitor display in reduction mode
This is the mode to display the bucket-loaded volume every time based on the pre-set target weight.
Use this mode for constant loading work.



- When reduction mode is selected, “REMAINING TARGET” is displayed at the display of reduction mode (1), which indicates the value obtained by reducing the value at the display of calculated bucket-loaded volume (3) from the value specified at the display of total loaded volume (2).
- Weight calculation can be displayed by cumulating up to any 5 working objects independently.
  Working objects can be selected from types A to E at the working object display (4) in mode selection.

★ For the display and calculation method when the value at the display of bucket-loaded volume (3) exceeds the value at the display of remaining volume (2), see Operation and Maintenance Manual “Handling the load meter”.

★ For details of the display of remaining volume, see “Display of total loaded volume and display of remaining volume”.

Display of total loaded volume and display of remaining volume

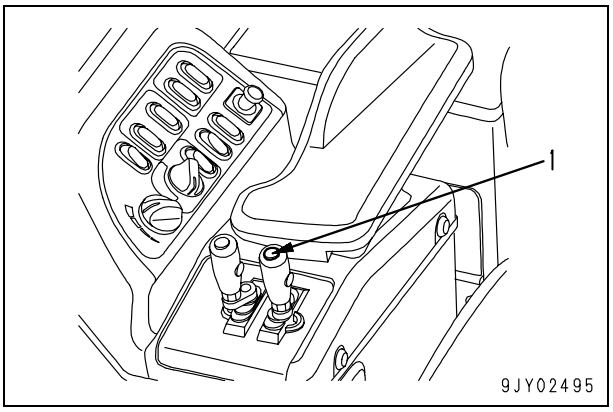
Actual total loaded weight (t)	Display of total loaded volume	Remarks
– –99.5	–99.9	Display of decimal point
–99.4 – –0.1	–**.*	Display of decimal point (the second decimal place is rounded off.)
0 – 999.4	***.*	Display of decimal point (the second decimal place is rounded off.)
999.5 – 9999.4	****	Display of integer (the second decimal place is rounded off.)
9999.5 –	9999	Display of integer

Unit of calculated weight

- Calculated weight values are all displayed in SI (metric ton).
  If “MPH” has been selected for speed display in monitor setting, however, it can be switched to short ton (US ton) in service mode optional setting.
  If you switch it to short ton, weight display is also output in short ton (US ton) on the printer.

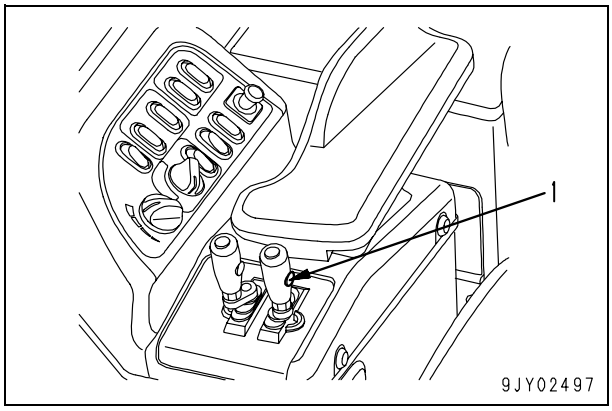
⚠ In countries where SI unit is adopted, the speed display unit and weight display unit must not be changed to non-SI unit.

Load meter cancel switch



- When the switch (1) is pressed during the holding time of calculated weight (15 seconds after completion of calculation), the value at the display of bucket-loaded volume is canceled, and the calculated weight is abandoned.)
  In this case, the display of total loaded volume (display of remaining volume) newly added (reduced) is also canceled, and the previous display value is returned.

Load meter subtotal switch



- To clear the display of total loaded volume (in addition mode) or display of remaining volume (in reduction mode), continuously press the switch (1) at least 2 seconds.

Specifications	Operation after operating switch
Printer not installed	Clears the display of total loaded volume (display of remaining volume).
Printer installed	Outputs saved subtotal data on the printer. After the output, the subtotal data is cleared.

Subtotal data

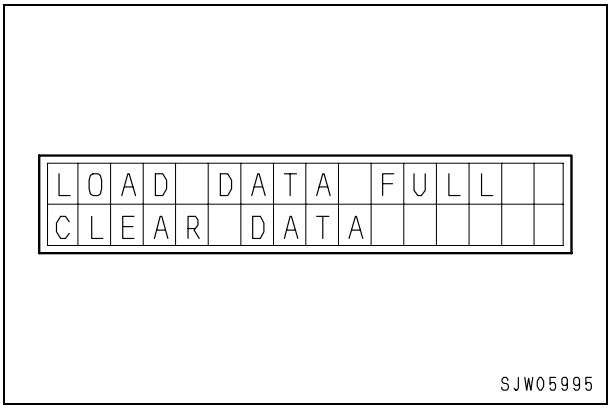
- The following data when calculated weight is confirmed is saved as a set.
  - Type of working object
  - Weight of loading in one bucket
  - Total number of loading
  - Total loaded volume

  Memory capacity: Min. 500 times of loading

4. Auto subtotal function
   1) When the printer (if equipped) is connected.
      The 501st weight calculation is executed, and after 15 minutes, data is stored in RAM and up to the 500th data is printed out on the printer at the same time.
      After the output on the printer, the subtotal data is cleared.
      The character display displays “LOAD DATA FULL” and “CLEAR DATA” after saving the 500th data, and continues measurement.

   2) When the printer (if equipped) is not connected
      The 501st weigh calculation is executed, and after 15 minutes, data is stored in RAM and up to the 500th weight data by bucket is abandoned to secure store data area.
      The character display displays “LOAD DATA FULL” and “CLEAR DATA” after saving the 500th data, and continues measurement.

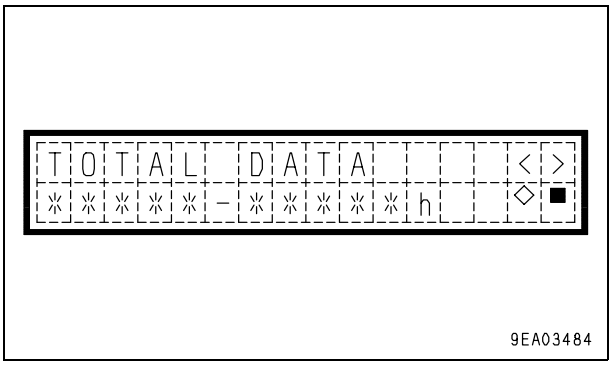
Display on character display after 500th data is stored



5. Cumulative data display function

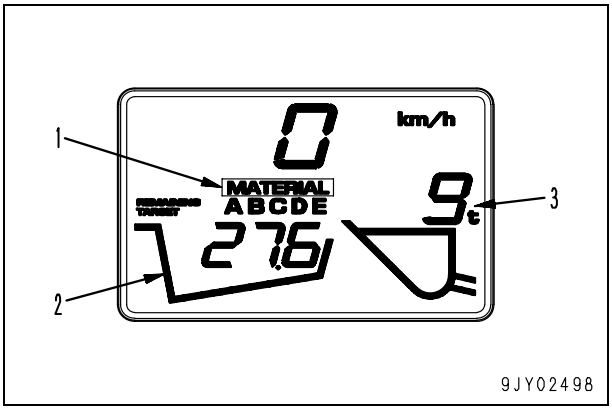
Display of data

- Total loaded volume and total number of loading in addition mode or reduction mode are displayed.
- Press the load meter mode selector switch to display “TOTAL DATA” on the character display.



★ The lower column (※※※※※-※※※※※h) displays cumulative hours according to the hour meter criteria.
Example) In the case of display of 12300-12450h, the cumulative data of 150 hours between 12300 and 12450 hours is displayed in the character display.

- Press the monitor panel mode selector switch 2 (>) or (<) to select “By the item (A) to (E)” or “All ON” at working object display (1).
  In the former case, cumulative weight by type (2) and the number of loading (3) are displayed.
  In the latter case, total loaded volume (2) of all objects from (A) to (E) and the total number of loading (3) are displayed.



Reset of data
- Cumulative data by the item (A) to (E) or of all objects are reset.
- Display “TOTAL DATA” on the character display. Press the load meter selector switch (A/B) to specify either “By the item (A) to (E) or “All ON” at the working object display. Press the load meter mode selector switch (A/B) at least 4 seconds.

6. Printer output (if equipped)
   ★ This function works only when the printer specified in optional setting is installed.

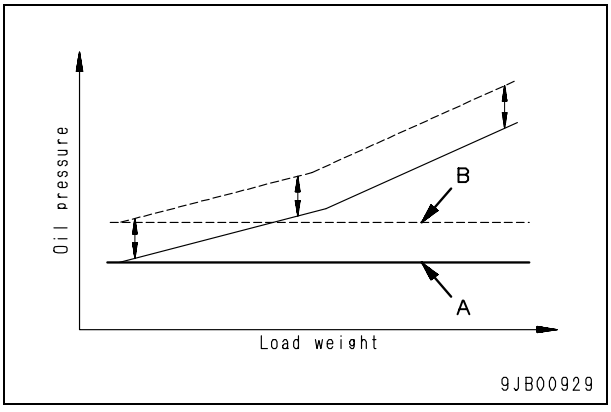
   The output format of load meter can be selected from 3 types (A, B, C) of output mode.
   The output format of each mode is as follows.

   ★ For selection of output mode and output method, see Operation and Maintenance Manual “Handling the load meter”.

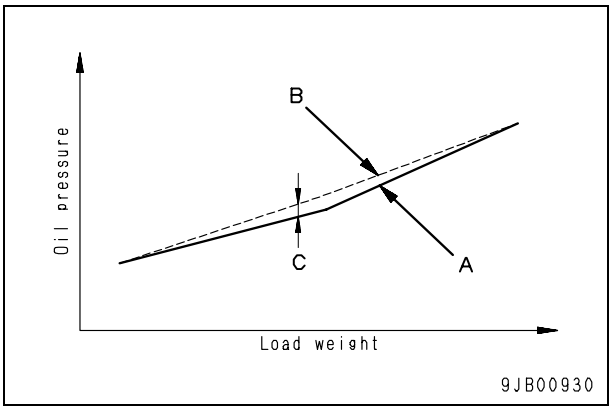
A-mode (Total printer output)	B-mode (Subtotal printer output)	C-mode (Operation record printer output)
• Model, serial number • Date and time of printing • Subtotal loading data (Type/number of loading/loaded mass) • Total loading data (Total number of loading/Total loaded mass)	• Model, serial number • Date and time of printing • Loading data (Loaded mass) • Subtotal loading data (Type/number of loading/loaded mass) • Total loading data (Total number of loading/Total loaded mass)	• Model, serial number • Date and time of starting record, service meter • Date and time of ending record (printing), service meter • Subtotal loading data (Type/number of loading/loaded mass) • Total loading data (Total number of loading/Total loaded mass) • Maintenance time (Maintenance item/remaining time)

7. Calibration
   - No load calibration and load calibration are provided: the former measures the pressure with the bucket empty and the latter measures the pressure with known weight loaded.
   - The lift arm is raised with the bucket full tilting. In this condition, the lift arm working pressure with no load (0 kg) or known weight loaded is saved.
   - If the center of gravity of load is deviated from the factory-set position due to modification of the lift arm or bucket, no load or load calibration must be executed to operate the machine with high precision.
   - ★ The saved calibration data is not cleared even after the battery has been removed for a long time.

   1) No load calibration
   - This function cancels the individual difference of weight inherent to the machine, e.g. the weight of working equipment. It makes compensation (B) by offsetting the error between the actual weight and the reference value (A) as shown below.



   2) Load calibration
   - This function compensates the reference pressure with the bucket loaded. It makes compensation (B) of the error between the actual pressure and the reference value (A) in the vicinity of the position where load calibration is executed (C) as shown in the figure below.



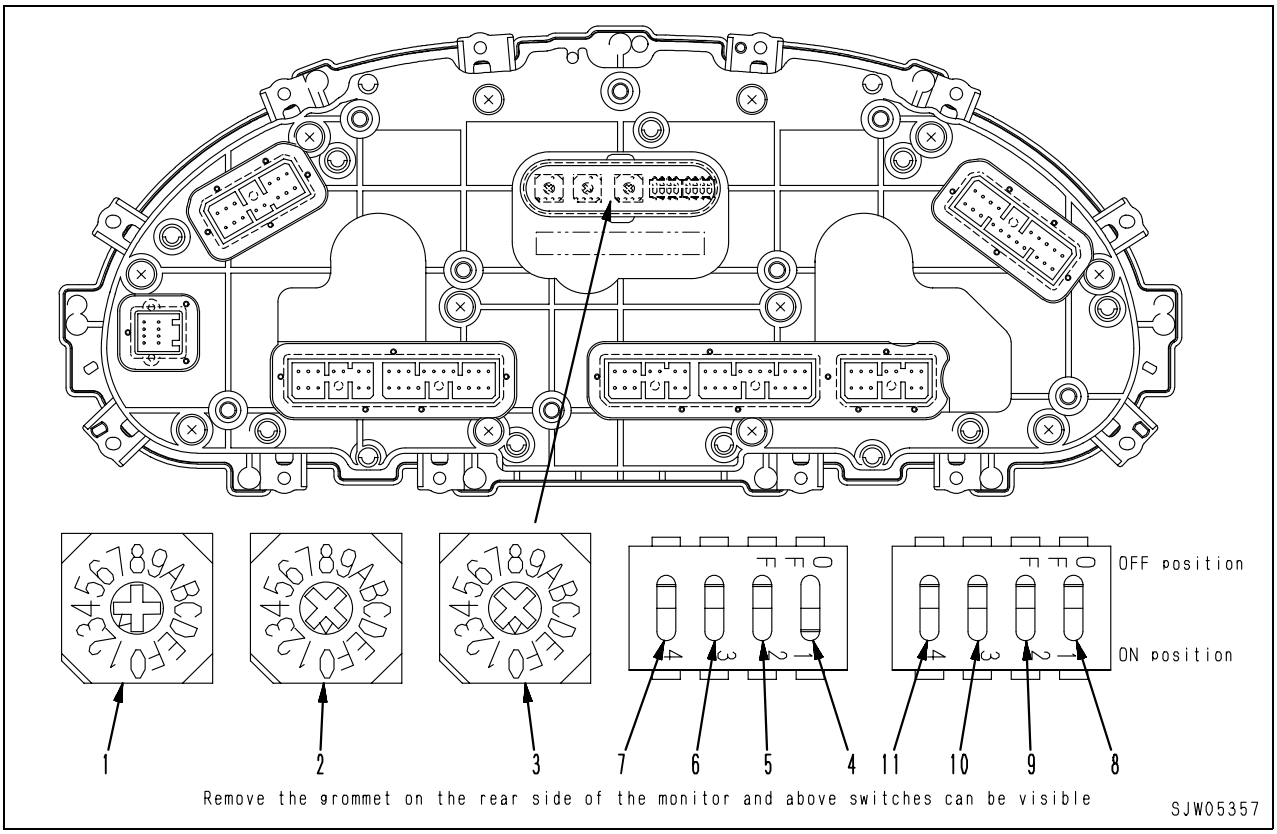
   ★ For the calibration method, see “Operation and Maintenance Manual”, “Operation of load meter”.

8. Calculation stop
   The calculation function of the load meter is stopped.
   During the calculation stop, the display of load meter disappears, and speed display or engine speed display appears. No data is added to the total data in this mode.
   To restart calculation, select the addition mode or reduction mode.
   ★ For the calculation stop method, see “Operation and Maintenance Manual: Handling the load meter”.

Function of troubleshooting

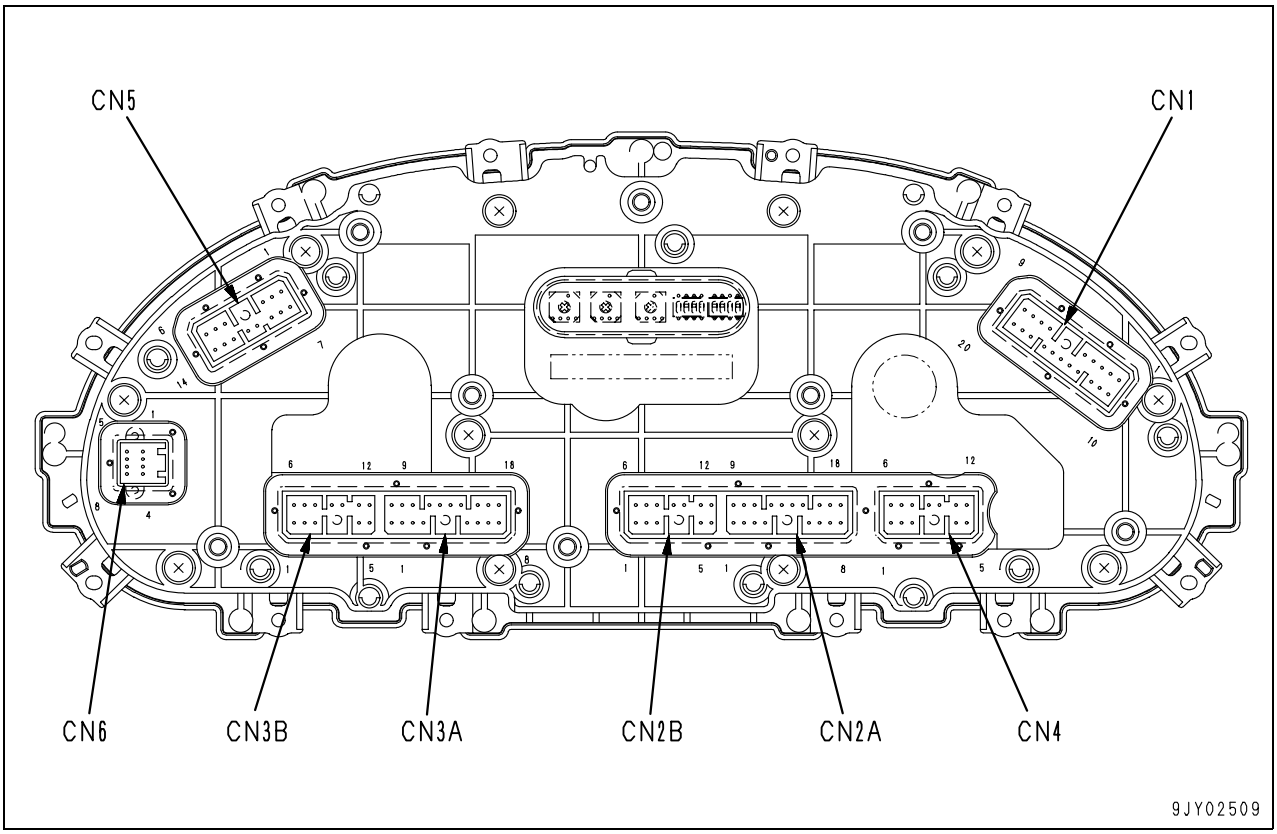
The machine monitors the input and output signals constantly for troubleshooting for the system.
If any abnormality is detected by self-diagnosis, the information on it is transmitted through the network to the machine monitor. When abnormality occurs, it can be confirmed on the machine monitor (display of failure history).

Rear side of machine monitor



1. Spare rotary switch (SW1)
2. Spare rotary switch (SW1)
3. Spare rotary switch (SW3)
4. Spare DIP switch (SW5-1)
5. Spare DIP switch (SW5-2)
6. Spare DIP switch (SW5-3)
7. Spare DIP switch (SW5-4)
8. Spare DIP switch (SW6-1)
9. Spare DIP switch (SW6-2)
10. Spare DIP switch (SW6-3)
11. Spare DIP switch (SW6-4)

Do not change settings of spare rotary switches and spare DIP switches.


CN5
CN1
CN6
CN3B
CN3A
CN2B
CN2A
CN4
9JY02509

Signal table by connector

CN1 (070-20-pole)

Pin No.	Specifications	I/O	Group	Form of use	Signal name	WA600-6	Remarks
1	—	—	—		—	—	
2	Power supply of small lamp	I	—	Power supply (+24 V)	—	—	
3	Power supply of small lamp	I	—	Power supply (+24 V)	—	—	
4	Unswitched power supply (+24 V)	I	—	Power supply (+24 V)	Unswitched power supply (+24 V)	Unswitched power supply (+24 V)	
5	Unswitched power supply (+24 V)	I	—	Power supply (+24 V)	Unswitched power supply (+24 V)	Unswitched power supply (+24 V)	
6	SW power supply (+24 V)	I	—	Power supply (+24 V)	SW power supply (+24 V)	SW power supply (+24 V)	
7	SW power supply (+24 V)	I	—	Power supply (+24 V)	SW power supply (+24 V)	SW power supply (+24 V)	
8	—	—	—	—	—	—	
9	GND	I	—	GND	GND	GND	
10	GND	I	—	GND	GND	GND	
11	D_OUT_3 (+24 V, sink 200 mA)	O	A	D/O sink	(Spare)	—	
12	D_OUT_2 (+24 V, sink 200 mA)	O	A	D/O sink	(Automatic preheater relay)	—	
13	D_OUT_1 (+24 V, sink 200 mA)	O	A	D/O sink	(HST solenoid cutout relay)	—	
14	D_OUT_0 (+24 V, sink 200 mA)	O	A	D/O sink	Buzzer (Monitor)	Buzzer (Monitor)	
15	Sensor power supply output (+24 V)	O	—	Sensor power supply	Lift arm pressure sensor power supply	—	
16	Sensor power supply output (+5 V)	O	—	Sensor power supply	Lift arm angle sensor power supply	Lift arm pressure and angle sensor power supply	For load meter
17	GND	I	—	GND	GND	GND	
18	GND	I	—	GND	GND	GND	
19	GND	I	—	GND	GND	GND	
20	GND	I	—	GND	GND	GND	

CN12 (070-18-pole + 12-pole)

Pin No.	Specifications	I/O	Group	Form of use	Signal name	WA600-6	Remarks
CN2A							
1	D_IN_0 (+24 V, 5 mA)	I	B	D/I+24V	Headlamp	Headlamp	
2	D_IN_2 (24 V, 5 mA)	I	B	D/I+24V	Starting motor C	Starting motor C	
3	D_IN_4 (24 V, 5 mA)	I	B	D/I+24V	Auto grease A	Auto grease A (If equipped)	If equipped
4	D_IN_6 (24 V, 5 mA)	I	B	D/I+24V	(Direction F)	—	
5	D_IN_8 (24 V, 5 mA)	I	B	D/I+24V	(Direction R)	—	
6	D_IN_10 (24 V, 5 mA)	I	B	D/I+24V	(Spare)	Load meter material selector switch input	
7	D_IN_12 (NSW 24 V, 5 mA)	I	C	D/I+24V	Winker right	Winker right	
8	D_IN_14 (NSW 24 V, 5 mA)	I	C	D/I+24V	◇ switch input	Monitor mode switch 1 ◇ input	Switch for monitor operation
9	GND	O	—	—	SIGNAL GND	SIGNAL GND	
10	D_IN_1 (24 V, 5 mA)	I	B	D/I+24V	Starting motor ACC	Starting motor ACC	
11	D_IN_3 (24 V, 5 mA)	I	B	D/I+24V	Preheat operation	—	
12	D_IN_5 (24 V, 5 mA)	I	B	D/I+24V	Auto grease B	Auto grease B (If equipped)	If equipped
13	D_IN_7 (24 V, 5 mA)	I	B	D/I+24V	(Direction N)	—	
14	D_IN_9 (24 V, 5 mA)	I	B	D/I+24V	(Spare)	—	
15	D_IN_11 (24 V, 5 mA)	I	B	D/I+24V	(Spare)	Load meter addition/ reduction selector switch input	
16	D_IN_13 (NSW 24 V, 5 mA)	I	C	D/I+24V	Winker left	Winker left	
17	D_IN_15 (NSW 24 V, 5 mA)	I	C	D/I+24V	■ switch input	Monitor mode switch 1 ■ input	Switch for monitor operation
18	A_IN_0 (0 – 30 V)	I	H	A/I	Alternator R	Alternator R	
CN2B							
19	D_IN_16 (24 V/GND, 5 mA)	I	D	D/IGND	Brake oil pressure (Front)	Brake oil pressure (Front)	
20	D_IN_18 (24 V/GND, 5 mA)	I	D	D/IGND	Brake oil level (Front)	—	
21	D_IN_20 (24 V/GND, 5 mA)	I	D	D/IGND	Air cleaner clogging 1	Clogging of air cleaner	
22	D_IN_22 (24 V/GND, 5 mA)	I	D	D/IGND	(Spare)	Parking brake emergency release switch signal	
23	D_IN_24 (24 V/GND, 5 mA)	I	E	D/IGND	Transmission filter clogging	Transmission filter clogging	
24	GND	O	—	GND	Sensor GND	Sensor GND	
25	D_IN_17 (24 V/GND, 5 mA)	I	D	D/IGND	Brake oil pressure (Rear)	Brake oil pressure (Rear)	
26	D_IN_19 (24 V/GND, 5 mA)	I	D	D/IGND	Brake oil level (Rear)	—	
27	D_IN_21 (24 V/GND, 5 mA)	I	D	D/IGND	Air cleaner clogging 2	—	
28	D_IN_23 (24 V/GND, 5 mA)	I	D	D/IGND	(Spare)	Load meter total weight display switch input	
29	D_IN_25 (24 V/GND, 5 mA)	I	E	D/IGND	(Seat belt fastening warning)	—	
30	A_IN_0 (0 – 30 V)	I	H	A/I	Small lamp switch	Small lamp switch	

CN3 (070-18-pole + 12-pole)

Pin No.	Specifications	I/O	Group	Form of use	Signal name	WA600-6	Remarks
CN3A							
1	D_IN_26 (24 V/GND, 5 mA)	I	E	D/IGND	Parking brake	Parking brake	
2	D_IN_28 (24 V/GND, 5 mA)	I	E	D/IGND	Engine oil pressure	—	
3	D_IN_30 (24 V/GND, 5 mA)	I	E	D/IGND	Normal emergency steering	Normal emergency steering	
4	D_IN_32 (24 V/GND, 5 mA)	I	F	D/IGND	Subtotal switch	Subtotal switch	For load meter
5	D_IN_34 (24 V/GND, 5 mA)	I	F	D/IGND	High beam switch	High beam switch	
6	D_IN_36 (24 V/GND, 5 mA)	I	G	D/IGND	Service function 2	Service function 2	
7	D_IN_38 (24 V/GND, 5 mA)	I	G	D/IGND	< switch input	Monitor mode switch 2 < switch input	Switch for monitor operation
8	P_IN_0(0.5Vp-p)	I	M	P/I	(Spare)	—	
9	GND	O	—	GND	GND	GND	
10	D_IN_27 (24 V/GND, 5 mA)	I	E	D/IGND	Engine coolant level	Engine coolant level	
11	D_IN_29 (24 V/GND, 5 mA)	I	E	D/IGND	Engine oil level	Engine oil level	
12	N.C.	I	E	D/IGND	N.C.	N.C.	
13	D_IN_33 (24 V/GND, 5 mA)	I	F	D/IGND	Cancel switch	Cancel switch	For load meter
14	D_IN_35 (24 V/GND, 5 mA)	I	F	D/IGND	(Spare)	—	
15	D_IN_37 (24 V/GND, 5 mA)	I	G	D/IGND	> switch input	Monitor mode switch 2 > input	
16	D_IN_39 (24 V/GND, 5 mA)	I	G	D/IGND	Low steering oil pressure	Spare	
17	P_IN_1(5Vp-p)	I	M	P/I	(Spare)	—	
18	N.C.	—	—		N.C.	N.C.	
CN3B							
19	A_IN_2 (High-resistance input)	I	J	A/I	Fuel level sensor	Fuel level sensor	
20	A_IN_4 (High-resistance input)	I	J	A/I	Torque converter oil temperature sensor	Torque converter oil temperature sensor	
21	A_IN_6 (High-resistance input)	I	K	A/I	Engine coolant temperature sensor (For automatic preheater)	—	
22	A_IN_8 (0 – 5 V)	I	L	A/I	Lift arm pressure sensor (Rod)	Lift arm pressure sensor (Head)	For load meter
23	A_IN_10 (0 – 14 V)	—	—		Battery electrolyte level A	Battery electrolyte level (If equipped)	If equipped
24	GND	O	—	GND	SIGNAL GND	GND	
25	A_IN_3 (High-resistance input)	I	J	A/I	Hydraulic oil temperature sensor	Hydraulic oil temperature sensor	
26	A_IN_5 (High-resistance input)	I	J	A/I	Engine coolant temperature sensor	Brake oil temperature sensor	
27	A_IN_7 (0 – 5 V)	I	L	A/I	Lift arm pressure sensor (Bottom)	Lift arm pressure sensor (Bottom)	For load meter
28	A_IN_9 (0 – 5 V)	I	L	A/I	Lift arm angle sensor	Lift arm angle sensor	
29	GND	O	—	GND	SIGNAL GND	GND	
30	A_IN_11 (0 – 14 V)	—	—		Battery electrolyte level B	—	

CN4 (070 12-pole)

Pin No.	Specifications	I/O	Group	Form of use	Signal name	WA600-6	Remarks
1	S_NET(+)	I/O	N	S-NET	Monitor – transmission work equipment controller	—	
2	S_NET(+)	I/O	N	S-NET	Monitor – transmission work equipment controller	—	
3	CAN+	I/O	P		Cummins engine controller, VSM controller communication (CAN (+))	Communication (CAN (+))	
4	S_NET(–)	O	N	S-NET	S_NET GND	—	
5	S_NET(–)	O	N	S-NET	S_NET GND	—	
6	GND	O	—	GND	S_NET shield	GND	
7	GND	O	—	GND	CAN shield		CAN: twisted only
8	CAN-	I/O	P		Cummins engine controller communication (CAN (–))	Communication (CAN (–))	
9	(NC)						
10	(NC)						
11	(NC)						
12	(NC)						

CN5 (070-14-pole)

Pin No.	Specifications	I/O	Group	Form of use	Signal name	WA600-6	Remarks
1	(NC)	—	—			—	
2	RS232C_1_RTS	I/O	Q		RS232C serial communication	—	
3	RS232C_1_RD	I	Q	RD	RS232C serial communication	—	
4	(NC)	I	R	RD	N.C.	N.C.	
5	(NC)	I/O	R		N.C.	N.C.	
6		—	—		BUSY input for load meter printer	Printer BUSY (if equipped)	For load meter (Spare for medium and large models)
7	(NC)	—	—			—	
8	RS232C_1_CTS	I/O	Q		RS232C serial communication	—	
9	RS232C_1_TX	O	Q	TX	RS232C serial communication	Printer and personal computer TX	
10	RS232C_1_SG	O	Q		RS232C serial communication	—	
11	(NC)	O	R		N.C.	N.C.	
12	(NC)	O	R	TX	N.C.	N.C.	
13	(NC)	I/O	R		N.C.	N.C.	
14	(NC)	—	—		N.C.	N.C.	

CN6 (040 8-pole)

Pin No.	Specifications	I/O	Group	Form of use	Signal name	WA600-6	Remarks
1	RS232C_0_TXD	O	S		—	—	
2	(NC)	—	—		N.C.	N.C.	
3	RS232C_0_TXD	O	S		—	—	
4	(NC)	—	—		N.C.	N.C.	
5	RS232C_0_RXD	I	S		—	—	
6	(NC)	—	—		N.C.	N.C.	
7	RS232C_0_RXD	I	S		—	—	
8	GND	O	—		GND	—	

Setting switches (On circuit board)

Switch No.	Specifications	I/O	Group	Form of use	Signal name	WA600-6	Remarks
1	16 Posi rotary switch 1	I	—		Selection of model	(Spare)	
2	16 Posi rotary switch 2	I	—		Selection of specification	(Spare)	
3	16 Posi rotary switch 3	I	—		Selection of specification	(Spare)	
4	2 Posi DIP switch 1	I	—		Selection of options	(Spare)	
5	2 Posi DIP switch 2	I	—		Selection of options	(Spare)	
6	2 Posi DIP switch 3	I	—		Selection of options	(Spare)	
7	2 Posi DIP switch 4	I	—		Selection of options	(Spare)	
8	2 Posi DIP switch 5	I	—		Selection of options	(Spare)	
9	2 Posi DIP switch 6	I	—		Selection of options	(Spare)	
10	2 Posi DIP switch 7	I	—		Selection of options	(Spare)	
11	2 Posi DIP switch 8	I	—		Selection of options	(Spare)	

WA600-6 Wheel loader
Form No. SEN01009-01

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

10 Structure, function and maintenance standard

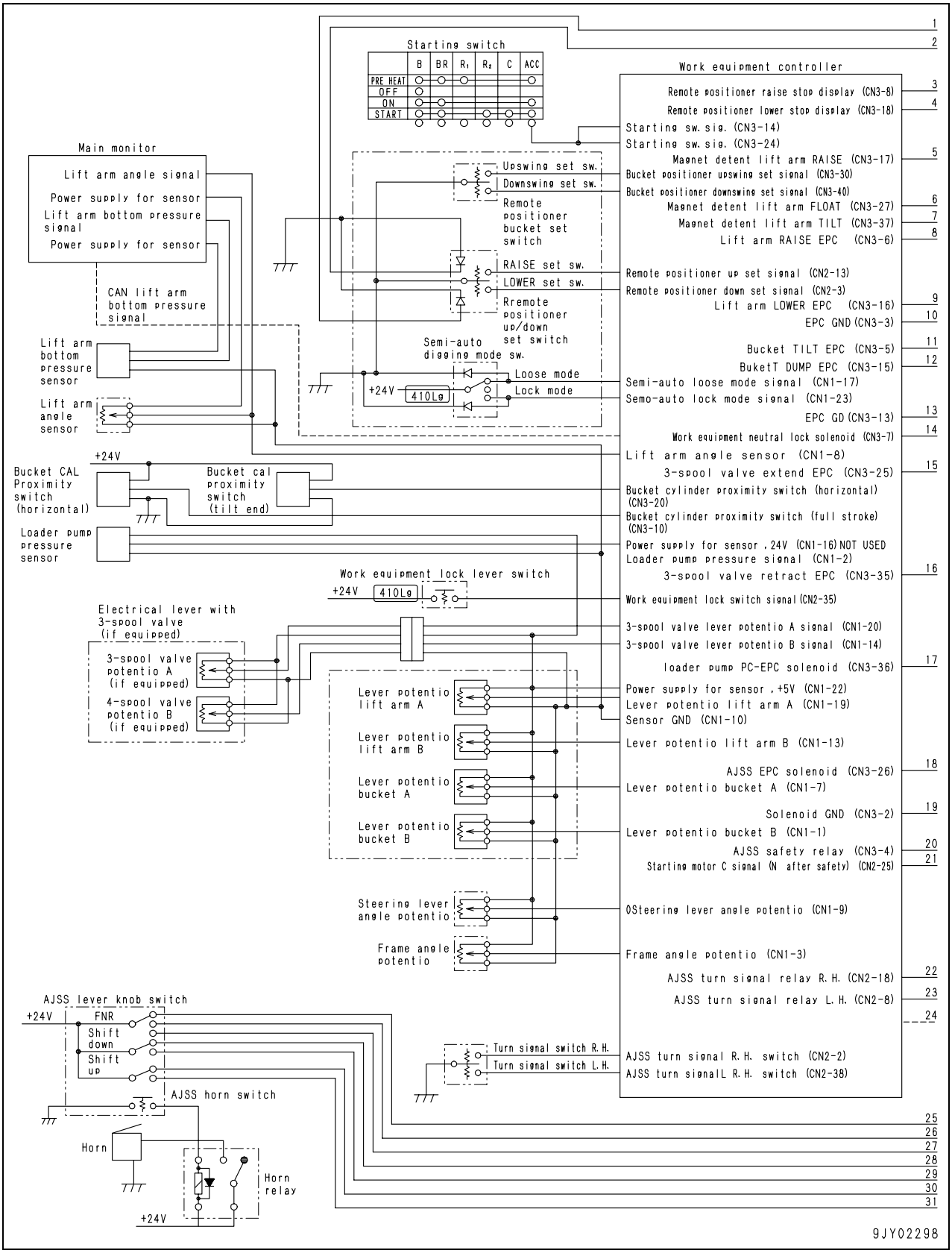
Electrical system, Part 2

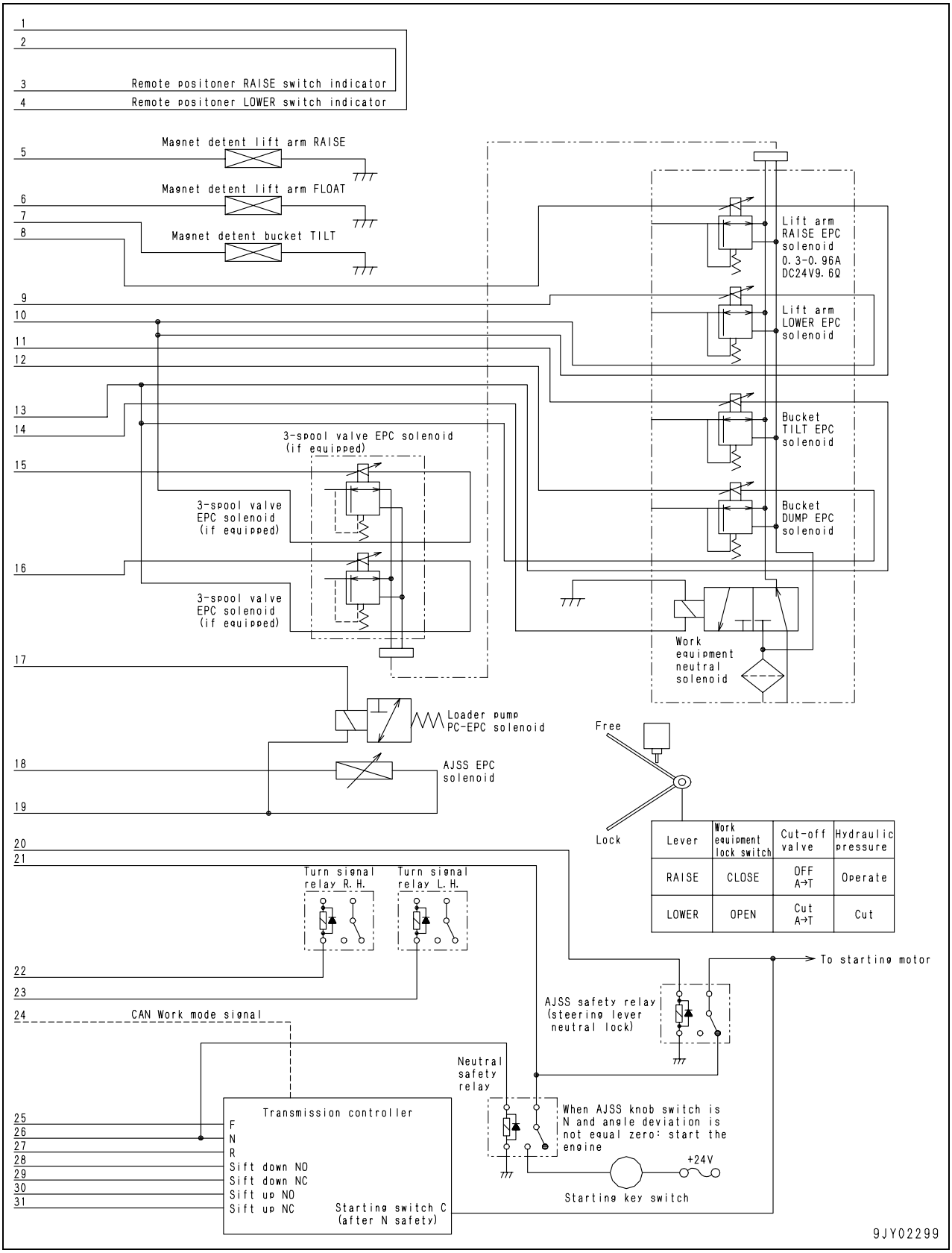
Electrical system, Part 2 2
Work equipment control system 2
Transmission controller system 38

Electrical system, Part 2

Work equipment control system

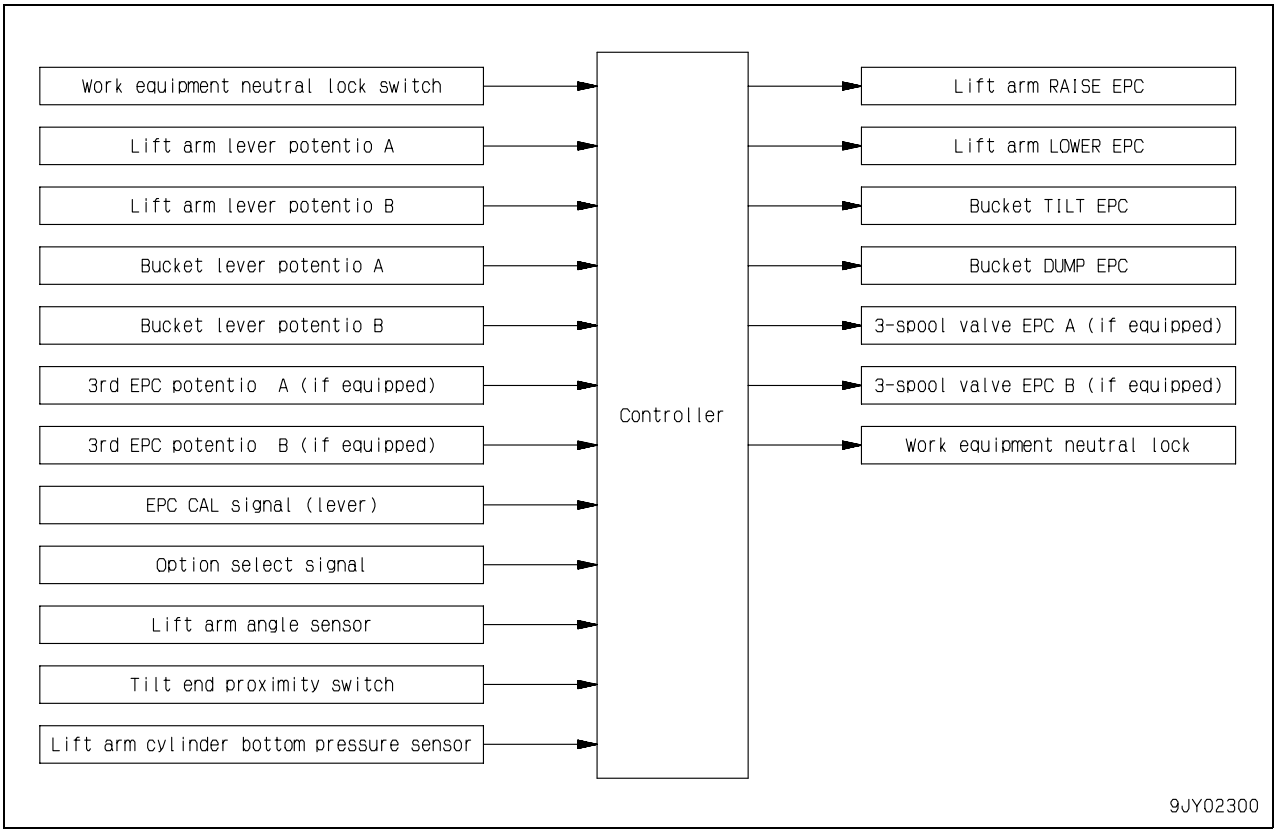
Work equipment controller




1
2
3 Remote positoner RAISE switch indicator
4 Remote positoner LOWER switch indicator
Magnet detent lift arm RAISE
5
Magnet detent lift arm FLOAT
6
7
8
Magnet detent bucket TILT
Lift arm RAISE EPC solenoid 0.3-0.96A DC24V9.6Ω
9
10
11
12
Lift arm LOWER EPC solenoid
13
14
3-spool valve EPC solenoid (if equipped)
15
3-spool valve EPC solenoid (if equipped)
16
3-spool valve EPC solenoid (if equipped)
Bucket TILT EPC solenoid
Bucket DUMP EPC solenoid
Work equipment neutral solenoid
17
Loader pump PC-EPC solenoid
18
AJSS EPC solenoid
19
Free
Lock
Lever | Work equipment lock switch | Cut-off valve | Hydraulic pressure
RAISE | CLOSE | OFF A→T | Operate
LOWER | OPEN | Cut A→T | Cut
20
21
Turn signal relay R.H.
Turn signal relay L.H.
22
23
To starting motor
24 CAN Work mode signal
AJSS safety relay (steering lever neutral lock)
Neutral safety relay
When AJSS knob switch is N and angle deviation is not equal zero: start the engine
+24V
Starting key switch
Transmission controller
25 F
26 N
27 R
28 Sift down NO
29 Sift down NC
30 Sift up NO
31 Sift up NC
Starting switch C (after N safety)
9JY02299

1. Work equipment control

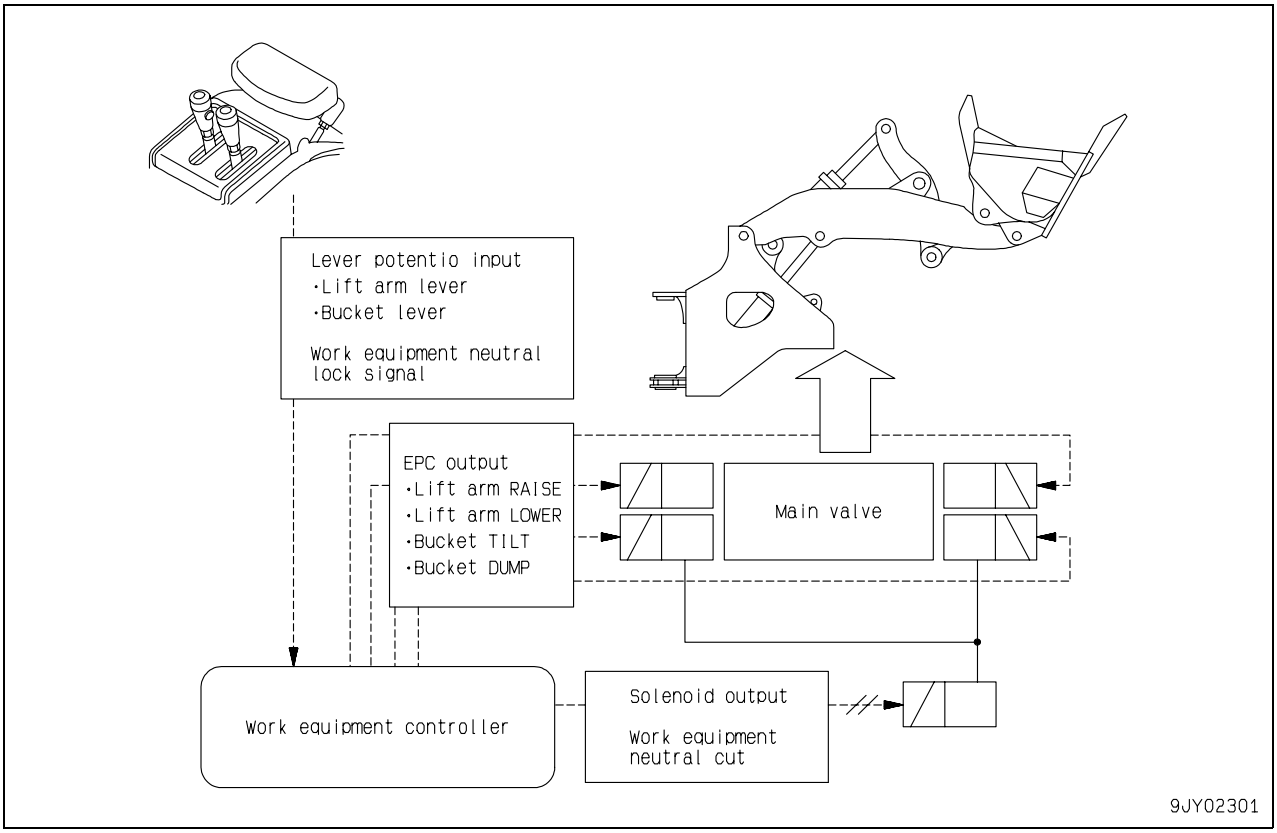
1) Work equipment control input and output



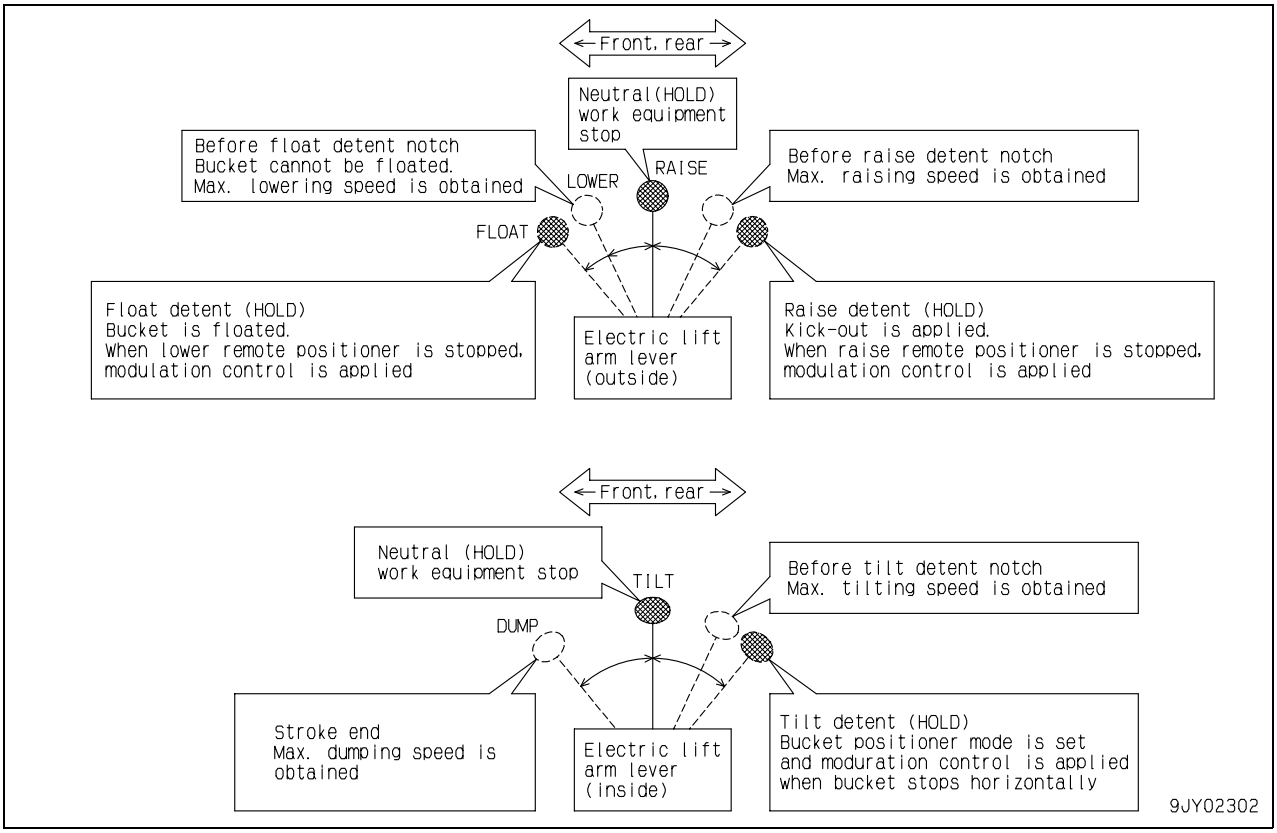
2) Work equipment control lever operation

Function

- The work equipment controller operates the work equipment by detecting the operating stroke of raise/lower, tilt/dump from the signals of the work equipment lever potentiometer, and operating the main spool by operating each EPC valve attached to the main valve with current control.



- The work equipment control lever is equipped with detent notches, and it is adjusted so that it will operate at the maximum speed before each detent. The range beyond lower detent is the “lift arm float” operation position, where the lift arm operates by external forces.

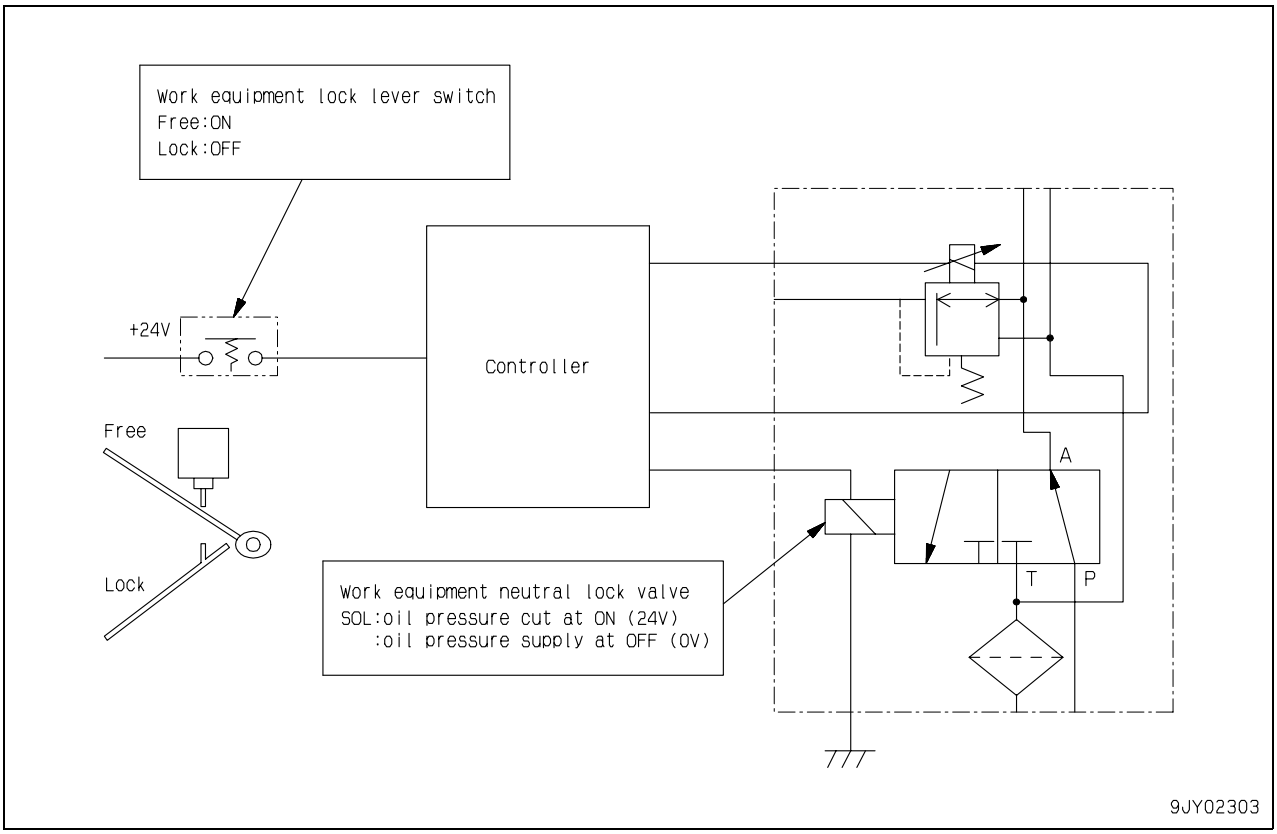


3) Work equipment neutral lock

Function

- When the work equipment lock lever is operated to the lock position, the lock switch becomes OPEN, and the controller stops the operation of the work equipment by turning ON the work equipment neutral lock valve, cutting EPC pilot basic pressure.

★ While the work equipment is locked, the detent does not operate, and the lever is not held at the detent position.



- The safety function, in which the work equipment is continued to be locked until the work equipment control lever is temporarily returned to the neutral position, even if the work equipment is unlocked, is incorporated.

Operation table

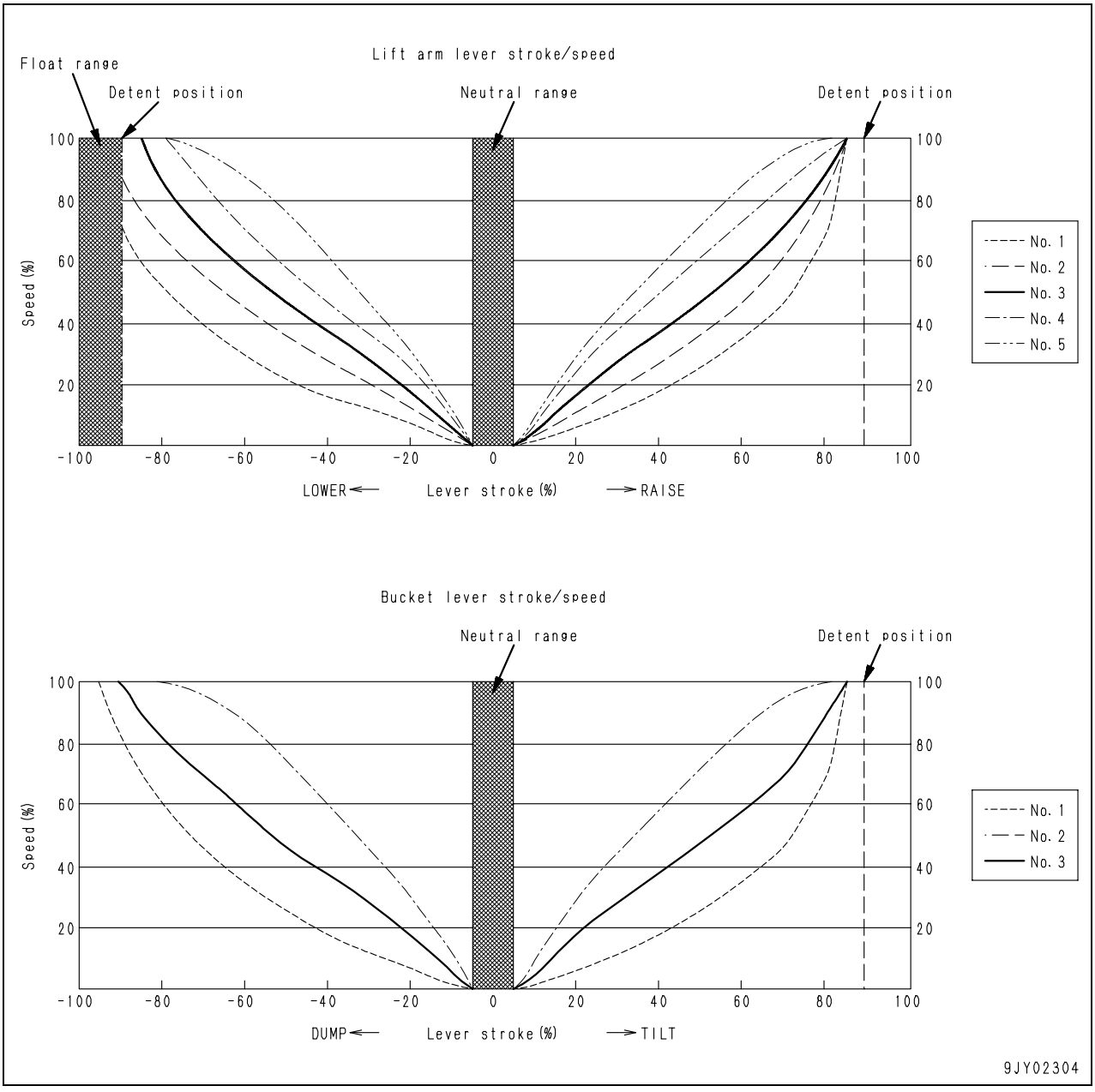
Operation by man	Input of controller	Work equipment control	Output of controller	Operation of machine
Work equipment lever	Work equipment lever switch	Work equipment lever potentiometer	Work equipment neutral lock valve	Oil pressure
Lock (LOCK)	OFF (OPEN)	—	ON (24V)	Cut
Free to Lock (unlocking)	OFF (OPEN)	Work equipment control lever being operated	ON (24V)	Cut
Lock to Free (unlocking)	OFF (OPEN)	After releasing, lever neutral of all work equipment detected once	OFF (OPEN)	Operating
Free (FREE)	ON (CLOSE)	—	OFF (OPEN)	Operating

4) Neutral position and work equipment speed

Function

- The work equipment control lever has neutral play of 5% in the lever stroke, and it is adjusted so that the work equipment will start working from the position beyond the play.
- It also has a function to change the work equipment speed for the lever stroke through setting of the controllers.
- The lift arm has five changeable tables, and the bucket has three.

★ For the adjustment method and the characteristics of each table, refer to “Testing and adjusting: changing the lift arm table or changing the bucket table.”



5) Tilt priority control

Function

- Because CLSS is employed in this machine, although the bucket and the lift arm can be operated simultaneously, it has a function that prevents the lift arm from rising when the tilt operating stroke is large, for more efficient digging.
- It is realized by limiting the maximum speed of lift arm raise (table below) for the tilt speed.

★ This function does not work in dump operation, which enables the simultaneous operation.

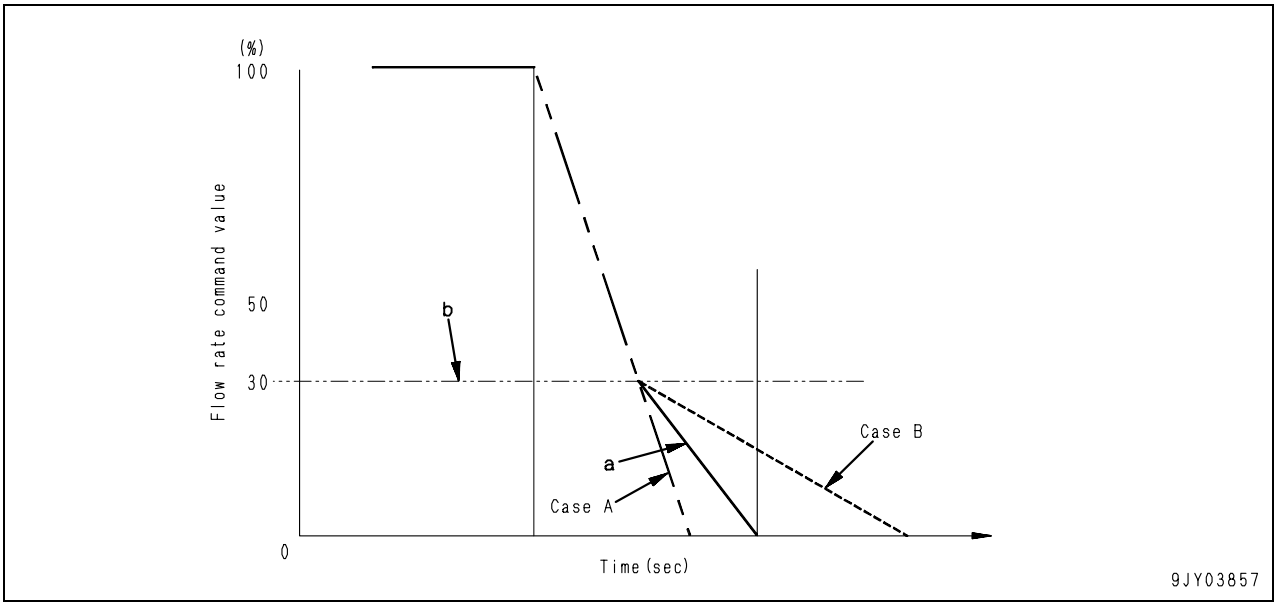
Bucket tilt speed	0%	20%	40%	60%	70%	100%
Maximum speed of lift arm raise	100%	80%	30%	0%	0%	0%

6) Lift arm raise/lower stop modulation

Function

- The work equipment controller operates modulation, when the lift arm stop operation is performed more suddenly than a certain speed by the operator, for easing stop shock of lift arm raise/lower.
- The operation of this stop modulation function can be changed through setting.

★ For the method to change and precautions, refer to “Testing and adjusting: changing the lift arm raise/lower stop modulation”.



Case A: Modulation rate is 0%

When lever command flow rate > modulation command flow rate

- The output is controlled according to the lever command flow rate.

Case B: Modulation rate is 200%

When lever command flow rate < modulation command flow rate

- The output is controlled according to the modulation command flow rate.

a: Modulation rate is 100% (When machine is delivered)

b: Modulation starting point: 30% of flow rate command.

7) Speed reduction function in raising cargo lift arm

Function

- When the lift arm is raised with load, the pump delivery is cut off.
  - Lift arm above horizontal (Lift arm angle sensor signal)
  - Bucket tilt end (Tilt end proximity switch signal)
  - Lift arm bottom pressure minimum 20 MPa {204 kg/cm^2} (Signal by network communication from the monitor)

  Only when the above conditions are simultaneously satisfied, the lift arm raise maximum speed will be limited to 70%.
- When the lift arm raise maximum speed is changed between 70% and 100%, modulation is equipped for reducing shocks, controlling so that the speed will not change suddenly.
- This function can change the condition value of the lift arm bottom pressure through controller setting. By changing the set value of the lift arm bottom pressure, matching of the lift arm rising speed and travel speed can be changed.

★ For the method to change and procedure, refer to “Testing and adjusting: adjustment of pump cut-off pressure in lift arm is raised.”

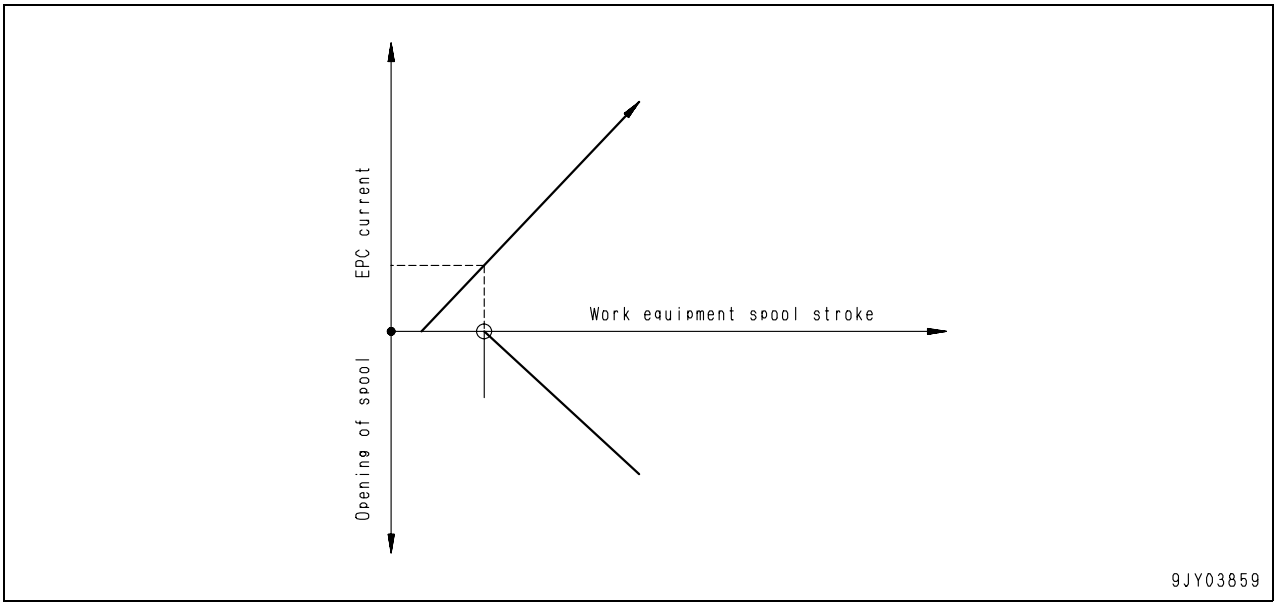
8) Adjusting range before lever detent position and work equipment starting current

Function

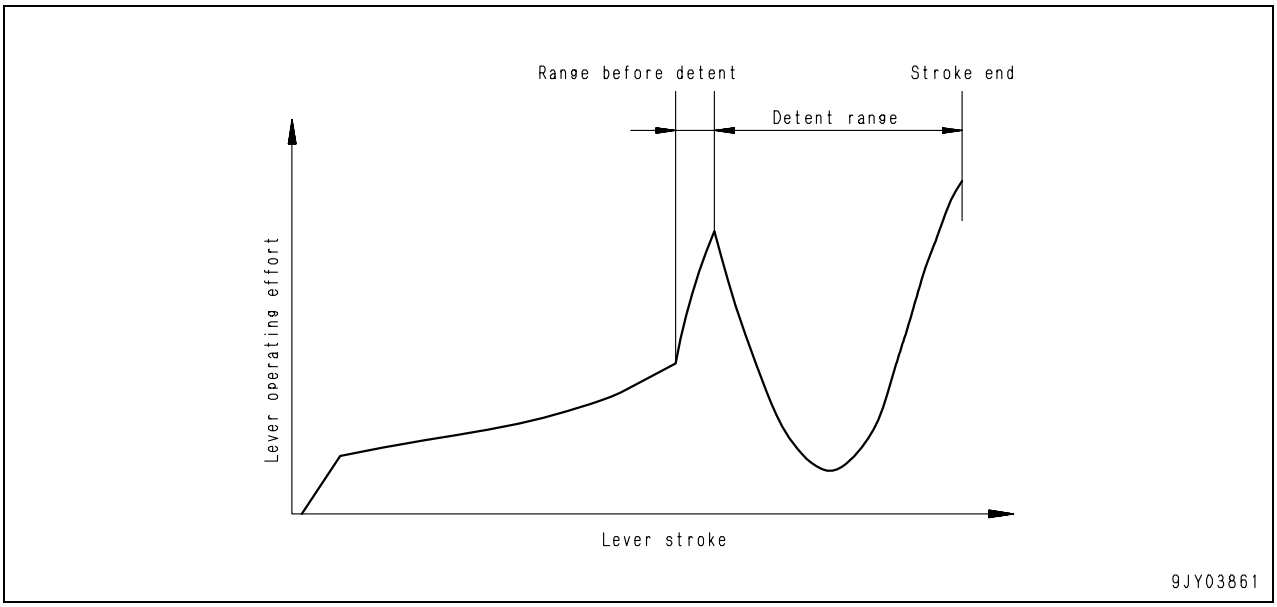
- The work equipment controller has an adjusting function for correction dispersion.
- The range before the detent position is adjusted so that the lever potentiometer voltage at the detent position will be saved, ensuring control before and after the detent. When it is not adjusted, such phenomena as “the positioner does not operate normally before and after the detent,” or “the lever position of lift arm float is not normal” may occur.
- When the work equipment starting current is not adjusted, such phenomena as “the neutral dead zone is large” or “dashing/stopping shock of the work equipment becomes large” may occur.

★ For the adjusting procedure, refer to “Testing and adjusting: Adjustment of lift arm raise lever position before detent and variations in the dead zone of EPC, Adjustment of lift arm lower (float) lever and variations in the dead zone of EPC, and Adjustment of bucket tilt lever position before detent and variations in the dead zone”.

- Adjusting the starting current means to make the controller recognize the current at which the work equipment starts moving, or the current at which the work equipment valve spool is “opened”.
- When the starting current is adjusted, the spool is opened and closed once and the EPC current output at this time is used as the starting current to make the effect of the spool operation hysteresis constant.



- The range before lever detent is a range where the lever operating effort before the notch changes suddenly.

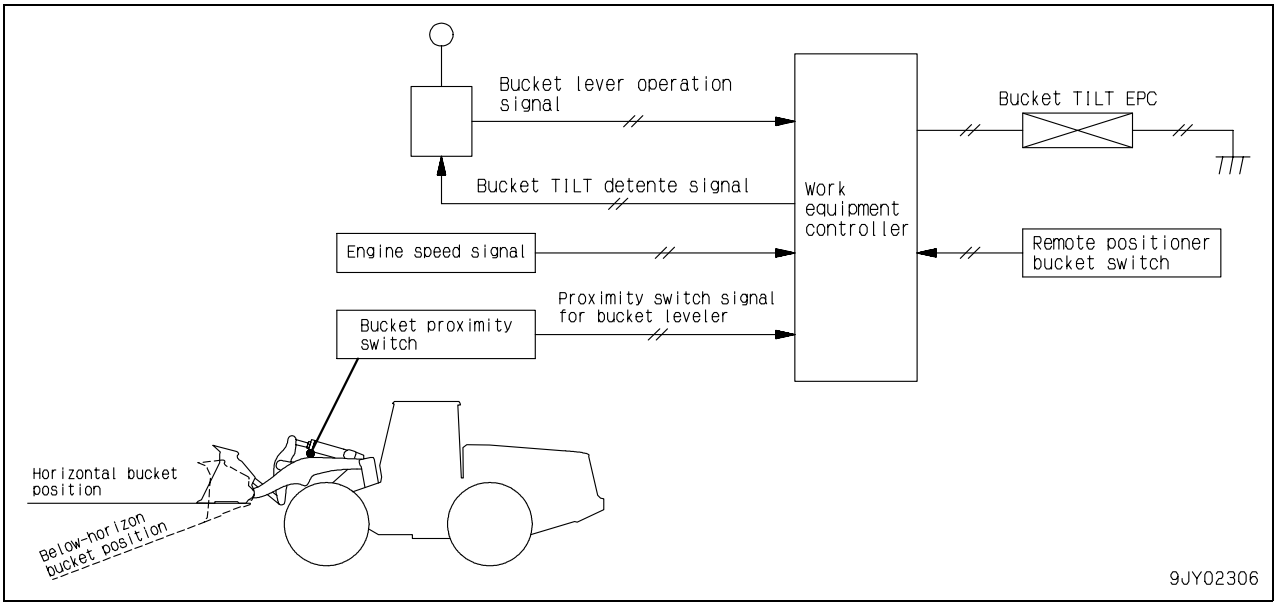


2. Remote positioner

1) Bucket positioner

Function

- This is a function that the bucket will gently stop at any set position, when the tilt lever is set to the detent position with the bucket level or lower.

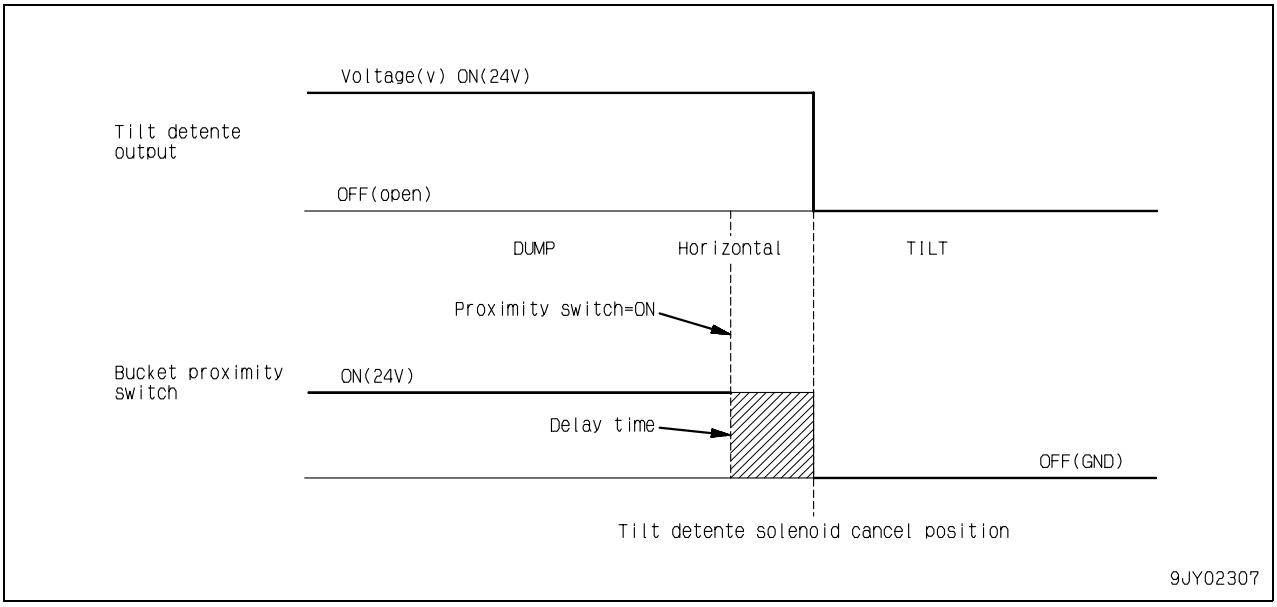


1] Setting stop position

- The stop position of the bucket will change when the positioner is operated through the operation of the bucket positioner position set switch.

Condition for setting	Bucket lever stroke: neutral and travel speed below 5 km/h
Setting method	(1) When setting it upward from the current stop position, press the bucket positioner + position set switch position (upward). (Use the downward switch to change it downward)
	(2) +1 for the currently set (saved) position is saved, the setting completion buzzer sounds (pip, pip), and the monitor displays the value for 3 seconds. (Set position will be maintained when the key is turned off.) * When the switch is operated exceeding ±5 of the set range, the monitor displays the same value, and the setting cancel buzzer (pip) sounds.
	(3) For further change, release the switch once, and then press it again. (when *, the same as (2))

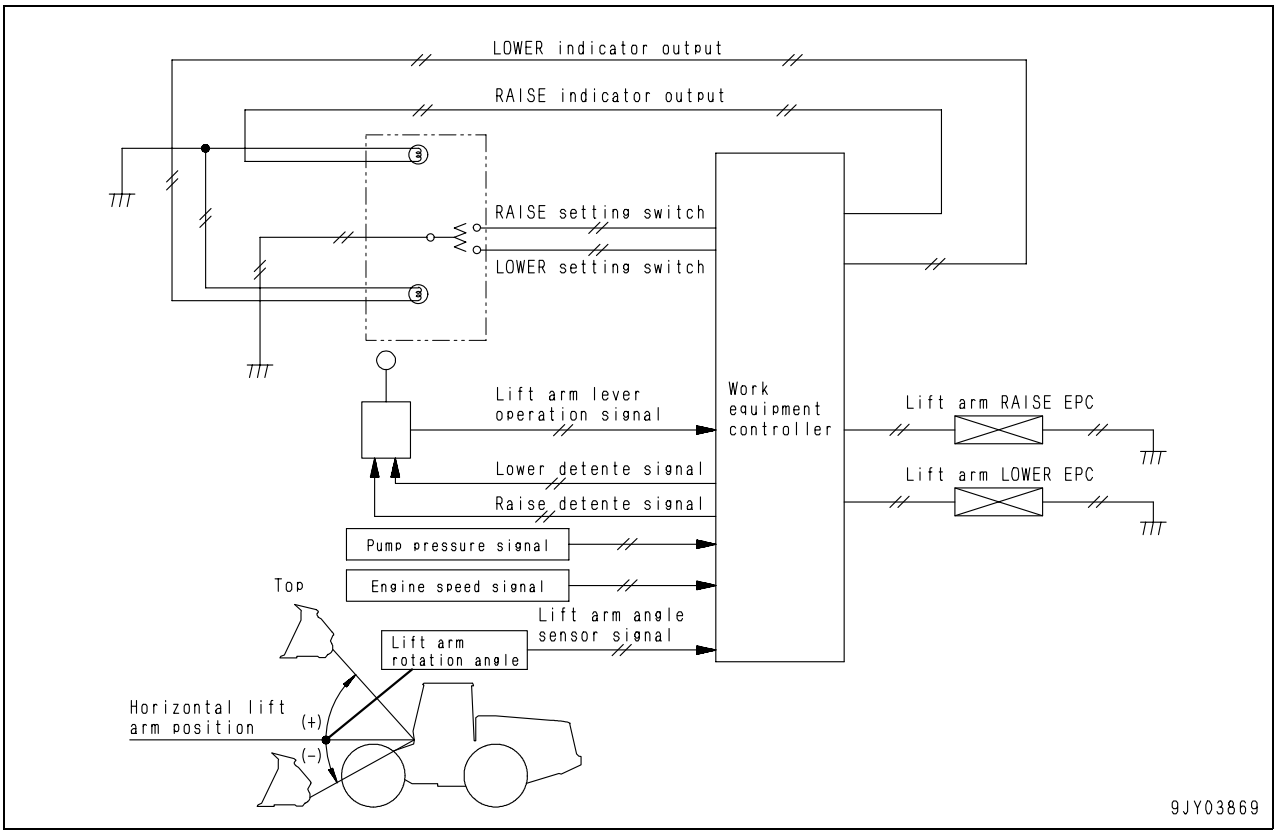
2] Operation of tilt detent solenoid
- If the bucket horizontal proximity switch is operated when the bucket lever is at the tilt detent position, the detent will be reset after the delay time, and the bucket will stop gently.



Delay time:
The bucket horizontal proximity switch is set at the position where the bucket is “downward (–5).”
The flow rate to the tilt cylinder is calculated from the pump delivery, and, when the necessary oil level for the set position is reached, the detent will be reset and it will stop gently.

3] Tilt stop (gentle)
- After the tilt detent is reset, if the bucket lever is maintained in the tilt detent position, the tilting operation is not stopped gently.
- When the tilting operation is stopped, if the bucket lever is operated, the faster of the target speed with the tilt lever operation and the target speed with the stop function is selected and output.
- If the bucket lever is operated in the direction of dump to a certain degree during the stop control operation, the stop control operation is stopped and the dump signal is output.

3. Lift arm remote positioner



Function

a) Raise kick-out (when raise set switch lamp is on)
Set the lift arm lever to “raise detent,” reset the lift arm raise detent when the lift arm rises before the set position, and perform stop (gentle) control.
When the lift arm is at other positions than the “raise detent,” it is raised with operation by the operator.
When raise is not selected, only raise detent will operate.
When the detent is turned on, the remote positioner will not operate, and only the kick-out function (stop at the top position of the lift arm) will operate.

b) Lower lift arm stop (when lower set switch lamp is on)
Set the lift arm lever to the “float detent,” start decreasing the speed when the lift arm is 10° before the set position, and reset the float detent when it is 4° before the set position, and perform stop (gentle) control.
If the lift arm lever is kept as it is, the lift arm starts lowering again.
When lower is not selected, only float detent will operate.
When the detent is turned on with the lift arm angle level or lower, the remote positioner will not operate, and only the float detent function (it will not stop automatically) will operate.

★ The remote positioner of lower will not function as positioner, and will not stop, when the detent is turned on with the lift arm angle level or lower, in order to distinguish it from float operation in grading operation.

1] Setting stop position

- The stop position of the lift arm will change when the positioner is operated through the operation of the remote positioner position raise/lower set switch.

Setting and resetting raise stop position

Condition for setting	Lift arm lever stroke: neutral
Method of setting raise stop	(1) Raise the lift arm to a desired set position.
	(2) Press the remote positioner raise position set switch (less than a second).
	(3) If the position where the switch is pressed is within the set range, save the lift arm angle, the setting completion buzzer sounds (pip, pip), and the switch indicator lights up.
	(4) If it is out of the range (lift arm angle less than 0°), and in sensor errors, it will not be set again. (The buzzer will not sound, the set position will not be changed.)
	(5) When the set switch is operated less than a second, the set position is always changed. (The set position is maintained when the key is turned off.)
Method of resetting raise stop	(1) Press and hold the remote positioner raise position set switch for a second or longer.
	(2) If it is within the set range when the switch is pressed, the position is set temporarily. If it is proceed for a second or longer in (3) above, the setting cancel buzzer (pip) sounds when a second elapses, raise selection is reset, and the switch indicator goes off. *After the setting is reset, the whole lift arm angle will be available.
	(3) Remote positioner raise stop control is not performed. Only boom kick-out control will be performed.

Setting and resetting lower stop position

Condition for setting	Lift arm lever stroke: neutral
Method of setting lower stop	(1) Lower the lift arm to a desired set position.
	(2) Press the remote positioner lower position set switch (less than a second).
	(3) If the position where the switch is pressed is within the set range, save the lift arm angle, the setting completion buzzer sounds (pip, pip), and the switch indicator lights up.
	(4) If it is out of the range (other than lift arm angle of –37° to 0°), and in sensor errors, it will not be set again. (The buzzer will not sound, the set position will not be changed.)
	(5) When the set switch is operated less than a second, the set position is always changed. (The set position is maintained when the key is turned off.)
Method of resetting lower stop	(1) Press and hold the remote positioner lower position set switch for a second or longer.
	(2) If it is within the set range when the switch is pressed, the position is set temporarily. If it is proceed for a second or longer in (3) above, the setting cancel buzzer (pip) sounds when a second elapses, lower selection is reset, and the switch indicator goes off. *After the setting is reset, the whole lift arm angle will be available.
	(3) Remote positioner lower stop control is not performed. Only float detent control will be performed.

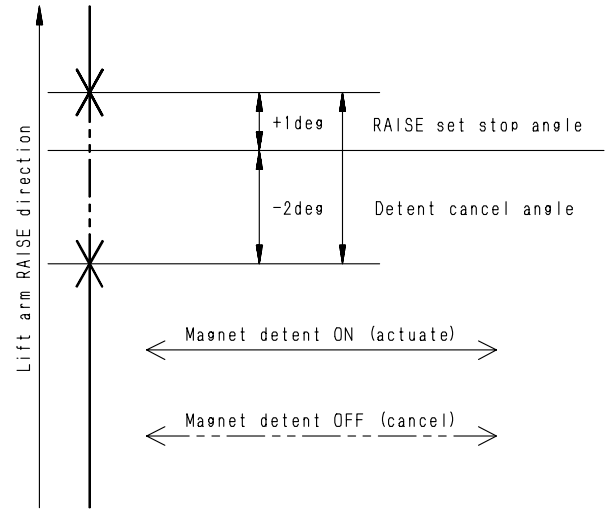
Settable range of remote positioner stop position

[Raise, lower stop position settable range]

Stop position	“Raise”	“Lower”
	Min. 0°	0 to –37°

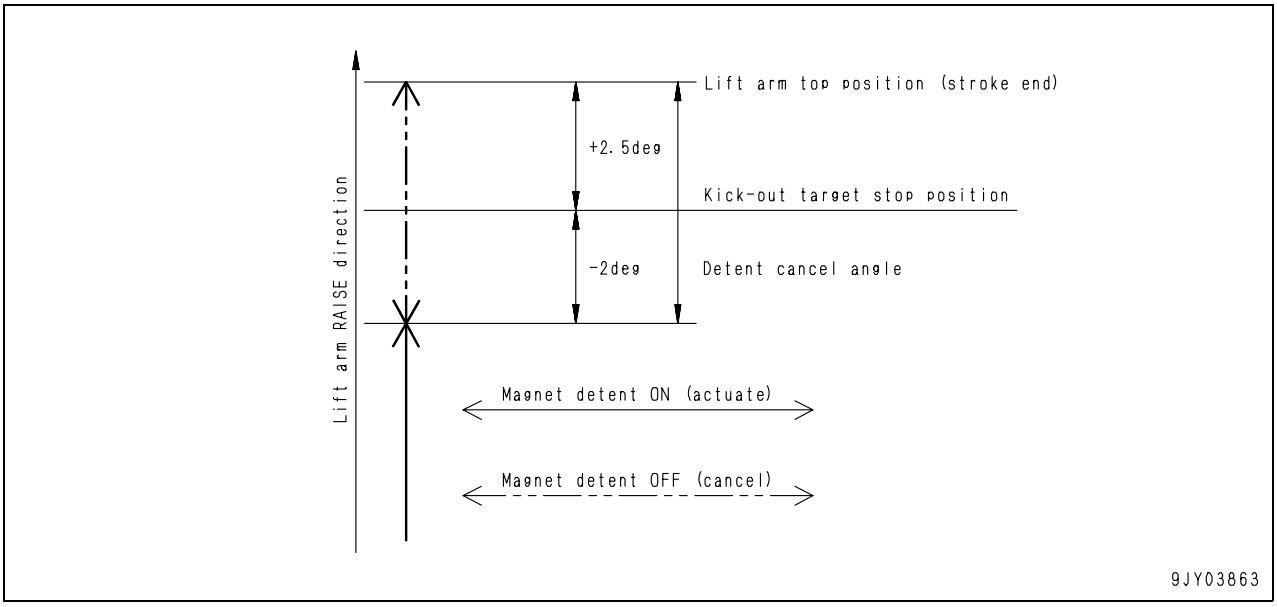
0°: Lift arm is level.

2] Operation of lift arm raise detent solenoid
- When the lift arm raise lever is operated more than a certain point, the raise detent solenoid is turned ON. When the former exceeds the notch, the latter is maintained.
- When the remote positioner operates, the detent is turned OFF in the range of the set stop angle from –2° to +1°.
- When the lift arm raise detent becomes automatically off due to the operation of the stop (gentle) function, the lift arm raise/lower detent stays off during a second after it is turned off.

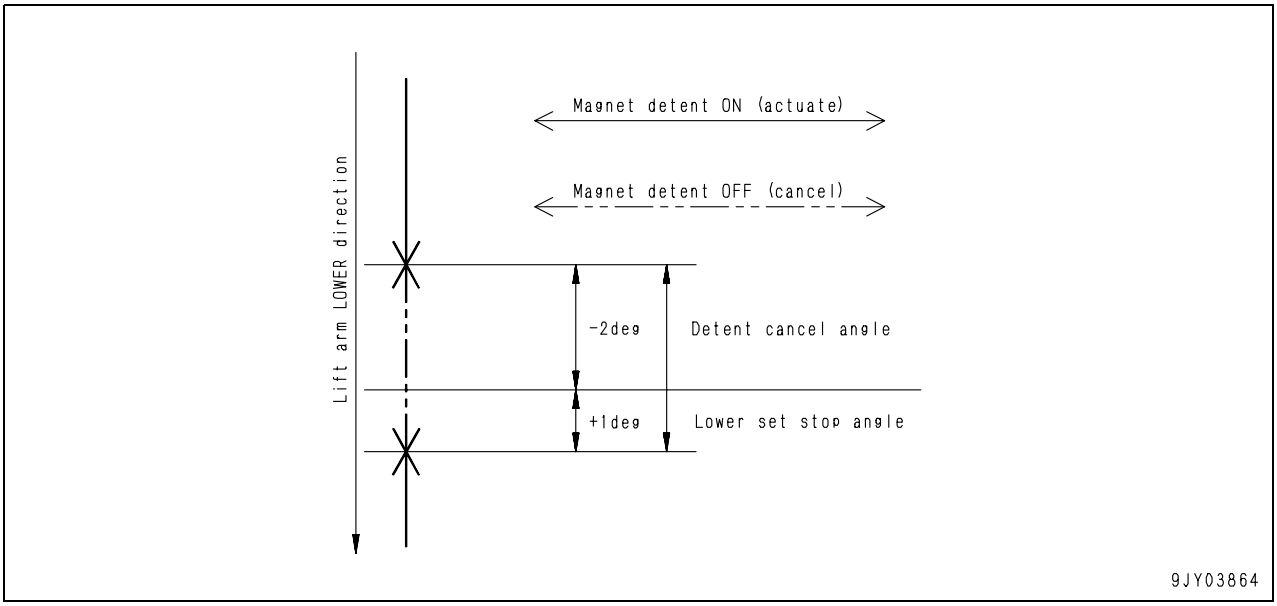


3] Lift arm raise stop (gentle)
- In the lift arm raise stop (gentle), the speed is decreased according to the stop angle in the range of the set stop angle from –9° to –2° by lift arm angle feedback.
- After the lift arm raise detent is reset, if the lift arm lever is maintained in the raise detent position, the lift arm raising operation is not stopped (gently) but accelerated so that the raising speed will reach the maximum when the lift arm is 10° above the stop position.
- Therefore, when operation exceeding the target stop angle is performed while the detent is maintained with the lift arm raise remote positioner operated, the speed of the lift arm raise temporarily decreases and then increases.

4] Boom kick-out
- When the lift arm raise detent is set, when the stop position of the remote positioner is not set or above the stop position, the lift arm slowly stops before the stroke end as kick-out operation, reducing stop shock due to stroke end.
- When the kick-out operates, the detent is turned OFF in the range of the set stop angle from –2° to +2.5°.



5] Operation of lift arm lower detent solenoid
- When the lift arm lower lever is operated more than a certain point, the lower detent solenoid is turned ON. When the former exceeds the notch, the latter is maintained.
- When the remote positioner operates, the detent is turned OFF in the range of the set stop angle from –2° to +1°.
- When the lift arm angle is less than –37°, the detent turns on for grading operation, regardless of operation of the remote positioner.
- When the lift arm lower detent becomes automatically off due to the operation of the stop (gentle) function, the lift arm raise/lower detent stays off during a second after it is turned off.

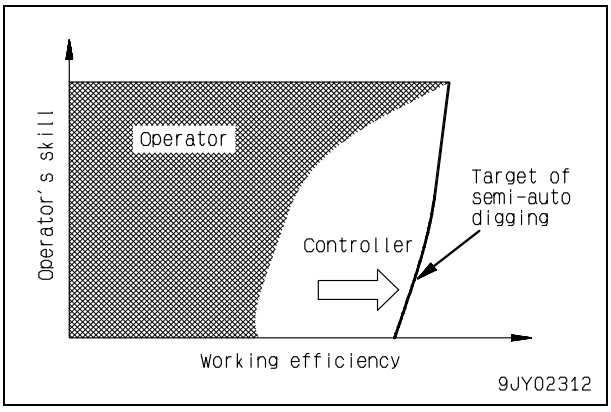


4. Semiautomatic digging

Function

Control of semiautomatic digging

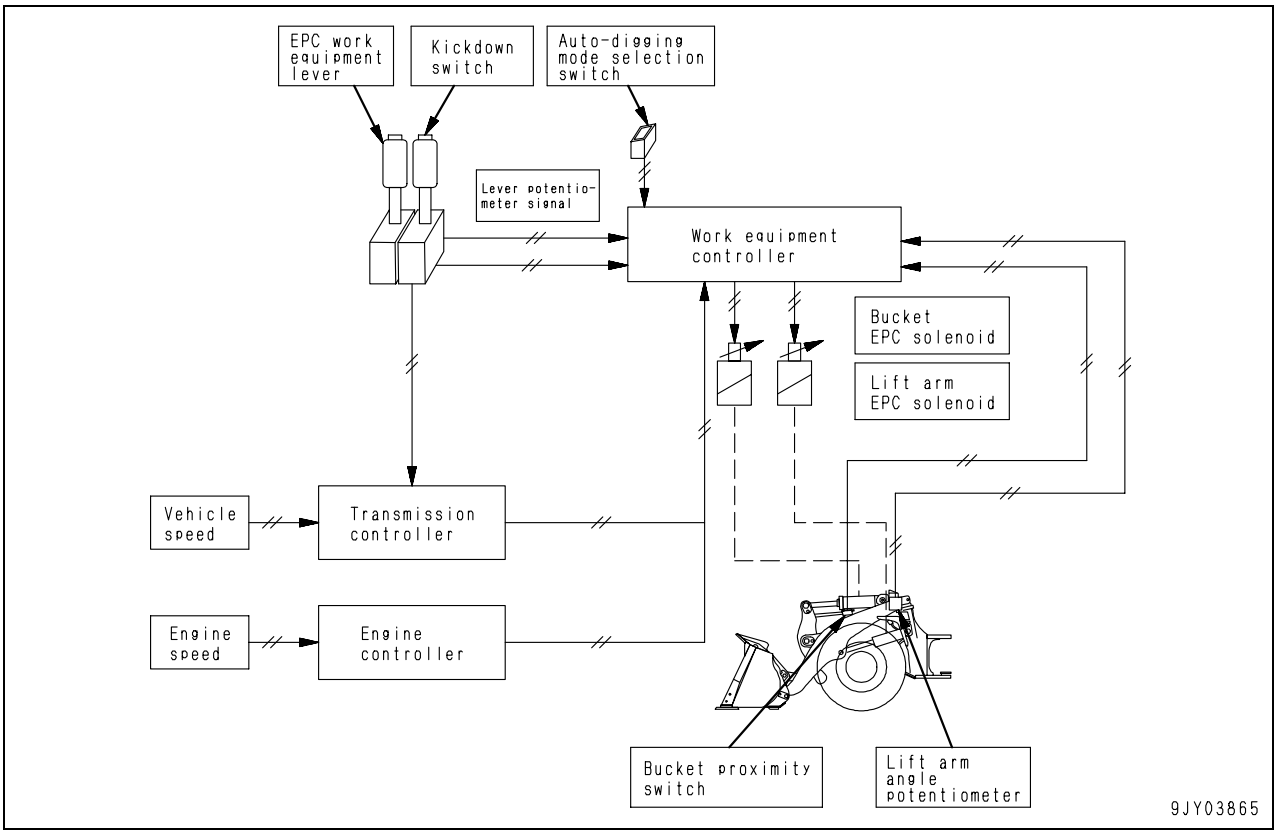
- Semiautomatic digging is a function, in which digging operation can easily be performed only with the kick-down switch and lift arm raise operation, improving the working efficiency of less experienced operators, and the two modes of LOOSE mode/ROCK mode are separately used due to the characteristics of work objects.



- Select the bucket automatic operation pattern appropriate for work cycle/load

Mode selection

No.	Object	Mode
1	Gravel/sand	LOOSE mode
2	Quarry/ blasted rock	ROCK mode



1) Conditions for starting semiautomatic digging

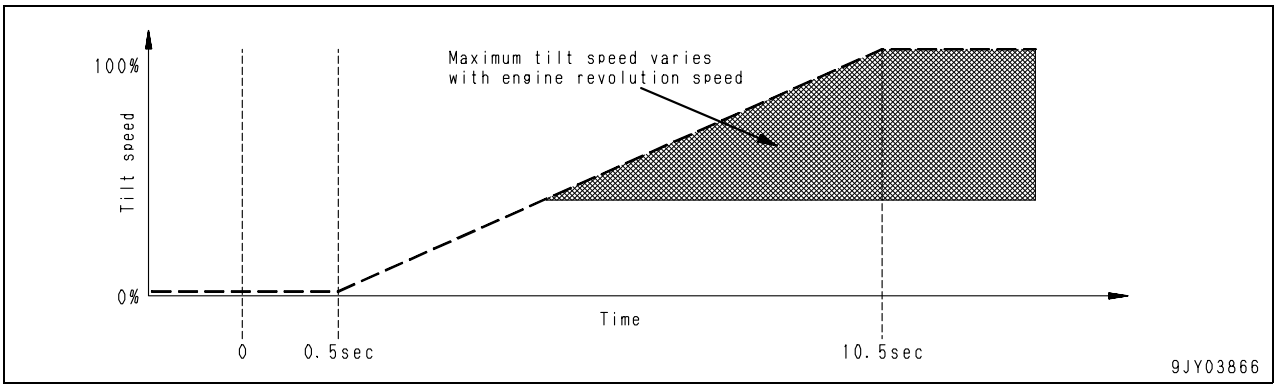
Condition 1	Semiautomatic digging is ready with (1) to (4) below.
	(1) The semiautomatic digging switch is either in “ROCK” or “LOOSE” mode.
	(2) In forward (with F signal)
	(3) Lift arm angle less than –30° (almost to the ground)
	(4) Operate the kick-down switch. * Even when working in 1st, semiautomatic digging will not start without operating the kick-down switch.
Condition 2	Semiautomatic digging (automatic tilting) will start when the following conditions (1) and (2) are satisfied.
	(1) Perform lift arm raise operation after condition 1 is satisfied.
	(2) Travel speed km/h <3.5 × ENG rpm/1,800>

2) Conditions for finishing semiautomatic digging

Conditions	Automatic tilting is finished when any of the following conditions is satisfied.
	(1) Forward finished (F signal: ON → OFF)
	(2) Lift arm angle level or higher
	(3) Detect tilt end (becomes full tilt)

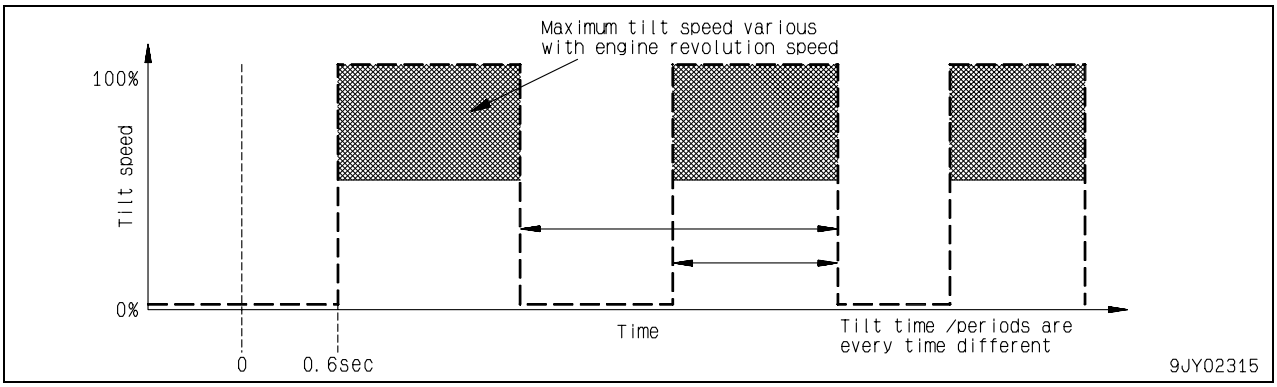
3) Tilt operation of digging mode

1] Operation of LOOSE mode



- Tilt operation will start 0.5 seconds after the conditions for starting semiautomatic digging are satisfied.
- The speed is increased so that it becomes 100% 10 seconds after starting tilt, the maximum speed depends on engine speed.

2] Operation of ROCK mode



- Tilt operation will start 0.6 seconds after the conditions for starting semiautomatic digging are satisfied.
- Tilt repeats operation/stop, with different tilt time/cycle for each cycle, and the number of tilts changes until loading is finished in accordance with loading object.
- The maximum speed depends on engine speed.

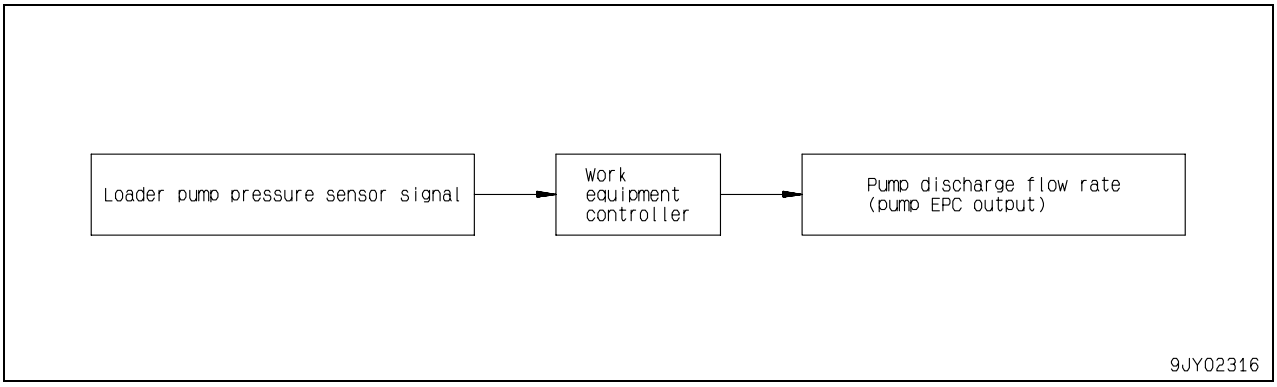
5. Pump swash plate control

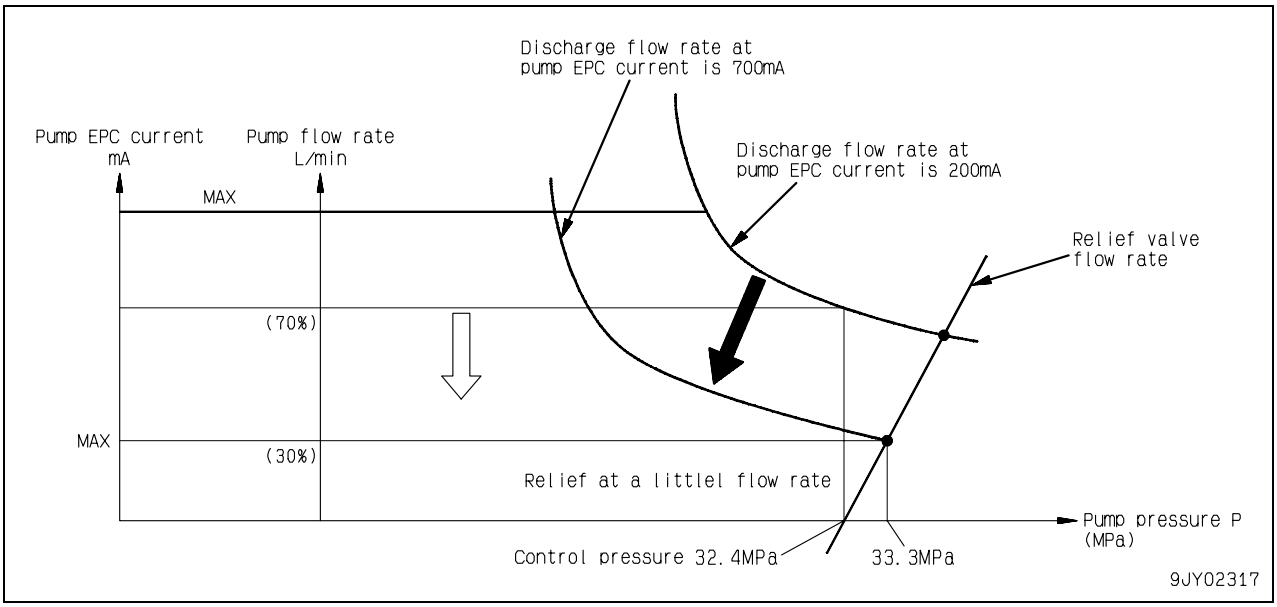
Function

In pump swash plate control, “horsepower loss decrease function in pump relief” and “pickup auxiliary function when engine speed is low” are included, and based on calculation results of each function, data with less pump delivery (larger pump EPC current) will be selected.

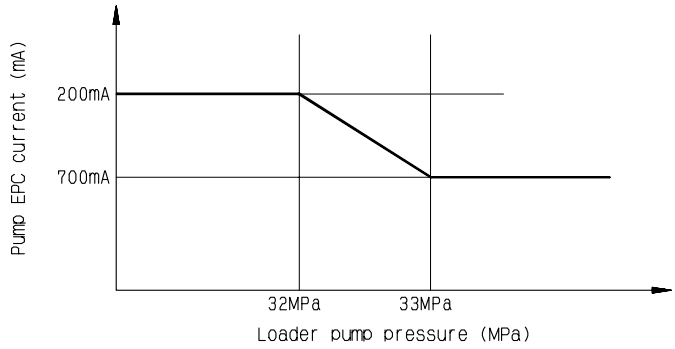
1) Horsepower loss decrease function in pump relief

- Horsepower loss is decreased by controlling pump delivery in relief, changing the command value of the pump swash plate, when the work equipment pump is relieved.
- Output to pump EPC is changed with input signal of the loader pump pressure sensor.





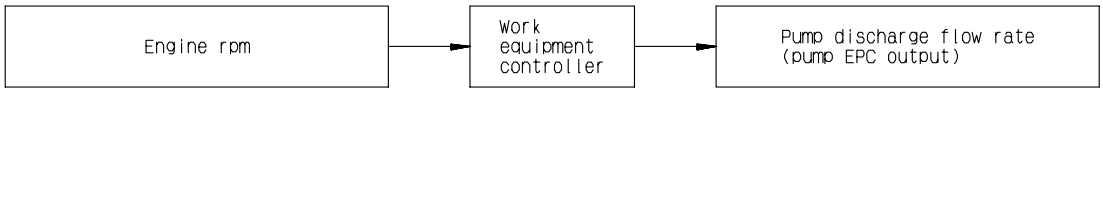
- The work equipment controller operates pump EPC in 200 mA until loader pump pressure reaches 32 MPa, and when it becomes 33 MPa or higher, the controller operates pump EPC in 700 mA.
- In this control, the delivery (pump EPC current) is changed over a second from 700 mA to 200 mA in order to prevent sudden operation due to rapid increase of flow rate, when the delivery changes in increasing direction (current decreasing direction).



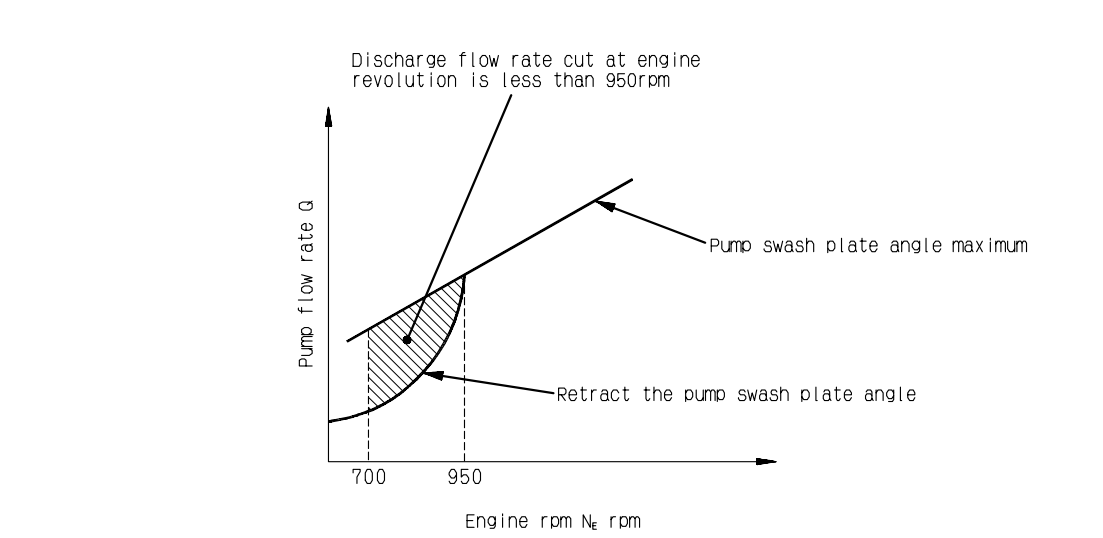
Pump pressure	Current value (A)	Pump flow rate
32.4 MPa	0.2	100%
33.3 MPa	0.7	≒ 30%

2) Pickup auxiliary function when engine speed is low

- When the engine speed is low and torque is low, acceleration of the engine in work equipment operation is aided by limiting the pump delivery.



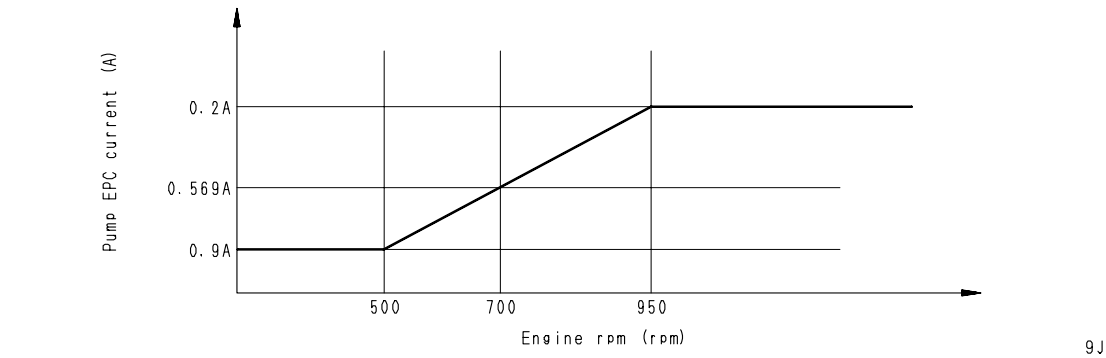
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9JY02320

- The work equipment controller operates pump EPC in 0.9 A until engine speed reaches 500 rpm, and when it becomes 950 rpm or higher, the controller operates pump EPC in 0.2 A.

Engine speed	Current value (A)	Pump flow rate
500 rpm	0.9	MIN
700 rpm	0.569	≒ 40%
950 rpm	0.2	100%

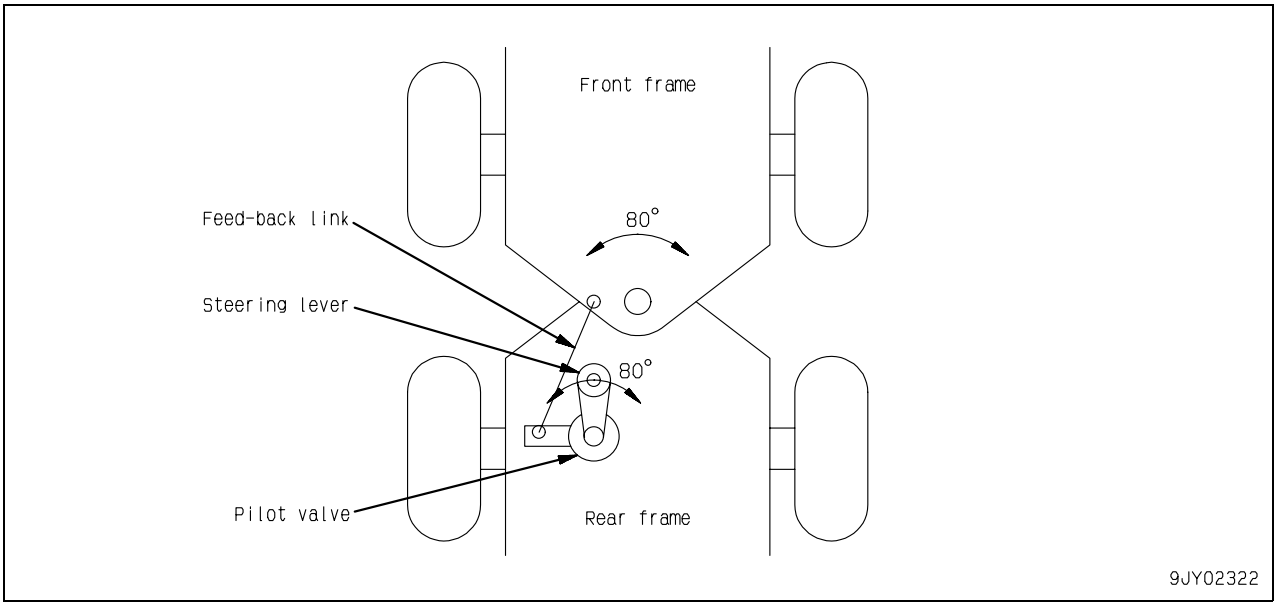


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6. AJSS control

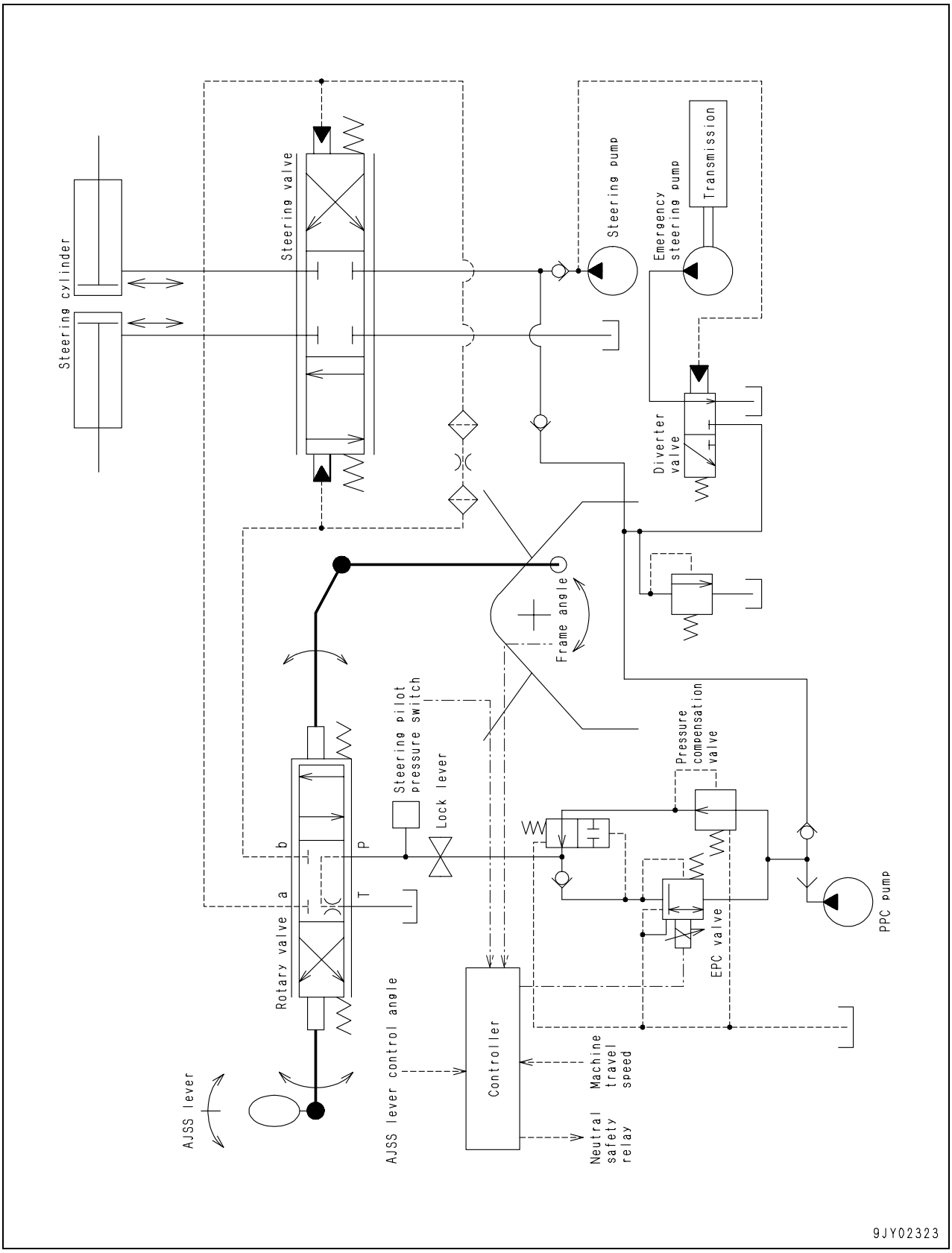
Function

AJSS is a turn control system with a joystick, which senses articulation angle and faithfully bends the machine in accordance with the tilting angle of AJSS lever, by adopting pilot oil pressure method with feedback mechanism.



1) AJSS system

- In AJSS, when the joystick steering lever and the frame are connected with link through the rotary valve, and deviation occurs between the operating angle of the lever and the machine frame turning angle, the pilot oil pressure is applied to the steering valve from the rotary valve, and the machine turns in the direction of lever operation until the operating angle of the lever and the machine frame turning angle match and the rotary valve closes.
- Even if the EPC valve malfunctions, the operator can steer the machine with the function of the pressure compensation valve of AJSS. In addition, even if the engine stops, the operator can steer the machine with the operation of the diverter valve as long as the transmission is rotating (the machine is traveling).


Steering cylinder
Steering valve
Steering pump
Emergency steering pump
Transmission
Diverter valve
Frame angle
Steering pilot pressure switch
Lock lever
Pressure compensation valve
PPC pump
EPC valve
Rotary valve
a
b
P
T
AJSS lever
AJSS lever control angle
Controller
Machine travel speed
Neutral safety relay
9JY02323

2) AJSS neutral interlock

- In AJSS, since there is a possibility that the machine operates and turns immediately after the engine is started, if the joystick steering lever is in a position other than neutral (there is deviation between the operating angle of the lever and the machine frame angle), the engine start signal is cut, and starting the engine is prohibited by turning the neutral safety relay on.
- If the steering lock lever is locked, and the joystick steering lever is in a position other than neutral while the engine is operating, there is a possibility that the machine turns immediately after the lever is unlocked, the caution buzzer is sounded in order to call attention of the operator.
- Since the machine does not turn with the steering locked, operation of FR is prohibited with the transmission controller. Therefore, if the forward-reverse switch of the joystick steering knob is set to a position other than neutral while the steering is locked, because there is a possibility that forward-reverse operation occurs immediately after unlocked, the caution buzzer is sounded in order to call attention of the operator.

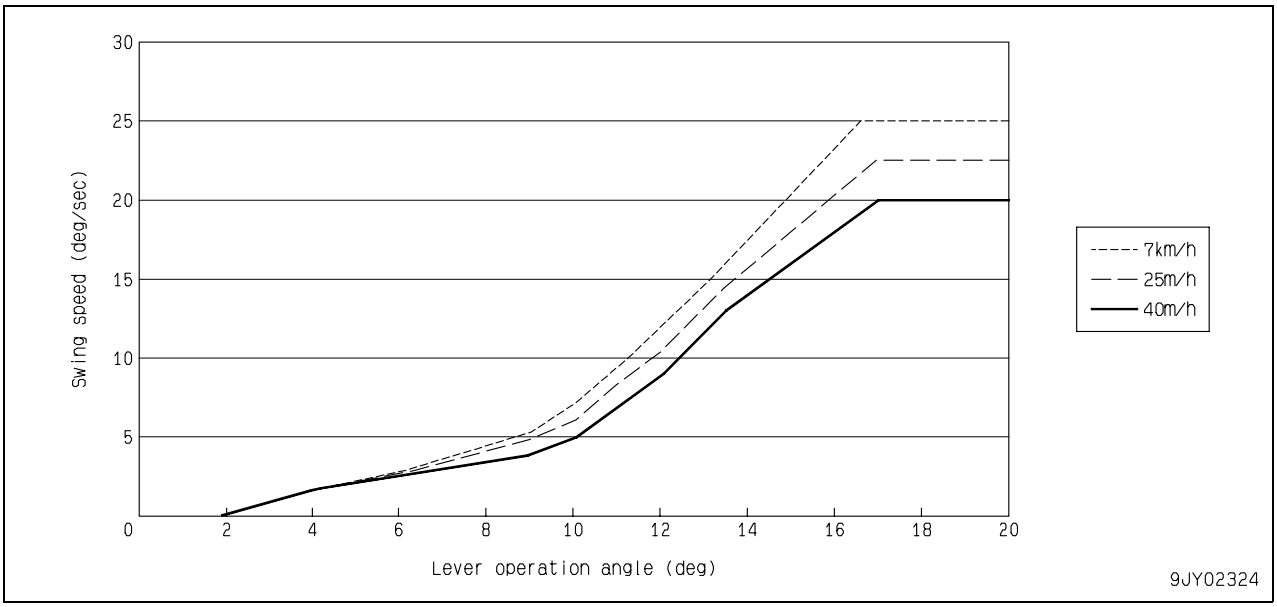
Conditions				Reference	Neutral safety control	
Engine	Joystick steering lever	Steering lock lever	Steering pilot pressure NET signal	Machine state	Engine start neutral safety	Reference Transmission neutral safety
Stopped (below 500 rpm)	Neutral position deviation angle less than 6°	Locked	Without pressure (switch = OPEN)	The key is on, the engine is stopped		
		Unlocked	Without pressure (switch = OPEN)			
	Operation position deviation angle more than 6°	Locked	Without pressure (switch = OPEN)		Starting the engine is not possible when the joystick steering lever is operated	
		Unlocked	Without pressure (switch = OPEN)			
Operating (500 rpm or above)	Neutral position deviation angle less than 6°	Locked	Without pressure (switch = OPEN)	Lever locked		Transmission shift is not possible when the steering is locked (N maintenance).
		Unlocked	With pressure (switch = CLOSE)	Normally operating		
	Operation position deviation angle more than 6°	Locked	Without pressure (switch = OPEN)	The lever is operated while it is locked	The caution buzzer sounds	Transmission shift is not possible when the steering is locked (N maintenance)
		Unlocked	With pressure (switch = CLOSE)	Normally operating		

3) Speed-sensing steering

- In AJSS, the steering characteristics is changed in accordance with travel speed, by controlling the pilot basic pressure of the rotary valve with EPC.
- When travel speed is 7 km/h or less, it is controlled to turn speedily when the lever operating stroke is large, prioritizing V shape work efficiency.
- When travel speed is higher, the turning speed is reduced from the neutral range of lever operating stroke, limiting sudden turning operation in rapid lever operation.
- It has three changeable tables.

★ For the adjustment method and the characteristics of each table, refer to “Testing and adjusting: Modification of AJSS oil pressure command table pattern”.

AJSS characteristics



4) Adjusting neutral position of AJSS

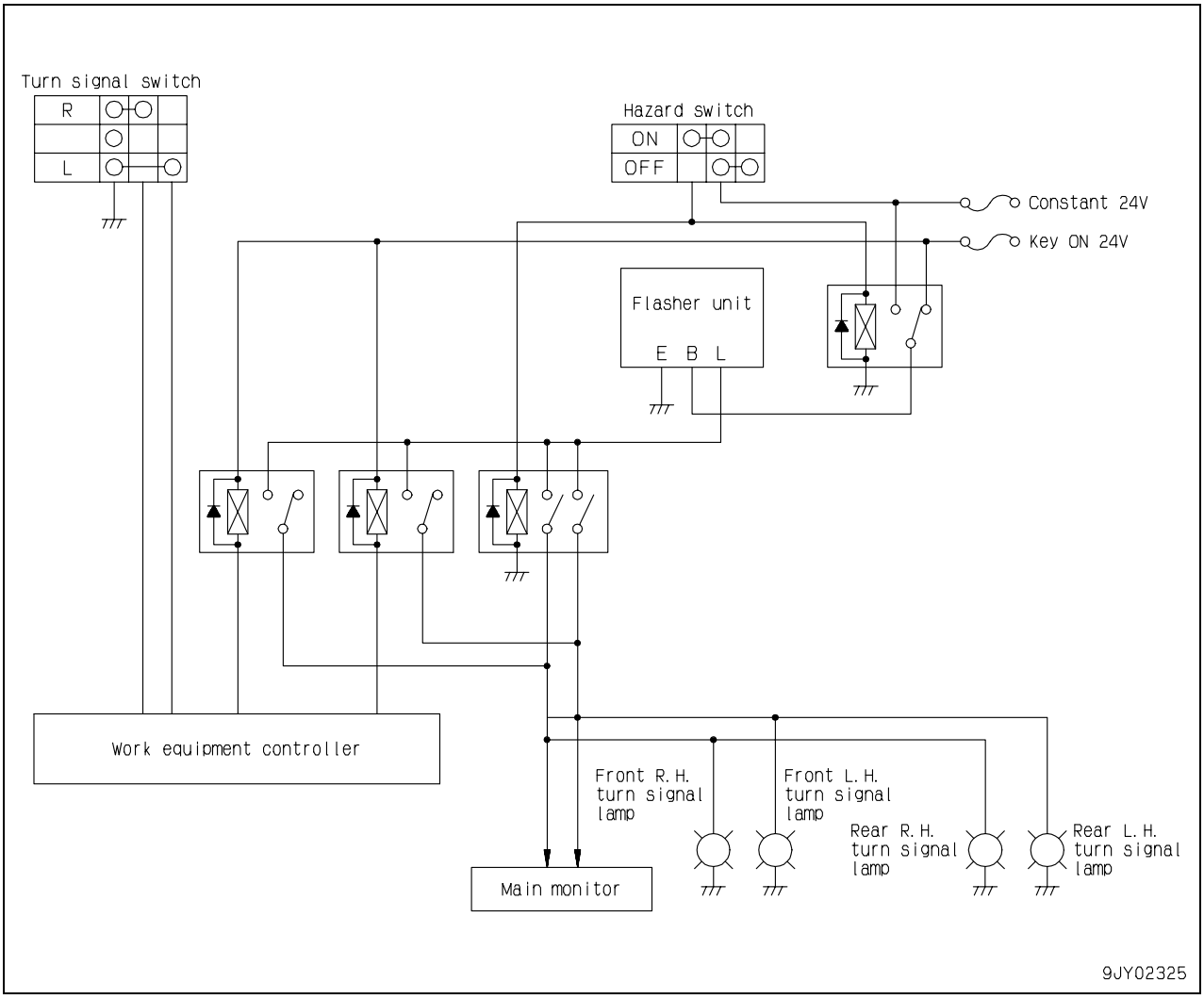
- AJSS recognizes opening of the rotary valve made by lever operation with the frame angle sensor and lever angel sensor.
- Adjust the neutral position of AJSS to cancel the installation error of the sensors when the machine travels straight and the rotary valve is set in neutral.

★ For adjustment method, see “Testing and adjusting: Adjustment of AJSS neutral position”.

7. AJSS turn signal control

- In AJSS, since the turn signal can not be reset automatically, the turn signal automatic reset operation is performed using the frame angle input in the controller.
- This control is operated only in AJSS. (In machines with steering, automatic reset is performed with the mechanism of the conventional turn signal switch installed in the steering.)

1) Machine circuit



2) Operating and stopping turn signal

The operation and stop conditions of the right turn signal are shown below. (Same for the left turn signal)

Operation: When the right turn signal switch is pressed while the right turn signal is stopped, the turn signal flashes because the right turn signal relay operates. The flash operation is performed with the flasher unit.

Stop: Perform the following operation while the right turn signal is operating in order to stop the right turn signal.

Press the right turn signal switch again.

Press the left turn signal switch. In this case, the left turn signal will start flashing at the same time.

After the turn signal lights up, when the machine turns right for 10° or more and then the machine is set in the straight travel position (8° or less), the right turn signal will stop. (Automatic stop)

After the turn signal lights up, when the machine turns left for 10° or more, the right turn signal will stop. (Automatic stop)

8. Real-time monitor

1) List of display contents of the real-time monitor

In WA600-6, the state of the controller input and output signals can be checked using the real-time monitor function of the monitor.

The following table shows the display items and display contents in normal operation of the real-time monitor in relation to the work equipment controller:

No.	Item	ID No.	Display of item name	Contents of display data	Display contents in normal operation	Remarks
1	Software part number	20202	VERSION	Part No. of software is displayed	Depends on the software number	
2	Application Version	20225	VERSION APP	Application version number is displayed	Depends on application version number	
3	Data Version	20226	VERSION DATA	Data version number is displayed	Depends on data version number	
4	Loader pump pressure	94700	PUMP PRESS	Converted value pressure of loader pump oil pressure is displayed	When work equipment is in neutral : 2.0 ± 2.0 MPa Work equipment relief : 34.0 ± 2.0 MPa	
5	Loader pump pressure	94701	PUMP PRESS	Input voltage value of loader pump oil pressure is displayed	When work equipment is in neutral : 0.70 ± 0.2V Work equipment relief : 3.22 ± 0.2V	
6	Loader pump EPC current value (command)	94500	PUMP EPC DIR	Loader pump EPC output command current value is displayed	Li (800 rpm) : 421 ± 30 mA Hi (above 950 rpm) : 200 ± 10 mA Work equipment relief : 700 ± 10 mA Engine stop (below 500 rpm) : 900 ± 10 mA	
7	Pump delivery	94600	PUMP FLOW	Results of pump delivery calculation are displayed	When work equipment is in neutral: 264CC/R Work equipment in relief: 45 ± 10 CC/R	
8	Lift arm angle	06002	BOOM ANG	Calculation results of lift arm angle is displayed	Standard lift arm Lift arm top : 46.8 ± 2.0 deg Lift arm bottom : –42.3 ± 5.0 deg Hi-lift lift arm Lift arm top : 49.3 ± 2.0 deg Lift arm bottom : –40.5 ± 5.0 deg	
9	Lift arm angle	06005	BOOM ANG	Input voltage value to lift arm angle sensor potentiometer is displayed	Standard lift arm Lift arm top: 3.80 ± 0.3 V Lift arm bottom: 1.33 ± 0.5 V Hi-lift lift arm Lift arm top: 3.87 ± 0.3 V Lift arm bottom: 1.38 ± 0.5 V	

No.	Item	ID No.	Display of item name	Contents of display data	Display contents in normal operation	Remarks
10	Frame angle	94400	FRAME ANGLE	Operation angle converted value of AJSS frame potentiometer is displayed	When machine is traveling straight : 0.0 ± 1.0 deg When fully turned right : 39.0 ± 4.0 deg When fully turned left : –39.0 ± 4.0 deg	
11	Number of lift arm lever operations	42100	BOOM LVR	Number of lift arm lever operations is displayed in the unit of thousand	Display in accordance with the number of lever operations	
12	Lever potentiometer voltage lift arm 1	42000	BOOM POT1	Input voltage value to lift arm lever potentiometer 1 is displayed	Neutral 2.50 V ± 0.100 V Raise (before detent) 3.89 V ± 0.25 V Raise (detent position) 4.11 V ± 0.25 V Lower (before detent) 1.11 V ± 0.25 V Float (detent position) 0.89 V ± 0.25 V	
13	Lever potentiometer voltage lift arm 2	42001	BOOM POT2	Input voltage value to lift arm lever potentiometer 2 is displayed	Neutral 2.50 V ± 0.100 V Raise (before detent) 1.11 V ± 0.25 V Raise (detent position) 0.89 V ± 0.25 V Lower (before detent) 3.89 V ± 0.25 V Float (detent position) 4.11 V ± 0.25 V	
14	Number of bucket lever operations	42101	BUCKET LVR	Number of bucket lever operations is displayed in the unit of thousand	Display in accordance with the number of lever operations	
15	Lever potentiometer voltage bucket 1	42002	BUCKET POT1	Input voltage value to bucket lever potentiometer 1 is displayed	Neutral 2.50 V ± 0.100 V Tilt (before detent) 3.89 V ± 0.25 V Tilt (detent position) 4.11 V ± 0.25 V Full dump 0.89 V ± 0.25 V	
16	Lever potentiometer voltage bucket 2	42003	BUCKET POT2	Input voltage value to bucket lever potentiometer 2 is displayed	Neutral 2.50 V ± 0.100 V Tilt (before detent) 1.11 V ± 0.25 V Tilt (detent position) 0.89 V ± 0.25 V Full dump 4.11 V ± 0.25V	
17	Lift arm raise EPC current (command)	41900	RAISE EPC DIR	EPC output command current value to lift arm raise is displayed	Neutral 0 ± 10 mA Max. 896 ± 10 mA	
18	Lift arm lower EPC current (command)	41901	LOWER EPC DIR	EPC output command current value to lift arm lower is displayed	Neutral ±10 mA Before detent : 640 ± 10 mA Float position : 1,000 ± 10 mA	

No.	Item	ID No.	Display of item name	Contents of display data	Display contents in normal operation	Remarks
19	Bucket tilt EPC current (command)	41902	TILT EPC DIR	EPC output command current value to bucket tilt is displayed	Neutral 0 ± 10 mA Max. 930 ± 10 mA	
20	Bucket dump EPC current (command)	41903	DUMP EPC DIR	EPC output command current value to bucket dump is displayed	Neutral 0 ± 10 mA Max. 848 ± 10 mA	
21	J/S EPC current (command)	41908	AJSS EPC DIR	EPC output command current value to AJSS is displayed	Lever in neutral : 384 ± 10 mA Lever operated fully to the right 595 ± 10 mA Lever operated fully to the left 595 ± 10 mA	Check when AJSS is locked
22	J/S right EPC current (command)	41904	J/S EPC DIR RH	EPC output command current value to J/S right is displayed	In WA600-6, there is no corresponding functions	
23	J/S left EPC current (command)	41905	J/S EPC DIR LH	EPC output command current value to J/S left is displayed	In WA600-6, there is no corresponding functions	
24	Lever potentiometer voltage J/S1	42004	J/S POTI1	Input voltage value to J/S lever potentiometer 1 is displayed	In WA600-6, there is no corresponding functions	
25	Lever potentiometer voltage J/S2	42005	J/S POTI2	Input voltage value to J/S lever potentiometer 2 is displayed	In WA600-6, there is no corresponding functions	
26	3rd valve 1 ECMV current value (command)	41906	3RD EPC1 DIR	EPC output command current value to 3rd valve 1 is displayed	Neutral 0 ± 10 mA Max. 960 ± 10 mA	
27	3rd valve 2 ECMV current value (command)	41907	3RD EPC2 DIR	EPC output command current value to 3rd valve 2 is displayed	Neutral 0 ± 10 mA Max. 960 ± 10 mA	
28	Number of 3rd lever operations	42102	3RD LVR	Number of 3rd lever operations is displayed in the unit of thousand	Display in accordance with the number of lever operations	
29	Lever potentiometer voltage 3rd valve 1	42006	3RD POT1	Input voltage value to 3rd valve lever potentiometer 1 is displayed	Neutral 2.50 V ± 0.10 V Retract: 4.11 V ± 0.25 V Extract: 0.89 V ± 0.25 V	
30	Lever potentiometer voltage 3rd valve 2	42007	3RD POT2	Input voltage value to 3rd valve lever potentiometer 2 is displayed	Neutral 2.50 V ± 0.10 V Retract: 0.89 V ± 0.20 V Extract: 4.11 V ± 0.20 V	
31	AJSS lever operation angle	94300	AJSS LEVER	Operation angle converted value of AJSS lever potentiometer is displayed	When machine is traveling straight Neutral : 0.0 ± 0.5 deg Turn the lever fully to the right : 20.0 ± 3.0 deg Turn the lever fully to the left : –20.0 ± 3.0 deg	Check when the engine is stopped, or AJSS is locked

No.	Item	ID No.	Display of item name	Contents of display data	Display contents in normal operation	Remarks
32	AJSS lever potentiometer voltage	94301	AJSS LEVER	Input voltage value of AJSS lever potentiometer is displayed	When machine is traveling straight Neutral : 2.5 ± 0.3 V Turn the lever fully to the right : 3.33 ± 0.5 V Turn the lever fully to the left : 1.67 ± 0.5 V	Check when the engine is stopped, or AJSS is locked
33	AJSS frame potentiometer voltage	94401	FRAME ANGLE	Input voltage value of AJSS frame potentiometer is displayed	When machine is traveling straight : 2.5 ± 0.3 V When fully turned right : 0.96 ± 0.5 V When fully turned left : 4.04 ± 0.5 V	
34	AJSS S/T deviation angle	94800	S/T DEFLECTION	Deviation angle value of AJSS frame and lever is displayed	When machine is traveling straight Neutral : 0.0 ± 0.5 deg Lever fully to the right : 20.0 ± 2.0 deg Lever fully to the left : –20.0 ± 2.0 deg	Check when AJSS is locked
35	Digging flag	94900	WORK FLAG	The state of digging judgment is displayed	During digging operation: ON Other than above: OFF	
36	Input signal D_IN_0 – 7	40910	The state of input signal is displayed	00000000 (Semi auto SW = OFF) 10000000 (Semi auto SW = ON) 01000000 (Semi auto SW = ON)	D-IN-0 : Semi auto ROCK mode SW D-IN-1 : Semi auto LOOSE mode SW	D-IN-0 : Semi auto ROCK mode SW D-IN-1 : Semi auto LOOSE mode SW
37	Input signal D_IN_8 – 15	40911	D-IN--8-----15	The state of input signal is displayed	11000000 (Dump) 10000000 (Bucket level) 00000000 (Full tilt) 10100000 (Bucket raise set SW = ON) 10010000 (Bucket lower set SW = ON)	
38	Input signal D_IN_16 – 23	40912	D-IN-16-----23	The state of input signal is displayed	1000000 (Work position) 00000000 (Lock position) 01000000 (Starter operation)	D-IN-16 : Work equipment N lock SW D-IN-17 : Starter terminal C signal

No.	Item	ID No.	Display of item name	Contents of display data	Display contents in normal operation	Remarks
39	Input signal D_IN_24 – 31	40913	D-IN-24-----31	The state of input signal is displayed	0000000 00001000 (Lift arm raise set SW = ON) 00000100 (Lift arm lower set SW = ON) 00000010 (Right winker SW = ON) 00000001 (Left winker SW = ON)	D-IN-28 : Lift arm positioner raise set SW D-IN-29 : Lift arm positioner lower set SW D-IN-30 : Right winker SW D-IN-31 : Left winker SW
40	Input signal D_IN_32 – 39 (Work equipment controller does not have 33 – 39)	40961	D-IN-32-----39	The state of input signal is displayed	There is no used items in this data 00000000 is constantly displayed	
41	ON/OFF output D_OUT0--7	40952	D-OUT--0------7	ON/OFF output state of SOL_OUT0 to 7 '0' is displayed when setting current output	10000000 (Lock position) 00000000 (Unlock neutral) 01000000 (Raise detent SOL = ON) 00100000 (Float detent SOL = ON) 00010000 (Tilt detent SOL=ON)	D-OUT-0 : Work equipment N lock SOL D-OUT-1 : Lift arm raise detent SOL D-OUT-2 : Lift arm float detent SOL D-OUT-3 : Bucket tilt detent SOL
42	ON/OFF output D_OUT8--15	40953	D-OUT-8-----15	ON/OFF output state of SOL_OUT8 to 13 and ON/OFF output state of SIG_OUT0 and 1 '0' is displayed when setting current output	There is no used items in this data Constantly 00000000	
43	ON/OFF output D_OUT16--23	40954	D-OUT-16----23	SIG_OUT2 to 3 HSW_OUT0 to 1 ON/OFF output state of BATT_RY_OUT is displayed	10000000 (Operate winker right) 01000000 (Operate winker left) 00001000 (Operate safety relay) 00010000 (Display lift arm positioner lower = ON) 00110000 (Display lift arm positioner raise/lower = ONon)	D-OUT-16 : Operate winker right D-OUT-17 : Operate winker left D-OUT-18 : Light up lift arm positioner raise set indicator D-OUT-19 : Light up lift arm positioner lower indicator D-OUT-20 : Operate safety relay

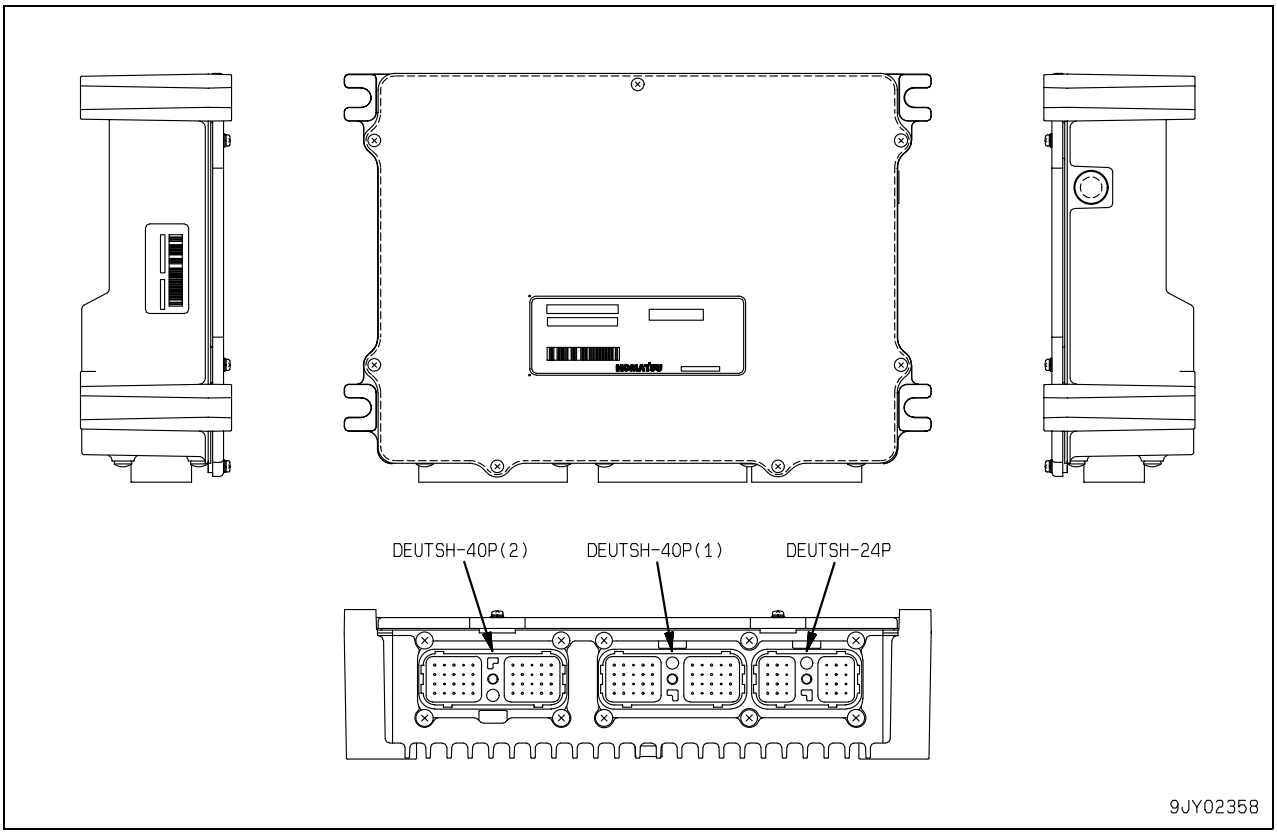
9. Diagnosis

1) Function of troubleshooting

The work equipment controller monitors the input and output signals constantly for troubleshooting for the system.

If any abnormality is detected by self-diagnosis, the information on it is transmitted through the network to the machine monitor. When abnormality occurs, it can be confirmed on the machine monitor/VHMS.

10. Pin assignment



Input and output signals

DEUTSCH-24P [CN-L05]

Pin No.	Signal name	Input/Output signal
1	Bucket lever potentio B	Input
2	Loader pump press. sensor	Input
3	AJSS frame potentio	Input
4	GND_SIG_D	
5	NC	Input
6	NC	Input
7	Bucket lever potentio A	Input
8	Boom angle sensor	Input
9	AJSS lever potentio	Input
10	GND_SIG_D	
11	NC	Input
12	NC	Input
13	Boom lever potentio B	Input
14	Third EPC lever B	Input
15	NC	Input
16	NC	Output
17	Semiauto loading loose mode SW.	Input
18	NC	Input
19	Boom lever potentio A	Input
20	Third EPC lever A	Input
21	GND_SIG_A	
22	PWR_OUT_5V_0	Output
23	Semiauto loading rock mode SW.	Input
24	NC	Input

DEUTSCH-40P(1) [CN-L06]

Pin No.	Signal name	Input/Output signal
1	NC	Output
2	Winker SW. right	Input
3	Remote positioner leveling set SW.	Input
4	NC	Input
5	NC	Input
6	NC	Input
7	NC	Input
8	Winker relay left	Output
9	NC	Output
10	NC	Input
11	NC	Output
12	NC	
13	Remote positioner lifting set SW.	Input
14	NC	Output
15	NC	Input
16	NC	Input
17	NC	Input
18	Winker relay right	Output
19	NC	Output
20	Third EPC lever A	Input
21	NC	Input/Output
22	COMM_CAN_L_O	Input/Output
23	NC	Input/Output
24	PWR_CTR_EXT	Input
25	Starter switch(IGN-C)	Input
26	NC	Input
27	NC	Input
28	NC	Input
29	NC	
30	NC	Input
31	NC	
32	COMM_CAN_H_O	Input/Output
33	NC	Input/Output
34	NC	
35	Lever prohibiting equipment SW.	Input
36	NC	Input
37	NC	Input
38	Winker SW. left	Input
39	NC	
40	NC	Input

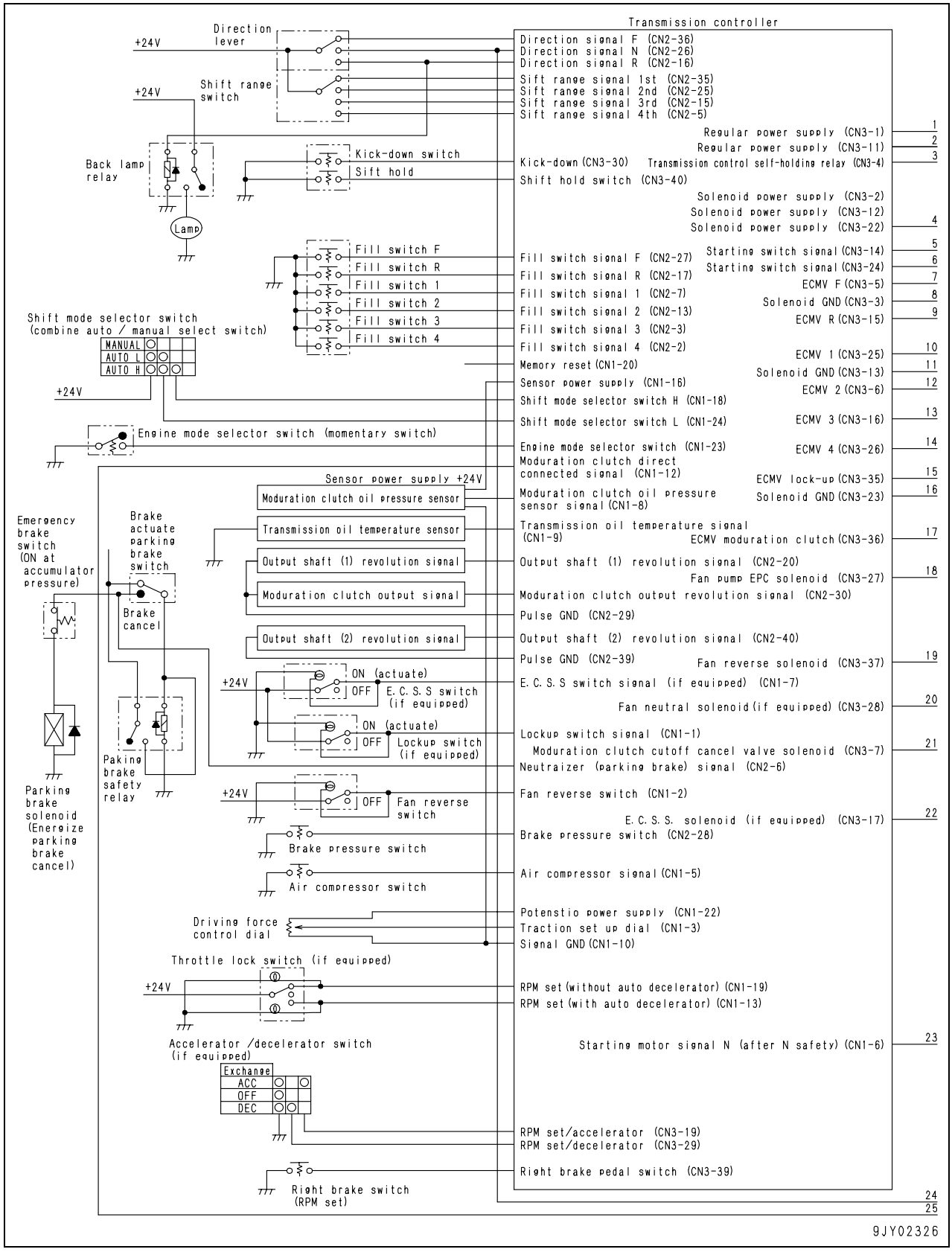
DEUTSCH-40P(2) [CN-L07]

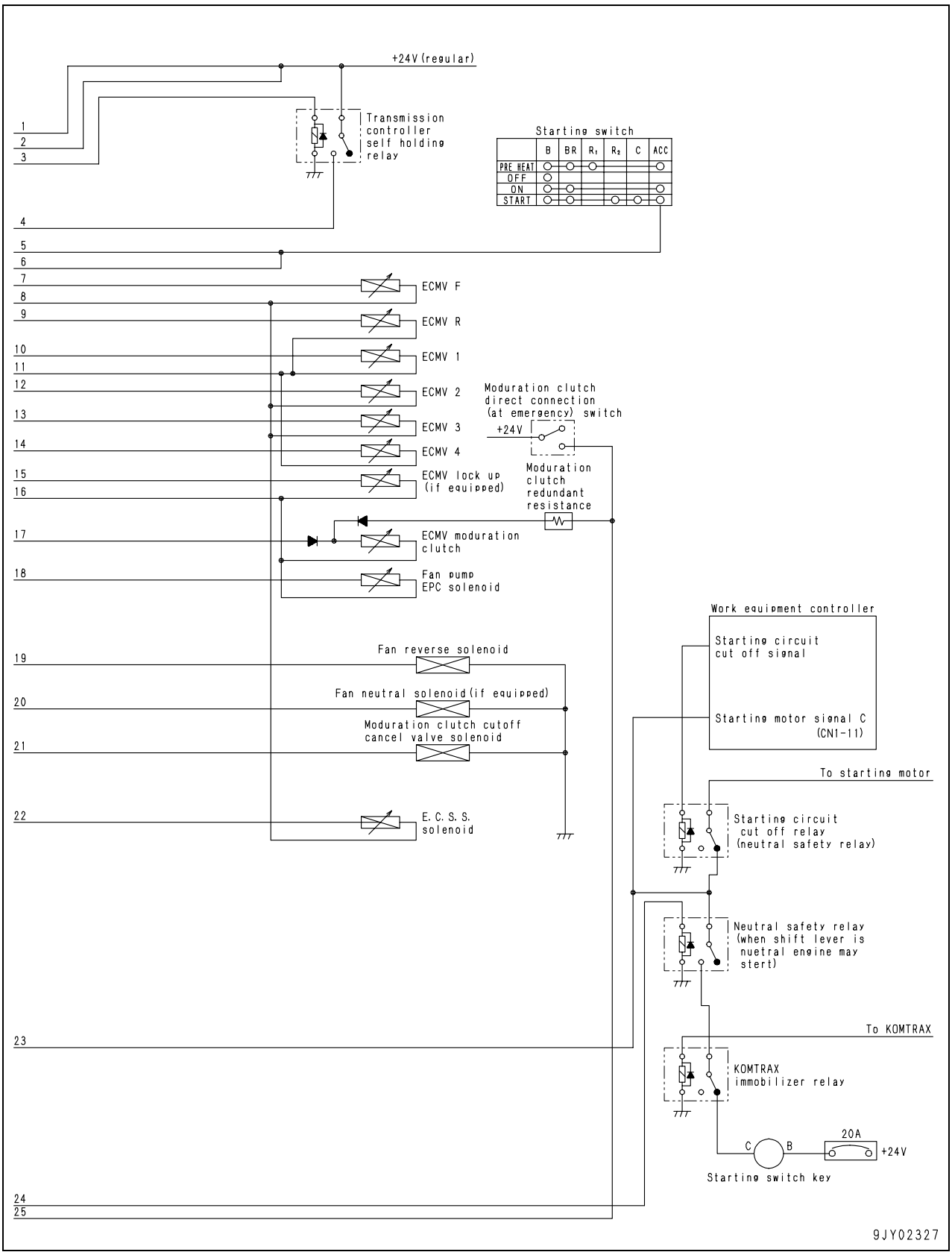
Pin No.	Signal name	Input/Output signal
1	PWR_IN_BATT	Input
2	PWR_IN_BRY	Input
3	GND_ACT	
4	Safety relay	Output
5	Bucket tilting EPC	Output
6	Boom lifting EPC	Output
7	Work neutral lock solenoid	Output
8	Remote positioner lifting Indicator	Output
9	NC	Input
10	Bucket cylinder tilt end SW.	Input
11	PWR_IN_BATT	Input
12	PWR_IN_BRY	Input
13	GND_ACT	
14	PWR_CTR_KEY	Input
15	Bucket dumping EPC	Output
16	Boom lowering EPC	Output
17	Magnetic detent of boom lever lift	Output
18	Remote positioner lowering indicator	Output
19	NC	Input
20	Bucket cylinder horizon SW.	Input
21	GND_PWR	
22	PWR_IN_BRY	Input
23	GND_ACT	
24	PWR_CTR_KEY	Input
25	Third EXT EPC	Output
26	AJSS EPC	Output
27	Magnetic detent of boom lever float	Output
28	NC	Output
29	NC	Input
30	Bucket positioner up set SW.	Input
31	GND_PWR	
32	GND_PWR	
33	GND_PWR	
34	NC	Output
35	Third RET EPC	Output
36	Loader pump EPC	Output
37	Magnetic detent of bucket lever tilt	Output
38	NC	Output
39	NC	Input
40	Bucket positioner down set SW.	Input

Transmission controller system

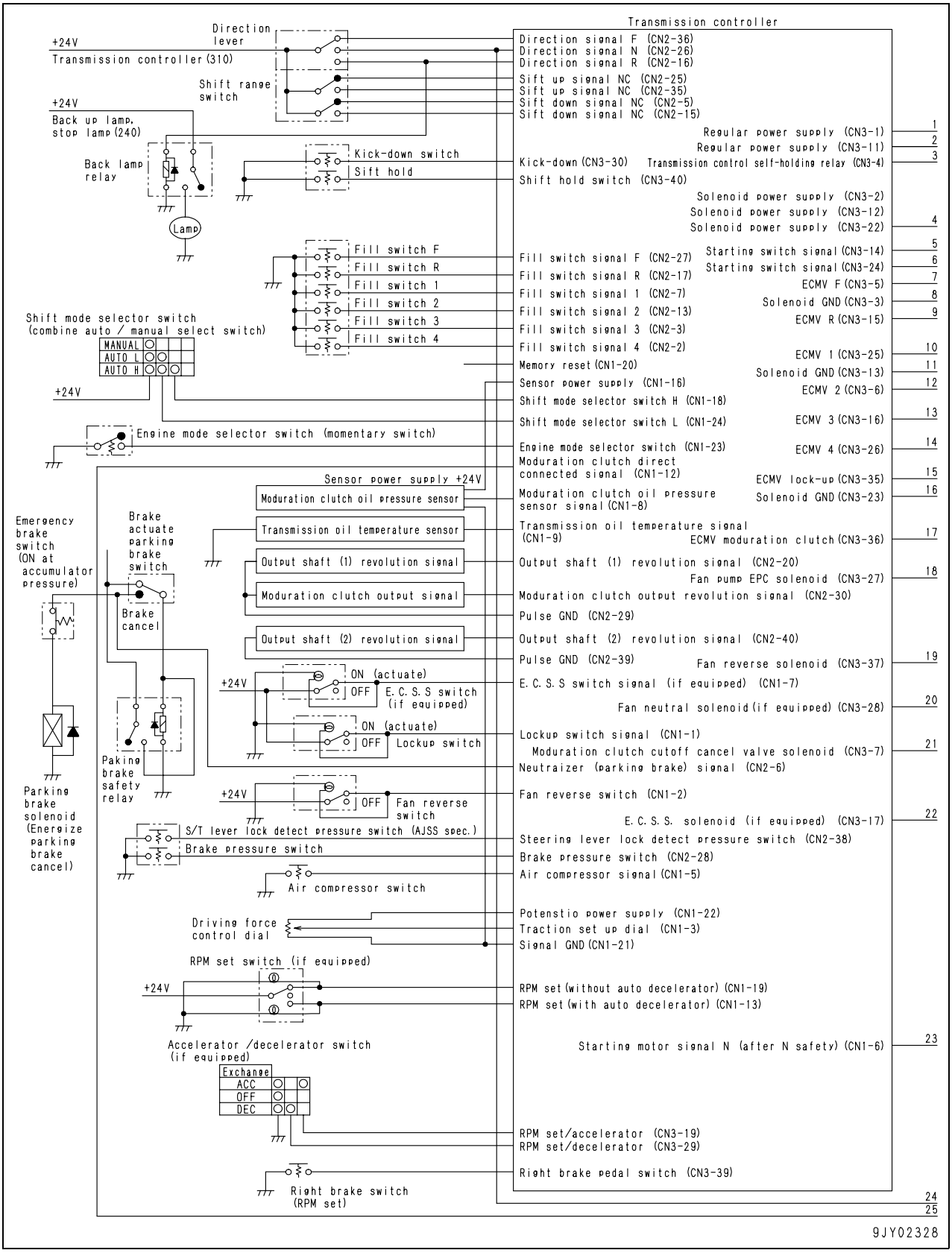
1. Electrical circuit diagram

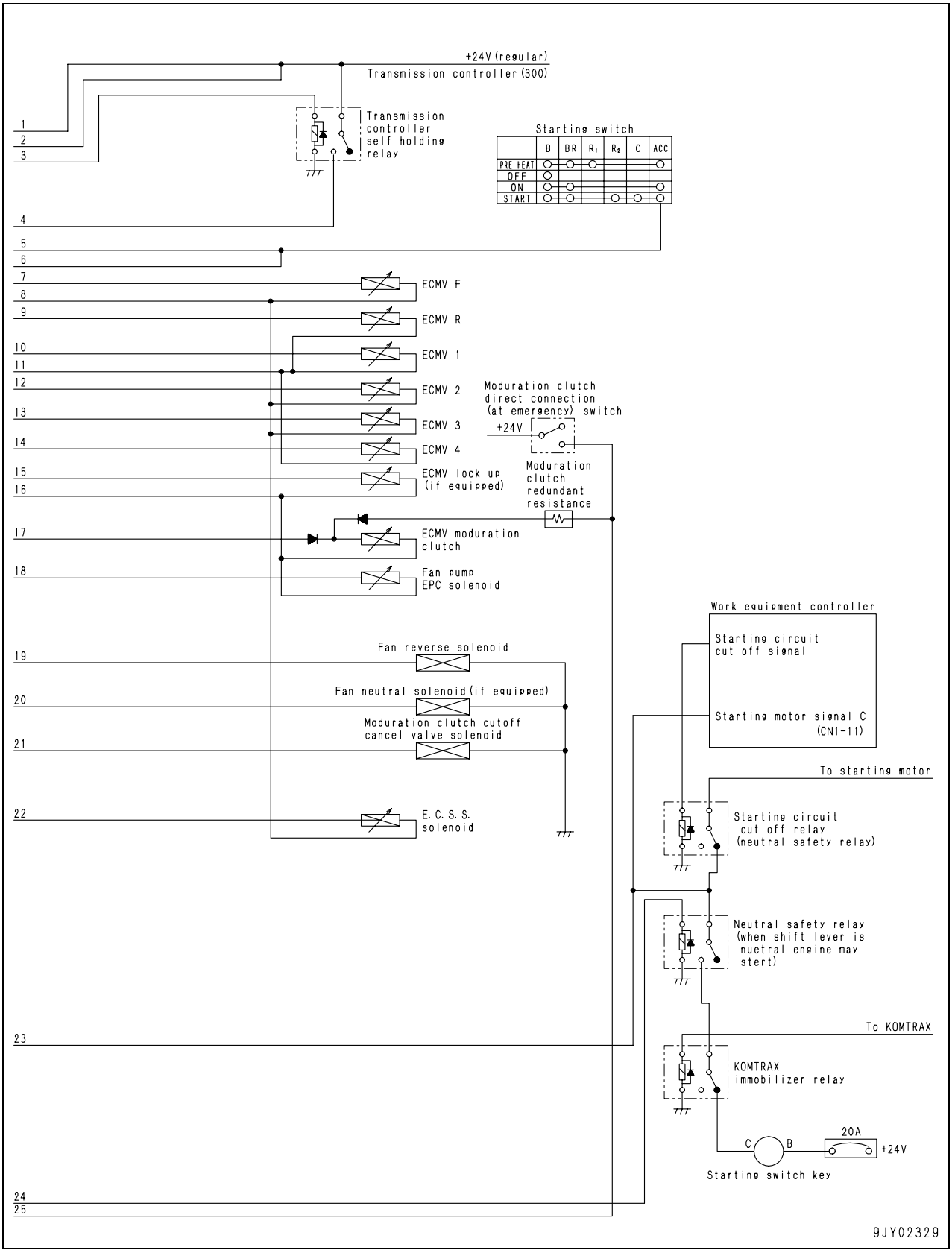
Transmission controller electrical circuit diagram (steering wheel specification)
Lockup




+24V (regular)
Transmission controller self holding relay
Starting switch
B BR R1 R2 C ACC
PRE HEAT
OFF
ON
START
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
ECMV F
ECMV R
ECMV 1
ECMV 2
ECMV 3
ECMV 4
ECMV lock up (if equipped)
Moduration clutch direct connection (at emergency) switch
+24V
Moduration clutch redundant resistance
ECMV moduration clutch
Fan pump EPC solenoid
Fan reverse solenoid
Fan neutral solenoid (if equipped)
Moduration clutch cutoff cancel valve solenoid
E. C. S. S. solenoid
Work equipment controller
Starting circuit cut off signal
Starting motor signal C (CN1-11)
To starting motor
Starting circuit cut off relay (neutral safety relay)
Neutral safety relay (when shift lever is nuetral engine may stert)
To KOMTRAX
KOMTRAX immobilizer relay
20A
C
B
+24V
Starting switch key
9JY02327

Transmission controller electrical circuit diagram (AJSS specification)
Lockup




+24V (regular)
Transmission controller (300)
Transmission controller self holding relay
Starting switch
B BR R1 R2 C ACC
PRE HEAT
OFF
ON
START
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
ECMV F
ECMV R
ECMV 1
ECMV 2
ECMV 3
ECMV 4
ECMV lock up (if equipped)
Moduration clutch direct connection (at emergency) switch
+24V
Moduration clutch redundant resistance
ECMV moduration clutch
Fan pump EPC solenoid
Fan reverse solenoid
Fan neutral solenoid (if equipped)
Moduration clutch cutoff cancel valve solenoid
E. C. S. S. solenoid
Work equipment controller
Starting circuit cut off signal
Starting motor signal C (CN1-11)
To starting motor
Starting circuit cut off relay (neutral safety relay)
Neutral safety relay (when shift lever is nuetral engine may stert)
To KOMTRAX
KOMTRAX immobilizer relay
20A
C
B
+24V
Starting switch key
9JY02329

2. Transmission controller gear shifting control

1) Electronic modulation function

To reduce the shocks made when the gear speed is changed (when the clutch is engaged), the modulation control is applied. The clutch oil pressure is controlled properly for the condition of the hydraulic circuit, depending on the engine speed, transmission oil temperature, travel speed, and gear shifting pattern and according to the transmission modulation data table saved in the transmission controller memory so that the transmission will be set in any gear speed (including the lockup clutch) smoothly.

The modulation control is also performed for the clutch on the side to be turned off in order to reduce lowering of the torque.

If an abnormal time lag is made in gear shifting, the learning function corrects the trigger operation time automatically.

2) Display of gearshift

The transmission controller displays the state of input signal related to gearshift by sending to the machine monitor via network.

1] Directional indicators

The directional indicators of the machine monitor display the signal input state of the directional lever, which is input to the transmission controller. Therefore, when the lever is in neutral position, and there is no input signal to the transmission controller, the directional indicators totally go out, and if two signals are input due to a problem, the two indicators may light up at the same time.

If the directional lever is in “R” state, the backup lamp relay will be operated, and the back lamp and back buzzer will be operated.

2] Gear speed indicators

The gear speed indicators of the machine monitor display the signal input state of the gear speed lever, which is input to the transmission controller. Therefore, when the lever is in neutral position, and there is no input signal to the transmission controller, the gear speed indicators totally go out, and if two signals are input due to a problem, an indicator different from the lever position may light up, because priority is given to higher gear speed.

3] Display of actual gear speed

The actual gear speed display of the machine monitor shows the state of the gear speed and travel direction, which is output from the transmission controller. When the directional lever is in “N,” it will be “N” display, and when the directional lever is in “F” or “R,” it will be “F” or “R” + gear speed display. While the parking brake is operating, this will always be “N” display, but when the clutch is turned off due to operation of the transmission cut-off brake, there will be no “N” display.

3) Automatic gear shifting function
In this function, auto shift, in which gear speed is automatically decided depending on travel speed, and manual shift, in which the speed is decided as the gear speed of the gearshift lever, are included. In auto shift, the auto shift indicator of the machine monitor lights up, and shifting up/down and ON/OFF of the lockup clutch are changed with the engine power mode and selected shift mode.
There are two modes, H/L, in auto shift, whose gearshift points are different depending on the engine power mode.
In auto shift, shifting up/down are controlled in accordance with the directional lever, gearshift lever, travel speed, accelerator pedal opening ratio, and data saved in the memory of the transmission controller according to the engine speed. For the gearshift point of each mode, refer to “3. Auto-shift points table.”

1] Gearshift lever in the 1st to 4th (when steering option is selected)
The maximum gear speed (gear shifting range) used in the automatic gear shifting operation is limited.
In the automatic gear shifting operation, the vehicle usually starts in the 2nd gear speed. Accordingly, if the gearshift lever is in 4th, the gear is shifted up and down between the 2nd gear speed and 4th gear speeds, and the vehicle starts in the 1st gear speed only when the kick-down function is used.

2] AJSS
Refer to the section of AJSS.

3] Directional lever in “N” position
The gear speed of transmission gearshift in neutral position is changed in accordance with travel speed, but display will always be “N”.

4) Shift hold function
- The shift hold function will hold the current gear speed when the hold switch is pressed if the auto-shift mode is selected, and will not shift up even when the travel speed is increased. Even if the travel speed is decreased, the gear will not be shifted down.
- While the shift hold function is operating, the shift hold indicator of the machine monitor lights up. When the shift hold switch is pressed again, the hold will be released, and the indicator will go out.
- The hold will be released automatically also by the directional lever, gearshift lever, and kick-down switch operation.
ON/OFF state of lockup will not be held.

5) Kickdown function
1] Kickdown in manual shift operation
- The kickdown switch operates only in the forward 2nd gear speed (F2), and the transmission is set in the forward 1st gear speed (F1). Operation of the kickdown switch is ignored in any gear speed other than (F2).
- After the actual gear speed becomes (F1) due to kickdown switch operation, the kickdown function will be released and the transmission will be set in the gear speed of the lever, when the directional lever is operated to a position other than forward, or the gearshift lever is operated to a position other than the 2nd gear speed.

2] Kickdown in auto-shift operation
- The kickdown function will work regardless of the lever position, if the directional lever is in a position other than N and the gearshift lever is in a position other than the 1st gear speed.
- The gear speed selected by the operation of the kickdown switch depends on the travel speed as shown in the following table.
- After the transmission gear is shifted because of the kickdown switch operation, ordinary gear shift will be performed in accordance with the auto-shift points table, after the time due to the no-shift time is passed or when the directional lever is operated.

Gear speed before shifting	Output shaft speed [rpm] when kickdown switch = ON	<Reference> Travel speed conversion	Gear speed after shifting	No-shift time
2nd	In all range		1st	5 sec
3rd	Below 860	12.5 km/h	1st	5 sec
	Above 860	12.5 km/h	2nd	4 sec
4th	Below 860	12.5 km/h	1st	5 sec
	Above 860	12.5 km/h	3rd	4 sec
2nd (lockup)	In all range		2nd	*1
3rd (lockup)	In all range		3rd	*1
4th (lockup)	In all range		4th	*1

*1: When lockup is released due to kickdown switch operation, lockup will not be ON again until the following conditions are satisfied.
- Perform temporary operation to turn the torque converter lockup switch OFF→ON.
- The travel speed changes from lockup ON speed or less to lockup ON speed or more as in the “3. Auto-shift points table.”

6) Torque converter lockup control function
- ON/OFF operation of the lockup is performed automatically due to ON operation of the torque converter lockup switch.
- When the lockup clutch is ON, the lockup indicator of the machine monitor lights up.
- Even when the manual shift is selected, if the torque converter lockup switch is ON, ON/OFF of the lockup is performed automatically by the transmission controller.
- The operation gear speed of lockup is shown in the following table.

Travel mode	Lockup operation gear speed (Lockup operates: ○)							
	F1	F2	F3	F4	R1	R2	R3	R4
MANUAL		○	○	○		○	○	○
Auto H		○	○	○		○	○	○
Auto L		○	○	○		○	○	○

1] Lockup rotation
For ON/OFF of lockup, refer to “3. Auto-shift points table.”

2] Lockup protection function
- Lockup ON only operates when the moving direction of the machine and the position of the directional lever match.

Determination of moving direction of the machine
- The machine is thought to be stopping when the transmission controller is started (key on), or the transmission output shaft speed is below 260 rpm.
- While the machine is thought to be stopping and the transmission output shaft speed becomes 260 rpm or more, if the directional lever is in “F” position, it is thought to be moving forward, and if it is in “R” position, it is thought to be moving backward.
  - ○ The travel speed is approximately 4 km/h when the transmission output shaft speed is 260 rpm.

7) Hunting prevention function
   - The transmission controller prevents hunting by detecting hunting, which occurs between 2nd and 3rd when auto shift is selected, with the controller.
   - If gearshifts of 2nd to 3rd to 2nd to 3rd are performed within 5 seconds from the previous gearshift, hunting is thought to have occurred, and the gear speed is selected from 2nd or 3rd, whose operation time is longer. When hunting prevention function operates, the shift point in hunting prevention stated in “3. Auto-shift points table” will be selected for the next automatic gear shifting operation.
   - The operation of hunting prevention function ends when the next gear shift operation (including FR, kickdown operation, etc.) is performed, and the gear will be set to the ordinary shift point of the auto shift.
   - When ON/OFF of 2nd lockup occurs consecutively within 5 seconds, the lock up will be turned off, and the speed will be changed to lockup ON travel speed when the hunting prevention function operates.
   - The hunting prevention function operates when hunting occurs even in the manual shift.

8) Changing shift points
   - The transmission controller has a function to adjust the gearshift points of L mode in auto shift.
   - If hunting occurs due to the conditions in a job site, travel speed when shifted up/down can be changed by adjusting the gearshift points.
   - ★ For the changing procedure, refer to “Testing and adjusting: Transmission gearshift point adjustment.”

9) 4th gear speed derating function
   - The transmission controller has a function to limit the operation of the 4th gear speed by changing the optional setting.
   - ★ For the changing procedure, refer to “Optional setting : Prohibition of 4th gear speed.”

10) Transmission initial learning and ECMV current adjustment
   - The transmission controller has an adjusting function to correct dispersion between the transmission unit and ECMV solenoid.
   - The initial learning function is used to adjust the fill time by changing the trigger operation time. The ECMV current adjustment function is used to adjust the modulation wave form. Dispersion of each device is eliminated and the normal condition is obtained by adjusting both of these items.
   - If the adjustment is not performed, a gear shifting shock or a time lag may be made.
   - ★ For adjusting procedure, refer to “Testing and adjusting: Setting of transmission initial learning/ Adjustment of transmission ECMV current”.

3. Auto-shift points table

- The relationship among transmission output shaft speed, engine mode, shift switch, and gear shifting operation are shown below.

		Engine mode and shift switch			
		Power mode		Economy mode	
		Shift switch H	Shift switch L	Shift switch H	Shift switch L
Gear shifting operation	F1→F2	373	373	373	373
	F2→F2 (lockup)	516 – 650	516 – 650	500 – 650	500 – 650
	F2→F2 (lockup) when hunting is prevented	616 – 700	616 – 700	600 – 700	600 – 700
	F2→F3	435 – 825	435 – 825	387 – 785	387 – 785
	F2→F3 when hunting is prevented	485 – 833	485 – 833	437 – 790	437 – 790
	F3→F3 (lockup)	987	903	903	903
	F3→F4	784 – 1,431	784 – 1,431	784 – 1,355	784 – 1,355
	F4→F4 (lockup)	1,743	1,607	1,607	1,607
	F4 (lockup) →F4	1,498	1,498	1,498	1,498
	F4→F3	688 – 1,375	688 – 1,375	688 – 1,320	688 – 1,320
	F3 (lockup) →F3	805 – 849	721 – 849	721 – 849	721 – 849
	F3→F2	333 – 791	333 – 791	319 – 738	319 – 738
	F3→F2 when hunting is prevented	283 – 691	233 – 691	269 – 638	219 – 638
	F2 (lockup) →F2	445 – 477	445 – 477	430	430

★ The transmission output shaft speed of 1 rpm corresponds to 0.0145 km/h.
★ The shifting down point of F4→F2 and F3→F2 will be 69 rpm, when the accelerator is idle.

4. Transmission protection function

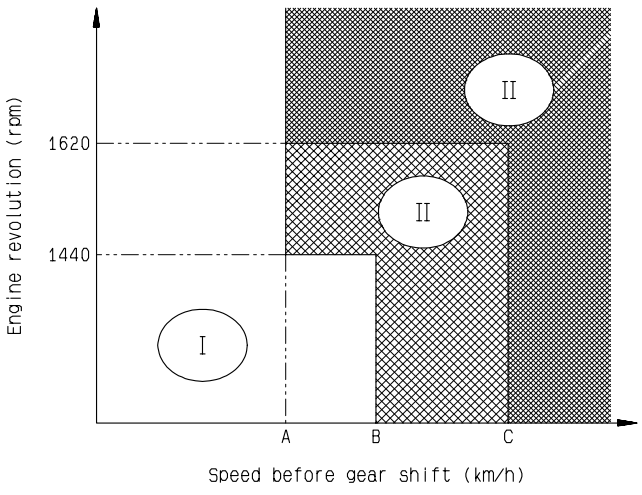
1) Protection function when changing FR
In order to protect the transmission, the controller limits changing F-R operation with the directional lever during high-speed travel.

1] All range of auto modes (speed position switch at a position other than 1st gear speed) and manual mode (2nd, 3rd, and 4th)

In auto-shift mode
Range I: F-R is changed and transmission is set in 2nd gear speed. (Ordinary range)
Range II: F-R is changed, transmission is set in 2nd gear speed, and the alarm is turned ON.
Range III: F-R is changed, and the alarm is turned ON. The gear speed of transmission gear-shift depends on the travel speed.
Then, transmission is shifted down to 2nd gear speed with reduction of the travel speed.

In manual-shift mode
Range I: Only F-R is changed. (Ordinary range)
Range II: F-R is changed, and the alarm is turned ON.
Range III: F-R is changed, and the alarm is turned ON. The gear speed of transmission gear-shift depends on the travel speed.
Then, transmission is shifted down to the speed position with reduction of the travel speed.

★ Two seconds immediately after the F-R changing operation, shifting up/down and kick-down switch operation will not be accepted, and if shifting up/down operation is performed with the lever operation, gear shift will be performed in two seconds.
In auto-shift, shifting up will not be performed until 2nd gear speed is obtained by speed reduction.



	Transmission output shaft speed before gear shift (rpm)		
	A	B	C
	928	963	1,100
Remarks (Travel speed conversion)	13 km/h	14 km/h	16 km/h

2) Engine overrun prevention function

1] Shift-down prohibit function (Engine overrun prevention function 1)

- In order to protect the engine and pump, the controller performs shift-down protection, in which operations are not accepted while shifting down, and the alarm is turned ON while it is operating.
- The operation conditions of the shift-down protection is shown below, and the alarm goes ON until the gear shift position of the shift lever and the actual output gear shift match. Therefore, even when the travel speed does not decrease, performing the shift-up operation will stop the alarm.

	Protect P condition (A or (B and C))			Condition for resetting protect (D and (E or F))		
Target gear speed to shift down	Condition A	Condition B	Condition C	Condition D	Condition E	Condition F
	Transmission output shaft speed	Transmission output shaft speed	Engine output speed	Transmission output shaft speed	Transmission output shaft speed	Engine output speed
To 3rd gear speed	Min. 1,721 rpm	Min. 1,721 rpm	—	Below 1,549 rpm	Below 1,549 rpm	—
To 2nd gear speed	Min. 1,102 rpm	Min. 895 rpm	Min. 1,620 rpm	Below 964 rpm	Below 861 rpm	Below 1,440 rpm
To 1st gear speed	Min. 895 rpm	Min. 895 rpm	—	Below 861 rpm	Below 861 rpm	—

- The shift-down protection is valid also in kickdown operation in auto-shift. If the machine is traveling in travel speed above the protect condition when kickdown operation is performed, the kickdown operation is not accepted, and the alarm goes ON for three seconds.

2] Lockup reset function (Engine overrun prevention function 2)

- When the transmission output shaft speed becomes equivalent to the engine speed of 2,525 rpm or above, the lockup is released automatically for preventing engine over run, and the alarm goes off. For five seconds after it is released temporarily, the lockup stays OFF, but if after five seconds pass and the transmission output shaft speed becomes equivalent to the engine speed of below 2,375 rpm, lockup will be on again.

Lockup OFF travel speed by function of engine overrun prevention (reference)

Actual gear speed	Lockup operation OFF value (equivalent to engine speed of 2,525 rpm)	
	WA600-6	
	Output shaft speed (rpm)	Reference travel speed (km/h)
F2	1,094	15.9
F3	1,949	28.3
F4	3,439	50.0
R2	1,200	17.4
R3	2,137	31.1
R4	3,770	54.8

3] Forced shift-up function (Engine overrun prevention function 3)

- When traveling in T/C, if the engine speed becomes 2,525 rpm or more, transmission is shifted up and the alarm goes ON. After shifting up, it will not be shifted down for three seconds.
- After three seconds pass, when the engine speed becomes below 2,375 rpm, the alarm stops and the shift control becomes the ordinary control.
- When traveling in 4th gear speed, shift-up is not performed, and only the alarm goes ON.

4] Overrun pre-alarm function

- When the engine speed becomes 2,425 rpm or more, the function to warn operation of overrun prevention action warning operates.
- The alarm is released when the engine speed becomes below 2,325 rpm.

5] Neutralizer function

- When the parking brake switch is ON (while the parking brake switch is operating), transmission output is maintained in neutral regardless of the state of the gearshift lever, for parking brake dragging prevention function.
- Therefore, while the key is on, transmission is always in neutral regardless of the state of the lever.

5. Engine control

1) Engine torque curve switching function
   - The transmission controller selects engine power mode from signal input of engine power mode changing switch, and while it sends torque curve information used in the engine controller, it also sends engine power mode information of power/economy to the monitor panel.

2) Maximum travel speed limit
   - For lower fuel consumption in load and carry, the maximum travel speed is limited by setting the maximum travel speed (select from three levels), and setting the upper limit to throttle value in F4 lockup state.

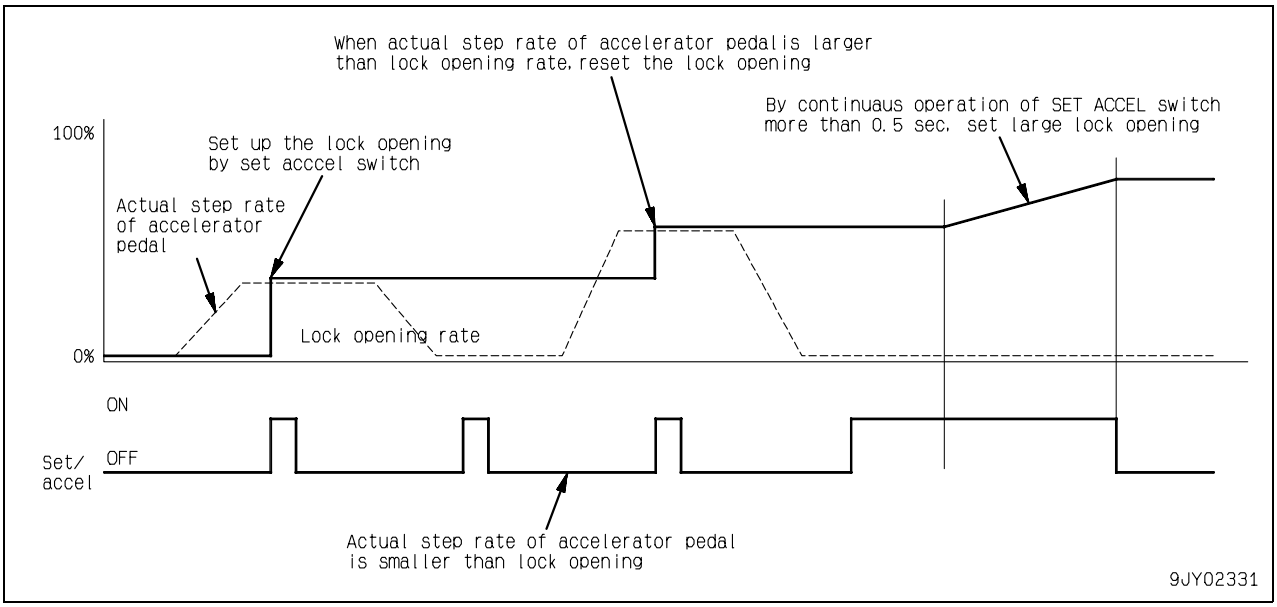
Setting information	Throttle value upper limit
(1) (Default)	90%
(2)	100%
(3)	80%

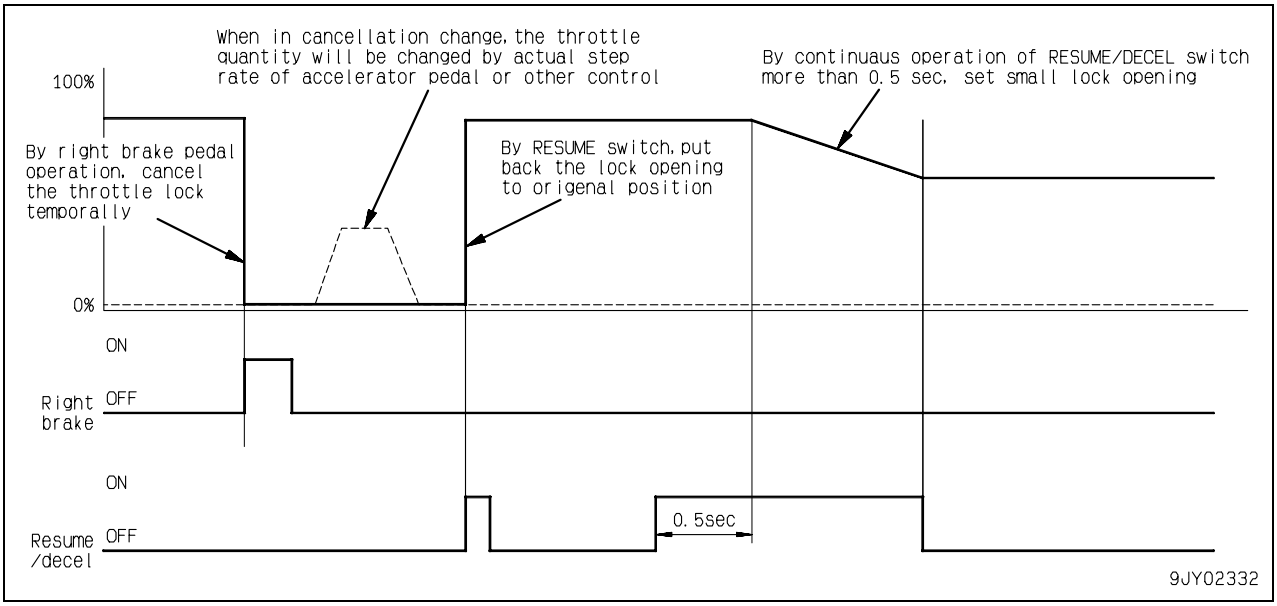
3) RPM set
   - For improving the working efficiency, the engine speed is maintained at an arbitrary speed.
   - The engine speed is set with pressing the accelerator pedal, and RMP set idle up/down switch.
   - When the right brake is pressed, RPM set is temporarily released.
   - For lower fuel consumption, in a setting with auto deceleration function, if the transmission neutral continues for four seconds or the work equipment neutral state lasts for four seconds or longer, if the RPM set SET/ACCEL SW and RPM set RESUME/DECEL SW are not operated, and if the travel speed is 5 km/h or less, the RPM set function is temporarily released, and transmission follows the signal of the accelerator pedal.
   - In the state where the RPM set is temporarily released, if the transmission is set to a position other than neutral, or the work equipment is in a state other than N, the throttle control state will be resumed automatically.

<table>
<tr><th>Component list</th><th>RPM set function switch</th><th>RPM set SET/ ACCEL switch</th><th>RPM set RESUME/ DECEL switch</th><th>Right brake pedal operation switch</th><th>RPM set indicator lamp</th></tr>
<tr><td>Switch composition</td><td>Alternate 3-position switch</td><td colspan="2">Momentary seesaw switch</td><td>Momentary proximity switch</td><td>In-switch LED</td></tr>
<tr><td>Switch theory</td><td>ON(24V)
OFF(OPEN)</td><td colspan="2">ON(GND)
OFF(OPEN)</td><td>Brake operated (GND)
Brake not operated (OPEN)</td><td>Performed through electrical circuit</td></tr>
<tr><td rowspan="2">Function</td><td rowspan="2">When this switch is pressed upward, “RPM set auto deceleration function is disabled.”
When this switch is pressed downward, “RPM set auto deceleration function is enabled.”

When this switch is pressed in the middle, the RPM set function is OFF.</td><td>Function to set throttle stroke
Save the throttle stroke when it is ON (lock accelerator opening ratio)
Controls with input signal edge</td><td>Resume function
While the RPM set function is released with the right brake pedal operation (release), press this switch and the RPM set function is resumed.
Controls with input signal edge</td><td rowspan="2">When the right brake pedal is pressed, the RPM set function is temporarily released.</td><td rowspan="2">Lights up when the RPM set function switch is ON</td></tr>
<tr><td>Acceleration function
When the switch is pressed and held for 0.5 seconds, the throttle stroke set value rises in accordance with the time the switch is pressed.</td><td>Deceleration function
When the switch is pressed and held for 0.5 seconds, the throttle stroke set value lowers in accordance with the time the switch is pressed.</td></tr>
</table>

- For description of the RPM set function, a sample time chart is shown below.





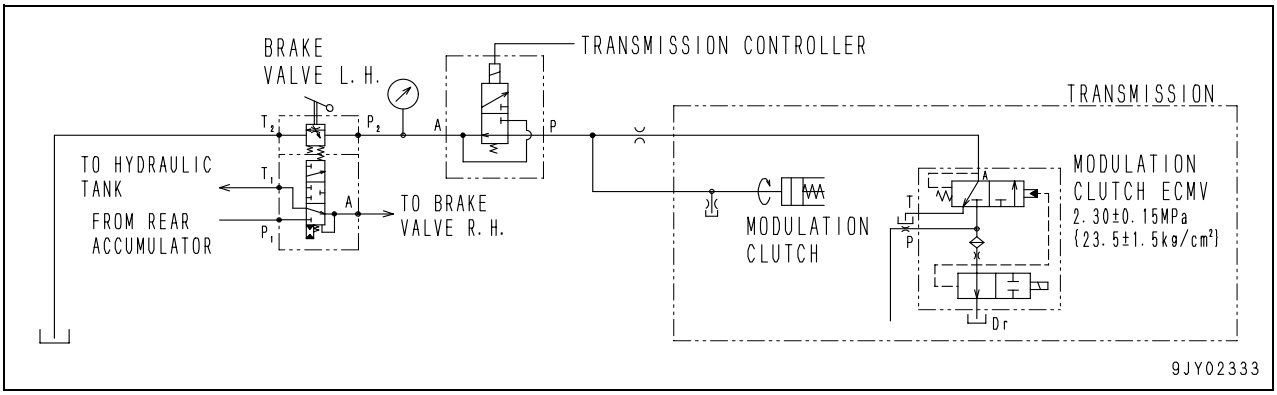
- RPM set ON-OFF switch
  Used to turn the RPM set system ON and OFF.
- RPM set idle-up/down selector switch
  Used to keep the engine speed at any level.

6. Modulation clutch

1) Modulation clutch control

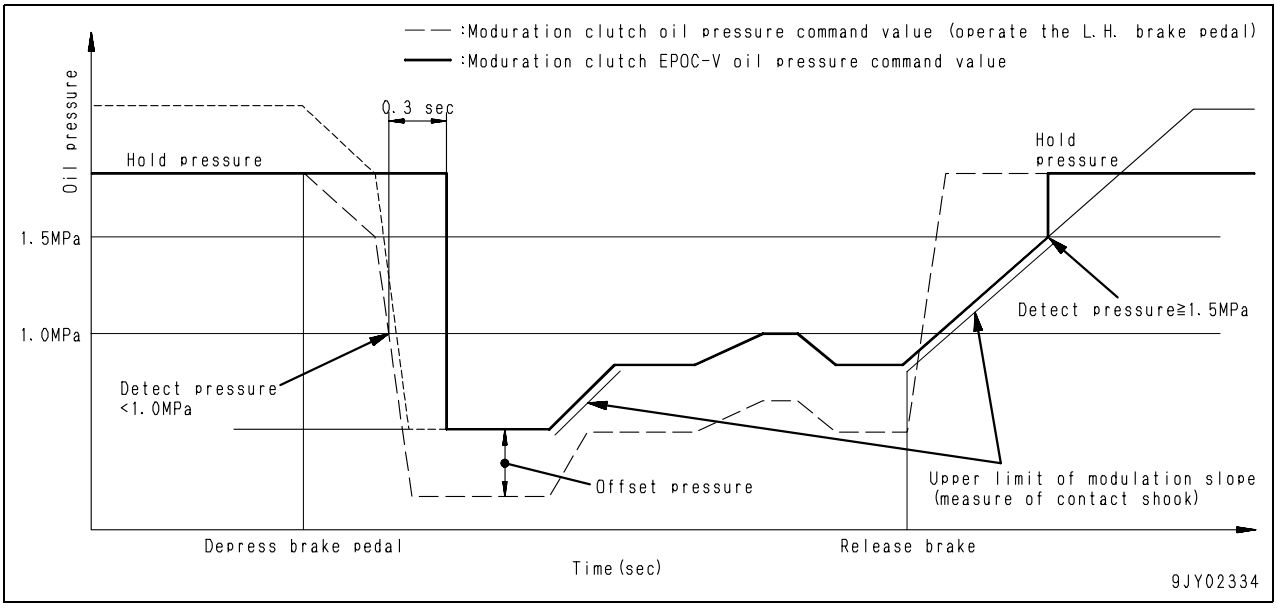
- The modulation clutch is a function in which drive force from the engine to the tires is continuously limited in accordance with the brake pedal when the left brake pedal is pressed.

1] Modulation clutch system hydraulic circuit diagram



2] Resume control in releasing left brake pedal

- The transmission controller controls so that sudden change of drive force will not occur in engagement.



3] Modulation clutch invalid control in traveling
- When the left brake is used while traveling, since the engagement of the modulation clutch is released and the effect of engine brake is not obtained, the following control is added so that the effect of engine brake is obtained in operation of the left brake.

- Modulation clutch invalid control condition
  Torque converter lockup = ON
  Or
  Throttle opening ratio is 30% or less in gear speed of F2, F3, F4, R2, R3, and R4

- Modulation clutch invalid control finish condition
  Torque converter lockup = OFF
  And
  Throttle opening ratio is 30% or more, or in gear speed of F1, R1, and N

Gear Speed	Throttle opening ratio	Torque converter lockup	Modulation clutch invalid control state
—	—	ON	Start invalid control
F2	Max. 30%	—	
F3			
F4			
R2			
R3			
R4			
—	Min. 30%	OFF	End invalid control
F1	—		
R1			
N			

4] Brake load reduction control
- When the machine is decelerated from high speed travel with the accelerator pedal and brake pedal pressed (in dump approach operation etc.), the brake load is reduced by lowering the modulation clutch oil pressure and reducing the transmissibility of the modulation clutch.
- Condition for starting brake load reduction control
  The throttle opening ratio is 70% or above and the output shaft speed is 1,032 rpm (Reference travel speed: 15 km/h) or above and the brake signal is turned ON.
- Condition for stopping brake load reduction control
  The throttle opening ratio is 50% or below or the output shaft speed is below 688 rpm (Reference travel speed: 10 km/h) or the brake signal is turned OFF.

Throttle opening ratio	Output shaft speed	Brake signal	Brake load reduction control	Torque converter lockup	Modulation clutch oil pressure command value
70% or above	1,032 rpm or above	ON	Started	ON → OFF OFF → OFF	Normal control command value → 0.2 MPa
50% or below	Below 688 rpm	OFF	Stopped	OFF → Normal control	0.2 MPa → Normal control command value

5] Modulation clutch control when transmission gear is shifted
- Transmissibility of the modulation clutch is controlled at the times of starting and changing directions for improved gear shifting and reducing clutch heat load.

6] Modulation clutch control at the time of starting the engine
- For reduced load of the travel system and improved engine start, the modulation clutch is completely disengaged when the engine is started.
- When the engine speed is 500 rpm or higher, it will be connected directly with the modulation clutch for performing ordinary control.

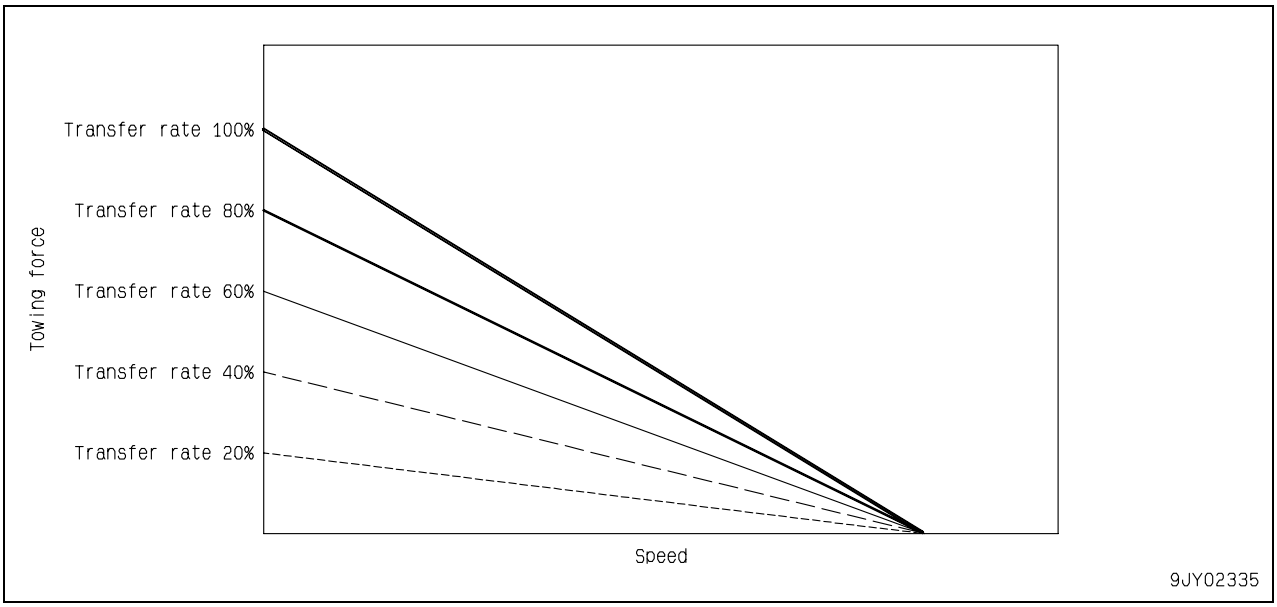
7] Setting modulation clutch drive force

- The slippage ratio of the modulation clutch in F1 can be adjusted with a dial.

Settable range (slippage ratio)
80% – 0%

Input:	Dial input voltage	V	4.00	3.63	3.25	2.88	2.50	2.13	1.75	1.38	1.00
	Dial set recognition	%	20	30	40	50	60	70	80	90	100
	Target transmissibility	%	20	30	40	50	60	70	80	90	100
Output:	Target modulation clutch oil pressure	MPa	0.3	0.35	0.45	0.5	0.6	0.8	1	1.5	2.5
	Current value	mA	212	222	240	248	264	302	333	408	552

- Image of speed, traction power, and transmissibility



8] Modulation clutch emergency operation switch

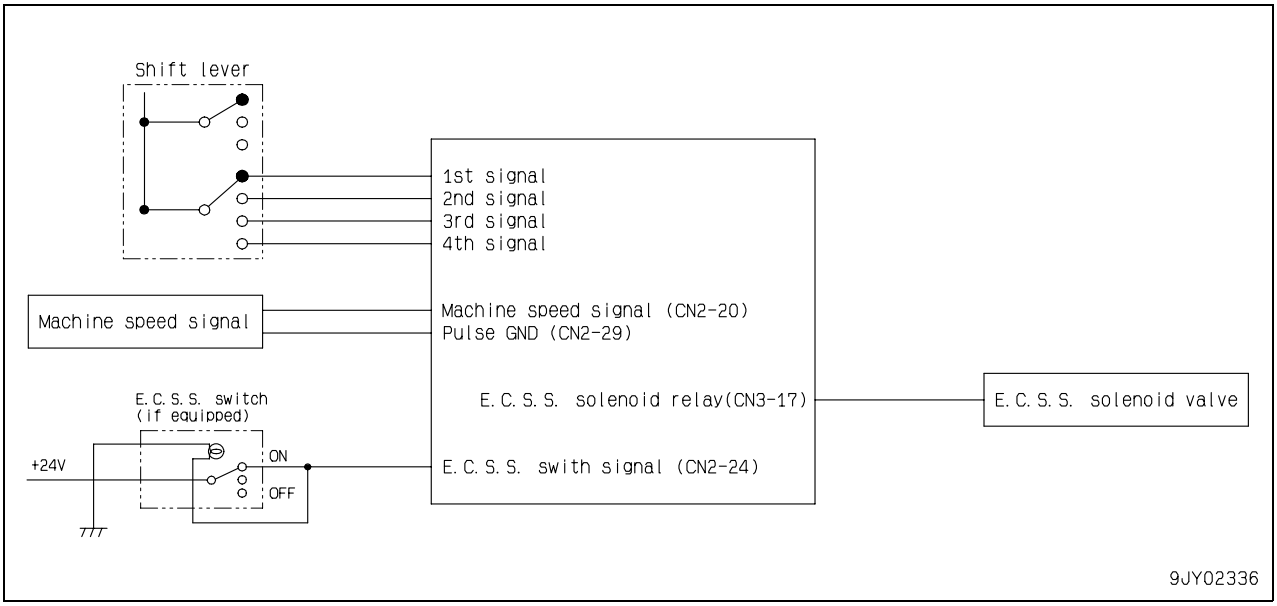
- Since the modulation clutch is engaged with command, and disengaged without command, when the transmission controller fails and cannot issue commands, the vehicle cannot be moved.
- In order to address such trouble, a circuit to directly connect the modulation clutch with modulation clutch emergency operation switch is equipped.
  When the solenoid valve fails, the plate for emergency escape of ECMV is used to address the problem.

7. ECSS

1) ECSS function
- It is a system in which the controller automatically turns on and off the accumulator charged with high-pressure gas according to the travel condition, and the lift arm operation condition, improving operator comfort and working efficiency by preventing spillage of material by absorbing the vertical movement of the work equipment, when the vehicle travels at high speed.

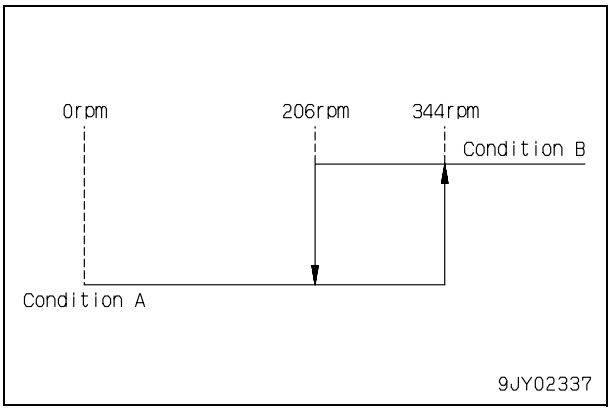
ECSS system of WA600-6

1] ECSS system circuit



2] Operation of ECSS
- The operating condition of ECSS is as follows.
  Since the ECSS is optional equipment, control will not be performed unless the option of ECSS is enabled in the optional setting of the machine monitor. For the setting procedure of options, refer to “Testing and adjusting: Special functions of machine monitor (EMMS), Select optional equipment.”

ECSS switch	Gear Speed	Output shaft speed	ECSS output
OFF	All	0 to MAX	OFF
ON	1st	0 to MAX	OFF
	2nd to 4th	Condition A	OFF
		Condition B	ON



- The transmission output shaft speed of 206 rpm corresponds to approximately 3 km/h.
- The transmission output shaft speed of 344 rpm corresponds to approximately 5 km/h.

3] Operation of solenoid in ECSS ON/OFF
- Modulation control is performed for the ECSS solenoid with EPC output in switching ON/OFF, reducing the lowering of the lift arm and occurrence of switching shocks.
- The constant current when the ECSS solenoid is ON is 800 mA.

8. Economy lamp

1) Control of economy lamp
- The transmission controller lights up the economy lamp indicator of the machine monitor when operating in low fuel consumption, in order to prompt low fuel consumption operation to the operator.

1] Lighting condition of economy lamp
- When the engine power mode is the economy mode, and the accelerator pedal opening ratio is 80% or less, the economy lamp is lighted.

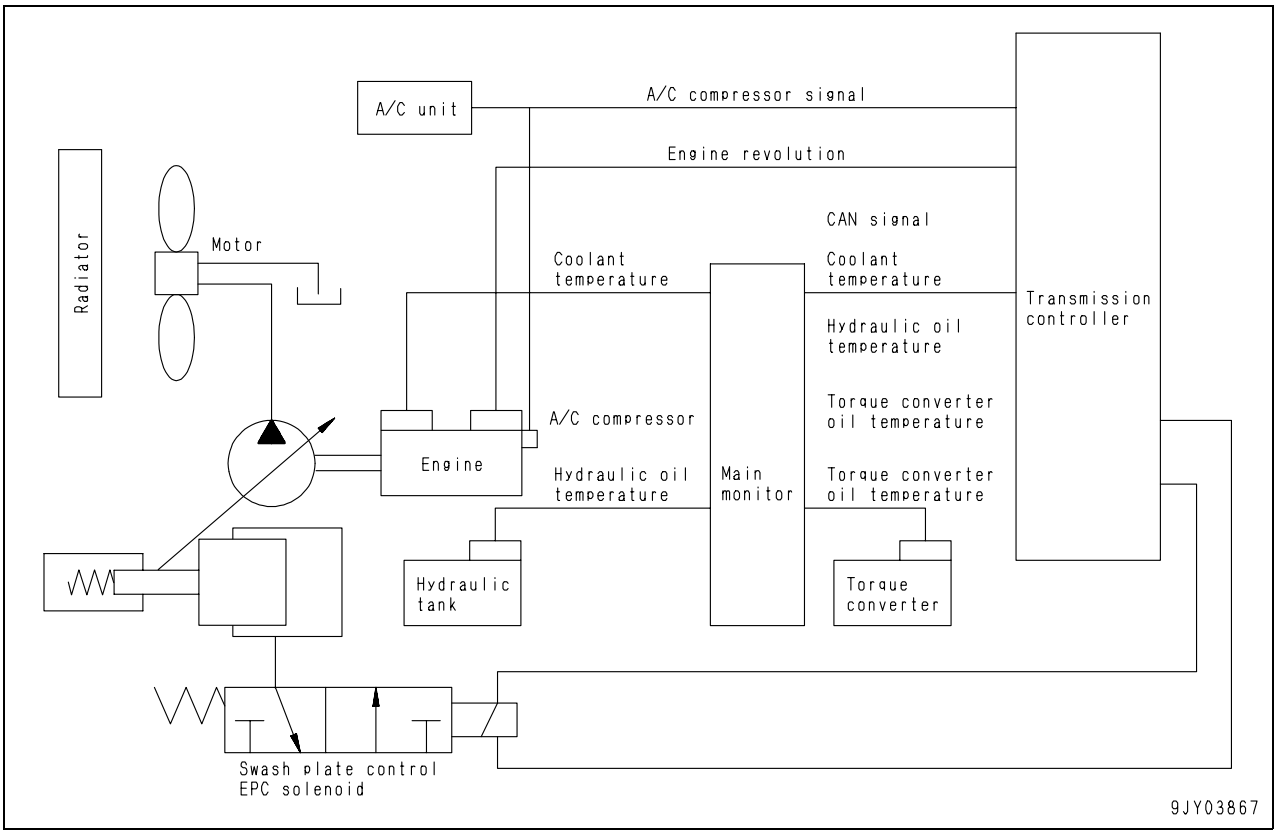
Accelerator opening ratio	Power mode	Economy mode
Min. 80%	OFF	OFF
Max. 80%	OFF	Lighting

2] Turning off economy lamp
- The economy lamp can be constantly kept off with the optional setting of the monitor.
- ★ For the setting procedure, refer to “Testing and adjusting: Special functions of machine monitor (EMMS), Select optional equipment.”

9. Cooling fan control

1) Control of fan

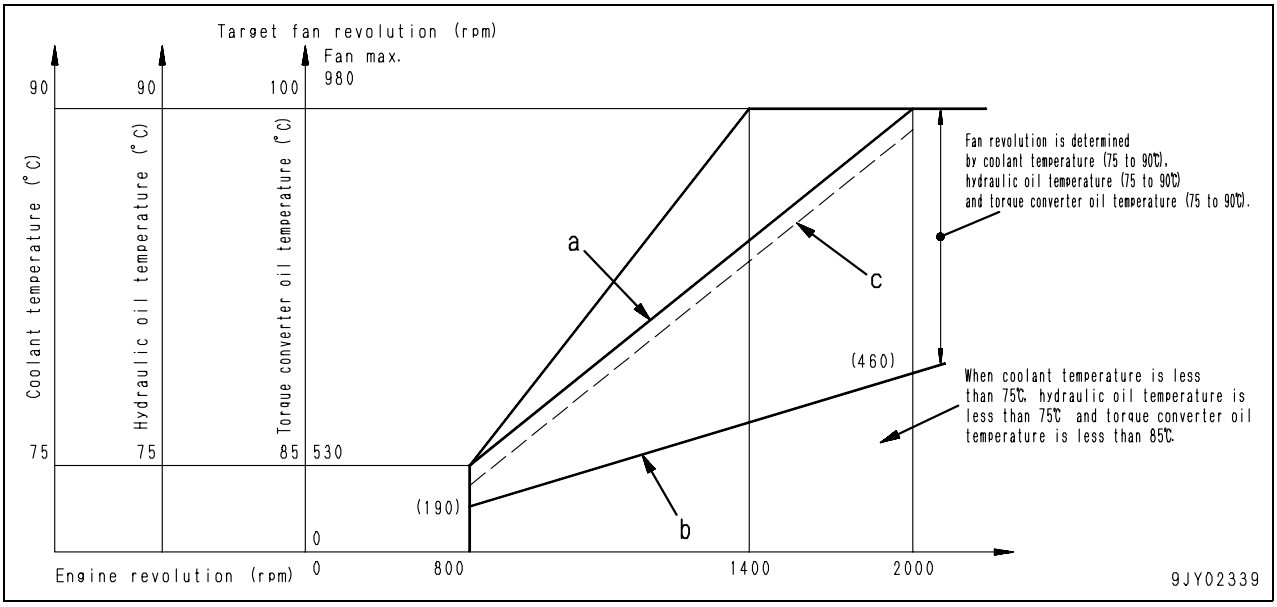
- The cooling fan is driven hydraulically and by controlling the swash plate of the main pressure pump, the horsepower loss and noise are reduced while the temperature is low.



- The information of the engine speed and engine coolant temperature sensed by the engine controller, and hydraulic oil temperature, and torque converter oil temperature sensed by the machine monitor is sent through the network to the transmission controller, and then current control is performed for the swash plate angle of the fan pump so that the fan speed will be matched to the temperature and engine speed.

2) Fan speed in accordance with temperature
   - As for the fan speed, the target fan speed is determined based on the data with highest temperature among coolant temperature, hydraulic oil temperature, and torque converter oil temperature.

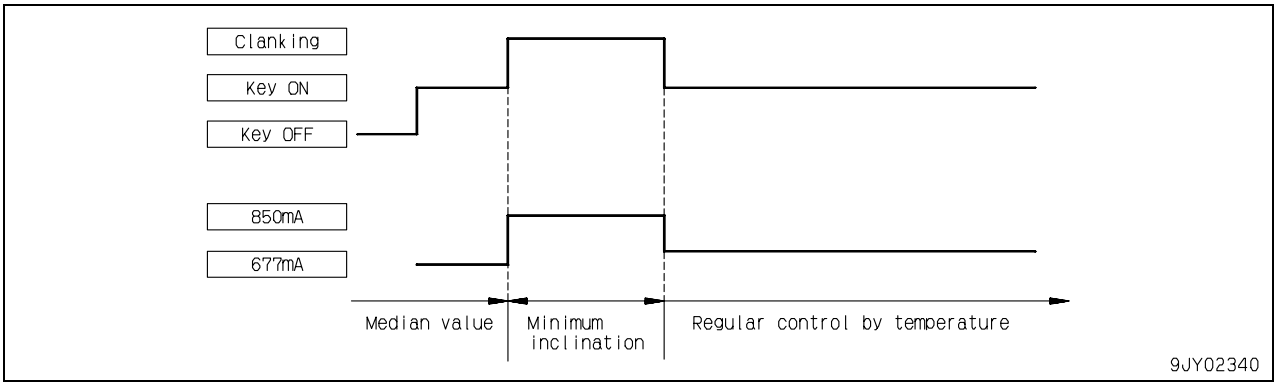
   - Basic control of fan speed



a. Target speed when air conditioner operates b. Minimum inclination: 850 mA c. Median value: 677 mA

3) Protection function
   - For preventing overrun of the motor of the fan pump, the minimum swash plate is used for the fan pump when the engine speed is 2,650 rpm or higher.
   - When the engine speed or respective temperature data cannot be recognized by the transmission controller due to such cause as failure of network communication, the fan pump EPC current is set to 677 mA, which is equivalent to that of the fixed pump.

4) Control for starting engine
   In fan control, a different control from the ordinary control with temperature when starting the engine.
   - When stopping the engine (key switch 1-stage on)
     When the engine is stopped, the fan pump EPC current of 677 mA is output, for it is the same as a state where the engine speed cannot be recognized.
   - While cranking
     While cranking to start the engine, in order to improve engine start, the minimum swash plate is used for the fan pump by setting the fan EPC current to 850 mA, reducing the torque necessary for starting the engine.



5) Fan reverse rotation function
- In the hydraulic fan, for cleaning the radiator core, when the fan reverse rotation switch is operated, the hydraulic fan motor reverse solenoid operates to reverse the fan.

1] Standard specification fan manual reverse rotation function
- It is a function to reverse the fan rotation arbitrarily by the operator. By pressing the fan manual reverse switch, the turning direction of the fan is changed.

- Changing from forward to reverse, and reverse to forward is performed when the following conditions are satisfied.
  - The fan manual reverse switch is pressed
  - The engine speed is 500 rpm or lower.

- The fan reverse indicator flashes when the state of the fan manual reverse switch and the rotation direction of the fan do not match. While the fan is rotating in reverse direction, the fan reverse indicator lights up.

Reverse SOL output before switch operation	Forward/reverse selector switch operation	Engine speed	Reverse SOL output	Fan pump EPC output	Monitor indicator lighting logic
OFF	From OFF to ON	Below 500 rpm	ON	MIN speed	From OFF to lighting
OFF	From ON to OFF		OFF	Ordinary	From flashing to OFF
ON	From OFF to ON		ON	MIN speed	From flashing to ON
ON	From ON to OFF		OFF	Ordinary	From flashing to OFF
OFF	From OFF to ON	Min. 500 rpm	OFF	Ordinary	From OFF to flashing
OFF	From ON to OFF		OFF	Ordinary	From flashing to OFF
ON	From OFF to ON		ON	As per 3]	From flashing to ON
ON	From ON to OFF		ON	As per 3]	From lighting to flashing

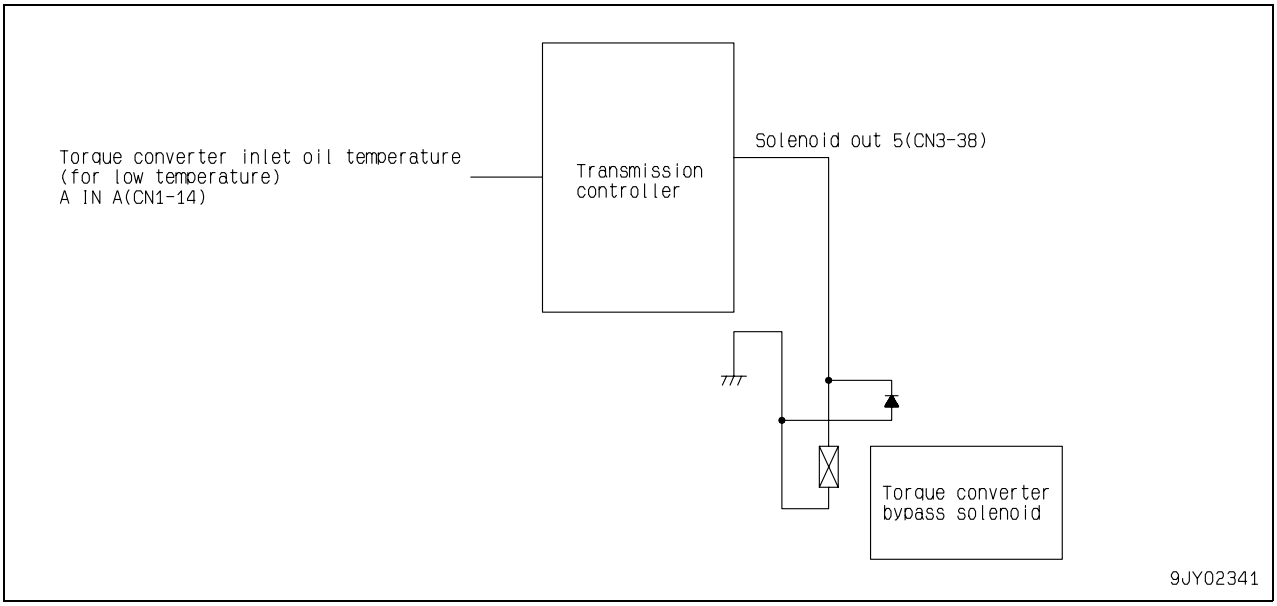
2] Optional specification of fan automatic reverse function
- Not used.

3] Fan speed in reverse
- While it is operating in reverse, cleaning of the radiator core is facilitated by increasing air flow by turning the fan at the maximum speed without outputting fan pump EPC current (output 0 mA).
- When the hydraulic oil temperature is below 30°C, however, the fan EPC current is set to 850 mA and the fan speed is minimized to protect the hydraulic circuit.

10. Low temperature bypass control (if equipped)

Low temperature bypass control

- In order to prevent transmission filter peak pressure in extremely low temperature, travel can optionally prohibited for 30 seconds by bypassing the torque converter charger pump circuit immediately after the engine is started.



1) Operation of low temperature bypass solenoid

Conditions	The bypass solenoid operates when all the following conditions are satisfied.
	(1) Torque converter inlet oil temperature < –20°C
	(2) Cold district option is enabled
	(3) When starting the engine (with C terminal signal and engine speed of 500 rpm or lower)

2) Finishing operation of low temperature bypass solenoid

- Elapsing time after the start of operation is 30 seconds or longer, or cold district option is disabled.

11. AJSS

1) AJSS control
   - Equipment allowing turning of the vehicle (steering operation), forward and reverse movement and shifting up/shifting down, with the AJSS lever located on the left console.
   - Since turning of the vehicle is performed by the work equipment controller, refer to the section of work equipment controller, for turning operation of AJSS.

2) AJSS shifting up/shifting down switch
   - The AJSS shifting up/shifting down switch performs shifting up/shifting down in accordance with the buttons in the manual shift mode.
   - ★ However, when shifting down during high-speed travel, the shift-down protection function operates and shifting down will be performed after the travel speed has decreased.
   - When the shift mode is the auto shift mode (both H and L), the maximum gear speed (gear shifting range) used in the automatic gear shifting operation is limited.
   - In the automatic gear shifting operation, the vehicle usually starts in the 2nd gear speed. Accordingly, if the shift range is 4, the gear is shifted up and down between the 2nd gear speed and 4th gear speed, and the vehicle starts in the 1st gear speed only when the kick-down function is used.

   1] Function of shifting up/shifting down switch
      - When the shifting up/shifting down switches are operated at the same time, shift down is effective.
      - After pressing a switch once, the next shifting up/shifting down switch operation is not accepted for 0.2 seconds.

3) Neutralizer function
   - While the parking brake is operating, or the steering lever is locked, neutral is maintained regardless of the shift lever position.
   - Also, while the parking brake is operating, the AJSS indicator and buzzer operate as shown below.

Steering lock	Shift switch position	Indicator	Buzzer
ON	Arbitrary	Lighting	None
OFF	F or R	Flashing	Sounding (pip, pip)
OFF	N	OFF	None

12. Real-time monitor

1) List of display contents of the real-time monitor

In WA600-6, the state of the controller input and output signals can be checked using the real-time monitor function of the monitor.

The following table shows the display items and display contents in normal operation of the real-time monitor in relation to the transmission controller:

No.	Item	ID No.	Display of item name	Contents of display data	Data unit (and range)	Remarks
1	Software part number	20201	VERSION	Output mass production software part number	Depends on the software part number	
2	Software application version	20223	VERSION (APP)	Output software version (software logic part version)	Depends on the software version	
3	Software application data version	20224	VERSION (DATA)	Output software version (software data part version)	Depends on the software version	
4	Engine mode	41600	ENGINE MODE	Output engine mode for controlling engine output	0: power mode 2: economy mode	
5	ECMV output command value (FAN pump)	41400	FAN EPC DIR	Output to FAN EPC output command current value	X1 [mA] (0 – 1000[mA]) When engine speed is below 500 rpm = 677 mA While cranking (C terminal operation) = 850 mA Switching fan reverse = 850 mA Fan operating in reverse = 0 mA	
6	Fan reverse switch input	93400	FAN REVERSE SW	Output fan reverse SW input state	1:ON(CLOSE) 0:OFF	
7	Torque converter inlet oil temperature	41501	T/C IN OIL TEMP	Output T/C inlet oil temperature	*1 [°C] (–30 – 100 [°C])	Option for low temperature detection
8	Torque converter inlet oil temperature	41502	T/C IN OIL TEMP	Output T/C inlet oil temperature	*0.01 [V] (0.00 – 5.00 [°C]) 4.72V = 0°C 4.33V = 30°C 3.55V = 60°C 2.20V = 100°C 1.61V = 120°C	
9	Torque converter input shaft speed	93500	T/C SPEED:IN	Output T/C input shaft speed	x 1 [min-1] (0 – 32,767 [min-1])	
10	Torque converter output shaft torque	93501	T/C TORQUE:OUT	Output T/C output shaft torque calculated value (T2)	x 1 [Nm] (0 – 400,000)	
11	Transmission input shaft speed	31200	T/M SPEED IN	—	0	Not used by this machine
12	Transmission output shaft speed	31400	T/M SPEED:OUT	Output output shaft speed [PLS_AC_IN_2]	x 1 [min-1] (0 – 32,767 [min-1]) 0 km/h = 0 rpm 10 km/h = 788 rpm 20 km/h = 1,376 rpm 30 km/h = 2,063 rpm 40 km/h = 2,751 rpm	
13	Transmission output shaft speed	31404	T/M SPEED:OUT2	Output output shaft speed [PLS_AC_IN_0]	x 1 [min-1] (0 – 32,767 [min-1]) 0 km/h = 0 rpm 10 km/h = 788 rpm 20 km/h = 1,376 rpm 30 km/h = 2,063 rpm 40 km/h = 2,751 rpm	

No.	Item	ID No.	Display of item name	Contents of display data	Data unit (and range)	Remarks
14	Transmission cut-off operation setting	41203	T/M CUT SET	—	0	Not used by this machine
15	Transmission cut-off (left brake) pressure	41201	T/M CUT OFF P	—	0	Not used by this machine
16	Transmission cut-off (left brake) pressure	41202	T/M CUT OFF P	—	0	Not used by this machine
17	Torque converter speed ratio	93700	TC SPEED RATIO	Output torque converter speed ratio	x 1 [%] (0 – 100 [%])	
18	Transmission oil temperature input	93600	T/M OIL TEMP	Output oil temperature value of transmission oil temperature (A_IN_1)	x 1 [°C] (0 – 150 [°C])	
19	Input voltage of transmission oil temperature	93601	T/M OIL TEMP	Output input voltage value of transmission oil temperature (A_IN_1)	x 1 [mV] (0.00 – 5.00 [V]) 4.72 V = 0°C 4.33 V = 30°C 3.55 V = 60°C 2.20 V = 100°C 1.61 V = 120°C	
20	MOD/C oil pressure input	92400	MOD/C PRESS	Output oil pressure conversion value of MOD/C oil pressure input (A_IN7)	x 1 [MPa] (0.00 – 5.00 [MPa])	
21	MOD/C oil pressure input voltage	92401	MOD/C PRESS	Output voltage value of MOD/C oil pressure input (A_IN7)	x 1 [mV] (0.00 – 5.00 [V])	
22	MOD/C heat release value	92500	MOD/C Q	Output the value of calculated heat release value (Q) of MOD/C	x 1 [100J/cm^2] (0.0 – 25.5 [100J/cm^2])	Overheat notice ON when the value is 2.2 or more (lamp on) Overheat warning operates and records when it is 2.9 or more (lamp on, buzzer operates, action code displays, and error is recorded) Overheat warning/ notice OFF when it is 1.8 or less (lamp off), resumed from error
23	MOD/C heat ratio	92501	MOD/C q	Output the value of calculated heat ratio value (q) of MOD/C	x 1 [0.1kW/cm^2] (0.00 – 2.55[0.1kW/cm^2])	
24	RPM set switch (pressed upward)	95500	THROT LOCK A	Output the state of input signal	0: RPM set switch OFF 1: RPM set switch ON	
25	RPM set switch (pressed downward) (RPM set auto deceleration switch)	95501	THROT LOCK B	Output the state of input signal	0: RPM set auto deceleration switch OFF 1: RPM set auto deceleration switch ON	
26	Output throttle correction command	95400	THROTTLE MOD	Output throttle correction command output amount	x 1 [%] (–100 – 100 [%])	
27	Output throttle stroke upper limit value	44200	THROT LIMIT UP	Output throttle upper limit command output amount	x 0.1 [%] (0.0 – 100.0 [%])	
28	Output throttle stroke lower limit value	44201	THROT LIMIT LO	Output throttle lower limit command output amount	x 0.1 [%] (0.0 – 100.0 [%])	

No.	Item	ID No.	Display of item name	Contents of display data	Data unit (and range)	Remarks
29	Acceleration mode	93801	THROTTLE MODE	Depends on accelerator opening ratio; output acceleration mode on control	Depends on accelerator pedal operation Accelerator pedal = 0 Accelerator pedal partial pressing (opened side) = 1 Accelerator pedal partial pressing (pressed side) = 2 Accelerator pedal pressing = 3	
30	Traction setting input value	94000	TRACTION DIAL	Output set value of traction dial	x 1 [%] (0 – 100 [%])	
31	Traction setting input voltage	94001	TRACTION DIAL	Output voltage value of traction dial setting input	Output voltage value of traction dial setting input	
32	Lockup changing switch input signal	95000	LOCK UP SW	Output the state of input signal	0: Lockup changing switch OFF 1: Lockup changing switch ON	
33	ECMV output command value (1st)	31602	ECMV 1 DIR	ECMV output to 1st clutch Output command current value	x 1 [mA] (0 – 1000 [mA])	
34	ECMV output command value (2nd)	31603	ECMV 2 DIR	ECMV output to 2nd clutch Output command current value	x 1 [mA] (0 – 1000 [mA])	
35	ECMV output command value (3rd)	31604	ECMV 3 DIR	ECMV output to 3rd clutch Output command current value	x 1 [mA] (0 – 1000 [mA])	
36	ECMV output command value (4th)	31605	ECMV 4 DIR	ECMV output to 4th clutch Output command current value	x 1 [mA] (0 – 1000 [mA])	
37	ECMV output command value (FWD)	31608	ECMV F DIR	ECMV output to FWD clutch Output command current value	x 1 [mA] (0 – 1000 [mA])	
38	ECMV output command value (L/U)	31609	ECMV LU DIR	ECMV output to L/U clutch Output command current value	x 1 [mA] (0 – 1000 [mA])	
39	ECMV output command value (MOD/C)	31640	ECMV MOD/C DIR	ECMV output to MOD/C clutch Output command current value	x 1 [mA] (0 – 1000 [mA])	
40	ECMV output command value (REV)	31606	ECMV R DIR	ECMV output to REV clutch Output command current value	x 1 [mA] (0 – 1000 [mA])	
41	ECMV output command value (ECSS)	93300	ECSS V DIR	Output to ECSS valve Output command current value	x 1 [mA] (0 – 1000 [mA])	
42	Fill time value (1st)	41802	FILL TIME 1	Output fill time value of 1st clutch (state of last gear shift)	x 0.01 [sec] (0 – 2.55 [sec], without fill: 0)	
43	Fill time value (2nd)	41803	FILL TIME 2	Output fill time value of 2nd clutch (state of last gear shift)	x 0.01 [sec] (0 – 2.55 [sec], without fill: 0)	
44	Fill time value (3rd)	41804	FILL TIME 3	Output fill time value of 3rd clutch (state of last gear shift)	x 0.01 [sec] (0 – 2.55 [sec], without fill: 0)	
45	Fill time value (4th)	41805	FILL TIME 4	Output fill time value of 4th clutch (state of last gear shift)	x 0.01 [sec] (0 – 2.55 [sec], without fill: 0)	

No.	Item	ID No.	Display of item name	Contents of display data	Data unit (and range)	Remarks
46	Fill time value (FWD)	41808	FILL TIME F	Output fill time value of FWD clutch (state of last gear shift)	x 0.01 [sec] (0 – 2.55 [sec], without fill: 0)	
47	Fill time value (REV)	41806	FILL TIME R	Output fill time value of REV clutch (state of last gear shift)	x 0.01 [sec] (0 – 2.55 [sec], without fill: 0)	
48	Input signal D_IN_0 – 7	40905	D-IN--0------7	Output the state of input signal	000***** : Changing engine mode SW OFF 100***** : Changing engine mode SW ON *000**** : Stopping air compressor *001**** : Operating air compressor *00*00** : Manual shift mode *00*10** : Shift mode L *00*11** : Shift mode H *00***0* : MOD/C opened *00***1* : MOD/C directly connected *00****1 : Cranking	D-IN0 : Engine mode selection SW D-IN3 : Operating air compressor D-IN4 : Shift mode L D-IN5 : Shift mode H D-IN6 : MOD/C direct connection signal D-IN7 : C terminal signal
49	Input signal D_IN_8 – 15	40906	D-IN--8-----15	Output the state of input signal	000*0*** : Kickdown SW = OFF 001*0*** : Kickdown SW = ON 00*00*** : Shift hold SW = OFF 00*10*** : Shift hold SW = ON 00**00** : RPM set SW = OFF 00**01** : RPM set SW = ON 00**0*0* : RPM set resume SW = OFF 00**0*1* : RPM set resume SW = ON 00**0**0 : RPM set release right brake pedal SW = OFF 00**0**1 : RPM set release right brake pedal SW = ON	D-IN10 : Kickdown SW D-IN11 : Shift hold SW D-IN13 : RPM set SW D-IN14 : RPM set resume SW D-IN15 : RPM set release right brake pedal SW

No.	Item	ID No.	Display of item name	Contents of display data	Data unit (and range)	Remarks
50	Input signal D_IN_16 – 23	40907	D-IN-16-----23	Output the state of input signal	01****** : AJSS shift-up SW = OFF (AJSS specification) 10****** : AJSS shift-up SW = ON (AJSS specification) **01**** : AJSS shift-down SW = OFF (AJSS specification) **10**** : AJSS shift-down SW=ON (AJSS specification) 1000**** : shift lever 1st (steering specification) 0100**** : shift lever 2nd (steering specification) 0010**** : shift lever 3rd (steering specification) 0001**** : shift lever 4th (steering specification) ****100* : direction lever F ****010* : direction lever N ****001* : direction lever R *******0 : parking brake release *******1 : parking brake operation	D-IN16 : AJSS shift-up (normally open) (AJSS specification) shift range 1st (steering specification) D-IN17 : AJSS shift-up (normally closed) (AJSS specification) shift range 2nd (steering specification) D-IN18 : AJSS shift-down (normally open) (AJSS specification) shift range 3rd (steering specification) D-IN19 : AJSS shift-down (normally closed) (AJSS specification) shift range 4th (steering specification) D-IN20 : direction lever F D-IN21 : direction lever N D-IN22 : direction lever R D-IN23 : parking brake signal
51	Input signal D_IN_24 – 31	40908	D-IN-24-----31	Output the state of input signal	0101000* : F1 traveling 0010100* : R2 traveling 0000010* : 3rd neutral 0100001* : F4 traveling 0******0 : Steering lock lever pressure SW = OFF or steering specification 0******1 : Steering lock lever pressure SW = ON	D-IN25 : fill SW F D-IN26 : fill SW R D-IN27 : fill SW 1st D-IN28 : fill SW 2nd D-IN29 : fill SW 3rd D-IN30 : fill SW 4th D-IN31 : Steering lever lock pressure SW (constantly 0 in steering specification)
52	Input signal D_IN_32 – 39 (Transmission controller does not have 33 – 39)	40942	D-IN-32-----39	Output the state of input signal	00000000 : when foot brake is released 10000000 : when foot brake is pressed	D-IN32 : brake pressure SW

No.	Item	ID No.	Display of item name	Contents of display data	Data unit (and range)	Remarks
53	Output signal D_OUT_0 – 7	40949	D-OUT 0 – 7	ON/OFF output state of SOL_OUT0 to 7 '0' is displayed when setting current output	000***00 : modulation clutch invalid solenoid OFF 100***00 : modulation clutch invalid solenoid ON *000**00 : fan reverse solenoid OFF *001**00 : fan reverse solenoid ON *00*0*00 : fan neutral solenoid OFF *00*1*00 : fan neutral solenoid ON *00**000 : low temperature bypass solenoid OFF *00**100 : low temperature bypass solenoid ON	D-OUT0 : modulation clutch invalid solenoid D-OUT3 : fan reverse solenoid D-OUT4 : fan neutral solenoid (optional) D-OUT5 : low temperature bypass solenoid (if equipped)
54	Output signal D_OUT_8 – 15	40950	D-OUT 8 – 15	ON/OFF output state of SOL_OUT8 to 11B, SIG_OUT0 to 1 '0' is displayed when setting current output	00000000	Not used by this machine
55	Output signal D_OUT_16 – 23	40951	D-OUT 16 – 23	ON/OFF output state of SIG_OUT2 to 3, HSW_OUT0 to 1, BATT_RY_OUT '0' is displayed when setting current output	00000000	Not used by this machine
56	Initial learning flag	94100	TRIG FR1234	Output initial learning flag state of trigger time of each clutch [F,R,1,2,3,4]	111111 (all clutches learned) 000000 (all clutches to be learned)	16-bit data is displayed in the order of F, R, 1, 2, 3, and 4 on the monitor

13. Diagnosis

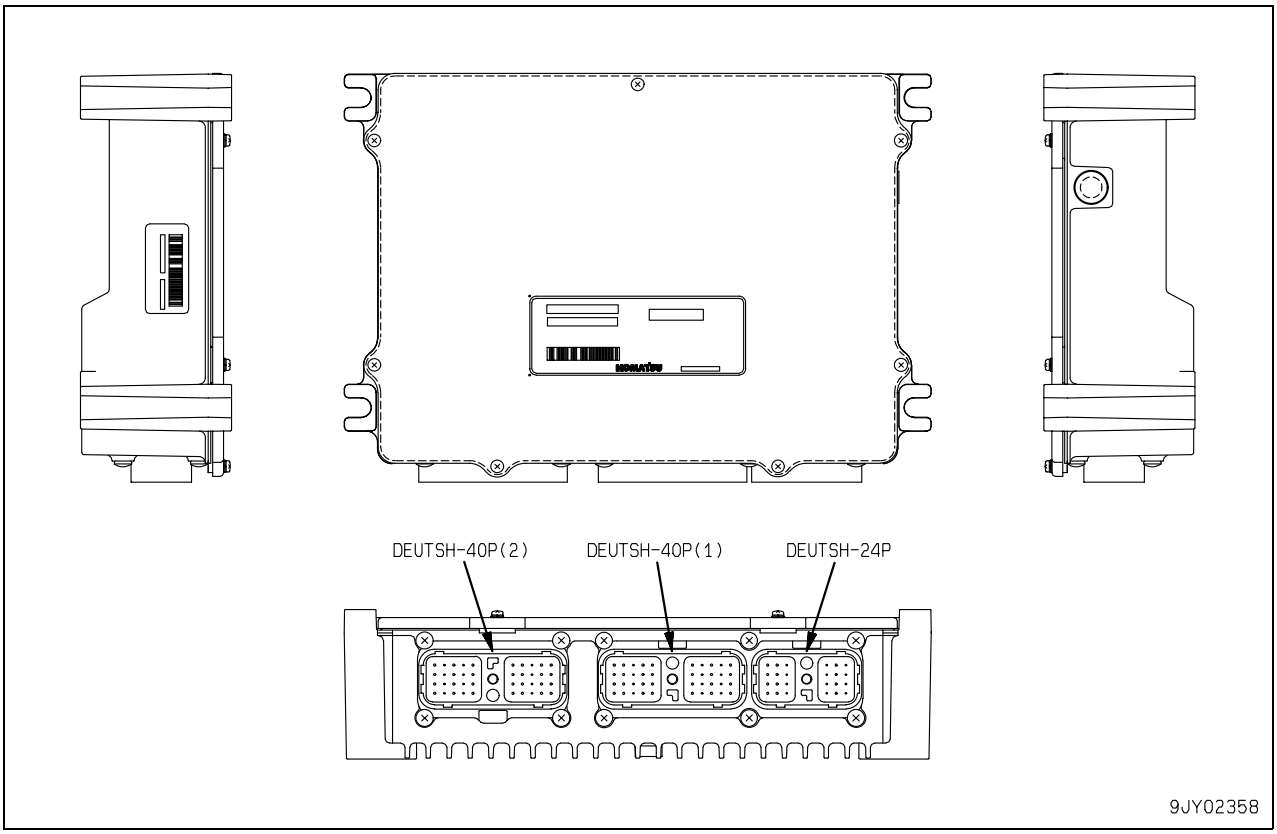
1) Function of troubleshooting

The transmission controller monitors the input and output signals constantly for troubleshooting for the system.

If any abnormality is detected by self-diagnosis, the information on it is transmitted through the network to the machine monitor.

When abnormality occurs, it can be confirmed on the machine monitor.

14. Pin assignment



Input and output signals

DEUTSCH-24P [CN-L02]

Pin No.	Signal name	Input/Output signal
1	T/C lock up SW.	Input
2	Fan reverse SW.	Input
3	Traction dial	Input
4	GND_SIG_D	
5	A/C compressor signal	Input
6	Starter switch(IGN-C)	Input
7	E.C.S.S. SW.	Input
8	MOD/C oil pressure	Input
9	T/M oil temp. sensor	Input
10	GND_SIG_D	
11	NC	Input
12	MOD/C direct signal	Input
13	Throttle with auto decel	Input
14	T/C inlet oil temp. sensor	Input
15	NC	Input
16	PWR_OUT_SENS	Output
17	NC	Input
18	Shift mode signal H	Input
19	Throttle lock without auto decel	Input
20	Memory reset	Input
21	GND_SIG_A	
22	PWR_OUT_5V_0	Output
23	Engine mode SW.	Input
24	Shift mode signal L	Input

DEUTSCH-40P(1) [CN-L03]

Pin No.	Signal name	Input/Output signal
1	NC	Output
2	ECMV fill SW.:4th	Input
3	ECMV fill SW.:3rd	Input
4	232C_RxD	Input
5	AJSS shift down(NC)or shift lever:4th	Input
6	Parking brake signal	Input
7	ECMV fill SW.:1st	Input
8	NC	Output
9	NC	Output
10	NC	Input
11	NC	Output
12	NC	
13	ECMV fill SW.:2nd	Input
14	232_TxD	Output
15	AJSS shift down(NO)or shift lever:3rd	Input
16	Direction lever:R	Input
17	ECMV fill SW.:R	Input
18	NC	Output
19	NC	Output
20	Speed sensor(1)	Input
21	NC	Input/Output
22	COMM_CAN_L_O	Input/Output
23	NC	Input/Output
24	PWR_CTR_EXT	Input
25	AJSS shift up(NC)or shift lever:2nd	Input
26	Direction lever:N	Input
27	ECMV fill SW.:F	Input
28	Brake pressure SW.	Input
29	GND_SIG_P	
30	MOD/C speed sensor	Input
31	NC	
32	COMM_CAN_H_O	Input/Output
33	NC	Input/Output
34	232C_GND	
35	AJSS shift up(NO)or shift lever:1st	Input
36	Direction lever:F	Input
37	NC	Input
38	S/T lever lock pressure SW.	Input
39	GND_SIG_P	
40	Speed sensor(2)	Input

DEUTSCH-40P(2) [CN-L04]

Pin No.	Signal name	Input/Output signal
1	PWR_IN_BATT	Input
2	PWR_IN_BRY	Input
3	GND_ACT	
4	TM power hold relay	Output
5	ECMV:F. clutch	Output
6	ECMV:2nd clutch	Output
7	MOD/C cut off SOL.	Output
8	NC	Output
9	NC	Input
10	NC	Input
11	PWR_IN_BATT	Input
12	PWR_IN_BRY	Input
13	GND_ACT	
14	PWR_CTR_KEY	Input
15	ECMV:R. clutch	Output
16	ECMV:3rd clutch	Output
17	E.C.S.S. solenoid	Output
18	NC	Output
19	SET/ACCEL SW.	Input
20	NC	Input
21	GND_PWR	
22	PWR_IN_BRY	Input
23	GND_ACT	
24	KEY switch signal	Input
25	ECMV:1st clutch	Output
26	ECMV:4th clutch	Output
27	Fan pump EPC	Output
28	Fan pump neutral solenoid	Output
29	RESUME/DECEL SW.	Input
30	Kick down SW.	Input
31	GND_PWR	
32	GND_PWR	
33	GND_PWR	
34	NC	Output
35	ECMV:lock up clutch	Output
36	ECMV:modulation clutch	Output
37	Fan pump reverse solenoid	Output
38	T/M bypass solenoid	Output
39	Right brake SW.	Input
40	Shift hold SW.	Input

WA600-6 Wheel loader

Form No. SEN00410-02

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

10 Structure, function and maintenance standard

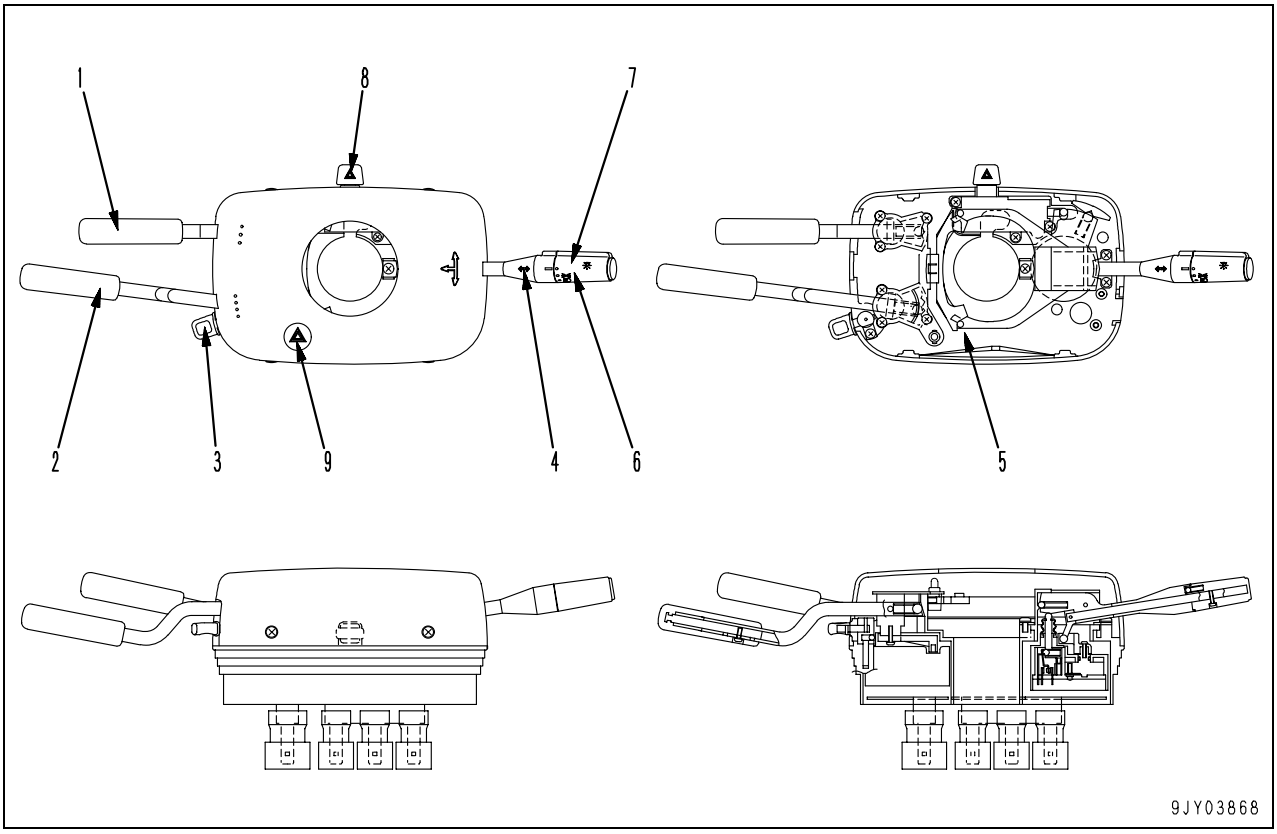
Electrical system, Part 3

Electrical system, Part 3 2
Electric transmission control 2
Engine starting/stopping circuit 4
Parking brake circuit 7
Sensor 11
VHMS controller related 33
Work equipment electric lever 37

Electrical system, Part 3

Electric transmission control

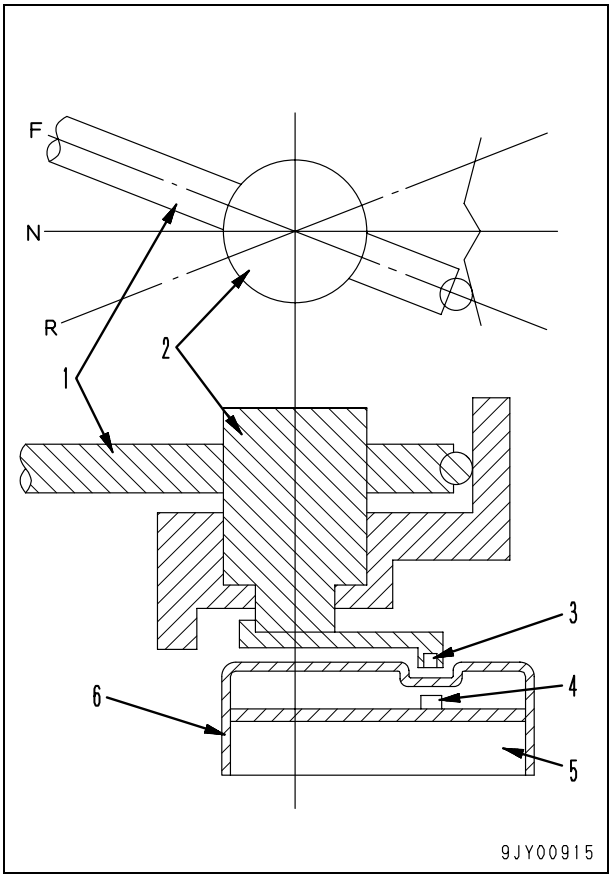
Combination switch
(Steering wheel specification)



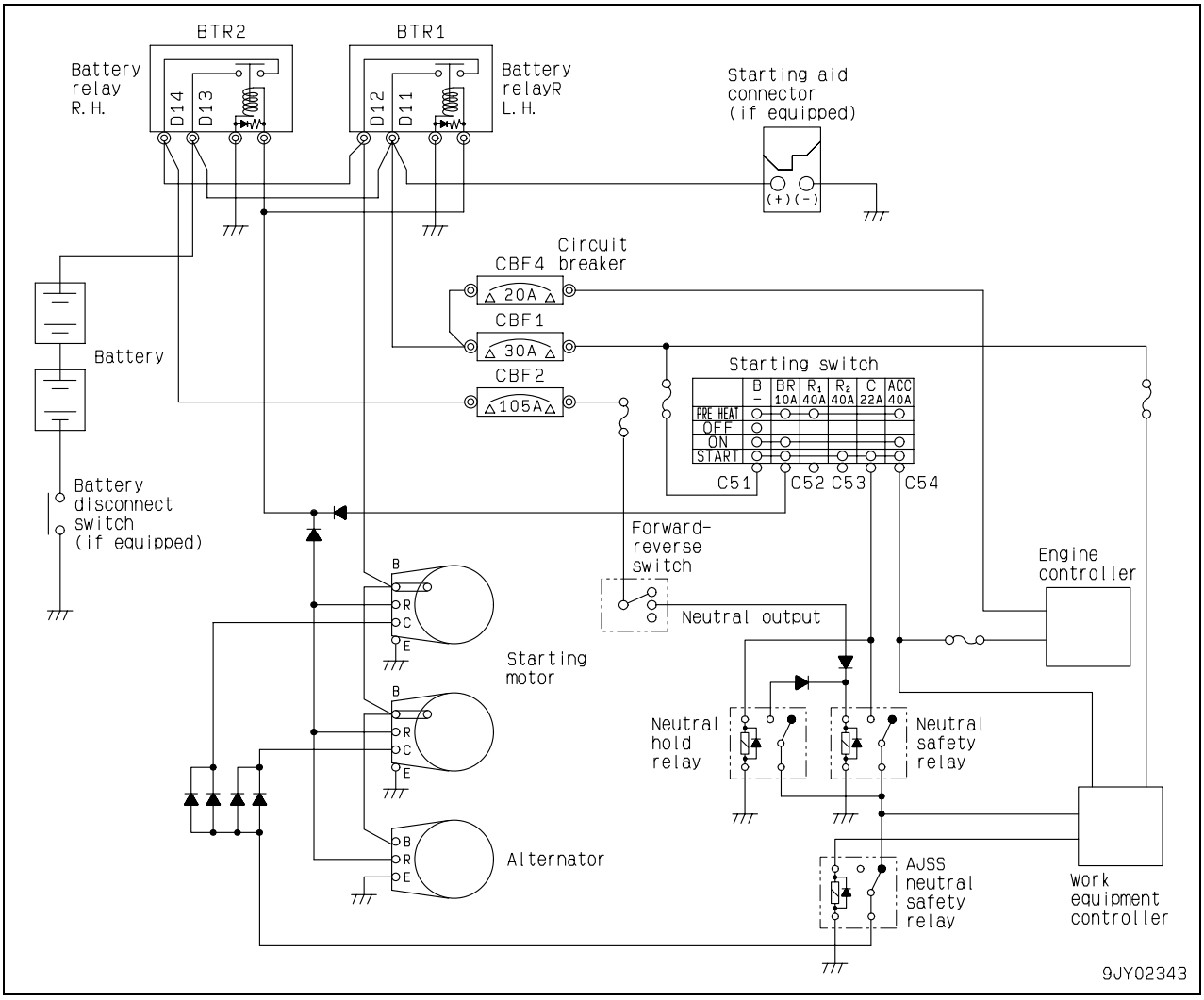
- The directional lever has 3 positions and the gearshift lever switch has 4 positions.The detent mechanism is not installed to each switch but installed to the body of the combination switch. Each switch is positioned with 2 pins and fixed to the body with 3 screws. If each lever is set in a desired position, the switch connected by the shaft operates to supply the current to only the circuit of the desired position.

No.	Type	Operation
1	Directional lever switch	Selects the travel direction and neutral.
2	Gearshift lever switch	Selects a gear speed.
3	Gearshift lever stopper	Prevents the gearshift lever from moving to the 3rd or 4th position during work.
4	Turn signal	Turn signal for L.H. and R.H. turns
5	Self-cancel	Returns the turn signal lever automatically to neutral when the steering wheel is returned after turning to the right or left.
6	Lamp switch	Selects the clearance lamp, headlamp, parking lamp, etc.
7	Dimmer switch	Selects main beam and low beam.
8	Hazard switch	Flashes turn signals to the left and right simultaneously.
9	Hazard pilot lamp	Flashes while the hazard lamp flashes.

- Shaft (2) of directional and gearshift lever (1) of the combination switch is made one with magnet (3). As lever (1) moves, magnet (3) moves, too.
- Control switch (5) having Hall IC's (4) in it is installed under magnet (3). Hall IC (4) are arranged on the board for each position.
- When the directional lever is set in the “F” position, magnet (3) comes to directly above Hall IC (4) of the “F” position of the control switch. Magnet (3) magnetizes Hall IC (4) through the clearance and case (6).
- Hall IC (4) is in the magnetism sensor circuit and it detects the magnetism of magnet (3) and sends the signal of the “F” position of the directional lever to the current amplifier circuit. The current amplifier circuit outputs the signal to operate the transmission valve.



Engine starting/stopping circuit



Function

1. The neutral safety circuit is employed to secure safety when the engine is started.
   - The engine can not be started while the directional lever is not in N (Neutral).
   - When the AJSS lever is in a position other than neutral, the engine can not be started.

Operation

1. When starting switch is turned to “ON” position
   - If the starting switch is turned to the “ON” position, terminals B and BR of the starting switch are closed and the current flows from the battery through the starting switch and battery relay coil to the ground and the contacts of the battery relay are closed. As a result, the power is supplied to each circuit of the vehicle.
     Also, the operation signal is provided from the terminal ACC of the starting switch into the engine controller, and the engine is ready to start.
2. Neutral safety circuit
   - When the directional lever is set in the “N” position, current flows from the N contact of the directional switch to the coil of the neutral safety relay, and by conducting the three terminals of the neutral safety relay with the five terminals, the engine becomes ready to be started.
3. AJSS neutral safety circuit
   - When the engine is started in a condition other than steering neutral condition, in which the lever angle of AJSS and the machine frame angle are the same, the machine can begin turning immediately after it is started, which can be a cause of danger. Therefore, if the deviation of the lever angle and the frame angle, sensed by the work equipment controller, is 6° or more, starting the engine is prohibited by energizing the AJSS neutral safety relay coil by the work equipment controller, and opening the three and six terminals of the relay.
4. Neutral maintaining circuit
   - The neutral safety relay may not be maintained due to voltage decrease of neutral signal from the directional lever because of voltage decrease in starting the engine. In order to prevent this, the “neutral maintaining relay” is installed to maintain neutral safety relay as long as the signal from the C terminal of the starting switch, in case starting the engine is initiated in neutral state.
5. When starting switch is turned to “Start” position
   - If the starting switch is turned to the “Start” position, terminals B and C of the starting switch are closed and the current flows from the neutral safety relay through the AJSS neutral safety relay to the starting motor, and the engine starts rotating. When the engine starts rotating, fuel injection starts to each cylinder with the rotation signal from the engine rotation sensor connected to the engine controller, and then the engine starts.
6. Engine stopped
   - If the starting switch is set in the “OFF” position, the current of terminal ACC of the starting switch is cut out and the ACC signal to the engine controller is cut out accordingly, and the engine controller stops fuel injection.
   - When fuel injection stops, the engine slows down the rotation and stops. When the alternator stops generating electricity, voltage supply from R terminal stops, and the current from BR terminal of the starting switch is cut out, the contact of the battery relay opens, and the power supply provided to various parts of the machine is cut out.

7. When the option “battery disconnect switch” is equipped
   - When the battery disconnect switch is equipped and the switch is OFF (the contact is opened), the starting switch B terminal, respective controllers, and other constant power supplies are all cut out, and the state is the same as when the battery is not connected.
   - The battery disconnect switch is usually used for substitution to take off the minus terminal of the battery, when the machine is stored for a long time (a month or longer), when the electrical system is repaired, or when electrical welding is performed.

   When the battery disconnect switch is turned off, all the electrical system of the machine will be inoperative.
   - The clock of the monitor/radio and reception preset memory of radio will be lost, and need to be set again when using them.
   - Such functions as room lamp, step lamp, and hazard lamp cannot be used either.
   - Since VHMS is saving data with battery power immediately after the starting switch is turned off, when turning the battery disconnect switch off, ensure that the VHMS operation indicator (rear frame left component box) has gone out. If it is turned off before the indicator goes out, a cycle of VHMS data, from the time the starting switch is turned on to the time when it is turned off, will be lost. (Information necessary to set the machine will not be lost)
   - Immediately after the fan is operated in reverse, power is supplied to the fan reverse solenoid for a while after the starting switch is turned “OFF” in order to protect the oil pressure motor.
   - When turning the battery disconnect switch off, ensure that the fan rotating in reverse has stopped.

⚠ Important

Do not turn off the battery disconnect switch while the engine is rotating and immediately after the engine has stopped.

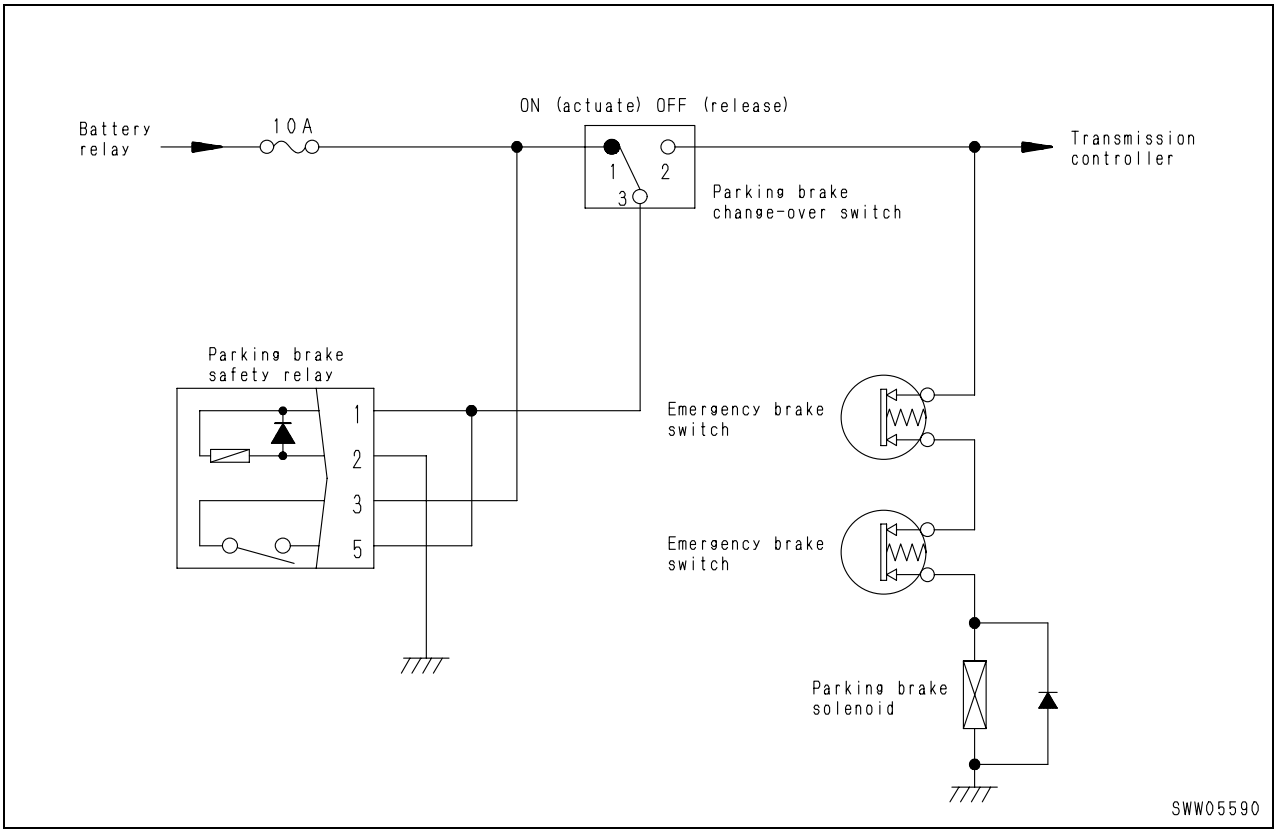
If the battery disconnect switch is turned off while the alternator is generating electricity, the generated current has nowhere to go, leading to overvoltage of the electrical system of the machine, which may cause serious damage to the electrical system such as electric devices or controllers.

8. Start auxiliary connector
   - This machine is optionally equipped with a start auxiliary connector in compliance with SAE J1283.
   - For usage and precautions of the start auxiliary connector, refer to Operation Manual.

Parking brake circuit

Operation

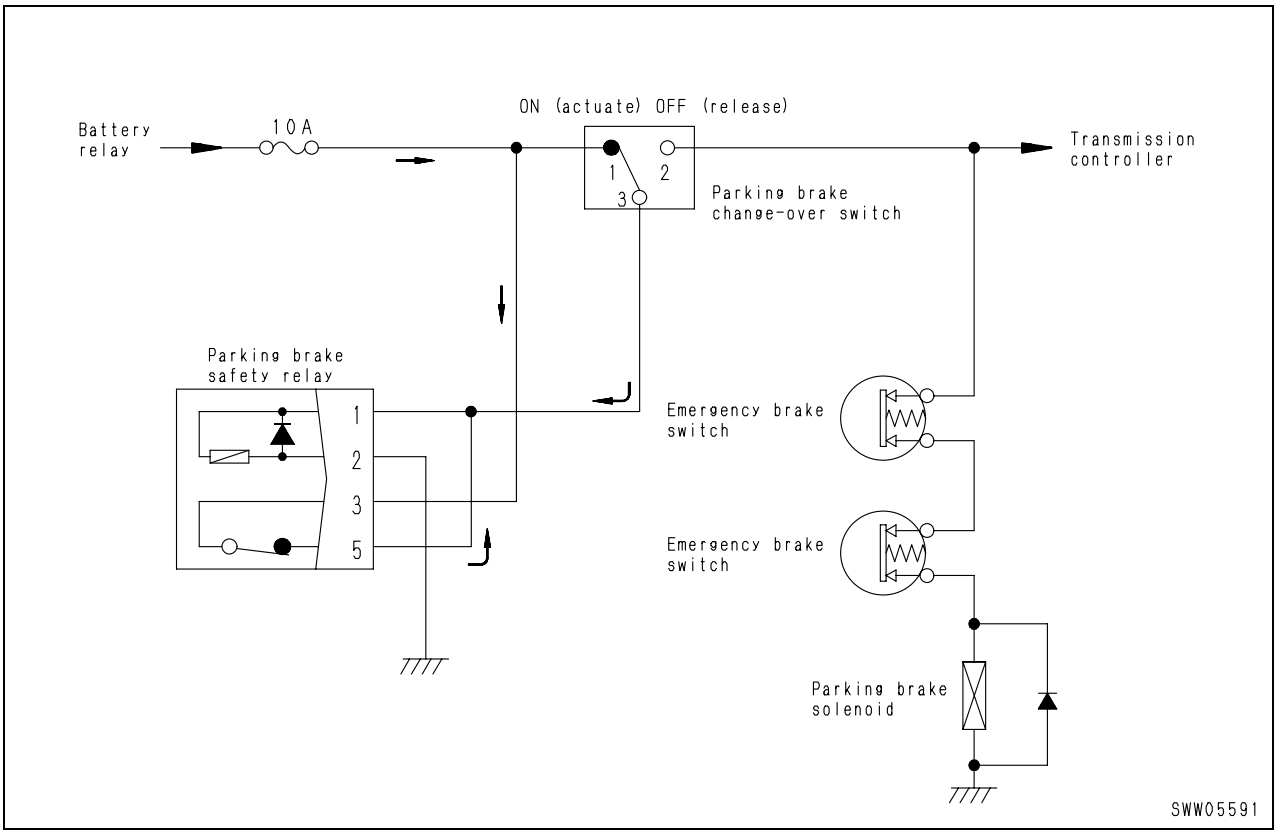
1. When starting switch is turned “OFF”



- If the starting switch is turned “OFF,” the contacts of the battery relay open, and no current flows to the parking brake circuit. While the starting switch is “OFF,” the current does not flow into parking brake solenoid valve and the parking brake is kept applied, regardless of the position of the parking brake switch, whether it is “ON (applied)” or “OFF (released).”

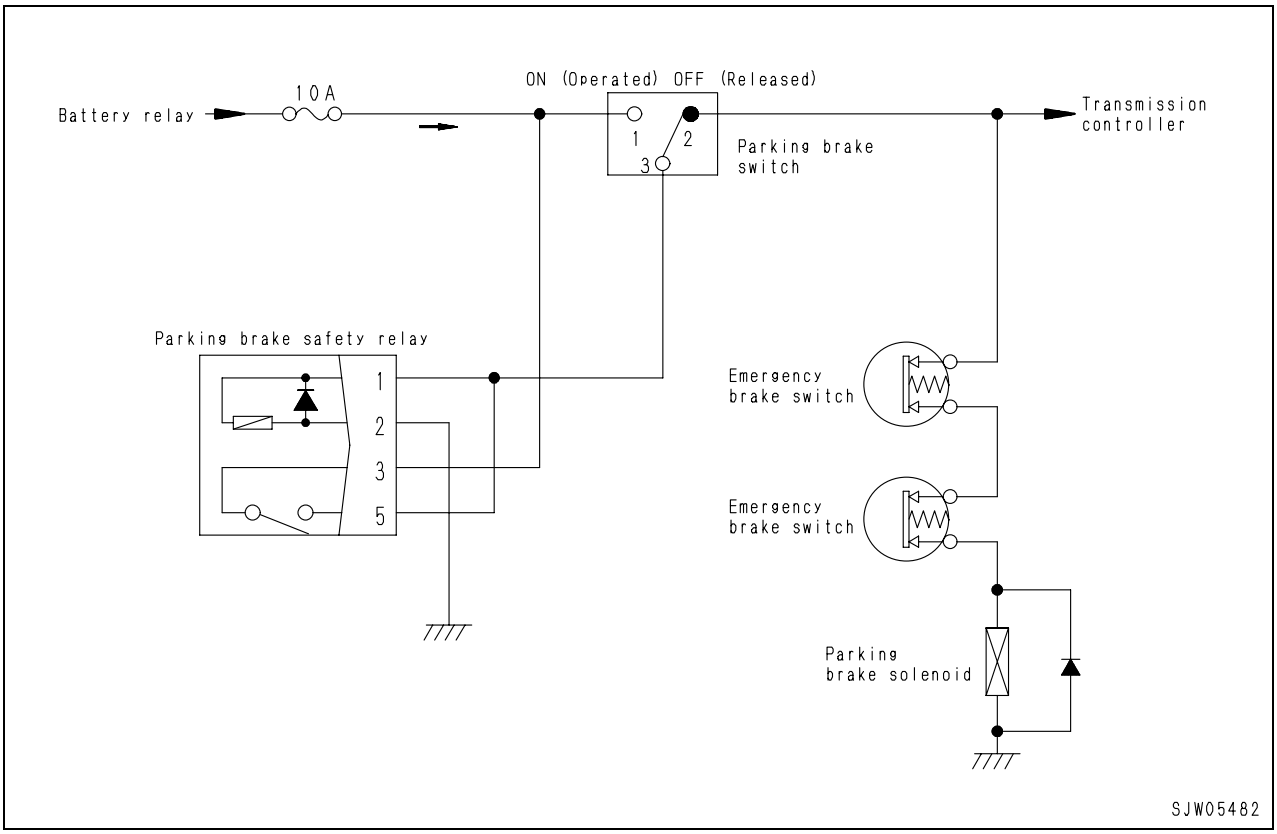
2. When starting switch is turned “ON”

2-1. When parking brake switch is turned “ON (actuate)” before starting switch is turned “ON”



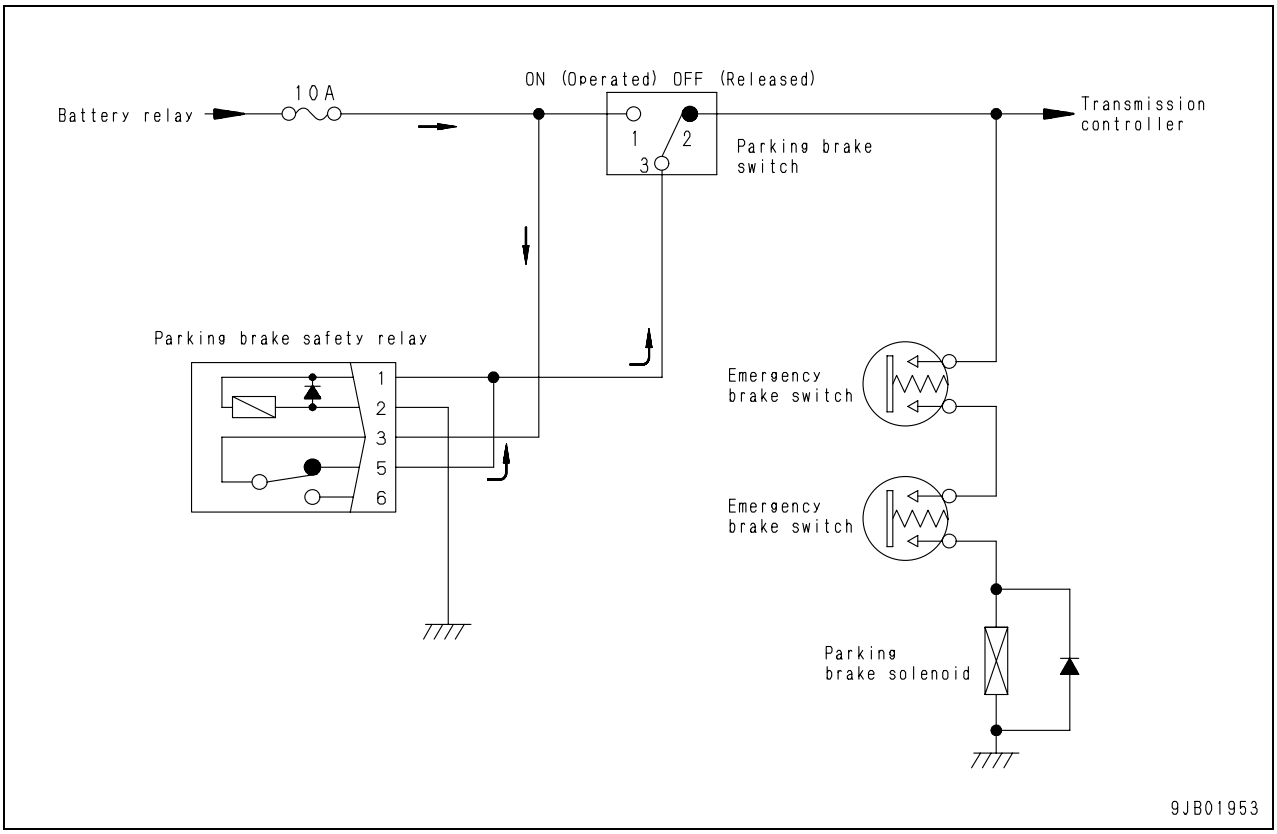
- Since parking brake selector switch is ON, the current flows from the battery relay through a contact of parking brake changing switch, three contacts, parking brake safety relay coil and to the chassis ground, thus closing three terminals and five terminals of parking brake safety relay. The current from the battery relay keeps flowing into the coil of parking brake relay to hold its contacts until the battery relay contacts open and the current does not flow into the parking brake circuit any more.
- At this time, the current does not flow into parking brake solenoid and the parking brake is kept applied.
- This signal is input to transmission controller to keep the transmission in neutral and prevent the parking brake from dragging while the parking brake is applied.
- After that, if the parking brake switch is turned “OFF (released),” the current flows through battery relay, parking brake safety relay, three contacts of parking brake selector switch, two contacts, emergency brake switch, and parking brake solenoid, to the chassis ground, and the parking brake is released.

2-2. When parking brake switch is turned “OFF (released)” before starting switch is turned “ON”



- While the starting switch is “OFF,” the current does not flow into parking brake safety relay and its contacts are open. Even if the starting switch is turned ON at this time, the current does not flow into parking brake solenoid. Accordingly, the parking brake will not be released automatically.

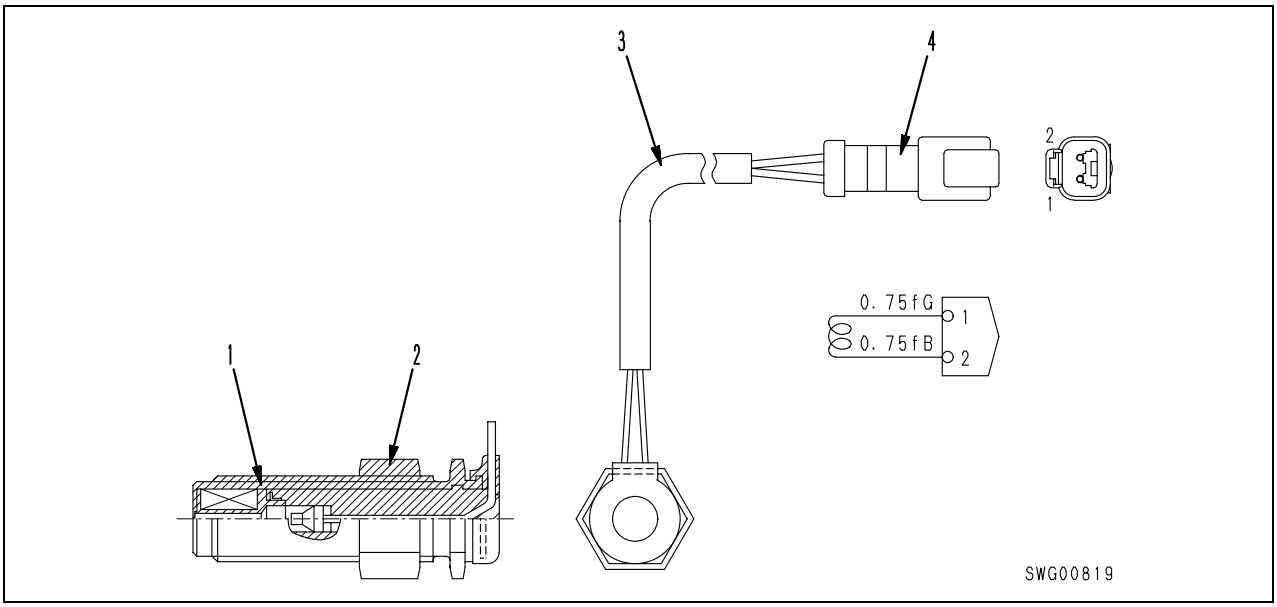
3. When main brake oil pressure lowers (emergency brake is applied)



- If the main brake oil pressure lowers, the contacts of the emergency brake switch installed to the accumulator open. As a result, the current flowing into parking brake solenoid valve is stopped and the oil in the parking brake cylinder is drained and the parking brake is applied.
  In this case, however, unlike the case where the parking brake switch is turned “ON (applied)”, the transmission is not set in neutral since the parking brake release signal is flowing into the transmission controller.
  By the above operation, when the emergency brake is applied, the braking distance can be reduced by using the engine as a brake. Also, even if the emergency brake is applied, the vehicle can be moved.

Sensor

Modulation clutch rotation sensor
Output shaft rotation sensor 1
Output shaft rotation sensor 2

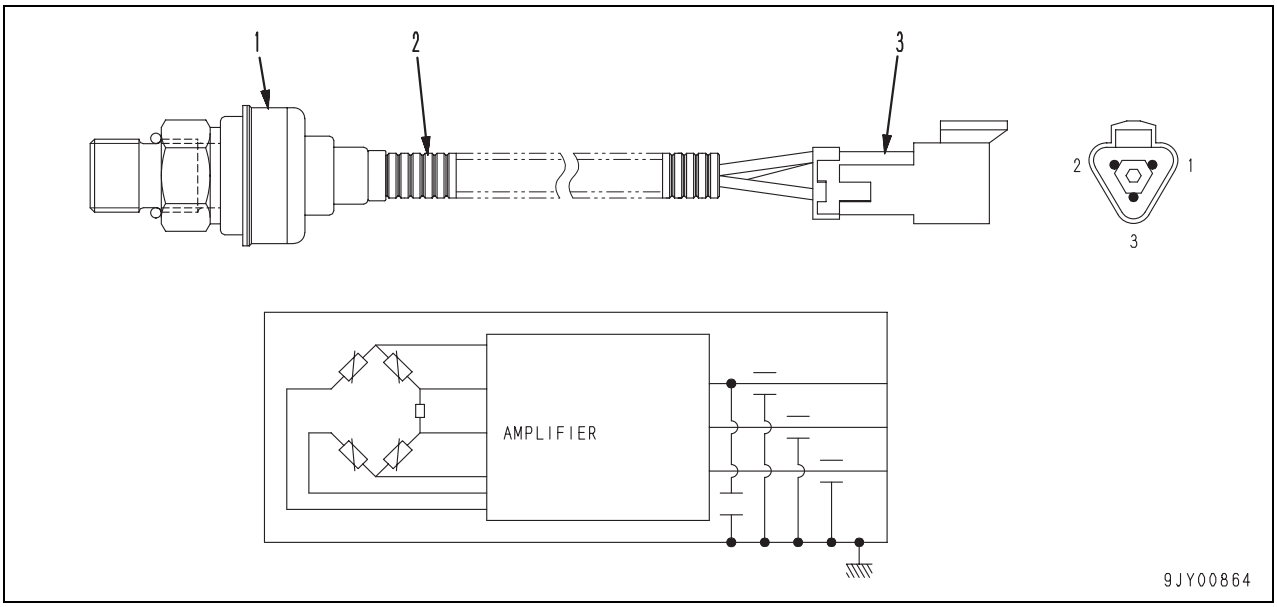


1. Magnet
2. Locknut
3. Harness
4. Connector

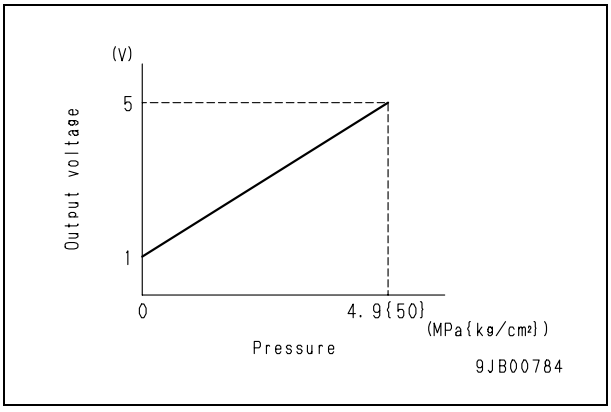
Function

- Modulation clutch rotation sensor is installed between torque converter and modulation clutch. Output shaft rotation sensors 1 and 2 are both installed in the output gear section at the bottom of the transmission main unit. Those sensors emit pulse signals according to the gear rotation signal, which are then transmitted to the transmission controller.
- Signals are converted from pulse to the number of rotation (rpm) in the transmission controller, transmitted to the machine monitor over the network. The rpm is then converted into travel speed in the machine monitor for display.

Modulation clutch pressure sensor



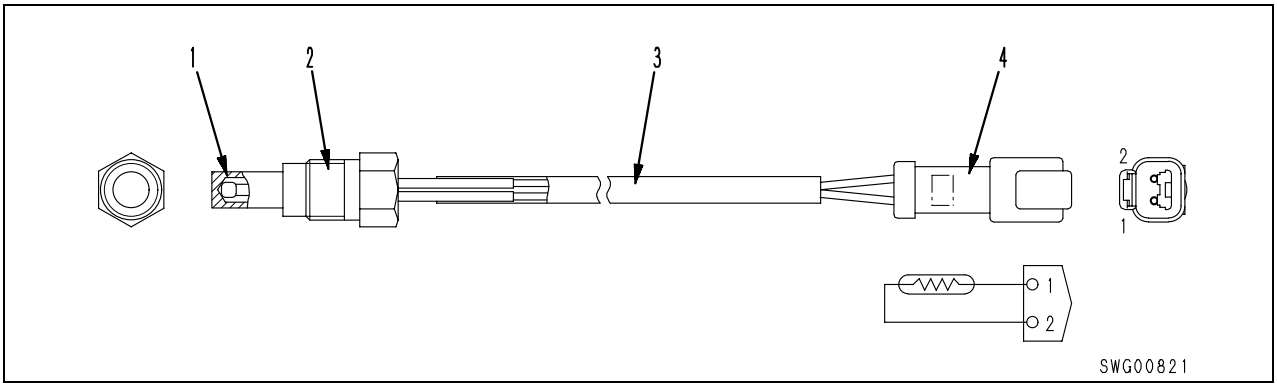
1. Sensor
2. Lead wire
3. Connector



Function

- Installed to the modulation clutch, this sensor detects pressure of the clutch to be used for calculating thermal load to the clutch.

Transmission oil temperature sensor
Torque converter oil temperature sensor
Hydraulic oil temperature sensor
Axle oil temperature sensor

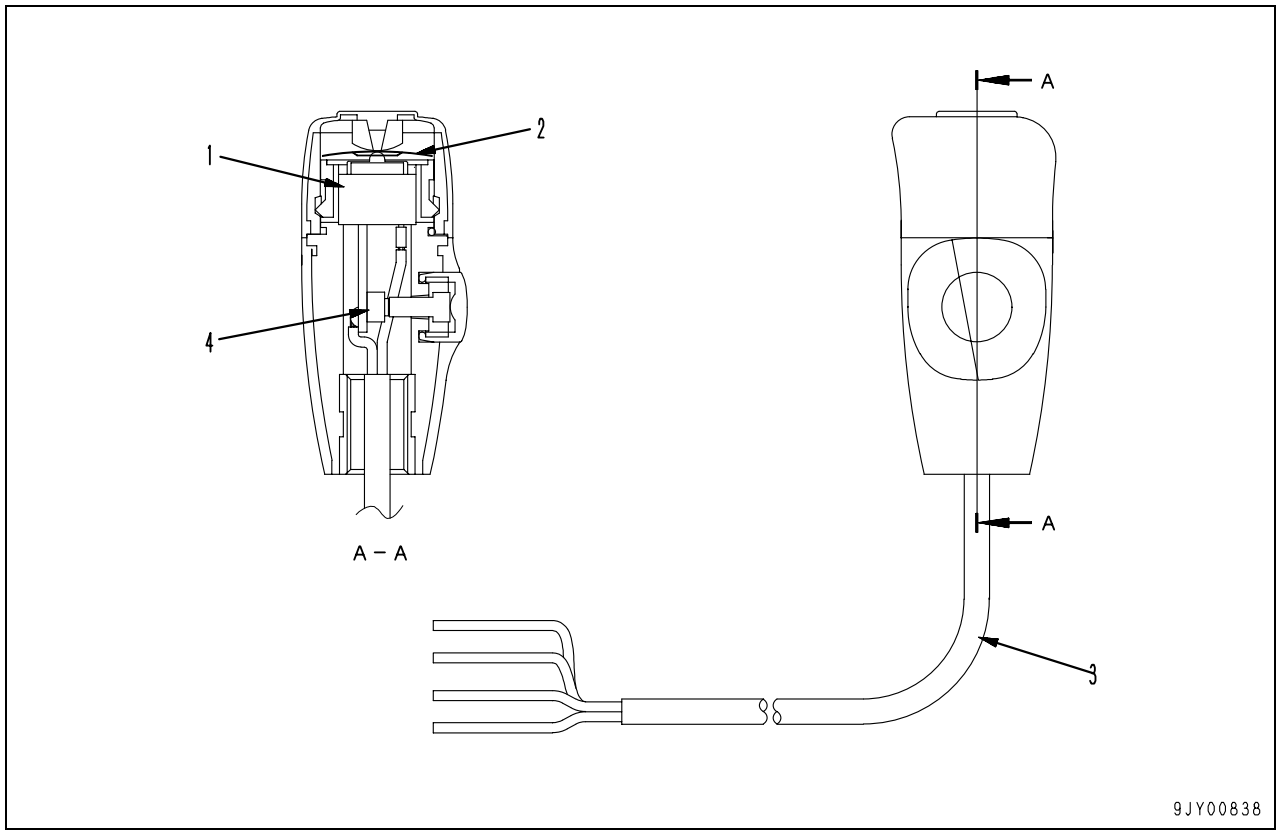


1. Thermistor
2. Plug
3. Harness
4. Connector

Function

- Transmission oil temperature sensor detects the internal temperature of transmission case. The temperature data is used by transmission controller to select the temperature table of electronic modulation so as to control modulation best matched to the oil temperature.
- Data from torque converter oil temperature sensor and hydraulic oil temperature sensor is detected by the machine monitor and indicated to the gauges. At the same time, the data is transmitted to the transmission controller via network and used as the cooling fan control data.
- Axle oil temperature sensor detects the internal oil temperature of rear axle with the monitor, and outputs a caution signal when the temperature rises to a high level.

Kick-down hold switch

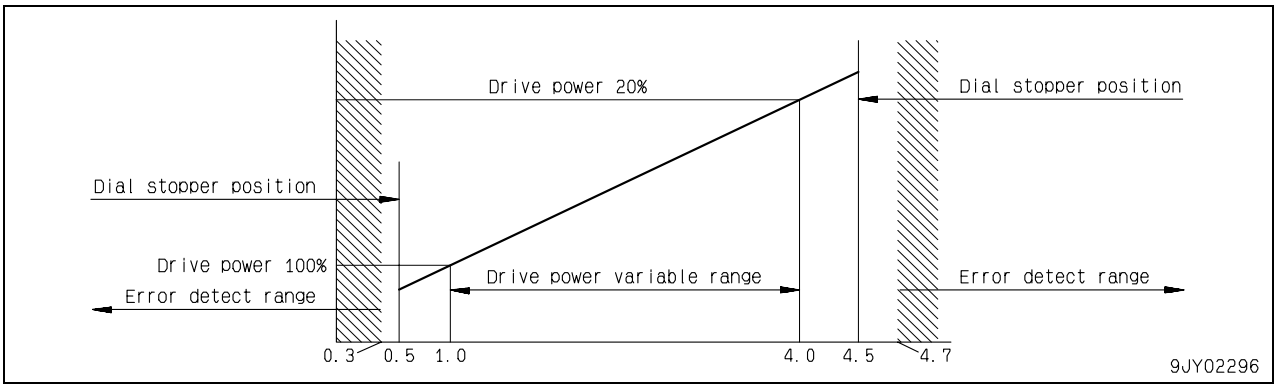


1. Switch A (White wiring harness)
2. Spring
3. Harness
4. Switch B (Yellow wiring harness)

Function

- These switches are installed to the knob of the lift arm control lever. Switch A (1) works as the kick-down switch and switch B (4) works as the hold switch.
- These switches are installed to the knob of the lift arm control lever when load meter (if equipped) is installed. Switch A works as the cancel switch and switch B works as the subtotal switch.
- Both of switch A (1) and switch B (4) are of momentary type, that is, their contacts are closed only while they are pressed.

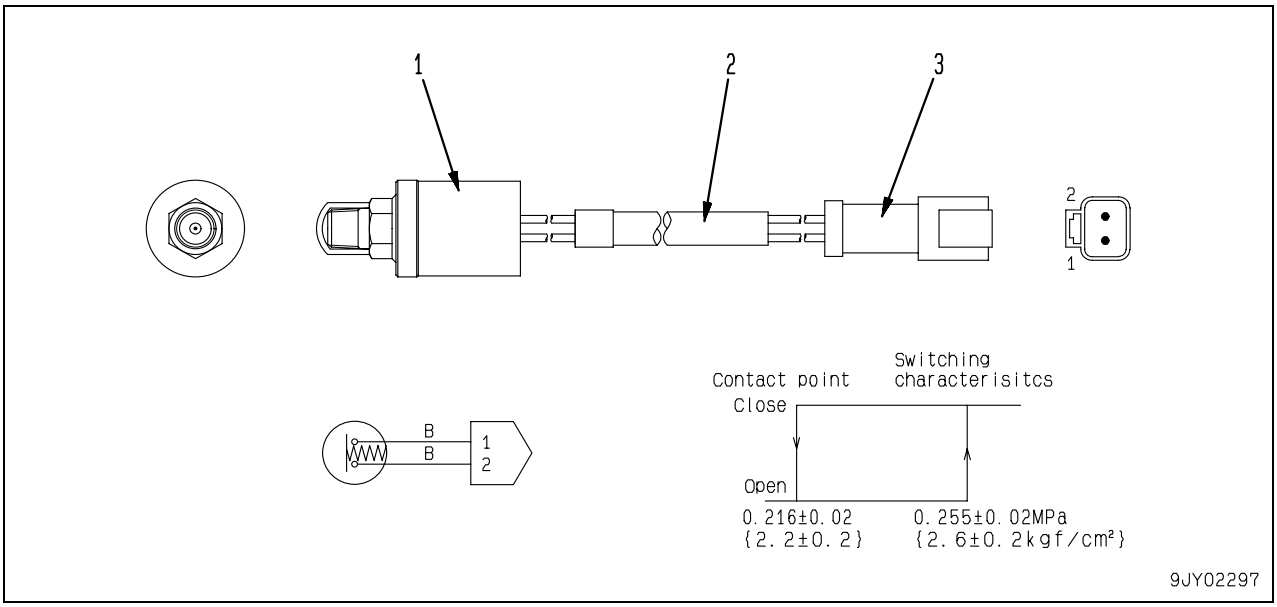
Driving force adjust dial



Function

- As the dial is turned, engagement ratio of 1st speed modulation clutch changes.

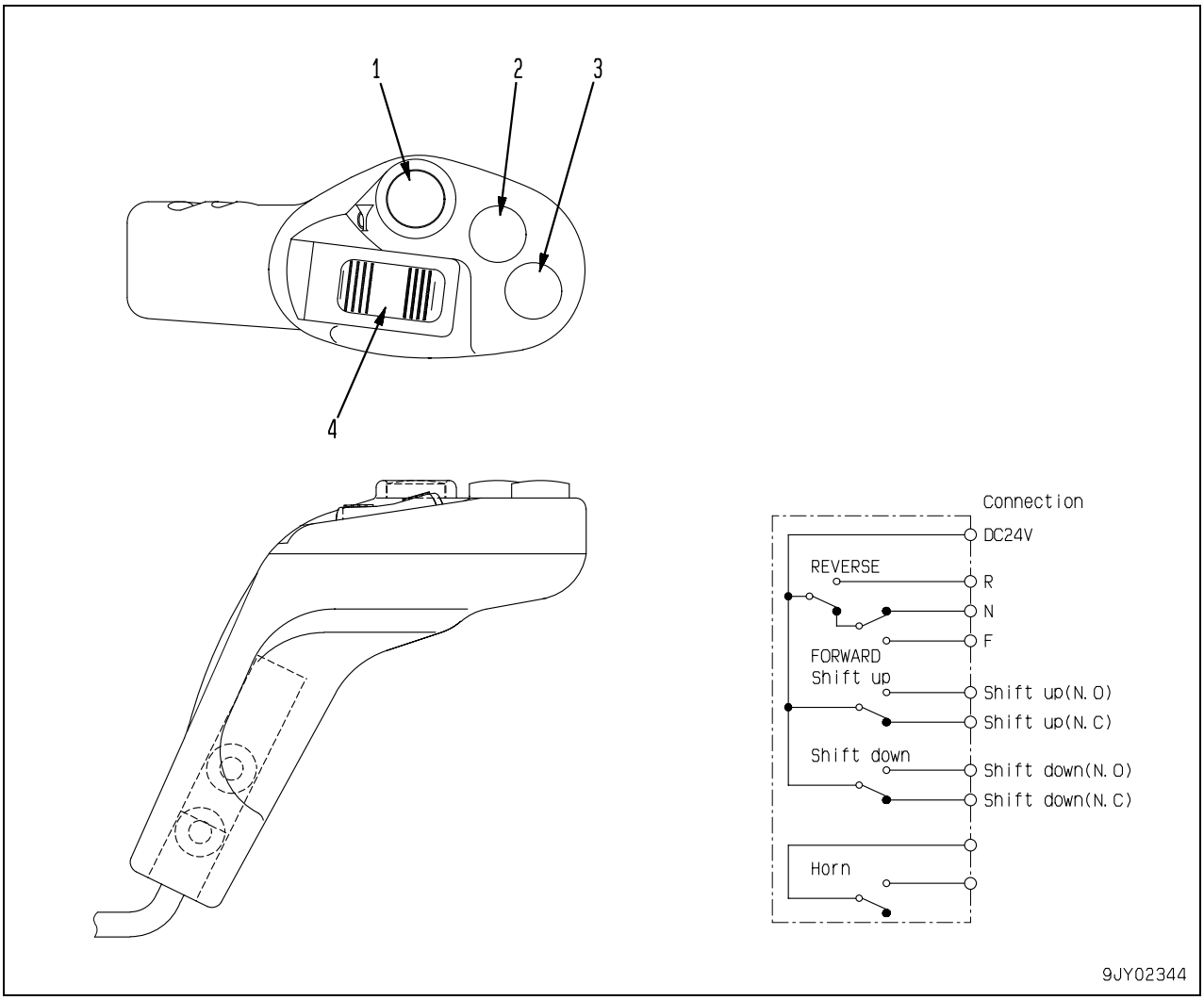
AJSS steering lock switch



Function

- When AJSS steering lock lever is operated, steering pilot pressure circuit is cut off, lowering the pilot pressure and opening the switch accordingly.
- When the steering lock lever is OFF, the pilot pressure is lowered while the engine is not running. As the result, AJSS does not operate same as when the steering lock lever is ON.

AJSS knob

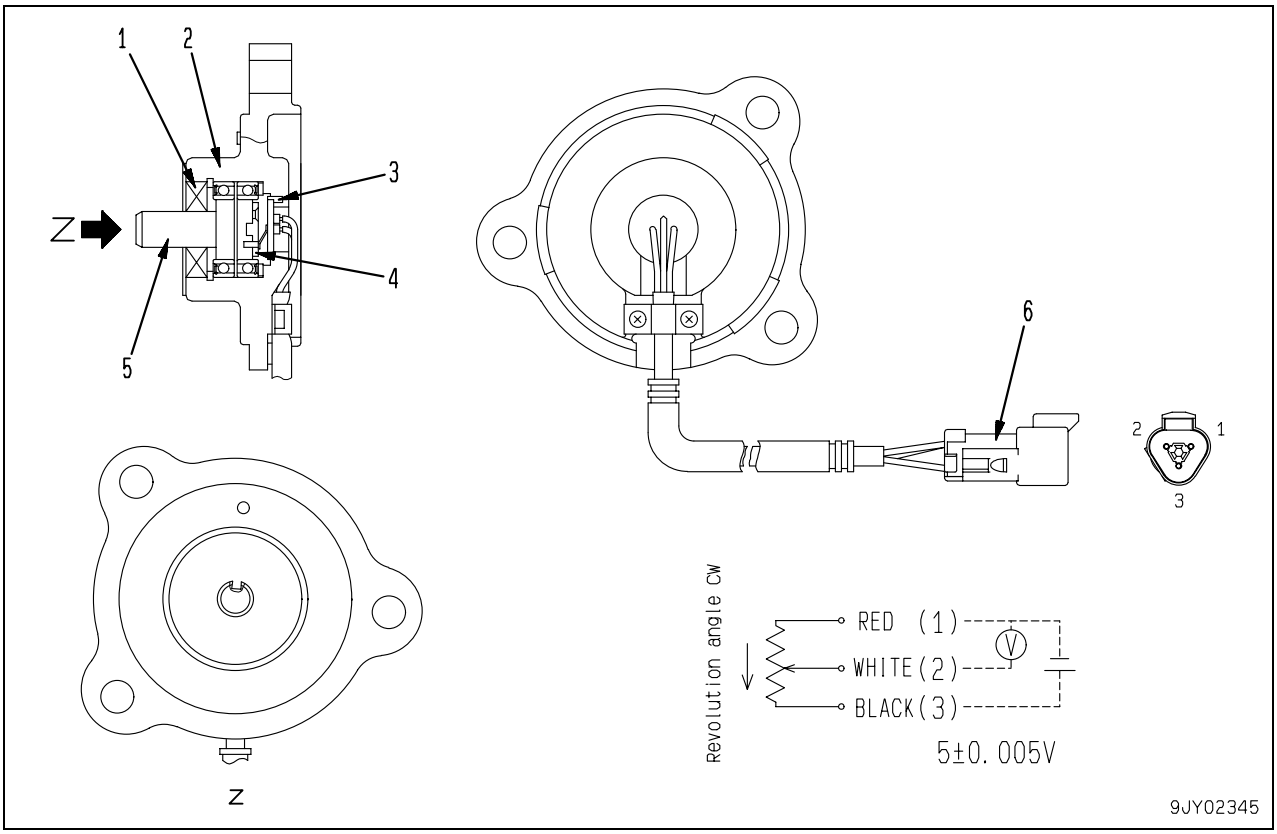


1. Horn switch: horn sounding switch
2. Shift down switch: Selects a gear speed.(shift down)
3. Shift up switch: Selects a gear speed.(shift up)
4. Directional switch: Selects the travel direction and neutral.

Function

- Directional switch is held at a selected position. Transmission controller shifts gear according to the signal from the directional switch.
- Shift-up and -down switches select circuit only while the switch is being depressed, and the transmission controller uses this signal for gear shifting operation accordingly.
- Horn switch operates the relay and sounds the horn while it is being depressed.

Lift arm angle sensor (if equipped)

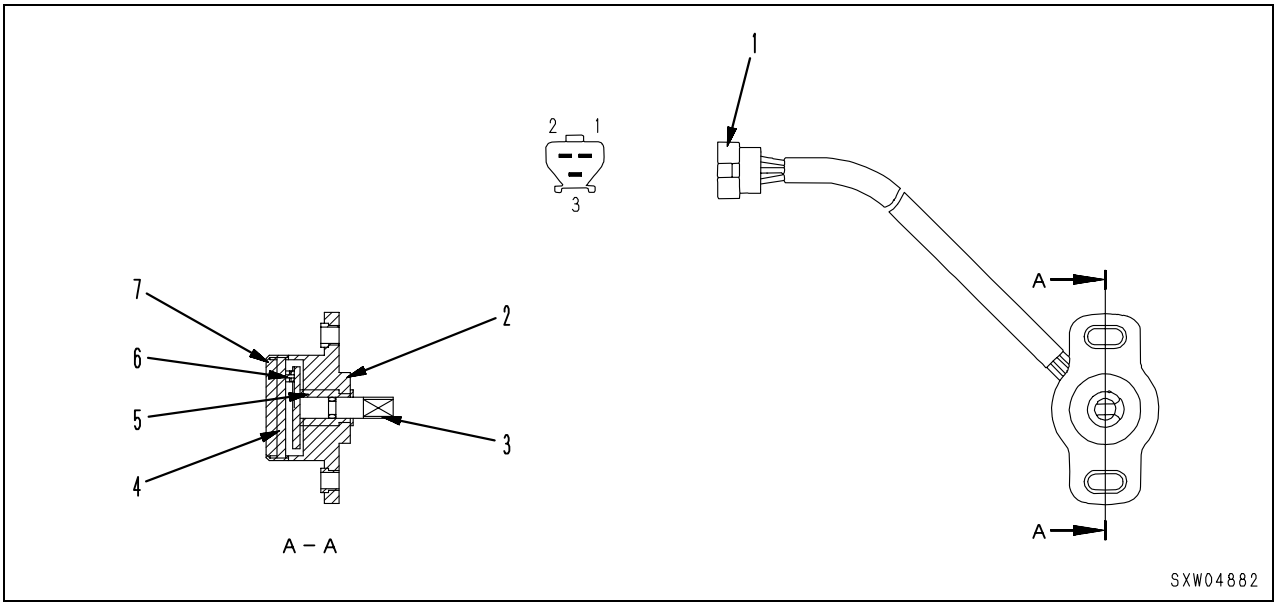


1. Oil seal
2. Case
3. Resistor assembly
4. Brush
5. Shaft
6. Connector

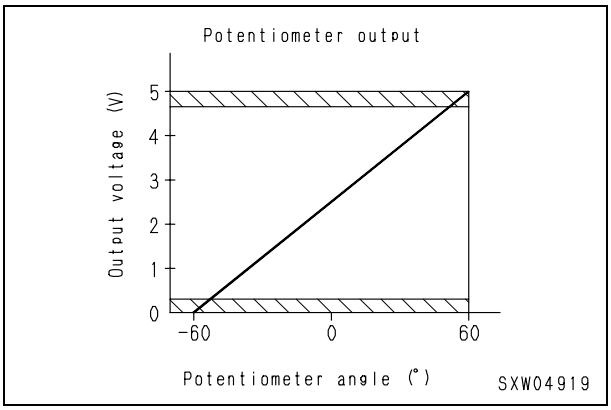
Function

- The lift arm angle sensor is installed to the front frame. When the lift arm angle changes, the shaft receives the sliding resistance through the link installed to the lift arm and the lift arm angle is detected from that sliding resistance.
  The angle sensor is installed to a machine installed with a load meter or electric work equipment lever.

AJSS lever angle sensor
AJSS frame angle sensor



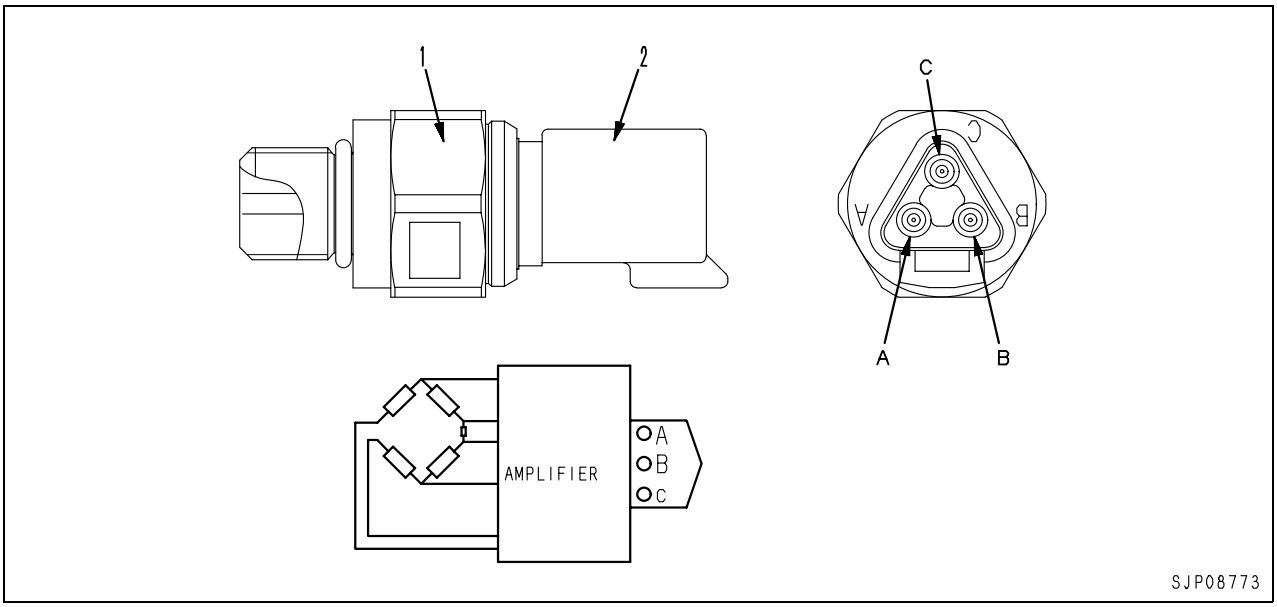
1. Connector
2. Case
3. Shaft
4. Element
5. Bearing
6. Contact
7. Mold



Function

- Lever angle sensor is installed to AJSS lever in the L.H. console, and frame angle sensor is to the follow-up linkage of the machine rear frame. Data from these sensors are converted to the lever angle and swing angle respectively inside the work equipment controller.

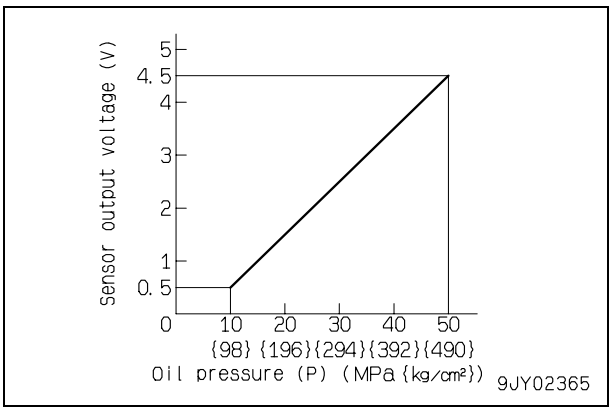
Loader pump pressure sensor
Lift arm bottom pressure sensor
Lift arm head pressure sensor (load meter (if equipped))
Steering pressure sensor (VHMS (if equipped))
Rear brake pressure sensor (VHMS (if equipped))
Front brake pressure sensor (VHMS (if equipped))



1. Sensor
2. Connector

Function

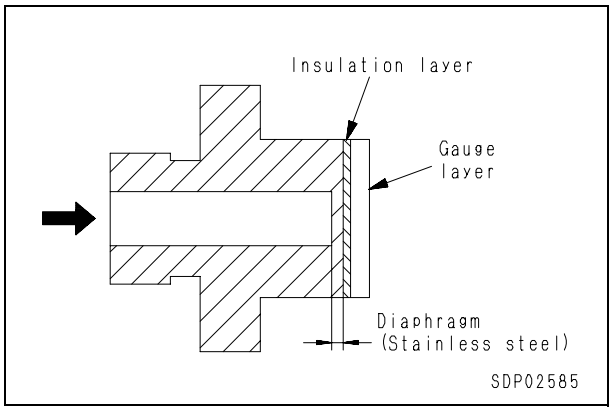
- Installed to the inlet port circuit for the control valve, these sensors convert pump discharge pressure to voltage and transmit to the governor pump controller.



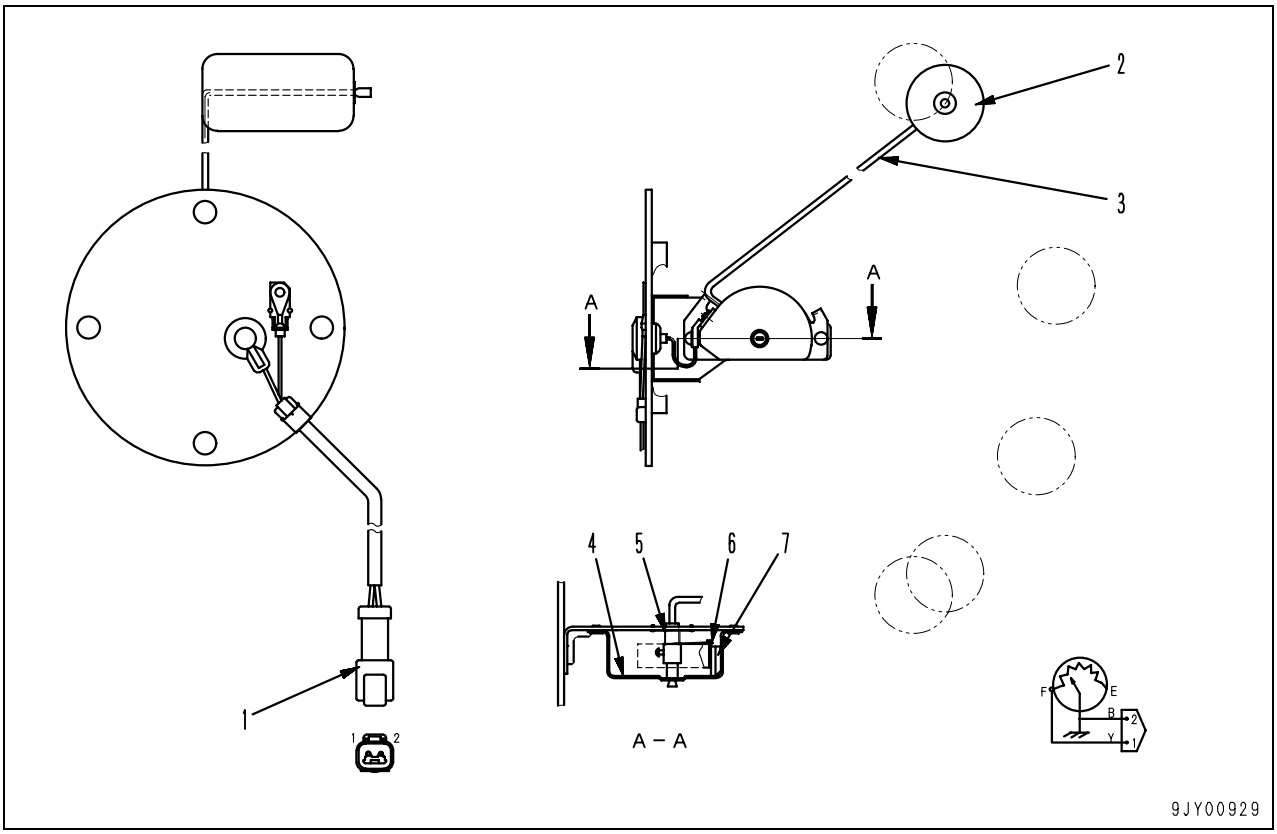
Operation

- When oil pressure led from the pressure input port applies pressure to the diaphragm of oil pressure sensor, the diaphragm is deformed from deflection.
- Gauge layer is installed to the opposite of the diaphragm. Deflection of the diaphragm is converted into output voltage by the resistance of the gauge layer and is sent to the amplifier.
- After amplifying the voltage, the amplifier transmits the voltage to the governor controller.
- Relational expression of pressure P (MPa {kg/cm^2}) and output voltage (V)

  V = 0.08 {0.008} × P + 0.5



Fuel level sensor

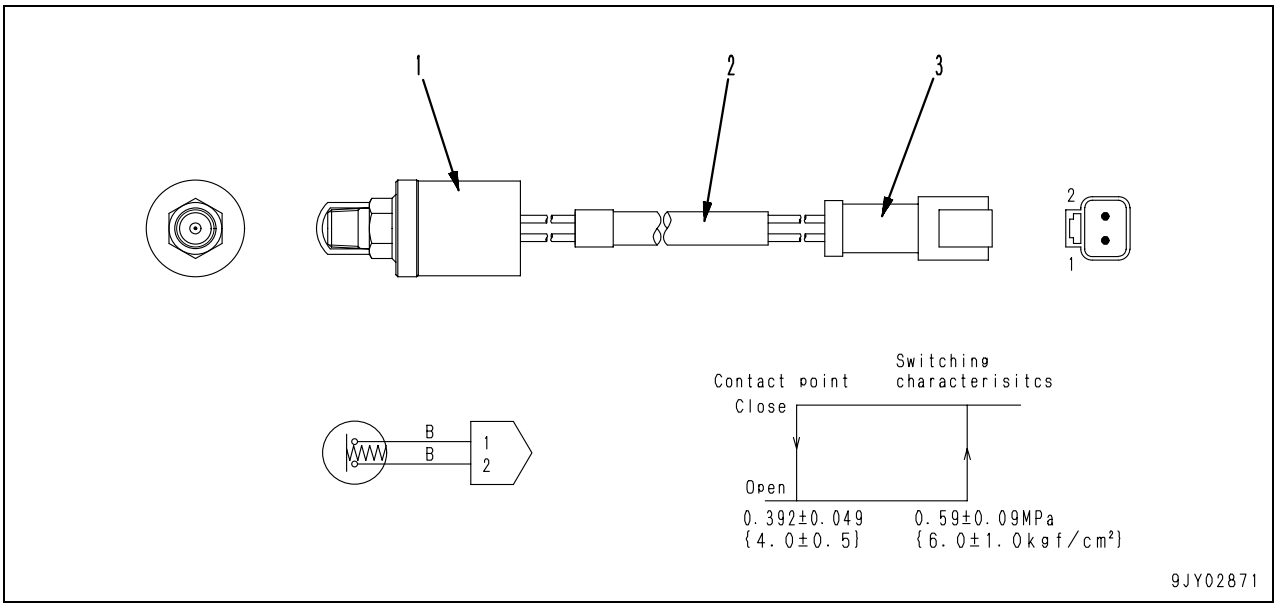


1. Connector
2. Float
3. Arm
4. Body
5. Spring
6. Contact
7. Spacer

Function

- The fuel level sensor is installed to the side of the fuel tank. The float moves up and down according to the fuel level.
  The float moves the variable resistor through the arm. The voltage signal is sent to the machine monitor to indicate the fuel level.
  Also, when the machine monitor indicator reaches a specified position, caution lamp is lit.

Parking brake pressure switch

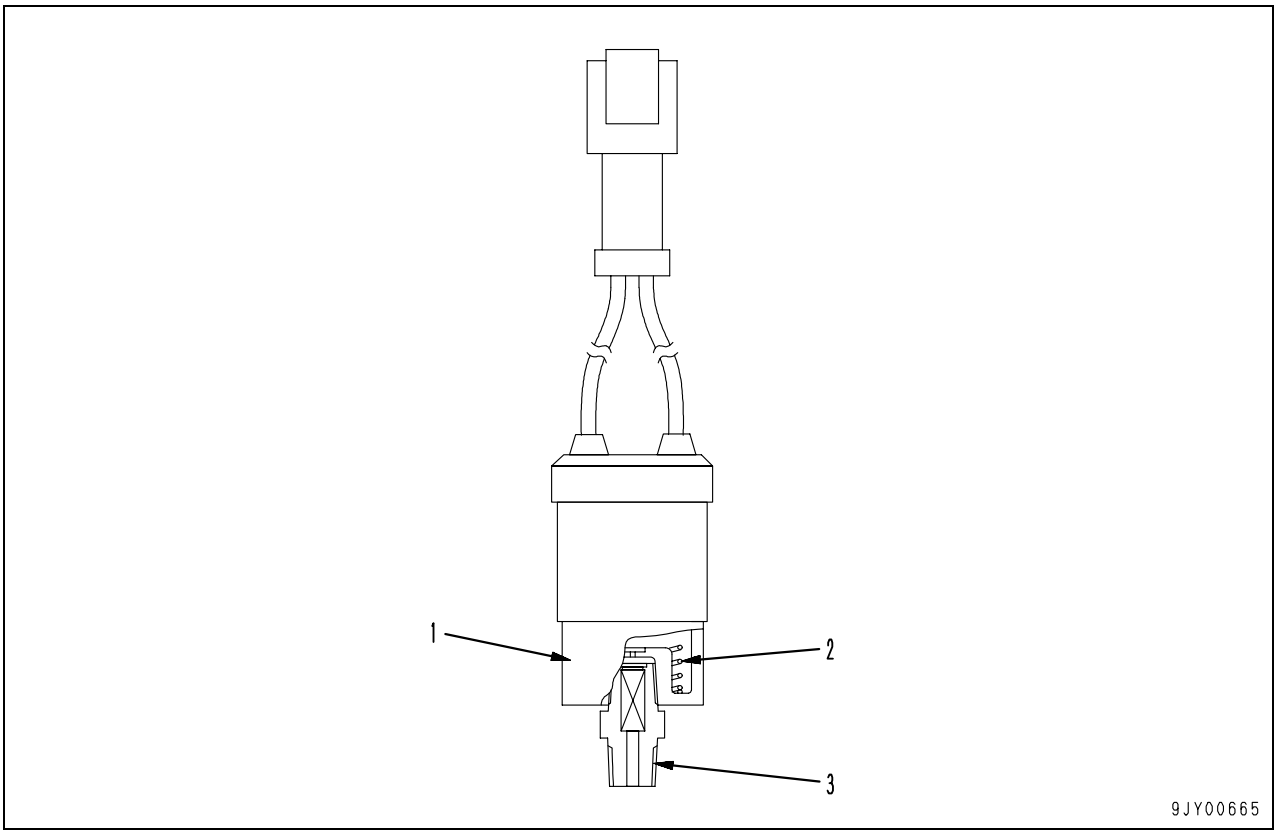


1. Case
2. Tube
3. Connector

Function

- When the parking brake is released, oil pressure is fed to the brake piston. The oil pressure operates the pressure switch to turn out the parking brake pilot lamp on the machine monitor.

Air cleaner clogging sensor

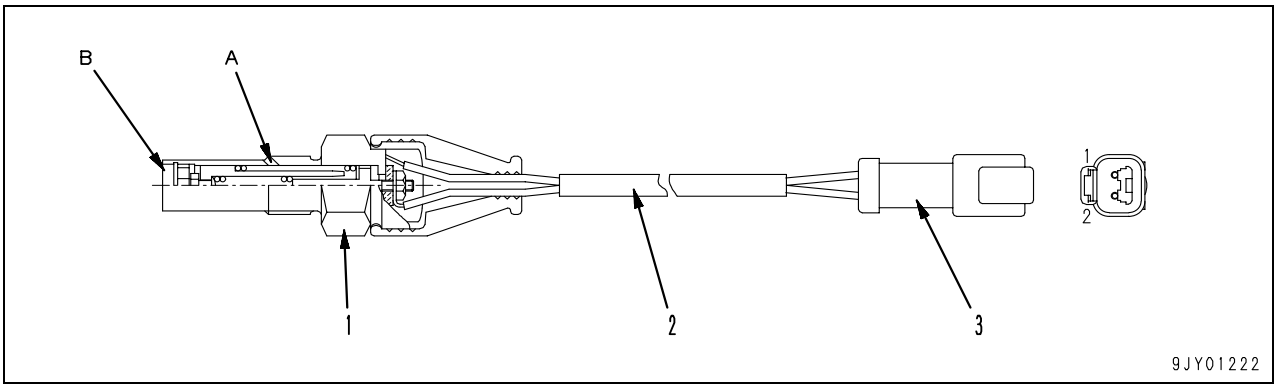


1. Indicator
2. Spring
3. Adapter

Function

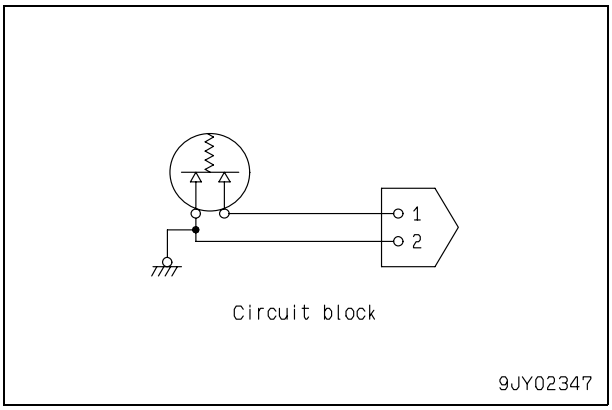
- The air cleaner clogging sensor is installed to the air cleaner outlet. If the air cleaner is clogged and the pressure reaches the specified level (negative pressure), caution lamp on the machine monitor lights up to output a warning.

Transmission clogging sensor



1. Body
2. Tube
3. Connector

A: Take-out port on low pressure side
B: Take-out port on high pressure side



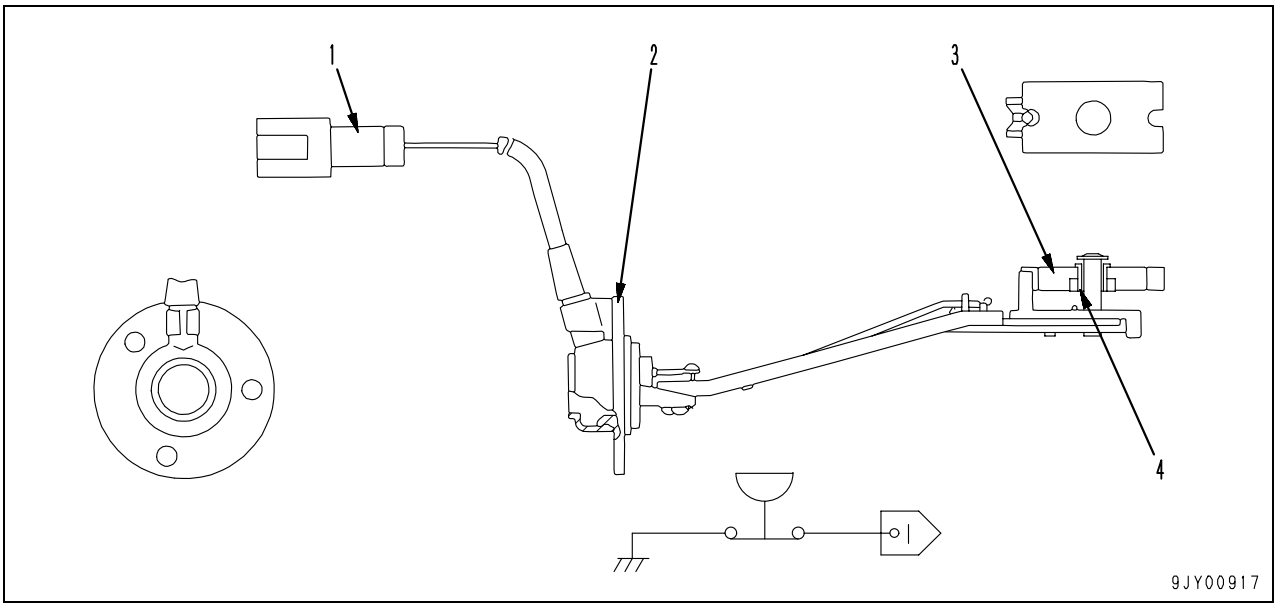
Function

- The clogging sensor is installed to the filter section. If the filter is clogged and the pressure difference between the lower and higher sides reaches a specified level, the switch turns OFF, and the maintenance caution lamp lights up. At the same time, a message appears to the character display to warn on abnormal situation.

  Operating pressure: 275 kPa {2.8 kg/cm^2}

  Principle of switching: Differential pressure sliding piston type

Engine oil level sensor

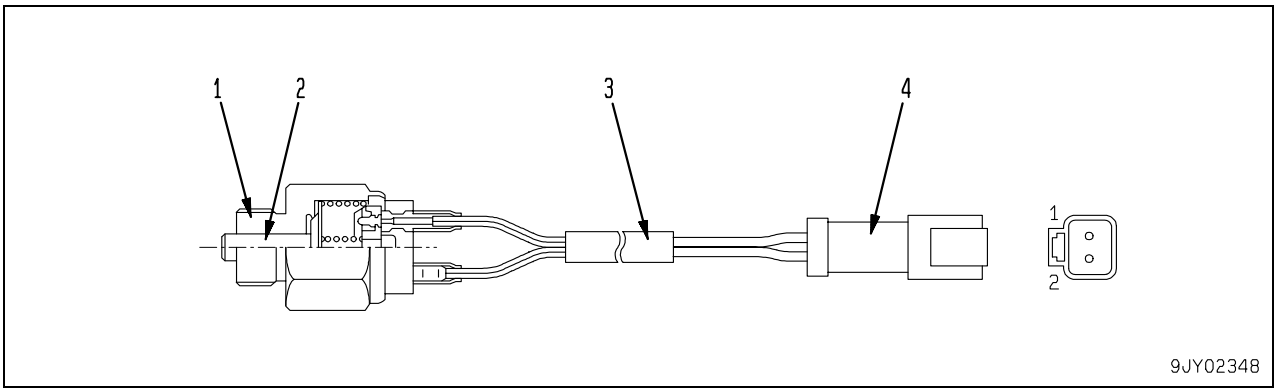


1. Connector
2. Bracket
3. Float
4. Switch

Function

- The engine oil level sensor is installed to the side of the oil pan. If the oil level lowers below the specified level, the float lowers and the switch is turned “OFF”.

Steering oil pressure sensor switch

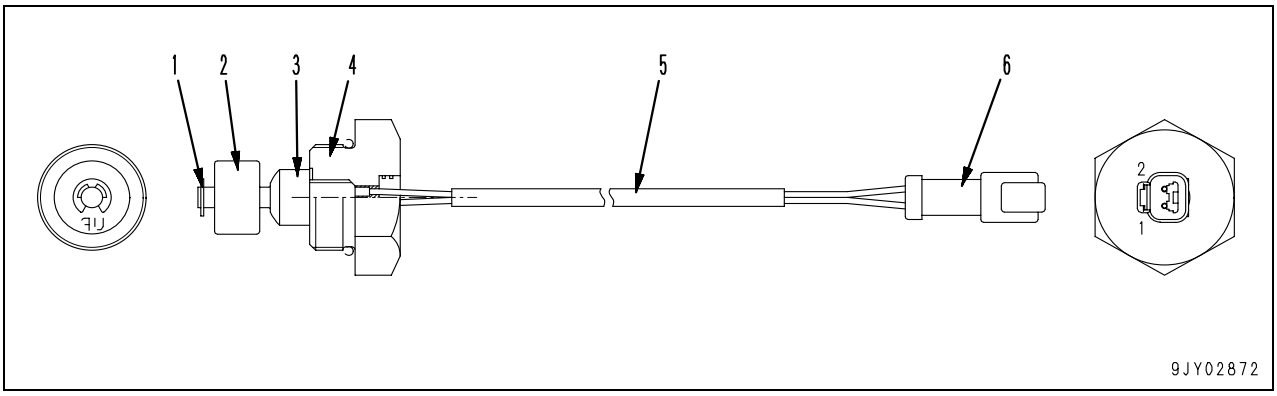


1. Body
2. Shaft
3. Tube
4. Connector

Function

- The steering oil pressure sensor switch detects operation of diverter valve spool, which is tripped to operate when the steering oil pressure drops.
- If the steering oil pressure drops and the spool operates, the switch piston is turned OFF and the circuit opens.

Radiator coolant level sensor

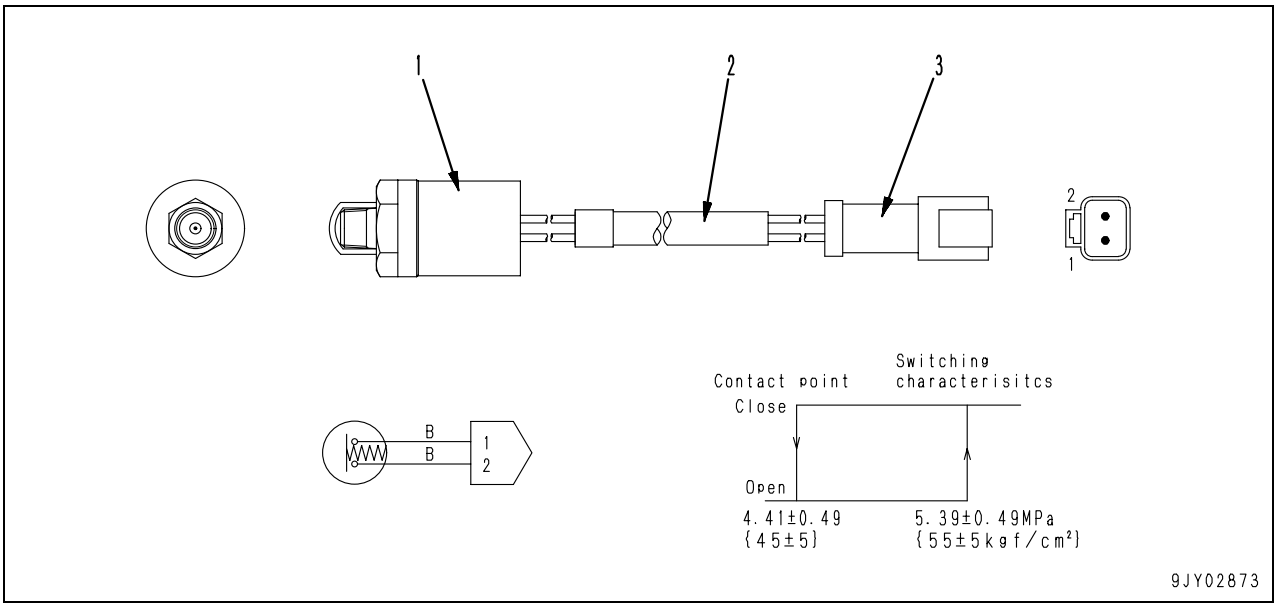


1. Stopper
2. Float
3. Sensor
4. Plug
5. Tube
6. Connector

Function

- The coolant level sensor is installed to the radiator upper tank. If the coolant level lowers below the specified level, the float lowers and the switch is turned “OFF”.

Brake accumulator pressure switch (Rear and front)

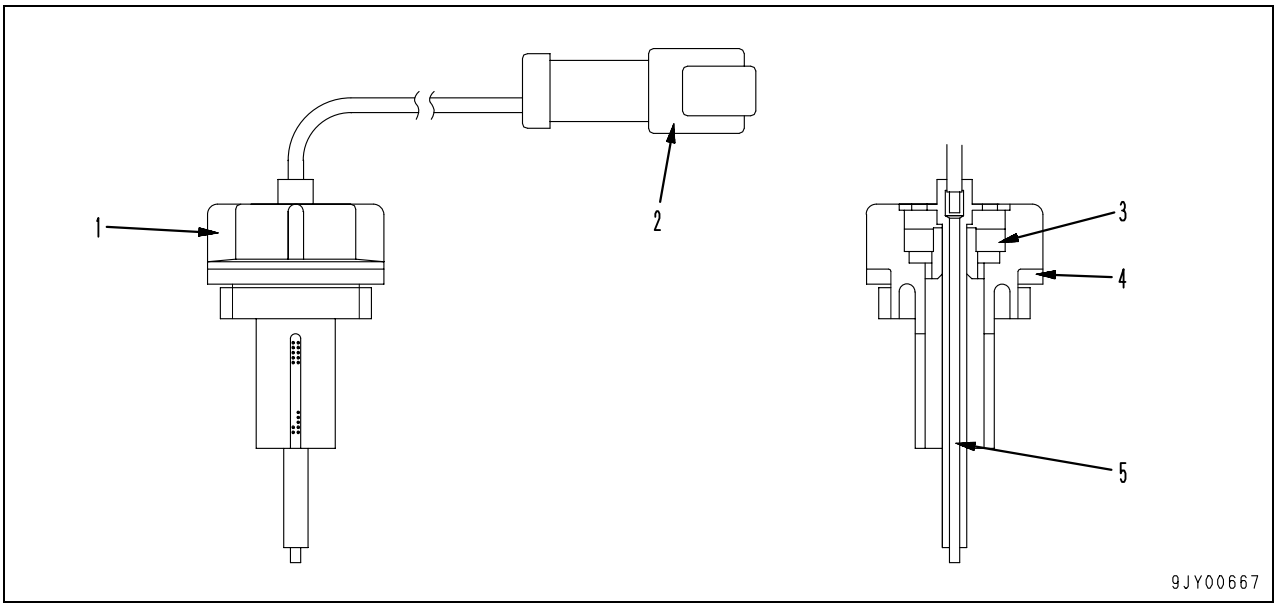


1. Case
2. Tube
3. Connector

Function

- If the brake accumulator oil pressure lowers, the contact becomes OPEN, and the caution lamp lights up on the machine monitor to warn of abnormality.

Battery electrolyte level sensor



1. Body
2. Connector
3. Filter
4. Packing
5. Pin

Function

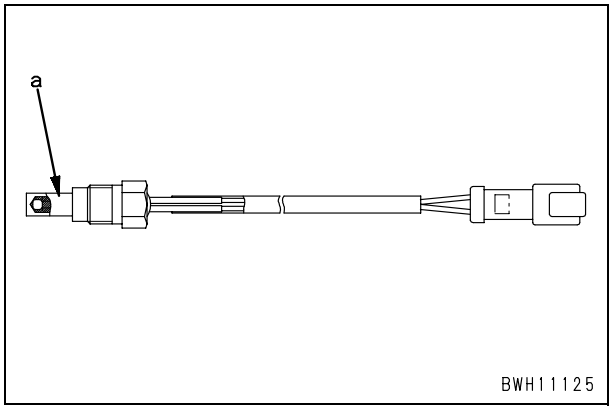
- The battery electrolyte level sensor is installed to the battery. If the battery electrolyte level lowers below the specified level, the sensor tip is exposed to air and a signal of voltage change is generated. The signal is sent to the machine monitor to warn of abnormal situation.

Atmospheric temperature sensor

Specifications

1. Power consumption: Max. 0.5 mW
2. Withstand pressure: 0.98 MPa {10 kg/cm^2}
3. Temperature detection range (ambient): –30°C to 120°C
4. Temperature conservation range: –50°C to 140°C
5. Performance table

Detected temperature (°C)	–20	–10	0	10	20	50
Resistance (kΩ)	30.32	18.58	11.74	7.623	5.077	1.712



a: Sensor heat sensitizing portion mount diameter 16 × 1.5

Function

This sensor inputs the atmospheric temperature to the VHMS controller as a variation of the thermistor resistance.

Exhaust temperature sensor and amplifier

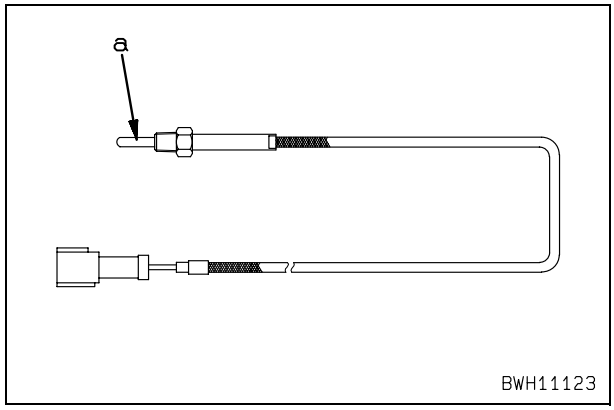
Specifications

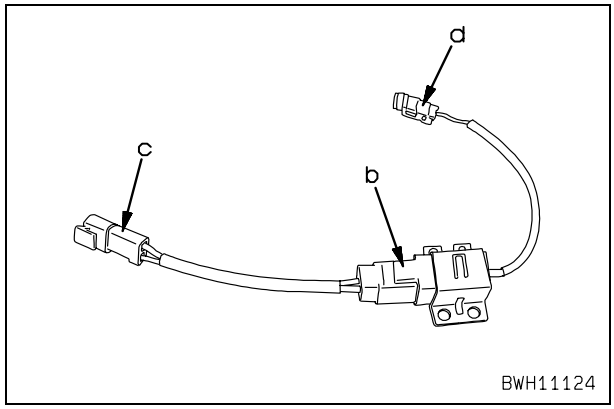
1. Rated output: DC 24 V
2. Temperature detection range:
   100 to 1000°C
   300 to 800°C (guaranteed accuracy ±10°C)
3. Output voltage characteristics: as per performance table below
4. Range of operating temperature: –40 to 110°C
5. Current consumption: Max. 30 mA

a: Sensor heat sensitizing portion mount diameter R1/8
b: Amplifier
c: Connector (power supply side)
c: Connector (sensor side)

Output voltage characteristics
(ambient temperature: 20°C)…Reference value

Detected temperature (°C)	50	100	400	700	800
Output voltage (V)	1.191	1.397	2.626	3.899	4.316





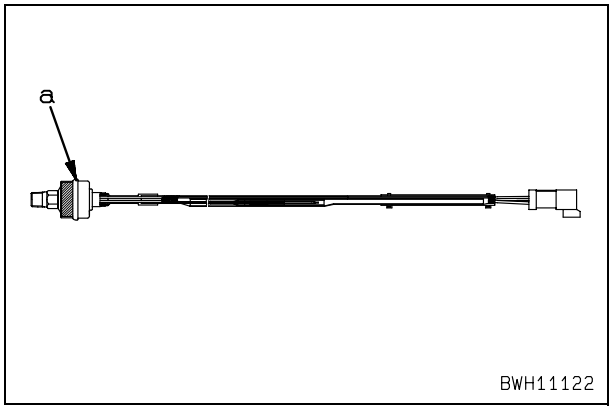
Function

A thermocouple type temperature sensor installed to the inlet port of turbocharger. It outputs the exhaust temperature data to the VHMS controller.

Blow-by pressure sensor

Specifications

1. Supply voltage: DC 5 V
2. Output voltage: 0.5 V (when engine stops) and up
3. Size: Mount (portion “a”) R1/4
   Outside diameter of pressure-receiving seat ϕ37
   Cable length 1,110 mm



Function

Converts the internal pressure of engine crankcase into voltage and inputs the data to the VHMS controller as a blow-by pressure value.

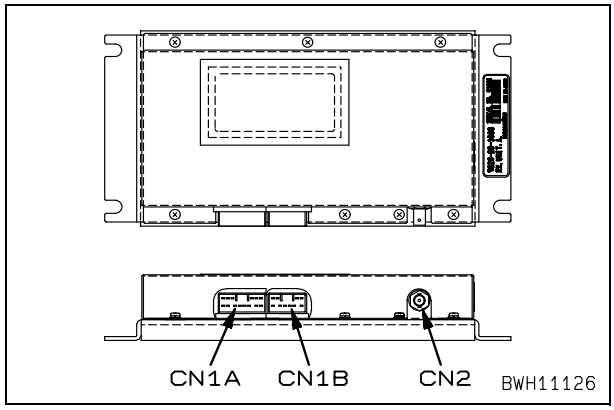
Communication (ORBCOMM) controller and antenna

Controller

Specifications
1. Operating power supply voltage: DC 12 V to DC 30 V
2. Size: W306 × D152 × H52 (mm)

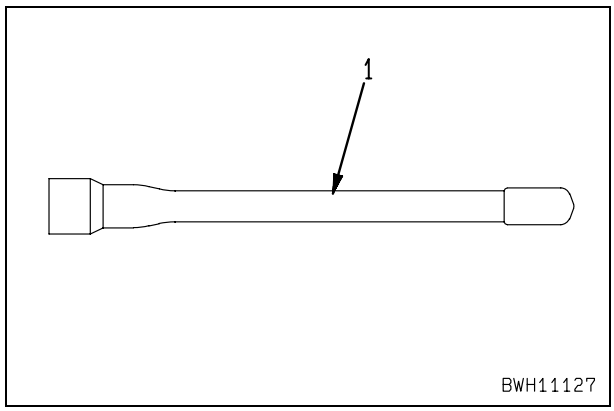
Installed position
Installed to under the auxiliary seat.

Connector section
CN1A(ORB-A): AMP070-14
CN1B(ORB-B): SMP070-10
CN2: Communication antenna cable connector

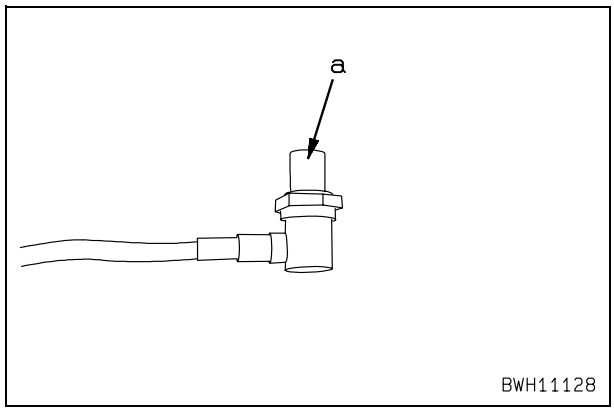


Antenna

Specifications
1. Type: helical whip antenna (1)
2. Impedance: 50 Ω
3. Input terminal: M-P type
4. Length: 165±20 mm

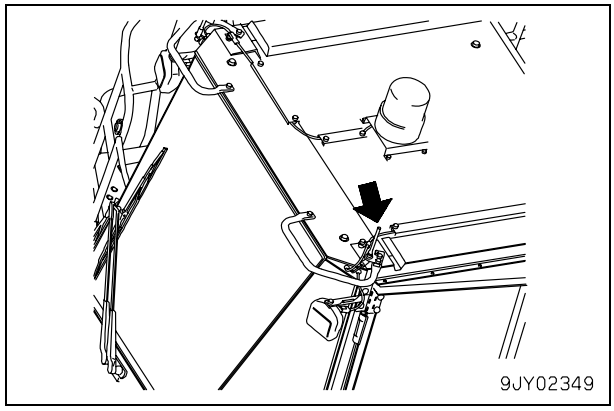


a: Communication antenna mount



Installed position
Installed on top of a pole erected on the front R.H. side of the machine body.

Function
Transmits data collected and stored by the VHMS controller to the computer center via communications satellites.



VHMS controller related

★ For details of basic precautions, outlines, see “Testing and adjusting”.

VHMS controller

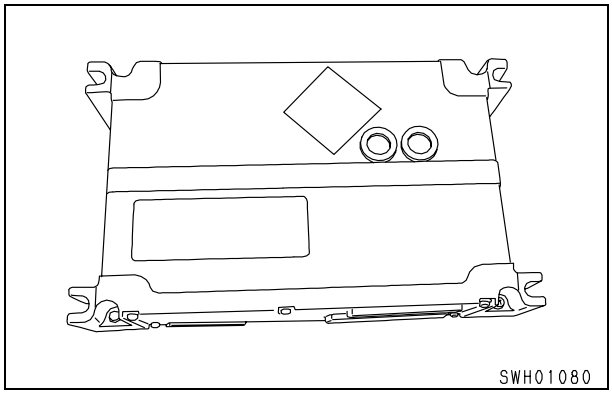
★ For details of basic precautions, outlines, method of sending and receving data, and the procedure for the initial setup, see “Testing and adjusting”.

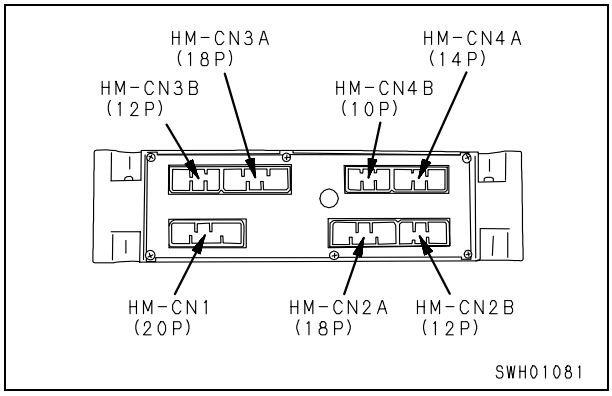
Specification

1. Voltage of power supply: DC20V – DC30V
2. Size (mm): W272 × D169 × H72

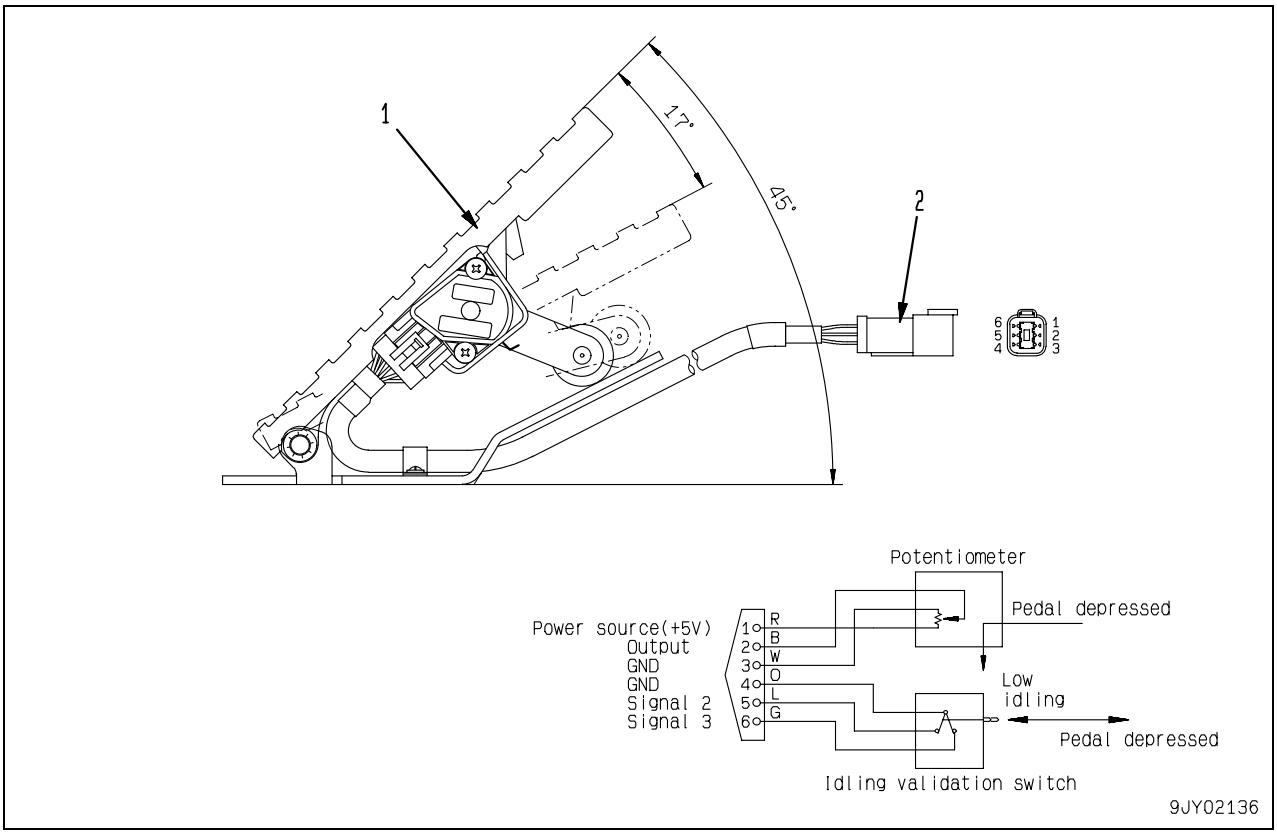
Function

The VHMS controller collects and stores signals from each sensor and signals from the machine controller. It also gives commands for transmitting the accumulated data through the communications satellite.

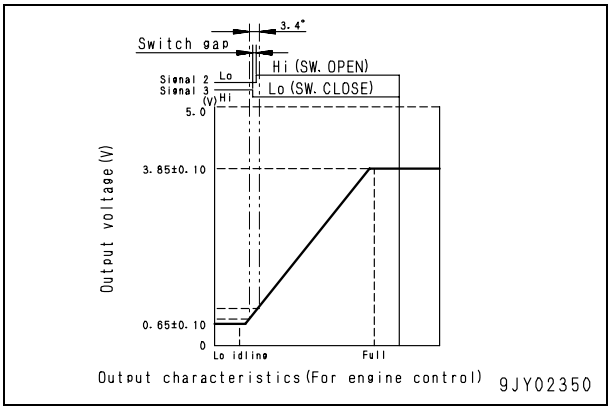




Accelerator pedal sensor



1. Pedal
2. Connector



Function

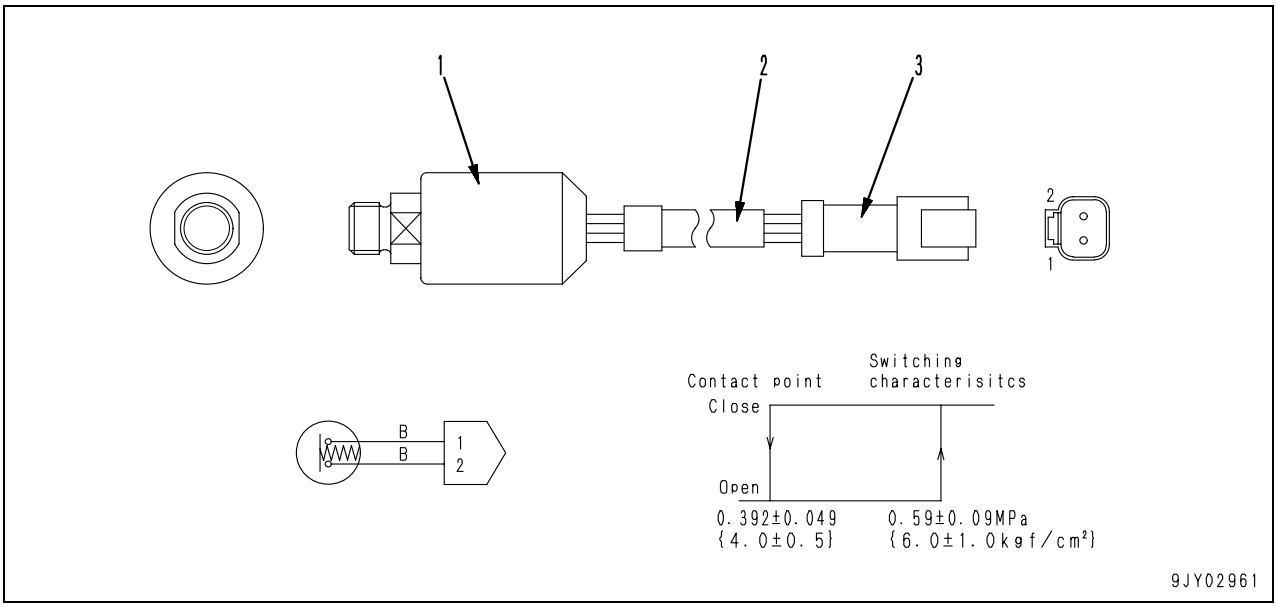
Accelerator signal

- Accelerator pedal installed to the floor is provided with accelerator sensor for the engine controller. When the accelerator pedal is stepped on, the potentiometer shaft inside the accelerator sensor starts rotation and resistance value changes accordingly. Potentiometer is applied with a constant level of voltage from the engine controller. Voltage signal is transmitted to the engine controller according to the depressed angle of accelerator pedal. In addition, the depressed angle is transmitted to each controller over the network as the accelerator pedal opening data.

Idle validation signal

- The idle validation switch is installed to the same case with the accelerator pedal sensor. While the accelerator pedal is released, signal 2 is connected to the ground. When the accelerator pedal is pressed, signal 3 is connected to the ground. The engine controller judges by these signals whether the accelerator pedal is released or pressed.

Stop lamp pressure switch

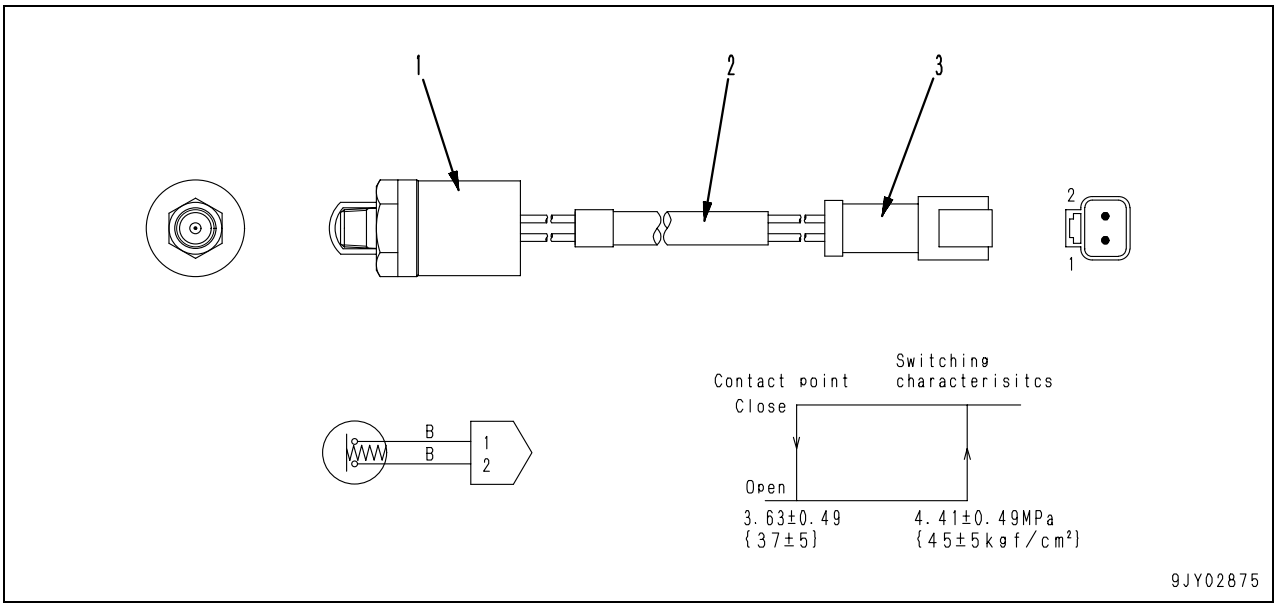


1. Case
2. Tube
3. Connector

Function

- When the foot brake is stepped on and the brake operating pressure is generated, the pressure switch contact is closed, the relay is operated and stop lamp lights up.

Emergency brake pressure switch (rear)
Emergency brake pressure switch (front)

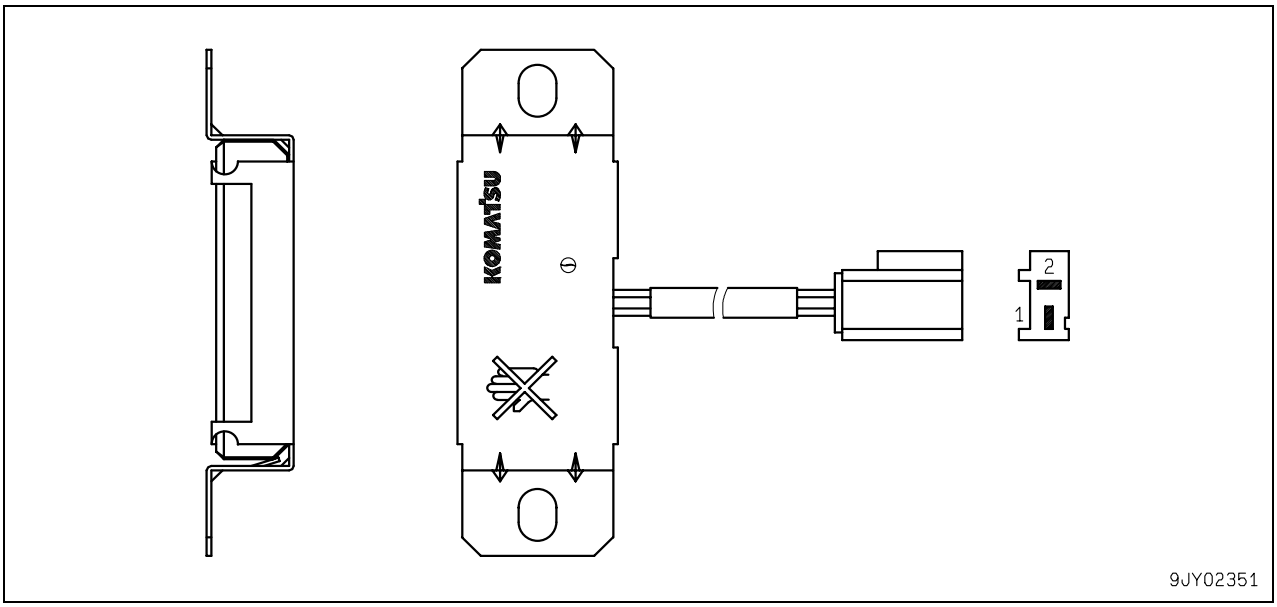


1. Case
2. Tube
3. Connector

Function

- When the brake accumulator pressure lowers, the switch contact opens. Circuit between the parking brake switch and parking brake solenoid is cut off, and the parking brake is tripped to operate.

Resistor for directly coupling modulation clutch

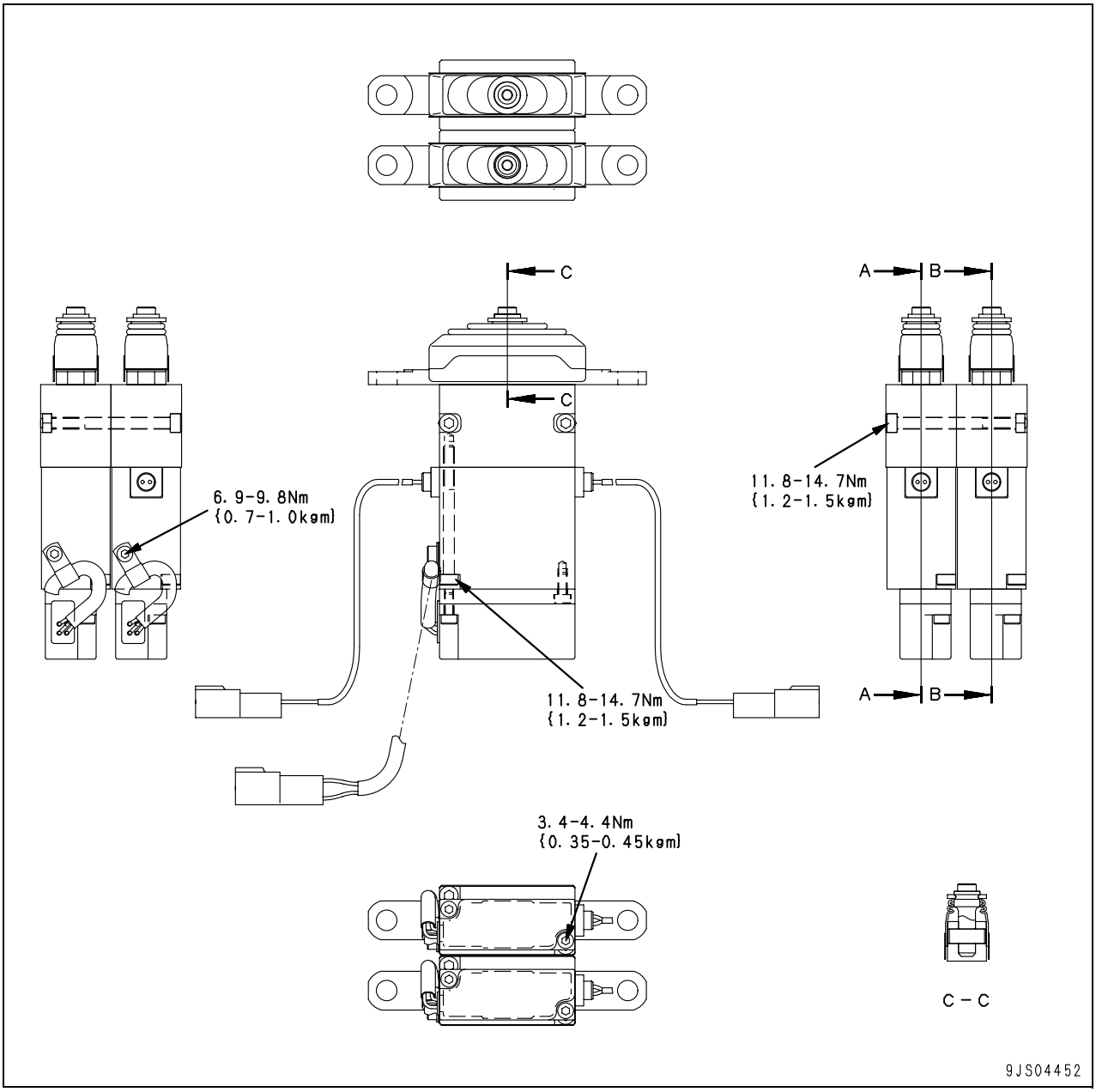


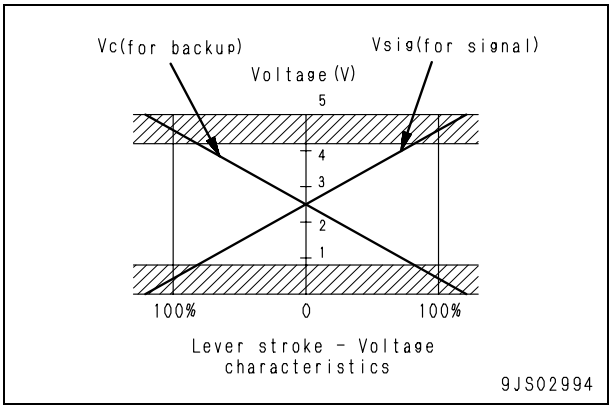
Function

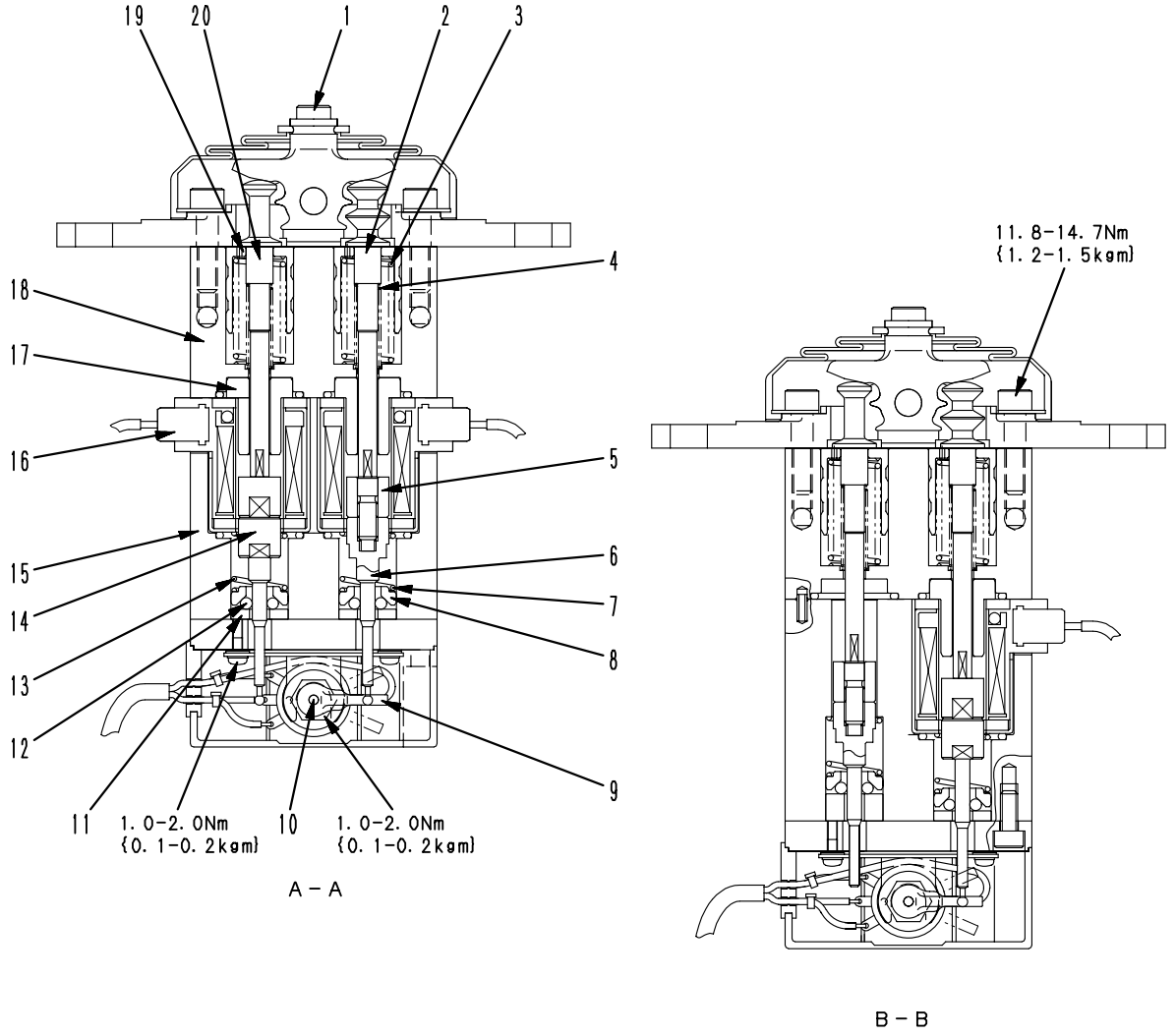
- Resistor for allowing appropriate current to flow to the ECMV solenoid for modulation clutch when the modulation clutch direct-coupling switch is turned ON.
- No current flows when the modulation clutch direct-coupling switch is turned OFF.

Resistance: 30 Ω

Work equipment electric lever







1. Lever
2. Rod
3. Centering spring
4. Metering spring
5. Nut
6. Rod
7. Detent spring
8. Retainer
9. Lever
10. Potentiometer
11. Seat
12. Ball
13. Detent spring
14. Rod
15. Body
16. Solenoid
17. Bushing
18. Body
19. Retainer
20. Rod

Function

- When lever (1) is operated, rod (20) moves up and down and rotates potentiometer (10) according to the operating distance of the lever.
- The operating angle (stroke) of the control lever is sensed with the potentiometer and output as a signal voltage to the controller.
- A potentiometer is installed, and it outputs 2 signal voltages which are opposite to each other as shown in “Lever stroke – voltage” characteristics.

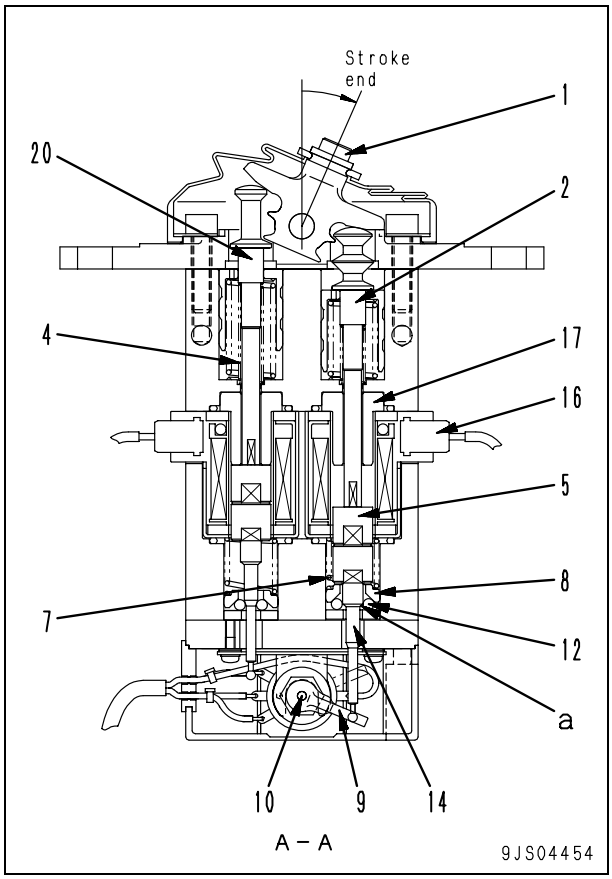
Operation

When work equipment control lever is operated

- Rod (20) is pushed up by spring (4) according to the operating distance of lever (1).
- Lever (9) and rod (14) installed to the rotary shaft of potentiometer (10) are connected to each other.
- Potentiometer (10) outputs voltage according to the vertical stroke of the rod.

When work equipment is operated to “lift arm lower” (Similar to “lift arm raise” or “bucket tilt”)

- If rod (2) on the “lift arm lower” side is pushed down by lever (1), ball (12) touches projection (a) of rod (14) in the middle of the stroke (before electric detent operation starts).
- If rods (2) and (14) are pushed in further, ball (12) pushes up retainer (8) supported on detent spring (7) and escapes out to go over projection (a) of rod (14).
- At this time, rod (20) on the opposite side is pushed up by spring (4).
- If rod (20) is pushed up while the current is flowing in solenoid (16), nut (5) is attracted by bushing (17).
- Accordingly, rod (20) is kept pushed up and the “lift arm lower” state is kept even if the lever is released.



When “lift arm lower” operation of work equipment control lever is reset

- Lever (1) is returned from the “lift arm lower” position by pushing down rod (20) with a force larger than the attractive force of the solenoid. The “lift arm lower” state also can be reset and lever (1) can be returned to the neutral position by turning off the current in solenoid.

WA600-6 Wheel loader

Form No. SEN00411-02

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

20 Standard value table

Standard service value table

Standard service value table 2
Standard service value table for engine 2
Standard service value table for chassis 3

Standard service value table

Standard service value table for engine

Machine model				WA600-6	
Engine				SAA6D170E-5	
Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Engine speed	• Engine coolant temperature: Within operating range	High idle (E-mode)	rpm	1,900 ± 50	1,900 ± 50
		High idle (P-mode)		2,000 ± 50	2,000 ± 50
		Low idle (E-mode)		800 ± 25	800 ± 25
		Low idle (P-mode)		800 ± 25	800 ± 25
		Rated speed (E-mode)		1,700	1,700
		Rated speed (P-mode)		1,800	1,800
Exhaust temperature	• All revolution ranges • Atmospheric temperature: 20°C		°C	Max. 650	700
Intake air pressure (Boost pressure)	• At rated output (P-mode)		kPa (mmHg)	Min. 147 {Min. 1,100}	133 {1,000}
Exhaust gas color	• Engine coolant temperature: Within operating range	At sudden acceleration	Bosch index	Max. 2.5	3.5
		At rated output (P-mode)		Max. 1.5	2.5
		At high idle (P-mode)		Max. 1.0	2.0
Valve clearance	• Normal temperature	Intake valve	mm	0.32	—
		Exhaust valve		0.62	—
Blow-by pressure	• At rated output (P-mode) • Engine coolant temperature: Min. 70°C		kPa (mmH_2O)	Max. 3.43 {Max. 350}	9.41 {960}
Oil pressure	• Engine oil temperature: Min. 80°C • SAE30 oil	At rated output (P-mode)	MPa {kg/cm^2}	Min. 0.34 {Min. 3.5}	0.21 {2.1}
		At low idle		Min. 0.1 {Min. 1.0}	0.08 {0.8}
Oil temperature	• All engine speed ranges (Inside oil pan)		°C	90 – 110	120
Belt tension for alternator and air conditioner compressor	Deflection made by finger pressure of about 98 N {10 kg}		mm	Auto-tensioner	Auto-tensioner

Standard service value table for chassis

*: The value shows the value before the detent.

Machine model					WA600-6	
Category	Item		Measurement conditions	Unit	Standard value for new machine	Service limit value
Transmission switch (*1)	Operating effort	N → FORWARD, REVERSE	• Engine stopped • Measure at end of switch	N {kg}	10.5 ± 1.0 {1.1 ± 0.1}	10.5 ± 1.0 {1.1 ± 0.1}
		Upshift	• Engine stopped • Measure at center of lever knob		7.0 ± 1.1 {0.7 ± 0.1}	7.0 ± 1.1 {0.7 ± 0.1}
		Downshift			7.0 ± 1.1 {0.7 ± 0.1}	7.0 ± 1.1 {0.7 ± 0.1}
Directional lever (*2)	Operating effort	N → FORWARD, REVERSE	• Engine stopped • Measure at center of lever knob	N {kg}	5.9 (+4.9/–2.9) {0.6 (+0.5/–0.3)}	Max. 16.7 {Max. 1.7}
	Stroke	N → FORWARD, REVERSE		mm	35 ± 10	35 ± 10
Gearshift lever (*2)	Operating effort	1st → 2nd	• Engine stopped • Measure at center of lever knob	N {kg}	5.9 (+4.9/–2.9) {0.6 (+0.5/–0.3)}	Max. 16.7 {Max. 1.7}
		2nd → 3rd			5.9 (+4.9/–2.9) {0.6 (+0.5/–0.3)}	Max. 16.7 {Max. 1.7}
		3rd → 4th			5.9 (+4.9/–2.9) {0.6 (+0.5/–0.3)}	Max. 16.7 {Max. 1.7}
	Stroke	1st → 2nd		mm	35 ± 10	35 ± 20
		2nd → 3rd			35 ± 10	35 ± 20
		3rd → 4th			35 ± 10	35 ± 20
Work equipment control lever	Operating effort	Lift arm: HOLD → RAISE (*)	• Engine speed: Low idle • Hydraulic oil temperature: 45 – 55°C	N {kg}	Max. 23.5 {Max. 2.4}	Max. 35.3 {Max. 3.6}
		Lift arm: RAISE → HOLD			Max. 19.6 {Max. 2.0}	Max. 29.4 {Max. 3.0}
		Lift arm: HOLD → LOWER (*)			Max. 15.7 {Max. 1.6}	Max. 23.5 {Max. 2.4}
		Lift arm: LOWER → HOLD			—	—
		Lift arm: LOWER → FLOAT			Max. 23.5 {Max. 2.4}	Max. 35.3 {Max. 3.6}
		Lift arm: FLOAT → HOLD			Max. 19.6 {Max. 2.0}	Max. 29.4 {Max. 3.0}
		Bucket: HOLD → DUMP			Max. 16.7 {Max. 2.0}	Max. 25.5 {Max. 2.6}
		Bucket: HOLD → TILT (*)			Max. 23.5 {Max. 2.4}	Max. 35.3 {Max. 3.6}
		Bucket: TILT → HOLD			Max. 19.6 {Max. 2.0}	Max. 29.4 {Max. 3.0}
	Stroke	Lift arm: HOLD ⟷ RAISE (*)	• Engine speed: Low idle • Hydraulic oil temperature: 45 – 55°C	mm	37 ± 10	37 ± 15
		Lift arm: HOLD ⟷ LOWER (*)			37 ± 10	37 ± 15
		Lift arm: HOLD ⟷ FLOAT			45 ± 10	45 ± 15
		Bucket: HOLD → DUMP			45 ± 10	45 ± 15
		Bucket: HOLD → TILT (*)			37 ± 10	37 ± 15

(*1): AJSS specification
(*2): Steering wheel specification

Machine model					WA600-6	
Category	Item		Measurement conditions	Unit	Standard value for new machine	Service limit value
Steering wheel	Play		• Engine stopped • Machine facing straight to front	mm	Max. 40	50 – 100
	Operating effort		• Flat, level, straight, dry, and paved road • Engine speed: Low idle (Bucket empty)	N {kg}	10.0 ± 3 {1.0 ± 0.3}	Max. 19.6 {Max. 2.0}
	Turns (Not including play)		• Engine speed: High idle • Left lock – right lock	Turns	3.9 ± 0.3	Max 4.5
	Operating time	Low idle	• Engine started • Hydraulic oil temperature: 45 – 55°C • Left lock – right lock	sec.	Max. 7.2	Max. 8.0
		High idle (P-mode)			Max. 4.2	Max. 5.0
Accelerator pedal	Operating effort		• Engine started • Measure at 150 mm from fulcrum of pedal.	N {kg}	53.9 – 73.6 {5.5 – 7.5}	Max. 107.9 {11.0}
	Operating angle	Neutral (a1)	★For measuring posture, see Fig. A at end of this section • Engine speed: Low idle • Hydraulic oil temperature: Within operating range	deg.	57	—
		Max. (a3)			40	—
Brake pedal	Operating effort		★For measuring posture, see Fig. B at end of this section • Engine speed: Low idle • Hydraulic oil temperature: Within operating range	N {kg}	Max. 294 ± 29.4 {Max. 30 ± 3}	Max. 421.4 {Max. 43}
	Operating angle	Neutral (a1)		deg.	45	—
		Max. (a2)			15(+4/0)	—
	Play			mm	5 ± 0.5	—
Tire	Fitting of wheel lock ring	A	★For measuring posture, see Fig. C at end of this section • Tire inflation pressure: Specified pressure	mm	Max. 2.5	—
		B			Max. 4.0	—
	Clearance of wheel lock ring	C			2 – 15	—
Engine speed	Torque converter stall		• Engine coolant temperature: Within operating range • Torque converter oil temperature: Within operating range • Hydraulic oil temperature: Within operating range	P-mode	rpm	1,800 ± 100	1,800 ± 200
				E-mode		1,730 ± 100	1,730 ± 200
	Hydraulic stall			P-mode		1,940 ± 100	1,940 ± 200
				E-mode		1,830 ± 100	1,830 ± 200
	Torque converter stall + hydraulic stall			P-mode		1,680 ± 100	1,680 ± 300
				E-mode		1,590 ± 100	1,590 ± 300
AJSS lever	Play		• Engine stopped • Machine facing straight to front	deg.	Max. 8	Max. 10
	Operating effort		• Flat, level, straight, dry, and paved road	N {kg}	13.7 ± 4.9 {1.4 ± 0.5}	23.5 {2.4}
	Operating angle		• Engine speed: High idle • Left lock – right lock	deg.	86 ± 5	Max. 95
	Operating time	Low idle	• Engine started • Hydraulic oil temperature: Within operating range • Left lock – right lock	sec.	Max. 6.6	Max. 7.6
		High idle (P-mode)			Max. 3.5	Max. 4.5

Machine model					WA600-6	
Category	Item		Measurement conditions	Unit	Standard value for new machine	Service limit value
Transmission, torque converter	Main relief pressure	Low idle	• Torque converter oil temperature: Within operating range • Working mode: P-mode	MPa {kg/cm^2}	Min. 3.09 {Min. 31.5}	Min. 3.09 {Min. 31.5}
		High idle			3.65 ± 0.2 {37.2 ± 2.0}	3.65 ± 0.2 {37.2 ± 2.0}
	Torque converter inlet port oil pressure		• Torque converter oil temperature: Within operating range • Working mode: P-mode • Engine speed: High idle		0.94 ± 0.2 {9.6 ± 2.0}	0.94 ± 0.2 {9.6 ± 2.0}
	Torque converter outlet port oil pressure				0.57 ± 0.1 {5.8 ± 1.0}	0.57 ± 0.1 {5.8 ± 1.0}
	Modulation clutch oil pressure				2.48 ± 0.2 {25.3 ± 2.0}	2.48 ± 0.2 {25.3 ± 2.0}
	Lubrication oil pressure				0.12 ± 0.06 {1.2 ± 0.6}	0.12 ± 0.06 {1.2 ± 0.6}
	ECMV output (clutch) oil pressure	F clutch	• Torque converter oil temperature: Within operating range • Working mode: P-mode • Engine speed: High idle • Manual switch: ON		2.68 ± 0.2 {27.3 ± 2}	2.68 ± 0.2 {27.3 ± 2}
		R clutch			3.12 ± 0.2 {31.8 ± 2.0}	3.12 ± 0.2 {31.8 ± 2.0}
		1st clutch			3.07 ± 0.2 {31.3 ± 2.0}	3.07 ± 0.2 {31.3 ± 2.0}
		2nd clutch			2.09 ± 0.2 {31.3 ± 2.0}	2.09 ± 0.2 {31.3 ± 2.0}
		3rd clutch			3.07 ± 0.2 {31.3 ± 2.0}	3.07 ± 0.2 {31.3 ± 2.0}
		4th clutch			3.07 ± 0.2 {31.3 ± 2.0}	3.07 ± 0.2 {31.3 ± 2.0}
		Lockup clutch			1.84 ± 0.2 {18.8 ± 2.0}	1.84 ± 0.2 {18.8 ± 2.0}
Steering	Steering relief pressure		• Hydraulic oil temperature: 45 – 55°C • Engine speed: High idle (P-mode)	MPa {kg/cm^2}	33.3 ± 0.98 {340 ± 10}	33.3 ± 0.98 {340 (+10/–20)}
	AJSS EPC pressure		• Hydraulic oil temperature: 45 – 55°C • Engine speed: High idle (P-mode) • Operating AJSS fuly • Frame lock bar: Lock position		2.45 ± 0.1 {25 ± 1}	2.45 ± 0.2 {25 ± 2}
	Pilot circuit pressure		• Hydraulic oil temperature: 45 – 55°C • Engine speed: High idle (P-mode) • Steering wheel or AJSS operation		Min. 0.49 {Min. 5}	Min. 0.49 {Min. 5}
	Steering control oil pressure		• Hydraulic oil temperature: 45 – 55°C • Engine speed: High idle (P-mode)		1.18 – 1.47 {12 – 15}	0.98 – 1.67 {10 – 17}
Accumulator	Charge cut-in pressure		• Engine speed: Low idle • Hydraulic oil temperature: Within operating range	• Point where brake oil pressure warning lamp goes out	5.88 (+0.49/0) {60 (+5/0)}	5.88 (+0.98/–0.49) {60 (+10/–5)}
	Charge cut-out pressure			• Point where oil pressure is going up and then starts to go down	9.8 (+0.98/0) {100 (+10/0)}	9.8 (+1.47/–0.49) {100 (+15/–5)}

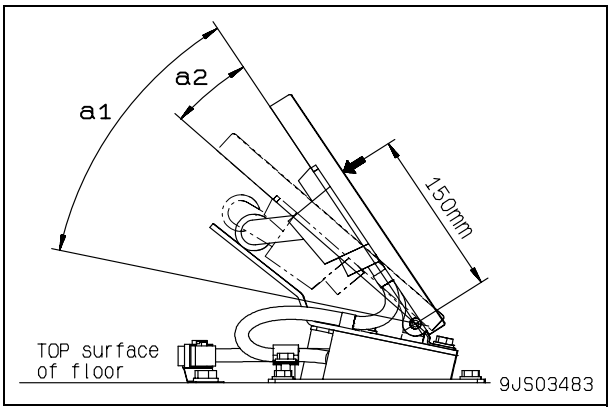
Machine model						WA600-6	
Category	Item	Measurement conditions			Unit	Standard value for new machine	Service limit value
Power train	Travel speed (Bucket empty)	FORWARD	P-mode • ( ): at lockup	1st	km/h	6.7 ± 0.3	6.7 ± 0.3
				2nd		11.7 ± 0.6 (12.4 ± 0.6)	11.7 ± 0.6 (12.4 ± 0.6)
				3rd		20.3 ± 1.0 (21.7 ± 1.1)	20.3 ± 1.0 (21.7 ± 1.1)
				4th		33.8 ± 1.7 (33.7 ± 1.7)	33.8 ± 1.7 (33.7 ± 1.7)
			E-mode • ( ): at lockup	1st		6.6 ± 0.3	6.6 ± 0.3
				2nd		11.5 ± 0.6 (12.1 ± 0.6)	11.5 ± 0.6 (12.1 ± 0.6)
				3rd		19.4 ± 1.0 (20.9 ± 1.0)	19.4 ± 1.0 (20.9 ± 1.0)
				4th		31.5 ± 1.6 (31.7 ± 1.6)	31.5 ± 1.6 (31.7 ± 1.6)
Power train	Travel speed (Bucket empty)	REVERSE	P-mode • ( ): at lockup	1st		7.3 ± 0.4	7.3 ± 0.4
				2nd		12.8 ± 0.6 (13.5 ± 0.7)	12.8 ± 0.6 (13.5 ± 0.7)
				3rd		22.0 ± 1.1 (23.7 ± 1.2)	22.0 ± 1.1 (23.7 ± 1.2)
				4th		37.0 ± 1.9 (41.0 ± 2.1)	37.0 ± 1.9 (41.0 ± 2.1)
			E-mode • ( ): at lockup	1st	km/h	7.3 ± 0.4	7.3 ± 0.4
				2nd		12.5 ± 0.6	12.5 ± 0.6
				3rd		21.1 ± 1.1	21.1 ± 1.1
				4th		34.0 ± 1.7	34.0 ± 1.7
Wheel brake	Brake oil pressure	• Hydraulic oil temperature: Within operating range			MPa {kg/cm^2}	4.9 (+0.69/0) {50 (+7/0)}	4.9 (+0.88/–0.2) {50 (+9/–2)}
	Drop in brake pressure	• Engine stopped • Keep brake pedal depressed at 4.9 MPa {50 kg/cm^2} and measure drop in oil pressure after 5 min.				Max. 0.49 {Max. 5}	Max. 0.49 {Max. 5}
	Performance	• Tire inflation pressure: Specified pressure • Flat, level, straight, dry, and paved road • Speed when applying brake: 20 km/h, braking delay: Within 0.1 sec. • Brake pedal operating effort: Specified operating effort 29.4 ± 2.94 N {30 ± 3 kg} • Measure braking distance			m	Max. 5	Max. 5
	Disc wear	• Measure with disc wear indicator			mm	0	Max. 5.5

Machine model						WA600-6	
Category	Item			Measurement conditions	Unit	Standard value for new machine	Service limit value
Parking brake	Parking brake inlet pressure			• Torque converter oil temperature: Within operating range • Engine speed: Low idle	MPa {kg/cm^2}	Min. 2.45 {Min. 25.0}	Min. 2.45 {Min. 25.0}
	Parking brake pilot pressure					Min. 3.09 {Min. 31.5}	Min. 3.09 {Min. 31.5}
	Parking brake solenoid valve output pressure					Min. 2.45 {Min. 25.0}	Min. 2.45 {Min. 25.0}
	Performance			• Tire inflation pressure: Specified pressure • Flat paved road with 1/5 (11° 20') grade. Dry, paved road surface • Machine at operating condition	—	Holds in position	Holds in position
	Disc thickness				mm	3.2 ± 0.08	Min. 2.97
Work equipment EPC	EPC valve basic pressure (Orbit-roll input pressure)			• Hydraulic oil temperature: 45 – 55°C • Engine speed: High idle (P-mode)	MPa {kg/cm^2}	4.02 (+0.2/0) {41 (+2/0)}	4.02 (+0.2/–0.2) {41 (+2/–2)}
	EPC valve output pressure	Lift arm RAISE, FLOAT; Bucket DUMP, TILT, Lift arm LOWER		• Hydraulic oil temperature: Within operating range • Engine speed: High idle (P-mode) • Control lever operated fully		3.72 (+0.2/0) {38 (+2/0)}	3.72 (+0.2/–0.2) {38 (+2/–2)}
Work equipment	Work equipment relief pressure			• Hydraulic oil temperature: Within operating range • Engine speed: High idle	MPa {kg/cm^2}	33.3 (1.47 ± 0.49) {340 (+15/–5)}	33.3 ± 1.47 {340 ± 15}
	Unload pressure			• Hydraulic oil temperature: 45 – 55°C • Engine speed: High idle (P-mode) • Work equipment control lever: Neutral		3.14 ± 0.29 {32 ± 3}	3.14 ± 0.59 {32 ± 6}
	LS differential pressure			• Hydraulic oil temperature: 45 – 55°C • Engine speed: High idle (P-mode) • Lift arm lever: at half stroke		1.67 ± 0.2 {17 ± 2}	1.67 ± 0.39 {17 ± 4}
	Work equipment speed	Lift arm RAISE		• Hydraulic oil temperature: Within operating range • Engine speed: High idle • Apply no load ★For measuring posture, see Figs. F and G at end of this section	P-mode	8.6 ± 0.5	Max. 10.5
					E-mode	9.1 ± 0.5	Max. 11.1
		Lift arm LOWER			P-mode	4.1 ± 0.5	Max. 5.3
					E-mode	4.2 ± 0.5	Max. 5.4
		Bucket tilt back	Bucket full stroke	• Hydraulic oil temperature: Within operating range • Engine speed: High idle • Apply no load ★For measuring posture, see Figs.H and J at end of this section	P-mode	3.0 ± 0.3	Max. 4.0
					E-mode	3.2 ± 0.3	Max. 4.2
			Moving bucket from level position		P-mode	2.0 ± 0.3	Max. 2.9
					E-mode	2.1 ± 0.3	Max. 3.0
	Hydraulic drift	Retraction of lift arm cylinder rod		• Hydraulic oil temperature: Within operating range • Stop engine and leave for 5 minutes, then measure for 15 minutes. ★Apply no load to bucket and set lift arm and bucket in level position. ★For measuring posture, see Fig.K at end of this section	mm	Max. 40	Max. 40
		Retraction of bucket cylinder rod				Max. 20	Max. 20
	Proximity switch	Clearance of bucket positioner proximity switch			mm	3 – 5	—

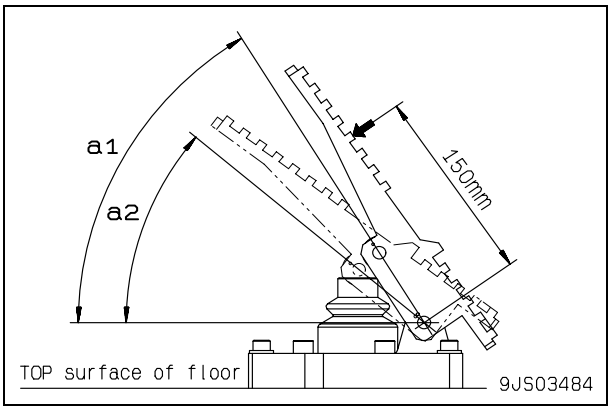
Machine model				WA600-6	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Hydraulic drive fan	Max. fan speed	• Engine speed: High idle (P-mode) • Engine coolant temperature: Min. 95°C • Hydraulic oil temperature: Min. 95°C • Torque converter oil temperature: Min. 105°C	rpm	980 ± 50	980 ± 100
	Min. fan speed	• Engine speed: High idle • Engine coolant temperature: Max. 75°C • Hydraulic oil temperature: Max. 75°C • Torque converter oil temperature: Max. 85°C		200 ± 30	200 ± 50
	Fan drive pressure	• Engine speed: High idle (P-mode) • Engine coolant temperature: Min. 95°C • Hydraulic oil temperature: Min. 95°C • Torque converter oil temperature: Min. 105°C	Mpa {kg/cm^2}	19.6 ± 2.5 {200 ± 25}	19.6 ± 2.5 {200 ± 25}
	Fan reverse solenoid output pressure	• Engine speed: High idle (P-mode) • Engine coolant temperature: Min. 95°C • Hydraulic oil temperature: Min. 95°C • Torque converter oil temperature: Min. 105°C		25 ± 2.5 {255 ± 25}	25 ± 2.5 {255 ± 25}

Machine posture and procedure for performance measurement

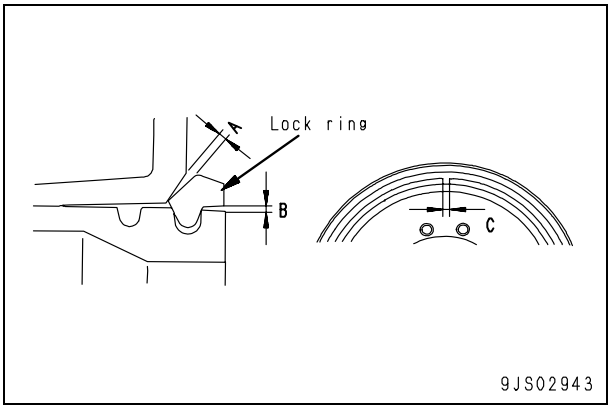
★ **Fig. A**



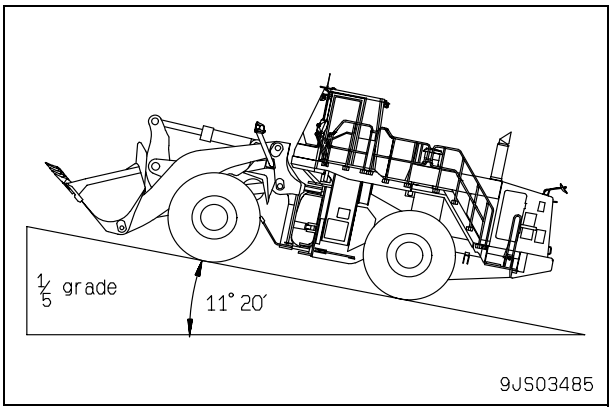
★ **Fig. B**



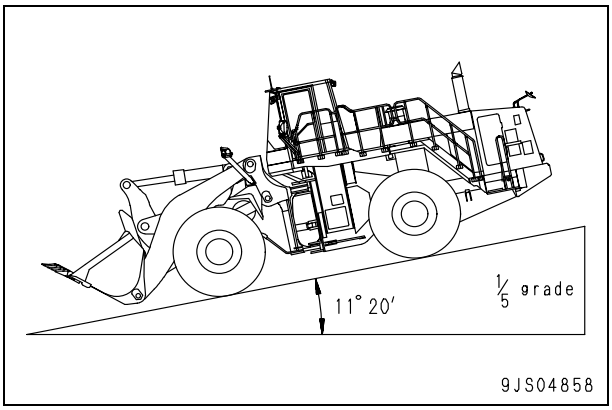
★ **Fig. C**



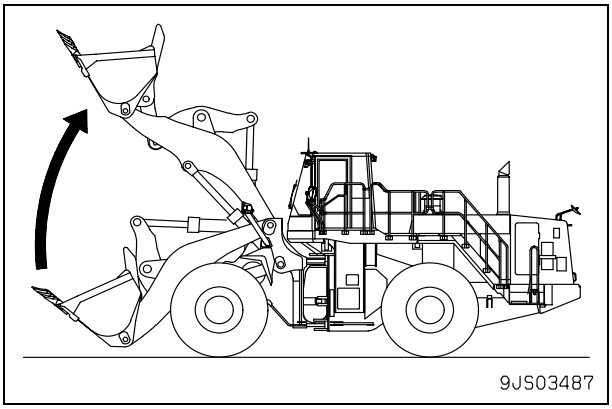
★ **Fig. D**



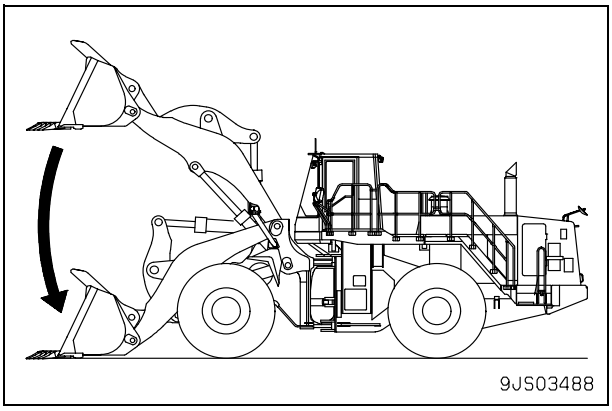
★ **Fig. E**



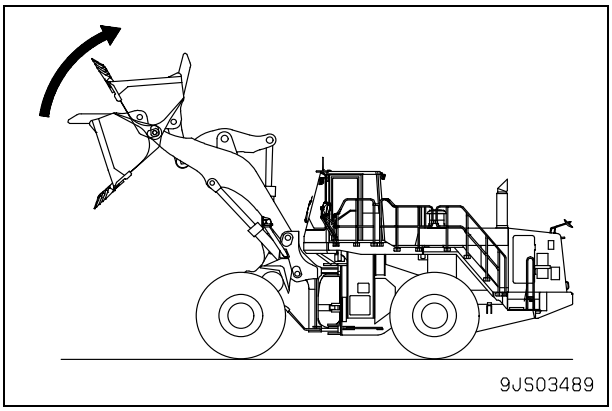
★ **Fig. F**



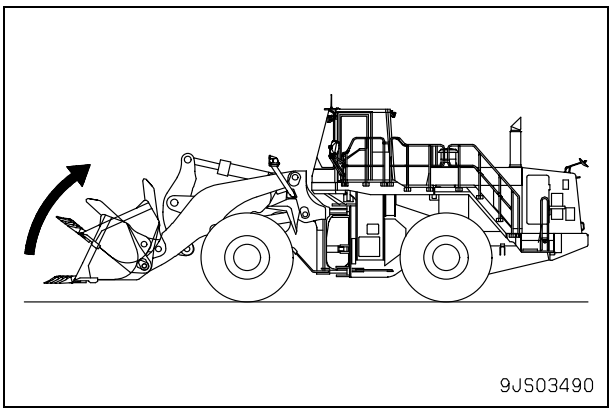
★ Fig. G



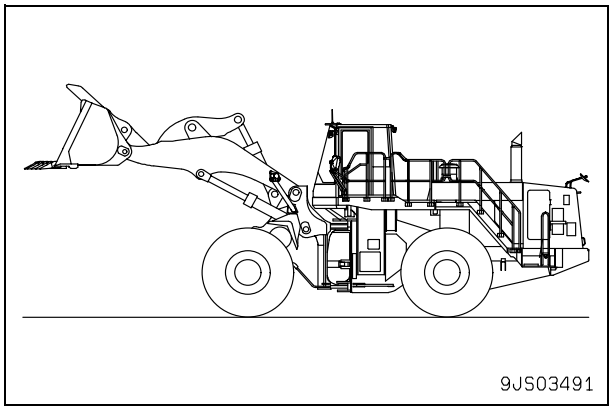
★ Fig. H



★ Fig. J



★ Fig. K



WA600-6 Wheel loader

Form No. SEN00552-01

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

30 Testing and adjusting

Testing and adjusting, Part 1

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Testing and adjusting, Part 1

Tools for testing, adjusting, and troubleshooting

Testing and adjusting item	Symbol		Part No.	Part Name	Q'ty	Remarks
Measuring exhaust gas color	A	1	799-201-9001	Handy smoke checker	1	Bosch index: Level 0 – 9
		2	Commercially available	Smoke meter	1	
Measuring exhaust temperature	B		799-101-1502	Digital thermometer	1	–99.9 – 1,299°C
Adjusting valve clearance	C		Commercially available	Clearance gauge	1	
Measuring compression pressure	D	1	799-502-1590	Compression gauge	1	0 – 6.9 MPa {0 – 70 kg/cm^2}
		2	795-611-1220	Adapter	1	
			6261-71-6150	Gasket	1	
		3	795-799-5410	Adapter	1	
			795-799-5420	Remover	1	
Measuring blow-by pressure	E		799-201-1504	Blow-by checker	1	0 – 5 kPa {0 – 500 mmH_2O}
Measuring engine oil pressure	F	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-401-2320	Hydraulic tester	1	Pressure gauge: 0.98 MPa {10 kg/cm^2}
		3	799-101-5230	Nipple	1	14 × 1.5 mm
			6215-81-9720	O-ring	1	
Measuring intake air (boost) pressure	G	1	799-201-2202	Boost gauge kit	1	–101 – 200 kPa {–760 – 1,500 mmHg}
Measuring fuel compression	H	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-101-5160	Nipple	1	
		3	799-401-2320	Hydraulic tester	1	Pressure gauge: 0.98 MPa {10 kg/cm^2}
Testing leakage from pressure limiter and return rate of injector	J	1	6167-11-6640	Spacer	1	Inside diameter: 10 mm
		2	6206-71-1770	Joint	1	Inside diameter of joint: 10 mm
		3	Commercially available	Hose	1	Ø 5 mm × 2 – 3 m
		4	Commercially available	Hose	1	Ø 15 mm × 2 – 3 m
		5	Commercially available	Measuring cylinder	1	
		6	Commercially available	Stopwatch	1	
Measuring directional lever	K		79A-264-0021	Push-pull scale	1	0 – 294 N {0 – 30 kg}

Testing and adjusting item	Symbol		Part No.	Part Name	Q'ty	Remarks
Testing power train oil pressure	L	1	799-101-5002	Hydraulic tester	1	Pressure gauge:2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-101-5220	Nipple	1	10 × 1.25 mm
			07002-11023	O-ring	1	Pressure gauge: 0.98 MPa {10 kg/cm^2}
Method of moving machine when transmission valve is broken	M		794-423-1190	Plug	1	M20 × 1.5
Measuring operating effort of AJSS lever	N		79A-264-0021	Push-pull scale	1	0 – 294 N {0 – 30 kg}
Testing and adjusting steering wheel	P		79A-264-0021	Push-pull scale	1	0 – 294 N {0 – 30 kg}
Testing and adjusting steering oil pressure	Q	1	799-101-5002	Hydraulic tester	1	Pressure gauge:2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1203	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-101-5220	Nipple	1	Size: M10 × 1.25
			07002-11023	O-ring	1	
		3	799-401-2701	Differential pressure gauge	1	
		4	799-401-3200	Adapter	1	Size 03
Testing hydraulic drive fan	R	1	799-205-1100	Tachometer kit	1	Digital indication: 6 – 99999.9 rpm
		2	799-101-5002	Hydraulic tester	1	Pressure gauge:2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		3	799-101-5220	Nipple	1	Size: M10 × 1.25
			07002-11023	O-ring	1	
			799-401-3500	Adapter	1	Size 06
Bleeding air from hydraulic drive fan circuit	S	1	799-101-5002	Hydraulic tester	1	Pressure gauge:2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-101-5220	Nipple	1	Size: M10 × 1.25
			07002-11023	O-ring	1	
		3	799-401-3500	Adapter	1	Size 06
		4	790-261-1130	Coupling	1	
Testing and adjusting accumulator charge pressure	T		799-101-5002	Hydraulic tester		Pressure gauge:2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
Testing wheel brake oil pressure	U	1	793-520-1821	Nipple	1	
		2	793-520-1810	Joint	1	
		3	385-10178481	Bleeder screw	1	
		4	793-520-1831	Case assembly	1	M20 × 1.5 (R1/8)
Measuring wear of wheel brake disc	V		Commercially available	Slide calipers	1	

Testing and adjusting item	Symbol		Part No.	Part Name	Q'ty	Remarks
Testing parking brake oil pressure	W	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-101-5220	Nipple	1	Size: M10 × 1.25
			07002-11023	O-ring		
		3	799-401-3100	Adapter	1	Size 02
Testing wear of parking brake disc	X		Commercially available	Slide calipers	1	
Measuring and adjusting work equipment control lever	Y	1	79A-264-0021	Push-pull scale	1	
		2	Commercially available	Scale	1	
Testing and adjusting work equipment oil pressure	Z	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-101-5220	Nipple		Size: M10 × 1.25
			07002-11023	O-ring		
		3	799-401-2701	Differential pressure gauge	1	
Moving machine when removing operator cab	ZA	1	426-06-32171	Wiring harness	1	
		2	08086-10000	Starting switch	1	
		3	421-06-36142	Parking brake switch	1	
VHMS controller initial setting procedure	ZB	1	799-608-3101	Service kit	1	
			• 799-608-3210	• Diskette	1	
			• 799-608-3220	• Wiring harness	1	
		2	Commercially available	Note type PC	1	WINDOWS 98/2000/ME/XP
Measuring coolant and oil temperature	—		799-101-1502	Digital thermometer	1	
Measuring operating effort and pressing force	—		79A-264-0021	Push-pull scale	1	0 – 294 N {0 – 30 kg}
			79A-264-0091	Push-pull scale	1	0 – 490 N {0 – 50 kg}
Measuring stroke and hydraulic drift	—		Commercially available	Scale	1	
Measuring work equipment speed	—		Commercially available	Stopwatch	1	
Measuring voltage and resistance	—		Commercially available	Tester	1	

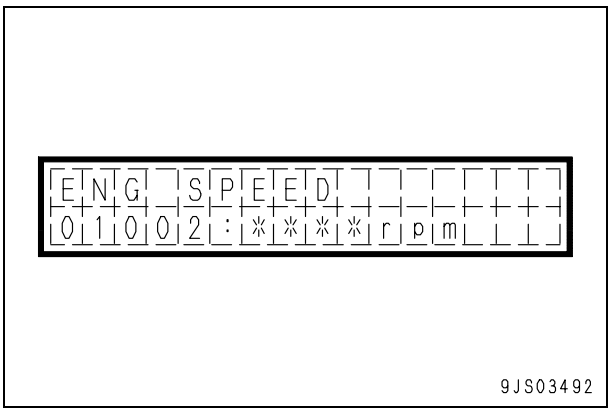
★ For the model names and part Nos. of the T-adapters and boxes used for troubleshooting of the controllers, sensors, actuators, and wiring harnesses, see Troubleshooting, T-branch box and T-branch table.

Measuring engine speed

⚠ **Put chocks under the tires.**
⚠ **When measuring, check that there are no persons around the machine.**

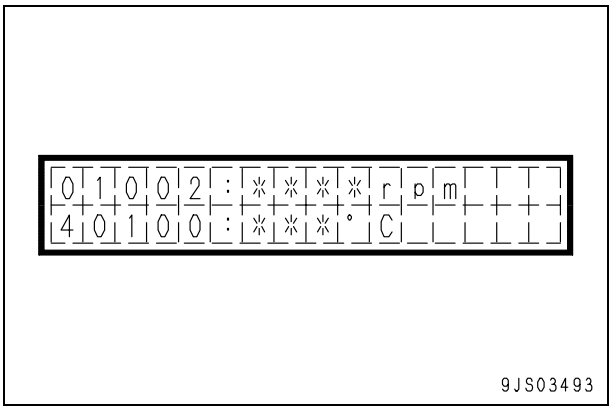
★ Measure the engine speed under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range
- Torque converter oil temperature: Within operating range

1. Measuring engine speed (low idle and high idle)
1) Referring to “Special function of machine monitor”, select the real time monitoring function of the service mode.
2) Select and display “ENG SPEED” from the engine controller monitoring items.
   ★ Monitoring item: ENG SPEED
   Code No. 01001: ENG SPEED (Engine speed)



3) Start the engine, set it in the measuring condition, and measure the engine speed.

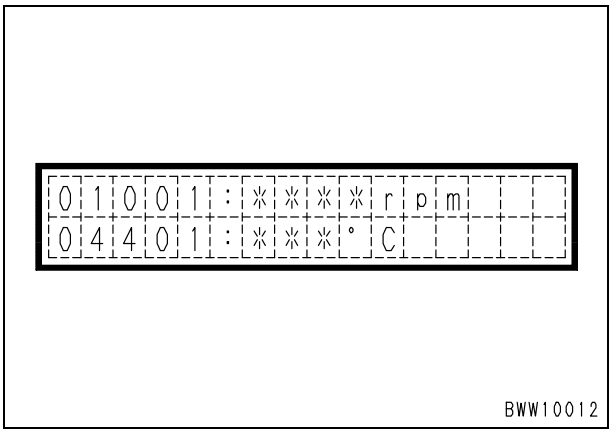
2. Measuring torque converter stall speed
1) Referring to “Special function of machine monitor”, select the real time monitoring function of the service mode.
2) Select the two-item simultaneous monitoring (2 ITEMS) and then enter the following code numbers directly.
   ★ Monitoring items
   [1] Code No.01002: ENG SPEED (Engine speed)
   [2] Code No.40100: TC OIL TEMP (Torque converter oil temperature)



3) Start the engine.
4) Press the left brake pedal securely.
5) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
6) While keeping the directional lever or forward-reverse switch at the N (Neutral) position, set the gearshift lever or gear shift switch to the 4th position.
7) Release the parking brake.
8) While pressing the brake pedal, set the directional lever or switch to the F (forward) or R (reverse) position.
   ⚠ **Keep pressing the brake pedal securely.**
9) While running the engine at high idle, press the accelerator pedal gradually. When the torque converter stalls, measure the engine speed.
   ★ Measure the stall speed 2 – 3 times.
   ★ Do not keep stalling the torque converter for more than 20 seconds. Take care that the torque converter oil temperature will not exceed 120°C.
   ★ Measure the torque converter stall speed when the power mode and economy mode are turned on.

3. Measuring hydraulic stall speed

1) Referring to “Special function of machine monitor”, select the real time monitoring function of the service mode.
2) Select the two-item simultaneous monitoring (2 ITEMS) and then enter the following code numbers directly.
   ★ Monitoring items
   [1] Code No.01001: ENG SPEED (Engine speed)
   [2] Code No. 04401: HYD TEMP (hydraulic oil temperature)



3) Run the engine at high idle.
4) Relieve the lift arm cylinder or bucket cylinder on the extraction side and measure the engine speed.
   ★ Measure the hydraulic stall speed when the power mode and economy mode are turned on.

4. Measuring torque converter stall and hydraulic stall (full stall) speed

1) Set the machine monitor as in “2. Measuring torque converter stall speed”.
2) Start the engine.
3) Press the left brake pedal securely.
4) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
5) While keeping the directional lever at N (Neutral) position, set the gearshift lever in the 4th position.
6) Release the parking brake.
7) While pressing the brake pedal, set the directional lever to the F (forward) or R (reverse) position.
   ⚠ **Keep pressing the brake pedal securely.**
8) While running the engine at high idle, stall the torque converter and relieve the lift arm cylinder or bucket cylinder on the extraction side simultaneously and measure the engine speed at this time.
   ★ Do not keep stalling the torque converter for more than 20 seconds. Take care that the torque converter oil temperature will not exceed 120°C.
   ★ Measure the full stall speed when the power mode and economy mode are turned on.

Measuring exhaust gas color

★ Measuring instruments for exhaust gas color

Symbol		Part No.	Part Name
A	1	799-201-9001	Handy smoke checker
	2	Commercially available	Smoke meter

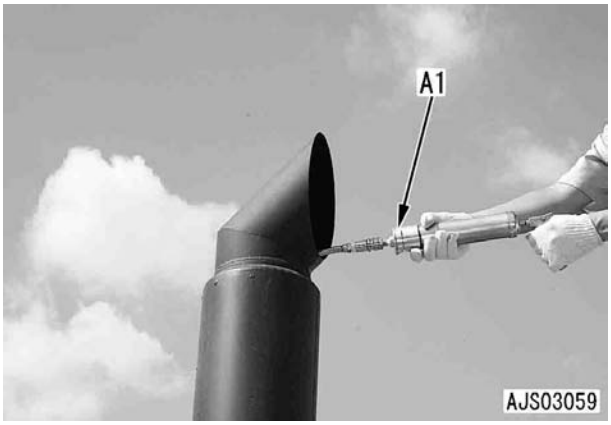
⚠ **When installing and removing the measuring instruments, take care not to touch a hot part.**

★ If an air source and an electric power source are not available in the field, use handy smoke checker **A1**. When recording official data, use smoke meter **A2**.

★ Measure the exhaust gas color under the following condition.
- Engine coolant temperature: Within operating range

1. Measuring with handy smoke checker A1

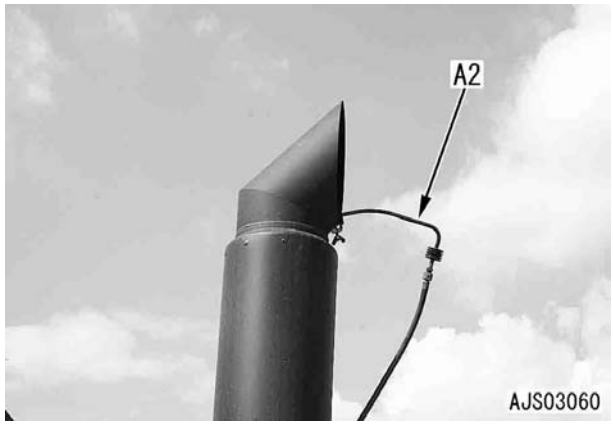
1) Stick a sheet of filter paper to smoke checker **A1**.
2) Insert the exhaust gas intake pipe in the muffler (exhaust pipe).
3) Start the engine and heighten the engine coolant temperature to the operating range.
4) Accelerate the engine suddenly or run it at high idle and operate the handle of smoke checker **A1** so that the filter paper will absorb the exhaust gas.



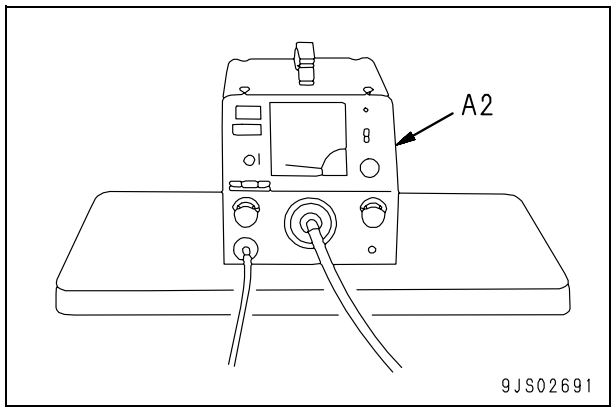
5) Take out the filtering paper and compare it with the attached scale for judgement.
6) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

2. Measuring with smoke meter A2

1) Insert the probe of smoke meter **A2** in the outlet of the muffler (exhaust pipe) and fix it to the exhaust pipe with a clip.



2) Connect the probe hose, receptacle of the accelerator switch, and air hose to smoke meter **A2**.
   ★ Keep the pressure of the supplied compressed air at 1.5 MPa {15 kg/cm^2} or below.
3) Connect the power cable to a 100 V AC receptacle.
   ★ Confirm that the smoke meter power switch is in the OFF position, before connecting the power cable to an outlet.
4) Loosen the cap nut of the suction pump and fit the filter paper.
   ★ Fit the filter paper securely so that the exhaust gas will not leak.
5) Turn on the power switch of smoke meter **A2**.



6) Start the engine and keep it running until the engine coolant temperature rises to the operating range.
7) Accelerate the engine suddenly or run it at high idle and press the accelerator pedal of smoke meter **A2** and collect the exhaust gas into the filter paper.
8) Put the polluted filtering paper on non-polluted filtering paper (more than 10 sheets) in the filtering paper holder, and read the indicated value.
9) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

Measuring exhaust temperature

★ Measuring instrument for exhaust temperature

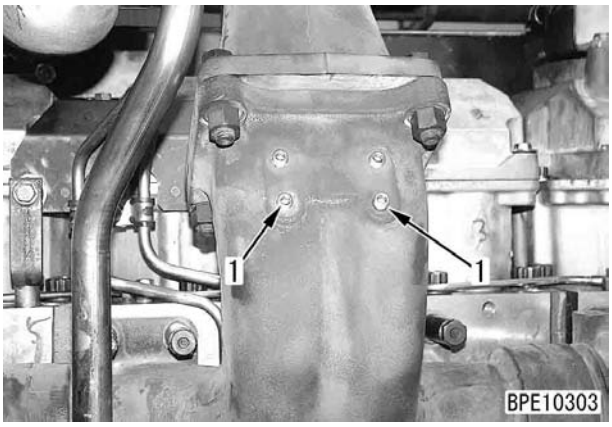
Symbol	Part No.	Part Name
B	799-101-1502	Digital thermometer

⚠ **Install and remove the measuring instrument after the exhaust manifold is cooled.**

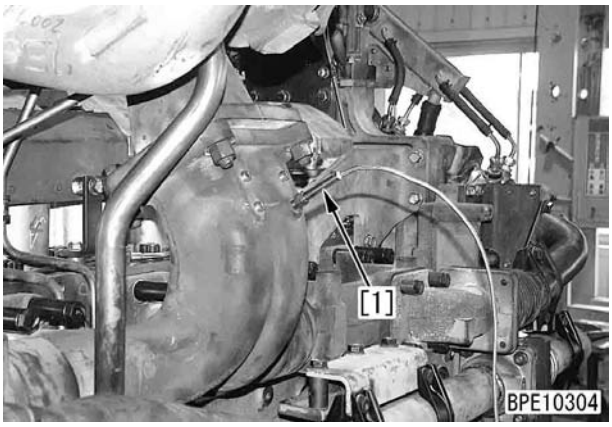
★ Measure the exhaust temperature under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range
- Torque converter oil temperature: Within operating range

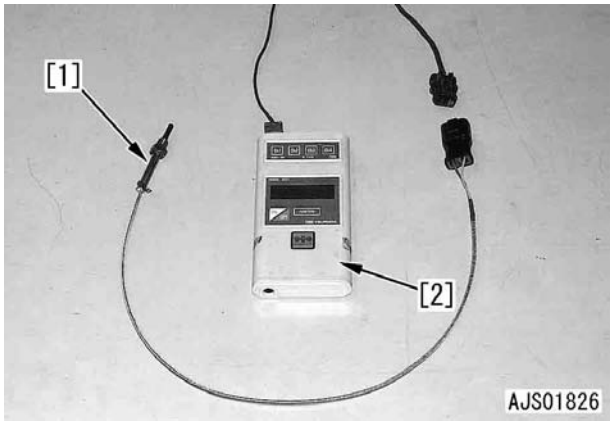
1. Open the left side cover.

2. Remove exhaust temperature pickup plug (1) (R1/8) at the bottom of exhaust manifold.
   ★ You may measure at either front or rear plug.



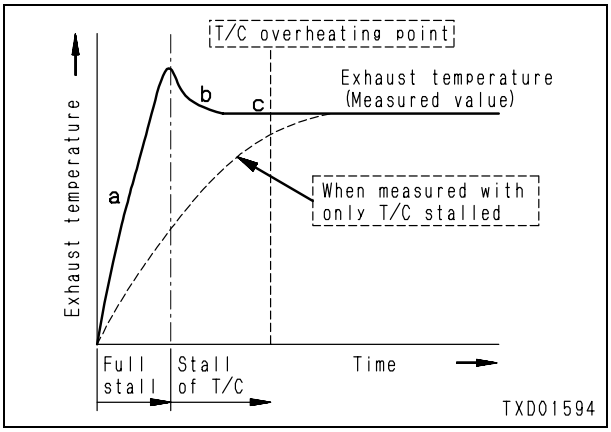
3. Install sensor [1] of digital thermometer **B** and connect them to meter [2].
   ★ Take care that the wiring harness of the digital thermometer will not touch a hot part during measurement.





4. Procedure for periodic measurement done in preventive maintenance
   ★ To prevent the torque converter from overheating, increase the exhaust temperature once through full-stall operation (torque converter stall + hydraulic stall), and then measure the exhaust temperature while only the torque converter is stalled.
   1) Start the engine and heighten the coolant temperature to the operating range.
   2) Press the left brake pedal securely.
   3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
   4) While keeping the directional lever at N (Neutral) position, set the gearshift lever to the 4th position.
   5) Release the parking brake.
   6) While pressing the brake pedal, set the directional lever or switch to the F (forward) or R (reverse) position.
      ⚠ **Keep pressing the brake pedal securely.**
   7) Press the accelerator pedal gradually to the high idle. While running the engine at high idle, stall the torque converter and relieve the lift arm cylinder or bucket cylinder on the extraction side simultaneously. (full stall)
      ★ Increase the exhaust temperature to about 650°C (the state of (a) in the figure).
      ★ Do not keep stalling the torque converter for more than 20 seconds. Take care that the torque converter oil temperature will not exceed 120°C.

8) As the exhaust temperature reached about 650°C, release the hydraulic relief and then decrease the exhaust temperature by stalling torque converter alone. (the state of (b) in the figure)
   ★ The exhaust temperature starts lowering from the level of the full-stall operation. Measure the exhaust temperature as it stabilized. (the state of (c) in the figure)
   ★ If the exhaust temperature rises in stead of going down, set a higher full stall temperature than the current one (650°C).



5. Procedure for measuring the maximum exhaust temperature
   Operate the machine actually and measure the maximum exhaust temperature.
   ★ Use the PEAK mode of the thermometer (in which the maximum value can be saved).
   ★ The exhaust temperature largely depends on the outside air temperature (intake air temperature of the engine). Accordingly, if any abnormal value is obtained, correct it by the following calculation.
   ★ Corrected value [°C] = Measured value + 2 × (20 – Outside air temperature)

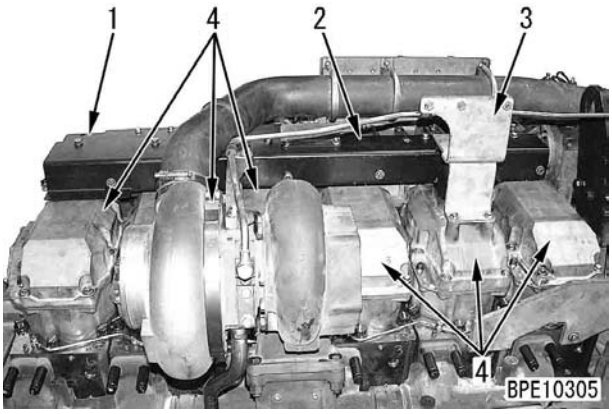
6. Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

Adjusting valve clearance

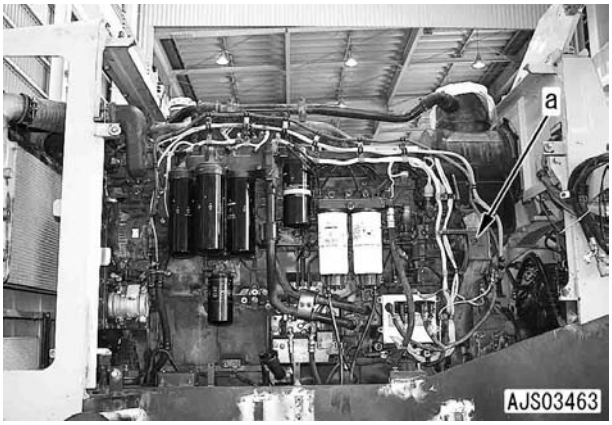
★ Adjusting tool for valve clearance

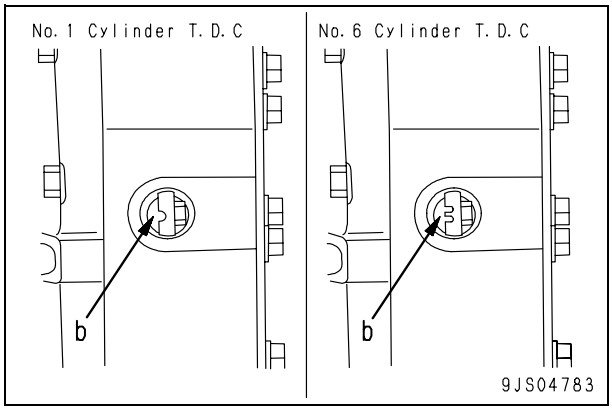
Symbol	Part No.	Part name
C	Commercially available	Clearance gauge

1. Remove covers (1) and (2) and bracket (3) and then remove 6 cylinder covers (4). For details, see Disassembly and assembly, “Removal and installation of cylinder head assembly”.



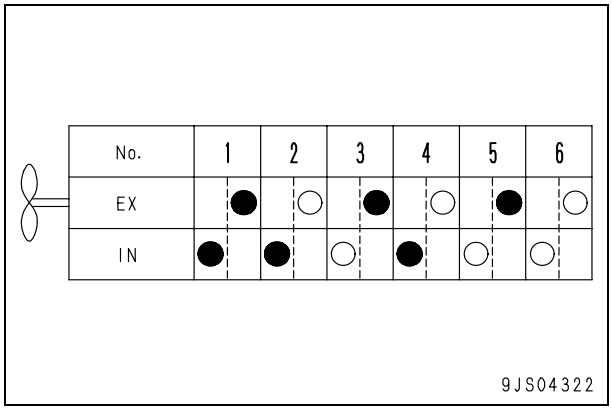
2. Rotate crankshaft forward to align cut (b) of supply pump drive gear to the center of inspection hole (a) situated in the left side of flywheel housing.
   - ★ Crank the crankshaft using the cranking device provided in the rear left side of the engine.
   - ★ The left side in above figure indicates the compression to dead center of No. 1 cylinder and right side is the compression to dead center position of No. 6 cylinder.
   - ★ The compression top dead center allows moving the rocker arm manually by the valve clearance. When the locker arm is not movable, the current position is not the compression top dead center. In this case, rotate the crankshaft one more turn.





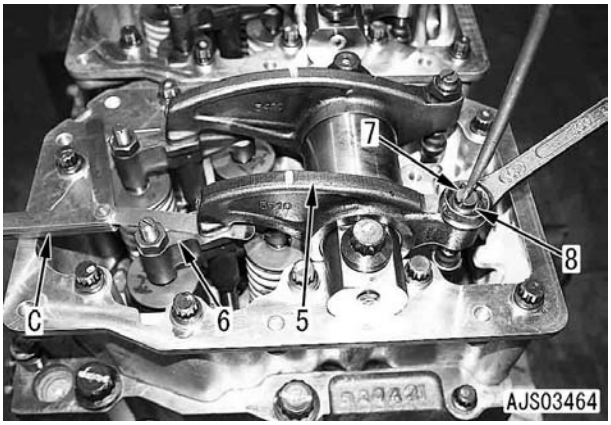
3. When the No. 1 cylinder is at the compression top dead center, adjust the valve clearances marked with ● in the valve arrangement drawing.
   - ★ When adjusting the position, loosen locknut (8) of adjustment screw (7) and then adjust the clearance by inserting clearance gauge **C** between crosshead (6) and rocker arm (5) until the cylinder becomes slightly movable.

4. Rotate the crankshaft forward by a single turn to adjust the valve clearance indicated with ○ in the valve arrangement drawing.
   - ★ Adjustment procedure is the same as above.



★ Valve clearance
- Intake valve: **0.32 mm**
- Exhaust valve: **0.62 mm**

5. While fixing adjustment screw (7), tighten locknut (8).
   - Locknut: **57.8 – 77.4 Nm {5.9 – 7.9 kgm}**
   - ★ After tightening the locknut, check the valve clearance again.



6. After finishing adjustment, return the removed parts.
   - Cylinder head cover mounting bolt:
     {No.1, 3, 4, 5 and 6 cylinders}
     9.8 ± 1.0 Nm {1.0 ± 0.1 kgm}
     {No.2 cylinder}
     58.8 – 73.5 Nm {6 – 7.5 kgm}

Testing compression pressures

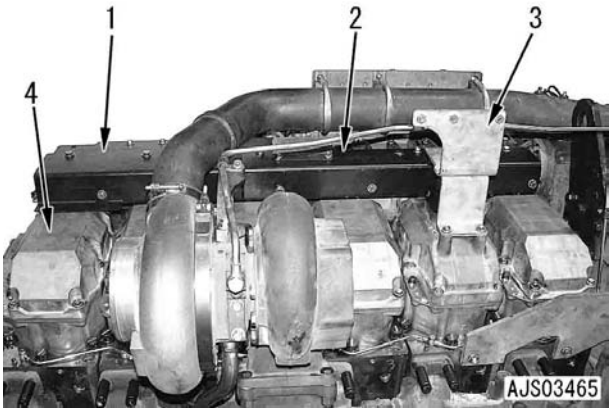
★ Testing tools for compression pressure

Symbol		Part No.	Part name
D	1	795-502-1590	Compression gauge
	2	795-611-1220	Adapter
		6261-71-6150	Gasket
	3	795-799-5410	Adapter
		795-799-5420	Remover

⚠ **When measuring the compression pressure, take care not to burn yourself on the exhaust manifold, muffler, etc. or get caught in a rotating part.**

★ Measure the compression pressure after the engine is warmed up (Engine oil temperature: 40 – 60°C).

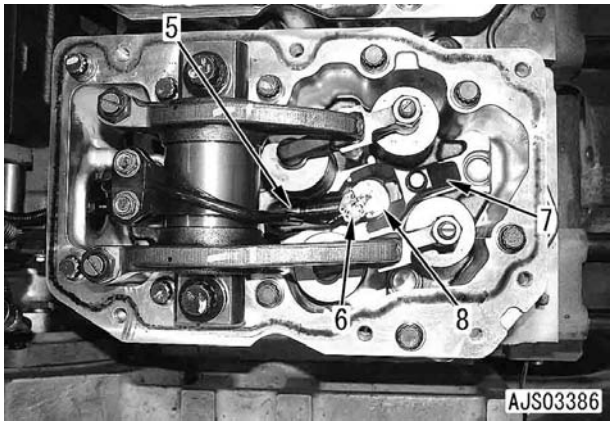
1. Remove covers (1) and (2) and bracket (3) and then remove cylinder head cover (4) to be check compression pressures. For details, see Disassembly and assembly, “Removal and installation of cylinder head assembly”.



2. Adjust the valve clearance of the cylinder to be check. For details, see “Adjusting valve clearance”.

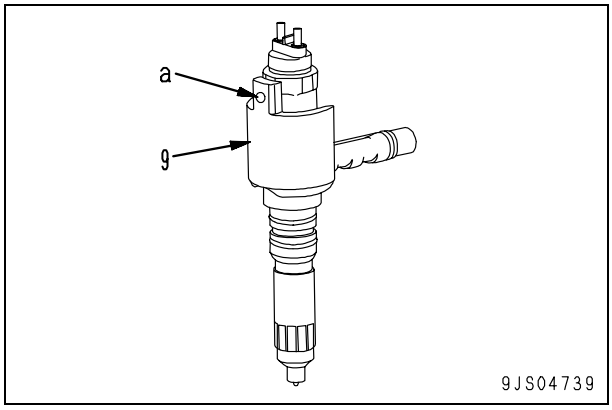
3. Disconnect fuel high-pressure tube (5) and injector harness (6).
   ★ When removing the injector harness, remove the injector side terminal and rocker housing side mounting bolt first.
   ★ Loosen two terminal nuts alternately.

4. Remove bolt (7) and then remove injector (8) along with adapter (9).



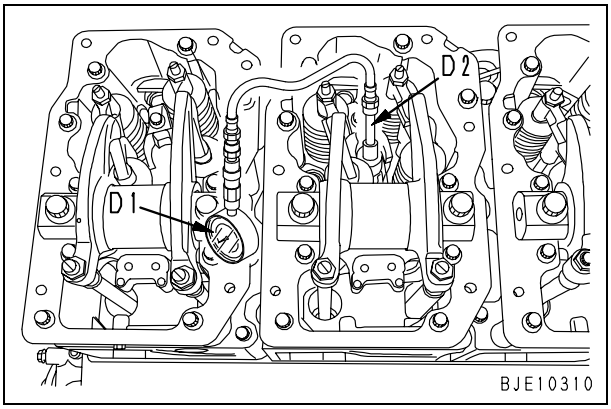
★ Pull out the injector by driving the weight of tool **D3** up and down while the pin (indicated with the arrow) at the tip of tool **D3** is being inserted to hole (a) of adapter (9).





5. Install adapter **D2** to the mounting hole on the injector and compression gauge **D1**.
   - ★ Fit the gasket to the injector end without fail
   - ★ Fix the adapter using the holder for injector and adapter.

   Holder mounting bolt:
   58.8 – 73.5 Nm {6.0 – 7.5 kgm}
   - ★ Apply a little amount of engine oil to the connecting parts of the adapter and gauge so that air will not leak easily.



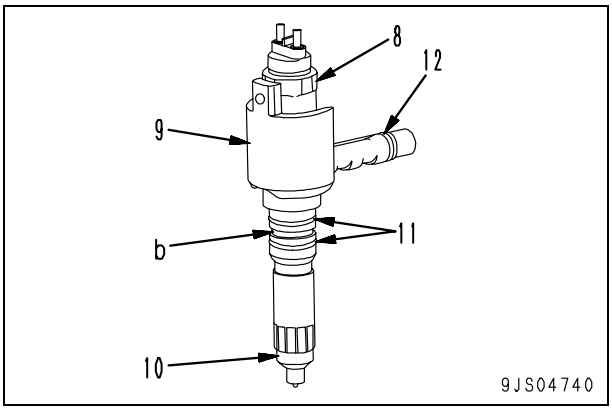
6. Set the mode to the no injection cranking operation. For details, see “Special functions of machine monitor”.
   - ⚠ **If the engine is not set in the no-injection cranking mode, it will start and will be dangerous. Accordingly, be sure to set the engine in this mode.**

7. Rotate the engine with the starting motor and measure the compression pressure.
   - ★ Read the pressure gauge pointer when it is stabilized.

8. After finishing testing, remove the testing tools and return the removed parts.
   - ★ Install the injector and fuel high-pressure tube according to the following procedure.

   1) Install gasket (10) and O-rings (11) and (12).
      - ★ Take care not to install O-ring (11) to slot (b).
   2) Set adapter (9) to injector (8) and then push them into the cylinder head with hands.

   O-ring: **Engine oil**



   3) Install holder (7) and then tighten bolt (13) and washer (14) temporarily.

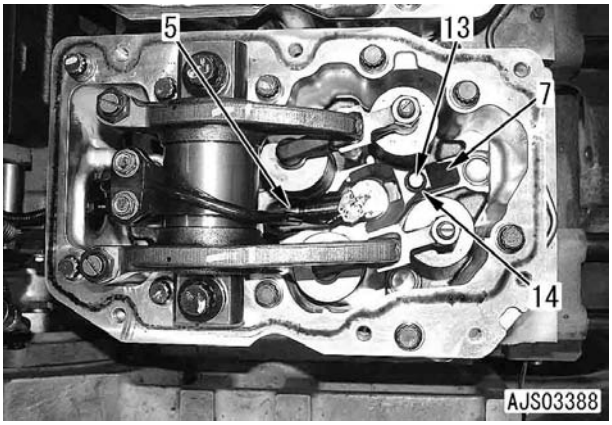
   Spherical part of washer: **Engine oil**

   4) Install the fuel high-pressure tube and then tighten sleeve nut (5).
   5) Tighten bolt (13) permanently.

   Bolt: **58.8 – 73.5 Nm {6.0 – 7.5 kgm}**

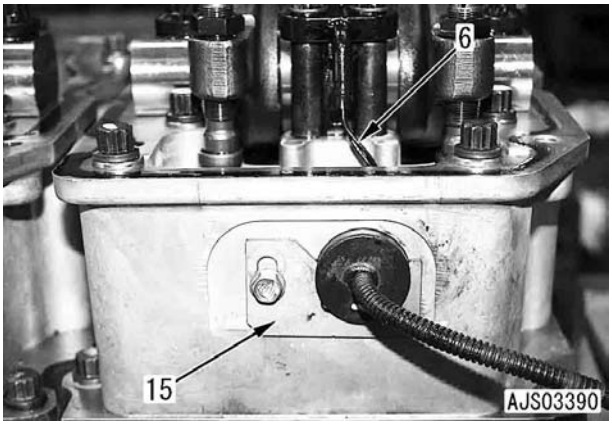
   6) Tighten sleeve nut (5) permanently.

   Sleeve nut: **39.2 – 44.1 Nm {4 – 4.5 kgm}**



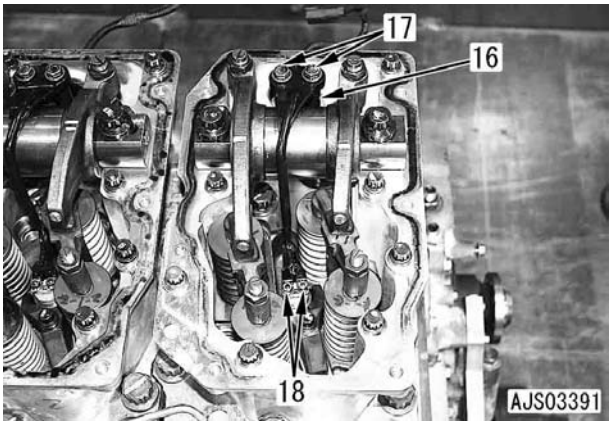
★ Install the injector wiring harness according to the following procedure.

1) Assemble injector harness (6) through inside of the rocker arm housing, and then fix the connector side with plate (15).



2) Set spacer (16) and fix with bolt (17).
3) Tighten nut (18) on the injector side alternately.

Nut: **2 ± 0.2 Nm {0.2 ± 0.02 kgm}**



Cylinder head cover mounting bolt:
{No.1, 3, 4, 5 and 6 cylinders}
9.8 ± 1.0 Nm {1.0 ± 0.1 kgm}
{No.2 cylinder}
58.8 – 73.5 Nm {6 – 7.5 kgm}

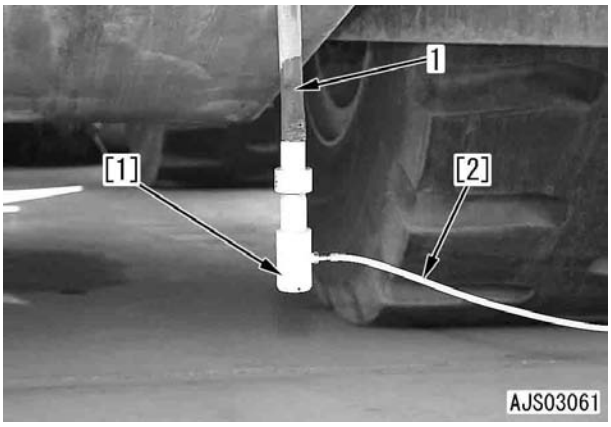
Measuring blow-by pressure

★ Blow-by pressure measurement tools

Symbol	Part No.	Part Name
E	799-201-1504	Blow-by checker

★ Measure the blow-by pressure under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range
- Torque converter oil temperature: Within operating range

1. Stop the engine. Install nozzle [1] and hose [2] of blow-by checker **E** to blow-by hose (1) and connect them to gauge [3].



2. Start the engine and increase the engine coolant temperature to the operating range.

3. Press the left brake pedal securely.

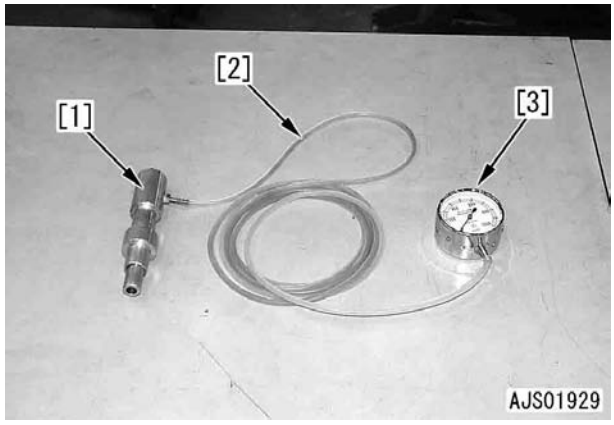
4. Set the transmission auto shift and manual shift selector switch in the MANUAL position.

5. While keeping the directional lever or forward-reverse switch at the N (Neutral) position, set the gearshift lever or gear shift switch to the 4th position.

6. Release the parking brake.

7. While pressing the brake pedal, set the directional lever or switch to the F (forward) or R (reverse) position.
   ⚠ **Keep pressing the brake pedal securely.**

8. Press the accelerator pedal gradually to the high idle. While running the engine at high idle, stall the torque converter and measure the blow-by pressure.
   ★ Do not keep stalling the torque converter for more than 20 seconds. Take care that the torque converter oil temperature will not exceed 120°C.
   ★ Normally, the blow-by pressure should be measured while the engine is operated at the rated output. In the field, however, an approximate value can be obtained by stalling the torque converter.
   ★ If it is impossible to run the engine at the rated output or stall the torque converter, measure while the engine is running at high idle. The value obtained in this case is about 80% of the blow-by pressure at the rated output.
   ★ Precaution for measuring blow-by pressure
   The blow-by pressure may vary largely with the engine condition. If the measured value is judged abnormal, check for increase of oil consumption, bad exhaust gas color, deterioration of oil, high deterioration speed of oil, etc. which are related to the abnormal blow-by pressure.



9. Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

Measuring engine oil pressure

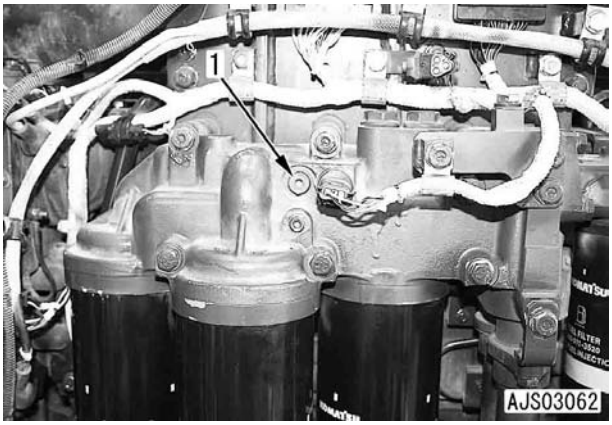
★ Engine oil pressure measurement tools

Symbol		Part No.	Part Name
F	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-401-2320	Hydraulic tester
	3	799-101-5230	Nipple (14 × 1.5 mm)
		6215-81-9720	O-ring

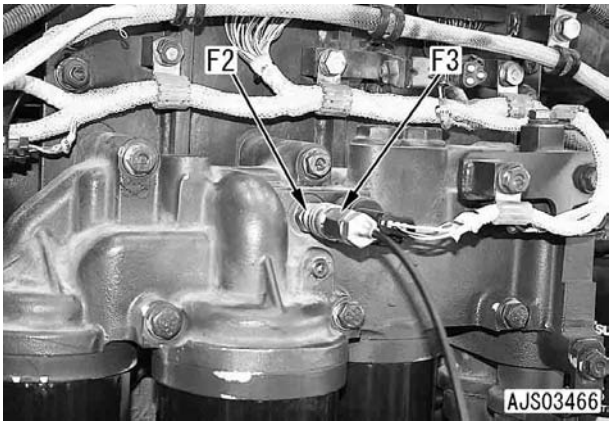
★ Measure the engine oil pressure under the following condition.
- Engine coolant temperature: Within operating range

1. Open the right side cover.

2. Remove engine oil pressure pickup plug (1) (14 × 1.5 mm) on the engine oil filter bracket.



3. Install nipple **F3** (14 × 1.5 mm) and then connect hydraulic tester **F2** (0.98 MPa {10 kg/cm^2).



4. Start the engine and heighten the coolant temperature to the operating range.

5. While running the engine at low idle and high idle, measure the oil pressure.



6. Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.
   Oil pressure pickup plug: **45 – 49 Nm {4.6 – 5 kgm}**

Measuring intake air (boost) pressure

★ Measuring instruments for intake air (boost) pressure

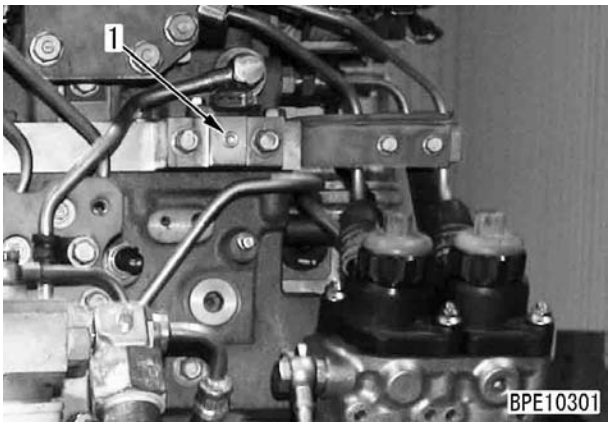
Symbol	Part No.	Part Name
G	799-201-2202	Boost gauge kit

⚠ **When installing and removing the measuring instruments, take care not to touch a hot part of the engine.**

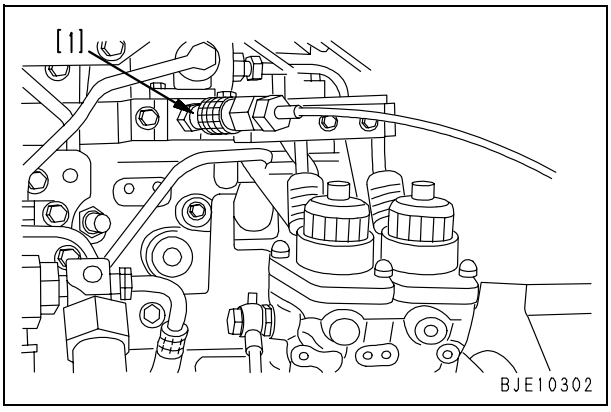
★ Measure the intake air pressure (boost pressure) under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range
- Torque converter oil temperature: Within operating range

1. Open the right side cover.

2. Remove exhaust temperature pickup plug (1) (R1/8) in the rear side of the air intake manifold.



3. Install nipple [1] in boost gauge kit **G** and connect pressure gauge [2].



4. Start the engine.

5. Press the left brake pedal securely.

6. Set the transmission auto shift and manual shift selector switch in the MANUAL position.

7. While keeping the directional lever or forward-reverse switch at the N (Neutral) position, set the gearshift lever or gear shift switch to the 4th position.

8. Release the parking brake.

9. While pressing the brake pedal, set the directional lever to the F (forward) or R (reverse) position.
   ⚠ **Keep pressing the brake pedal securely.**

10. Press the accelerator pedal gradually to the high idle. While running the engine at high idle, stall the torque converter and measure the intake air pressure (boost pressure).
    ★ Do not keep stalling the torque converter for more than 20 seconds. Take care that the torque converter oil temperature will not exceed 120°C.



11. Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

Handling fuel system equipment

★ Precautions for testing and maintaining fuel system
The common rail fuel injection system (CRI) consists of more precise parts than the conventional fuel injection pump and nozzle. If foreign matter enters this system, it can cause a trouble.
When testing and maintaining the fuel system, take care more than the past. If dust, etc. sticks to any part, wash that part thoroughly with clean fuel.

★ Precautions for replacement of fuel filter cartridge
The fuel filter cartridge used must be a genuine Komatsu part.
The fuel injection pump and nozzle of the common rail type fuel injection system (CRI) are consisted of more precision parts than those used for the current pumps and nozzles. This system, therefore, employs a special filter with highly efficient filtering performance to prevent mixing of foreign substances. Thus, substituting it with a non-genuine filter could cause troubles in the fuel system. It is strictly prohibited to use such part.

Releasing residual pressure in fuel system

★ Pressure is generated in the low-pressure circuit and high-pressure circuit of the fuel system while the engine is running.
Low-pressure circuit:
Feed pump – Fuel filter – Supply pump
High-pressure circuit:
Supply pump – Common rail – Injector

★ The pressure in both low-pressure circuit and high-pressure circuit lowers to a safety level automatically 30 seconds after the engine is stopped.

★ Before the fuel circuit is tested and its parts are removed, the residual pressure in the fuel circuit must be released completely. Accordingly, observe the following.

⚠ **Before testing the fuel system or removing its parts, wait at least 30 seconds after stopping the engine until the residual pressure in the fuel circuit is released. (Do not start the work just after stopping the engine since there is residual pressure.)**

Testing fuel pressures

★ Testing tools for fuel pressure

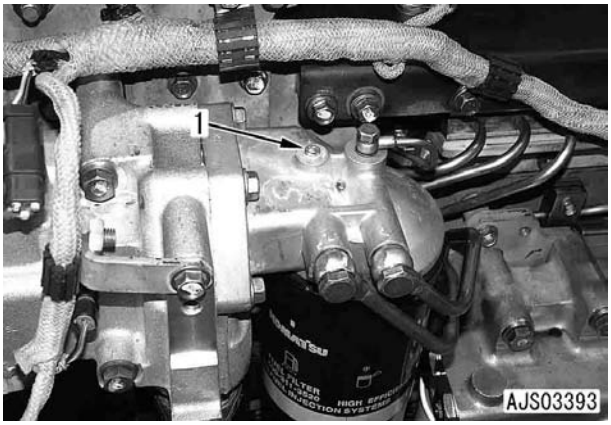
Symbol		Part No.	Part name
H	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5160	Nipple
	3	799-401-2320	Hydraulic tester

★ Test only the fuel pressure in the low-pressure circuit from the feed pump through the engine controller cooler and fuel filter to the supply pump.

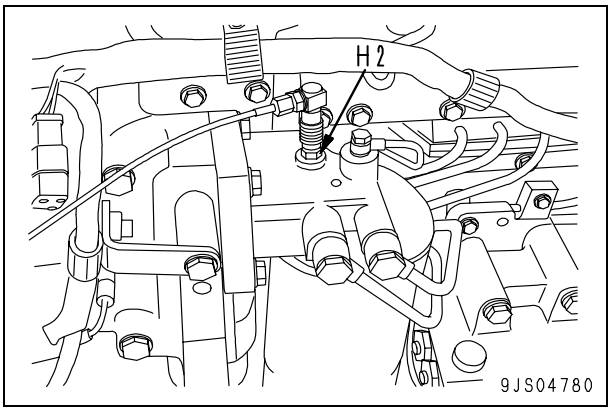
⚠ **Since the pressure in the high-pressure circuit from the supply pump through the common rail to the injector is very high, it cannot be measured.**

1. Open the right side cover.

2. Remove plug (1).



3. Install nipple **H2** and connect them to hydraulic tester **H3**.



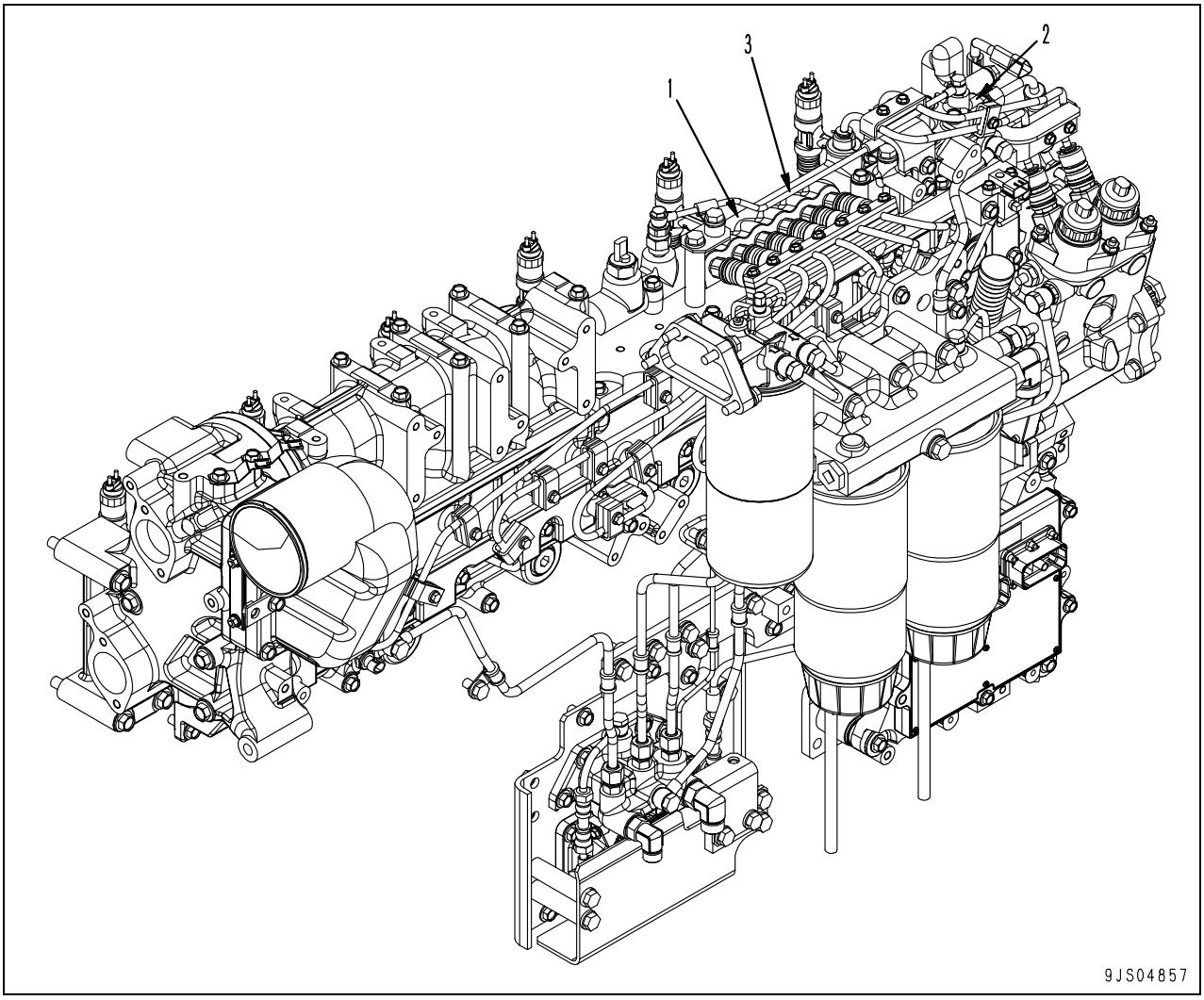
4. Run the engine at high idle and measure the fuel pressure.
   ★ If the fuel pressure is in the following range, it is normal.

Engine speed	Fuel pressure
High idle	Min. 0.15 MPa {Min. 1.5 kg/cm^2}



5. After finishing testing, remove the testing tools and return the removed parts.

Testing return rate and leakage



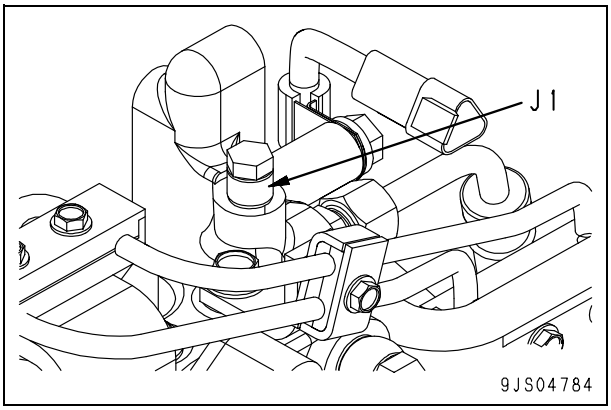
★ Testing tools for leakage from pressure limiter and return rate from injector

Symbol		Part No.	Part name
J	1	6167-11-6640	Spacer
	2	6206-71-1770	Joint
	3	Commercially available	Hose
	4	Commercially available	Hose
	5	Commercially available	Measuring cylinder
	6	Commercially available	Stopwatch

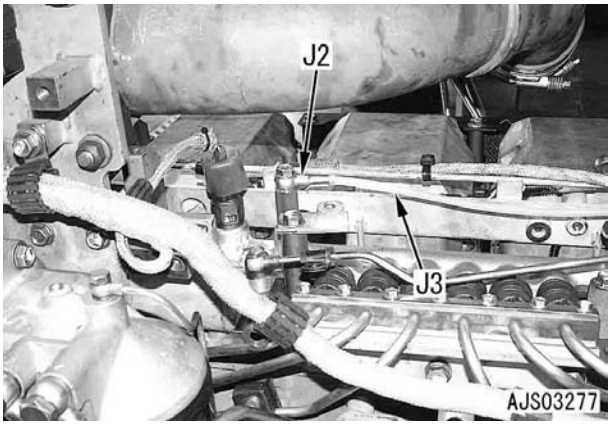
★ Prepare an oil pan of about 20 ℓ to receive the fuel flowing out during the test.

1. Preparation work

1) Remove tube (3) between common rail (1) and block (2).
2) Insert spacer **J1** to block (2) side and tighten the currently removed joint bolt again.
   ★ Connect the return pipe to the fuel tank again, too.
   ★ Be sure to provide a gasket to both ends of the spacer.



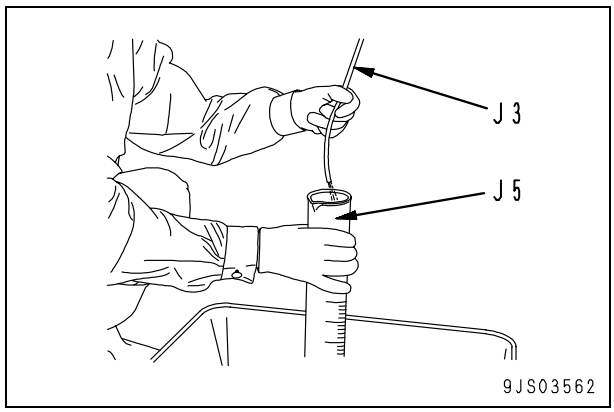
3) Insert joint **J2** to common rail (1) side and tighten the currently removed joint bolt again.
   ★ Be sure to fit the gaskets to both ends of the joint.
4) Connect inspection hose **J3** to the tip of joint **J2**.
   ★ Bind the connecting part of the test hose with a wire, etc. to prevent it from coming off.
   ★ The above is the preparation work for testing the leakage from the pressure limiter.



2. Testing leakage from pressure limiter

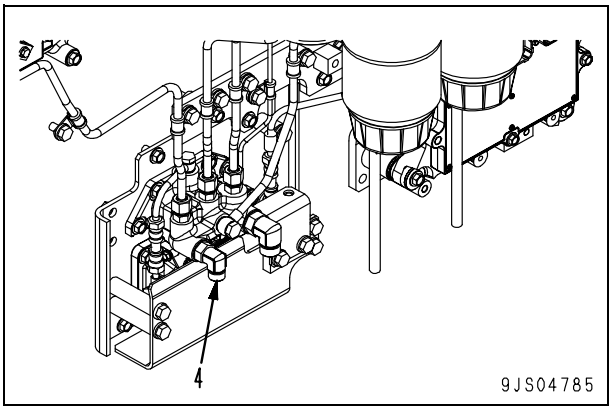
1) Route inspection hose **J3** in such that it may be free from slack and then insert its end to the oil pan (saucer).
2) Set the mode that allows confirming the engine speed with the real time monitoring function. For details, see “Special functions of machine monitor”.
3) Start the engine and keep its speed to 1,600 rpm with no load.
4) After making sure the engine speed is stabilized, measure leakage volume per minute using measuring cylinder **J5**.
   ★ You may test for 20 seconds and judge by multiplying the result by 3.
   ★ If the leakage from the pressure limiter is in the following range, it is normal.

Measurement condition	Leakage volume (cc/min)
At stall or relief	Max. 10



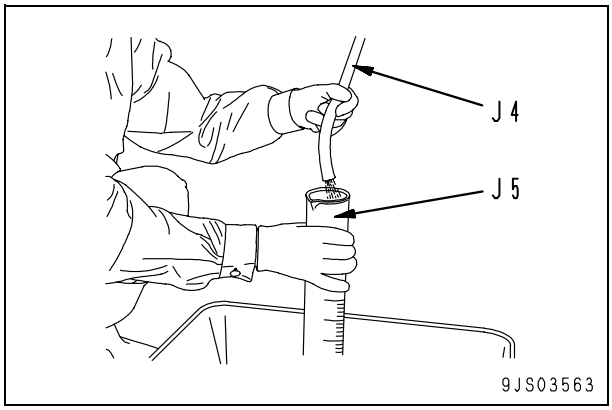
5) After finishing testing, stop the engine.

3. Testing return rate from injector



1) Remove the hose at spill outlet (4) and connect inspection hose **J4** in stead. Then insert the hose end to the oil pan (saucer).
2) Set the mode that allows confirming the engine speed with the real time monitoring function. For details, see “Special functions of machine monitor”.
3) Run the engine at the rated output.
4) After making sure the engine speed is stabilized, measure leakage volume per minute using measuring cylinder **J5**.
   - ★ You may test for 20 seconds and judge by multiplying the result by 3.
   - ★ If the supply pump is not supplying fuel, the engine speed may not rise. In this case, record the engine speed, too, during the test.
   - ★ If the return rate (spill) from the injector is in the following range, it is normal.

Rated output speed (rpm)	Limit of return rate (spill) (cc/min)
1,600	960
1,700	1,020
1,800	1,080
1,900	1,140
2,000	1,200



5) After finishing testing, stop the engine.

4. Work after finishing testing

After finishing all testing, remove the testing tools and return the removed parts.

Bleeding air from fuel circuit

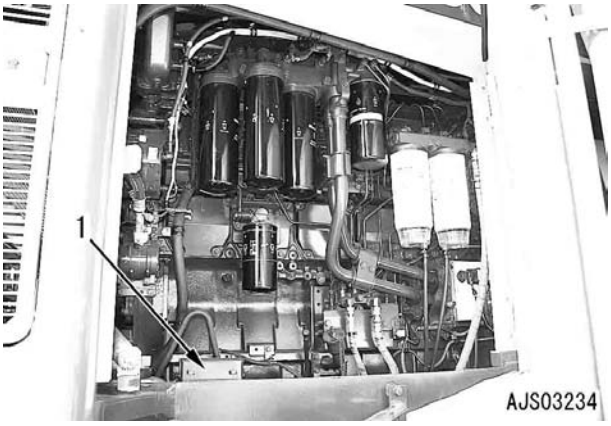
★ Bleed air according to this procedure in the following cases.
- When the fuel filter was replaced
- When fuel ran out
- When starting the engine for the first time after replacing the fuel piping or supply pump

★ When the fuel filter is replaced, don't feed fuel to the filters, including both the main and pre-filter.

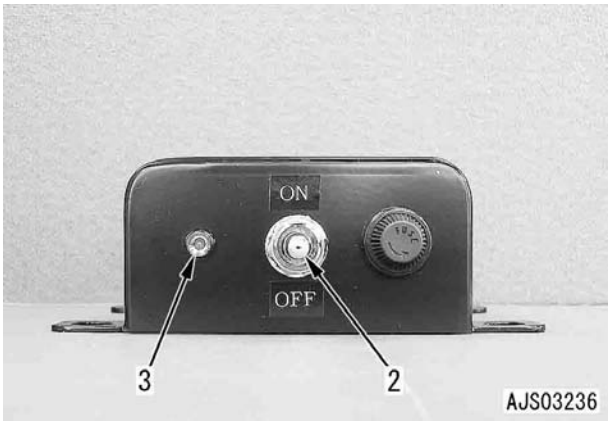
1. Set the starting switch to OFF position.

2. Open the right side cover.

3. Remove cover (1).

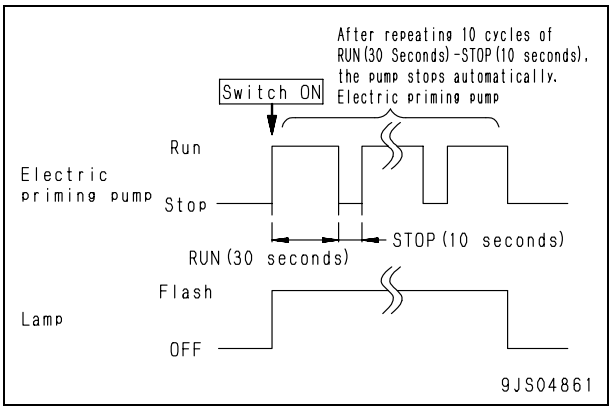


4. Shift switch (2) for the electric priming pump in the engine room to ON position.
   ★ Lamp (3) will start flashing and operation of the electric priming pump will be started.



★ The built-in timer of this switch automatically starts or stops operation of the electric priming pump. (See the figure below)
★ Operation of the electric priming pump is stopped as long as flashing of the lamp is continued. It is not an error.
★ Shifting the switch to “OFF” while the lamp is flashing turns off the lamp and stops the electric priming pump, too.

⚠ **Pressure is constantly applied to the fuel circuit as long as operation of the electric priming pump is continued. Loosening the air bleeding plug from this state might allow fuel to burst out. Thus, don't try to loosen the plug while the pump is in operation.**



5. As the specified duration (about 6.5 minutes) is expired, lamp (3) automatically goes off, stopping the electric priming pump.
   ★ When the fuel filter alone was replaced, above completes bleeding air.

6. When fuel is not provided in the fuel circuit such as when run out of fuel occurred or when replacement of the fuel pipe or supply pump was done, set switch (2) to “ON” again after the electric priming pump is automatically stopped.

7. Bleeding air, in this case, completes as lamp (3) went off.

8. Start the engine with the starting motor.
   ★ The air in the high-pressure circuit is bled automatically if the engine is cranked.
   ★ If the engine can't be started, inappropriate bleeding air in the low-pressure circuit may be suspected. In this case, steps 4 and after must be repeated.

Testing leakage in fuel system

⚠ **Very high pressure is generated in the high-pressure circuit of the fuel system. If fuel leaks while the engine is running, it is dangerous since it can catch fire.**
After testing the fuel system or removing its parts, test it for fuel leakage according to the following procedure.

★ Clean and degrease the engine and the parts around it in advance so that you can test it easily for fuel leakage.

1. Spray color checker (developer) over the fuel supply pump, common rail, fuel injector, and joints of the high-pressure piping.

2. Run the engine at speed below 1,000 rpm and stop it after its speed is stabilized.

3. Inspect the fuel piping and devices for fuel leakage.
   ★ Check mainly around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If fuel leakage is recognized, repeat the procedure from step 1 after repairing the leakage.

4. Run the engine at low idle.

5. Inspect the fuel piping and devices for fuel leakage.
   ★ Check mainly around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If fuel leakage is recognized, repeat the procedure from step 1 after repairing the leakage.

6. Run the engine at high idle.

7. Inspect the fuel piping and devices for fuel leakage.
   ★ Check mainly around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If fuel leakage is recognized, repeat the procedure from step 1 after repairing the leakage.

8. Run the engine at high idle and load it.
   ★ When checking while the components to be checked are mounted on the machine, stall the torque converter or relieve the hydraulic pump.

9. Inspect the fuel piping and devices for fuel leakage.
   ★ Check mainly around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If fuel leakage is recognized, repeat the procedure from step 1 after repairing the leakage.
   ★ If no fuel leakage is detected, check is completed.

Handling reduced cylinder mode operation

★ Reduced cylinder mode operation means to run the engine with the fuel injectors of 1 or more cylinders disabled electrically to reduce the number of effective cylinders. The purposes and effects of this operation are as follows.

1. This operation is used to find out a cylinder which does not output power normally (or, combustion in it is abnormal).

2. When a cylinder is selected for the reduced cylinder mode operation, if the engine speed and output do not change from the normal operation (all-cylinder operation), that cylinder has 1 or more defects. The possible defects are as follows.
   - Leakage through cylinder head gasket
   - Defective injection
   - Defective piston, piston ring, or cylinder liner
   - Defective valve mechanism (Moving valve system)
   - Defect in electrical system

3. Since the common rail fuel injection system controls the injector of each cylinder electronically, the operator can perform the reduced cylinder mode operation easily with switches to find out a defective cylinder.
   ★ The reduced cylinder mode operation is set from the service mode of the machine monitor.
   For details, see “Special functions of machine monitor”.

Handling no-injection cranking operation

★ No-injection cranking means to crank the engine with the starting motor while all the injections are stopped electrically. The purpose and effect of this operation are as follows.
- When a machine or engine has been stored for a long time, implementing the no-injection cranking before starting the engine lubricates the engine parts and thus prevents its seizure.

★ The no-injection cranking operation is set from the service mode of the machine monitor. For details, see “Special functions of machine monitor”.

Handling controller voltage circuit

1. Disconnection or connection of the connector between the engine controller and engine must be done after turning off the starting switch.

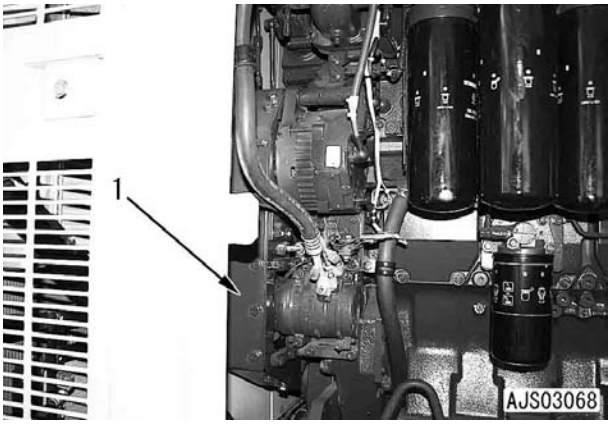
2. It is prohibited to start the engine when T-adapter is inserted or connected, for trouble-shooting purpose, to the connector between the engine controller and engine.
   ★ You may turn the starting switch to the OFF or ON position but must not turn it to the START position.

Replacing and adjusting alternator and air conditioner compressor belt tension

★ The auto-tensioner is provided for the alternator and air conditioner compressor belt. Thus, testing and adjustment of the belt is usually not necessary.
★ Following describes the auto-tensioner adjustment procedure to be employed for the belt replacement.

1. Open the right side cover.

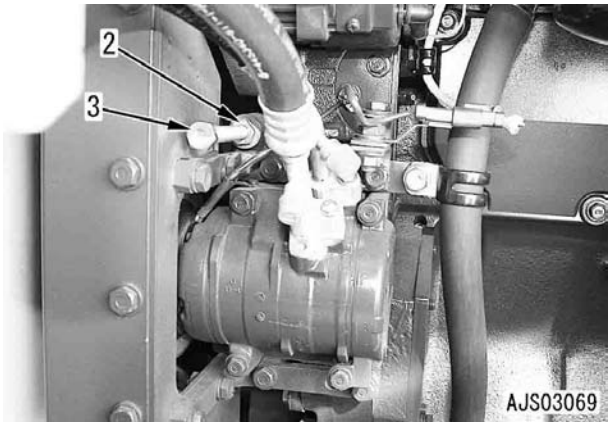
2. Remove cover (1).

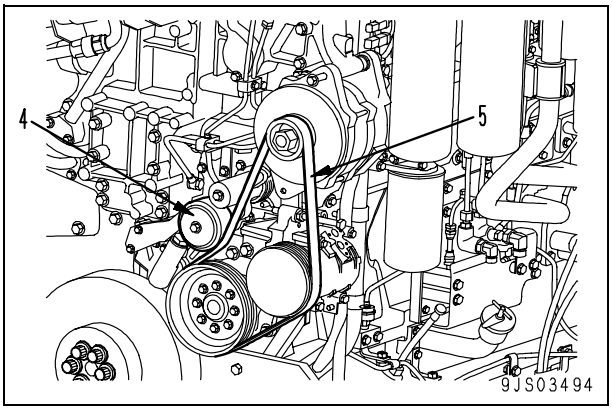


3. Loosen locknut (2), tighten push bolt (3) fully and then push in tension pulley (4).

4. Replace belt (5).

5. After replacing the belt, loosen push bolt (3) until its threaded portion protrudes 90 mm.

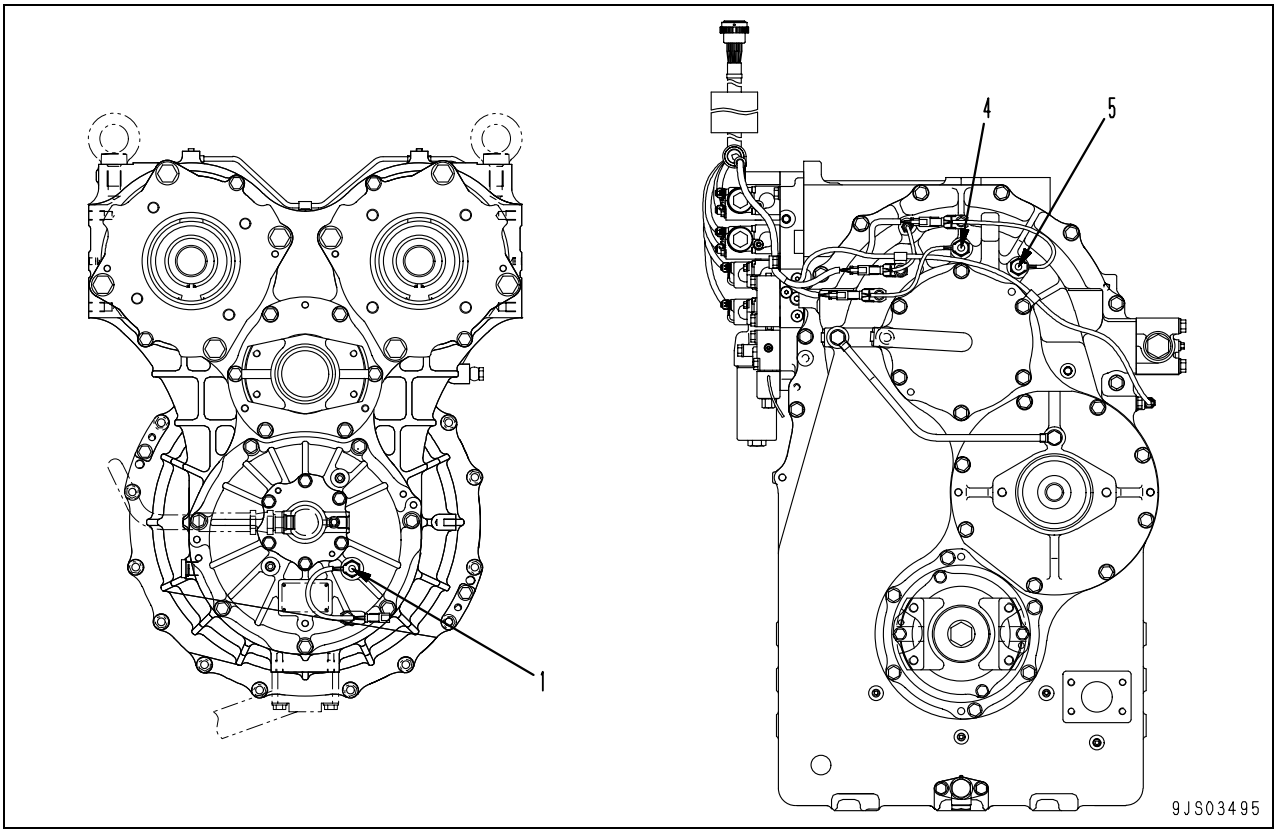




6. Tighten locknut (2).

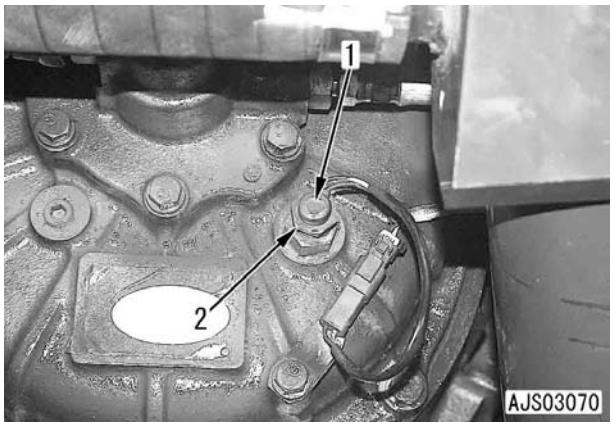
7. Install cover (1).

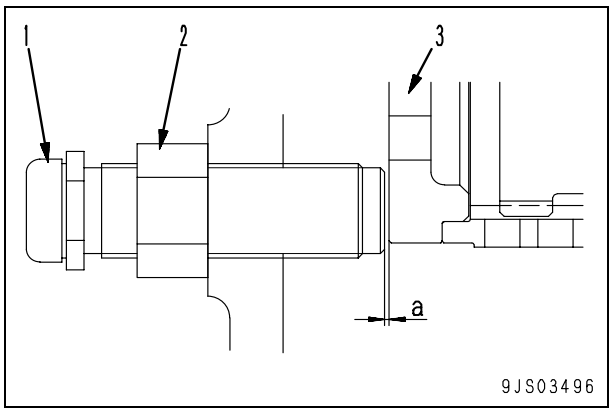
Adjusting modulation clutch speed sensor and speed sensor



1. Modulation clutch output shaft speed sensor

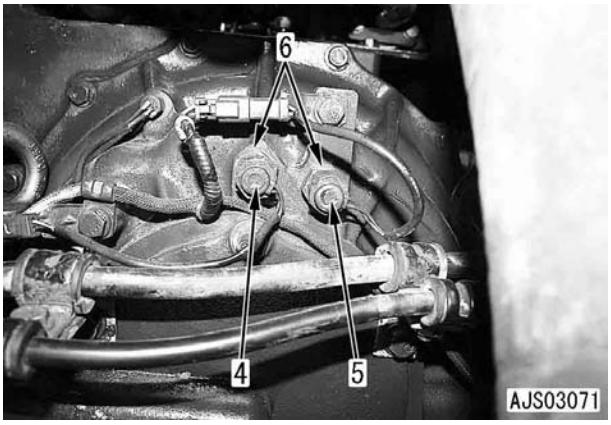
1) Loosen locknut (2) of modulation clutch output shaft speed sensor (1).
2) Screw in speed sensor (1) until its tip lightly contacts against the plate (3).
   ★ Before installing the sensor, check that its tip is free from steel chips and flaws.
   Threaded portion:
   Gasket sealant (LG-5)
3) Return speed sensor (1) by 3/4 – 1 turn.
4) Fix speed sensor (1) with locknut (2).
   Locknut:
   49.6 – 68.6 Nm {5 – 7 kgm}

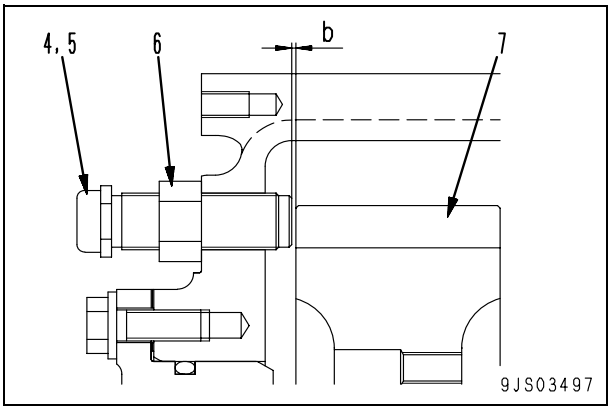




2. Speed sensor

1) Loosen locknut (6) of speed sensors (4) and (5).
2) Screw in speed sensors (4) and (5) until their tip lightly contacts against the gear tooth (7).
   ★ Before installing the sensor, check that its tip is free from steel chips and flaws.
   Threaded portion: **Gasket sealant (LG-5)**
3) Return speed sensors (4) and (5) by 1/2 – 1 turn.
4) Fix speed sensors (4) and (5) with locknut (6).
   Locknut: **49.6 – 68.6 Nm {5 – 7 kgm}**





Measuring directional lever (Steering wheel specification)

Measuring instrument

Symbol	Part No.	Part Name
K	79A-264-0021	Push-pull scale

⚠ **Put chocks under the tires securely.**

Operating effort of directional lever

1. Stop the engine.

2. Install tool **K** or a spring balance to a point 10 mm from the control lever end and pull it in the operating direction to measure the operating effort at that time.
   ★ Measure the operating effort at each gear speed.



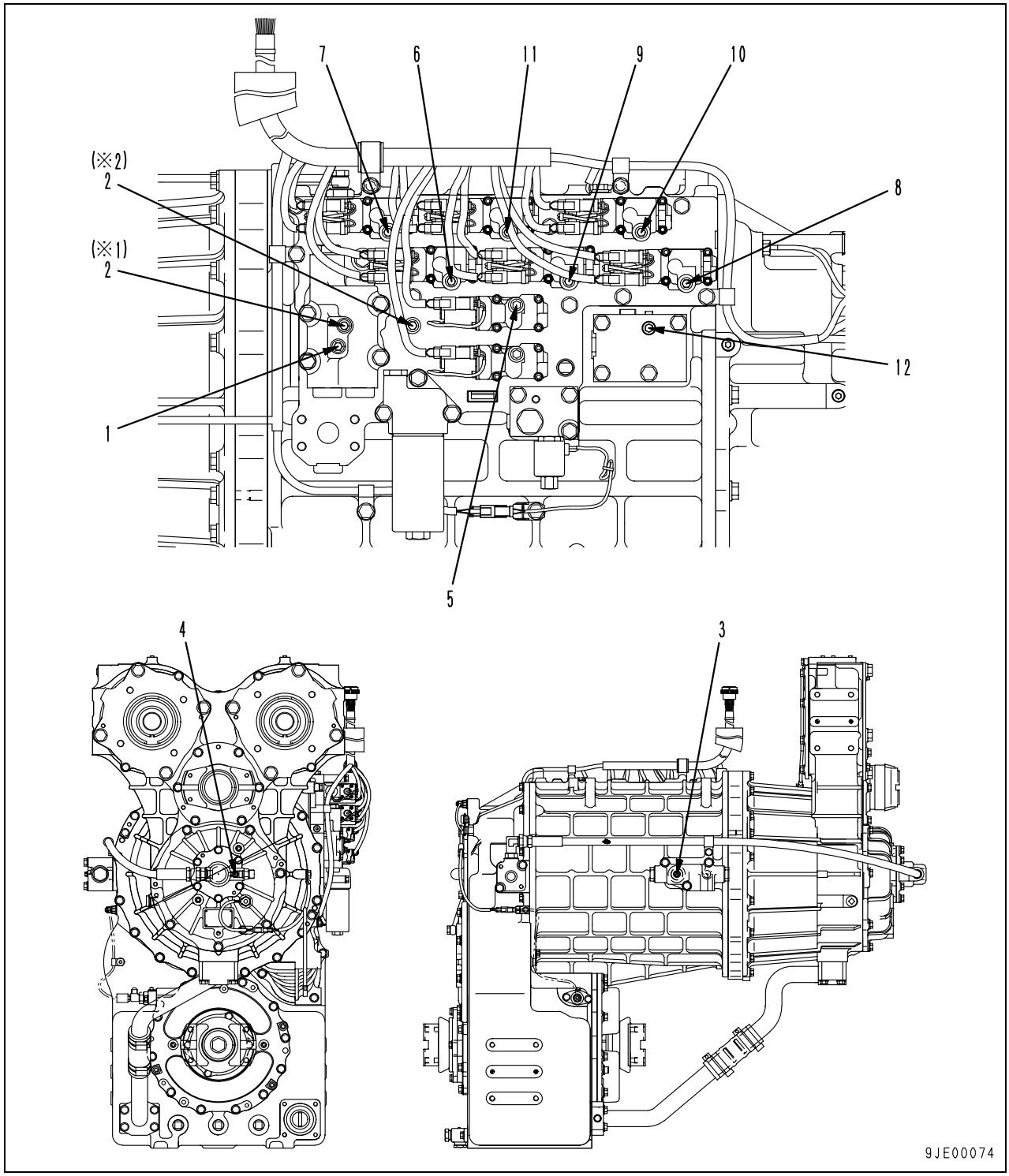
Stroke of directional lever

1. Stop the engine.

2. Make mark (a) at the center of the control lever knob. Move the knob in the operating direction and measure its stroke.



Testing and adjusting power train oil pressure



(*1): For transmission Serial No. up to 100090
(*2): For transmission Serial No. 100091 and up

Oil pressure measuring point and measuring gauge

No.	Measured oil pressure	Measuring gauge MPa {kg/cm^2}
1	Main relief pressure	5.9 {60}
2	Torque converter inlet pressure	2.5 {25}
3	Torque converter outlet pressure	0.98 {10}
4	Modulation clutch oil pressure	5.9 {60}
5	Lockup clutch pressure	5.9 {60}
6	Transmission F clutch pressure	5.9 {60}
7	Transmission R clutch pressure	5.9 {60}
8	Transmission 1st clutch pressure	5.9 {60}
9	Transmission 2nd clutch pressure	5.9 {60}
10	Transmission 3rd clutch pressure	5.9 {60}
11	Transmission 4th clutch pressure	5.9 {60}
12	Lubrication pressure	0.98 {10}

★ Testing and adjusting instruments for power train oil pressure

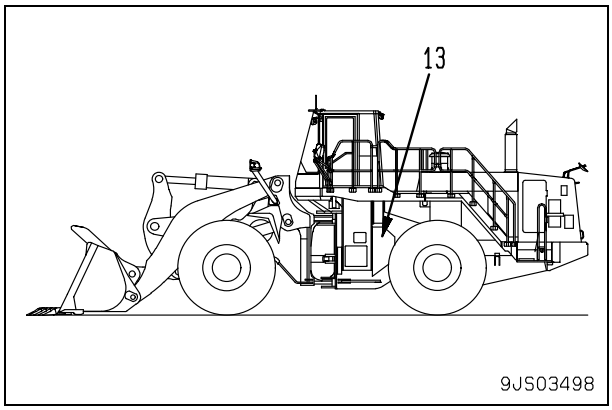
Symbol		Part No.	Part Name
L	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25 mm)
		07002-11023	O-ring

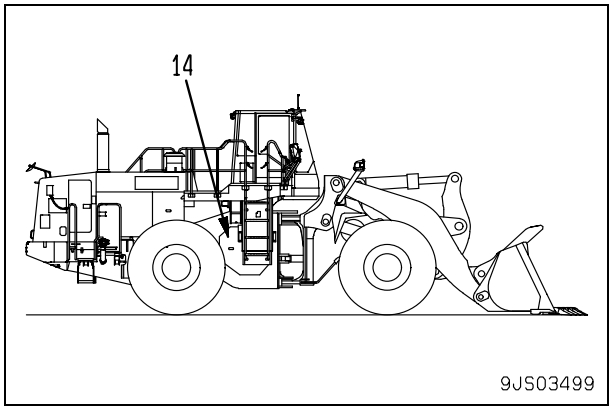
⚠ **Put chocks under the tires.**

★ Measure the power train oil pressure under the following condition.

- Engine coolant temperature: Within operating range
- Torque converter oil temperature: Within operating range

1. Remove rear frame left side cover (13) and right side cover (14).
   ★ Applicable only to the machine equipped with the rear frame side covers

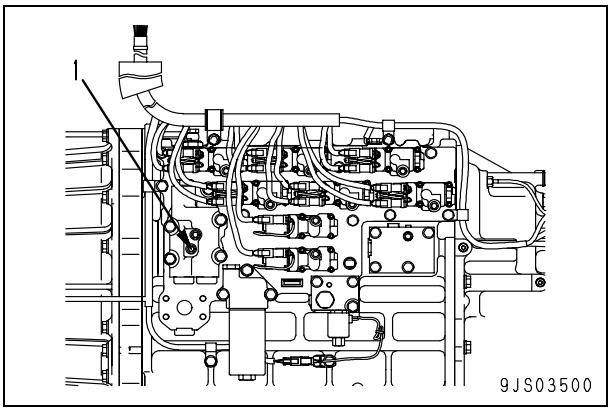




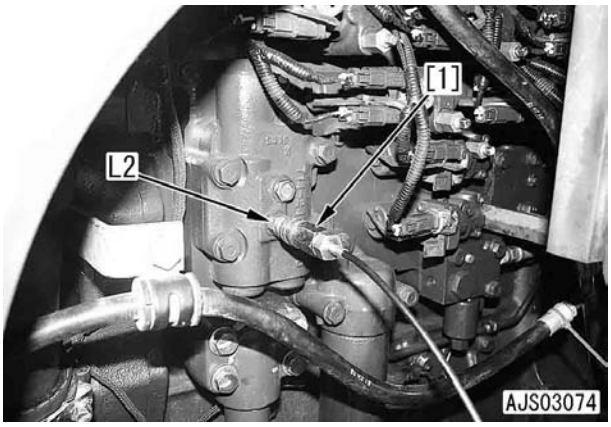
Measurement

1. Measuring transmission main relief pressure

1) Remove transmission main relief pressure pickup plug (1) (10 × 1.25 mm).



2) Connect nipple **L2** (10 × 1.25 mm) and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



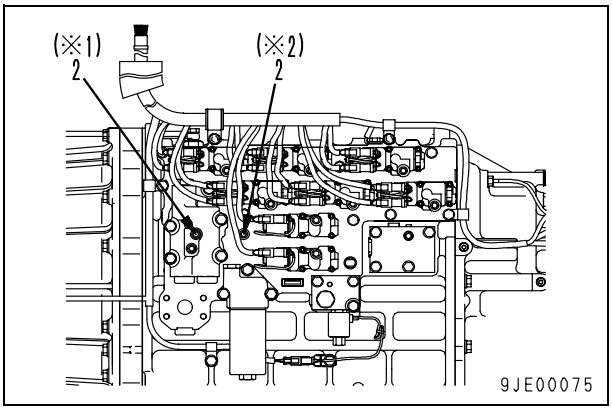
3) Start the engine and keep the directional lever or switch at the N (Neutral) position.
4) While running the engine at low idle and high idle, measure the transmission main relief pressure.



5) After finishing measurement, remove the measuring instruments and return the removed parts.

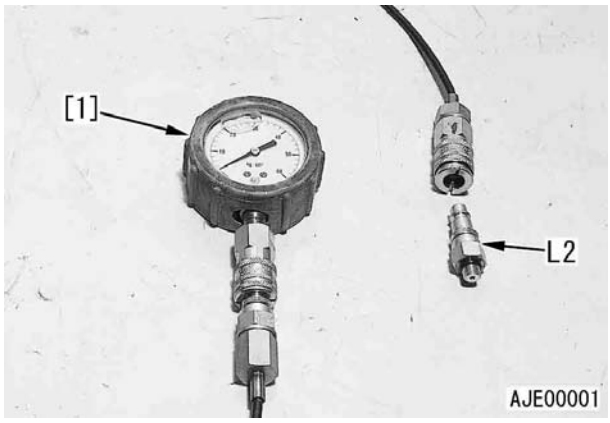
2. Measuring torque converter inlet pressure

1) Remove torque converter inlet pressure pickup plug (2) (10 × 1.25 mm).



(*1): For transmission Seral No. up to 100090
(*2): For transmission Seral No. 100091 and up

2) Connect nipple **L2** (10 × 1.25 mm) and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use the oil pressure gauge of 2.5 MPa {25 kg/cm^2}.



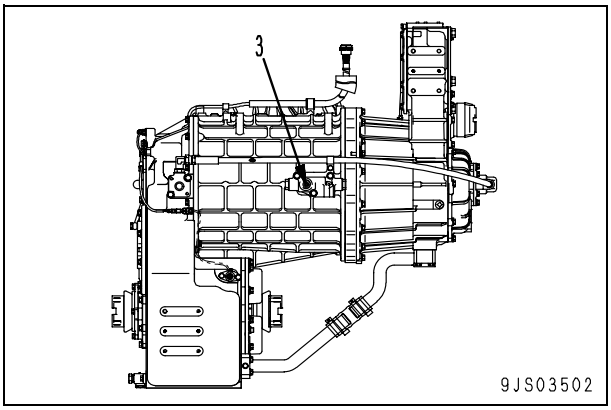
3) Start the engine and keep the directional lever or switch at the N (Neutral) position.
4) While running the engine at high idle, measure torque converter relief pressure (inlet pressure).



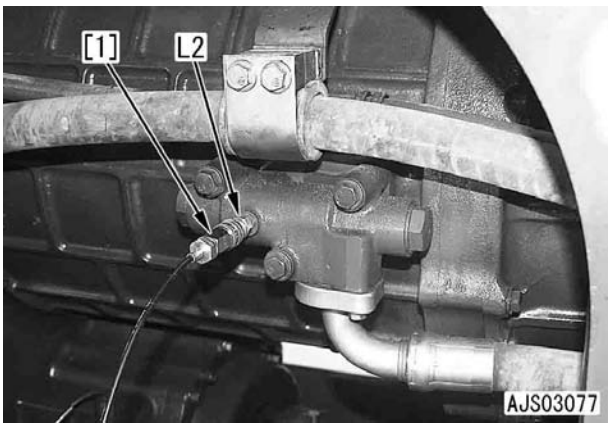
5) After finishing measurement, remove the measuring instruments and return the removed parts.

3. Measuring torque converter outlet pressure

1) Remove torque converter outlet pressure pickup plug (3).



2) Connect nipple **L2** and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use the oil pressure gauge of 0.98 MPa {10 kg/cm^2}.



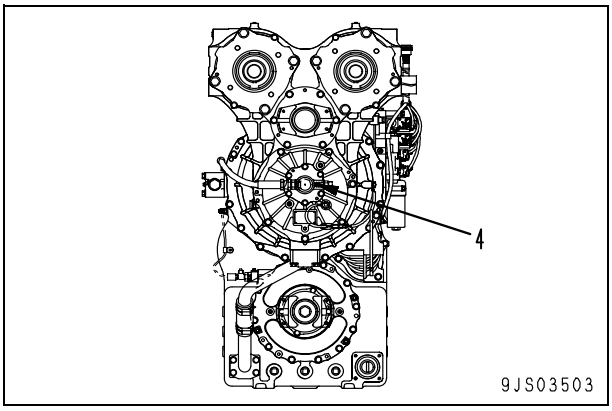
3) Start the engine and keep the directional lever or switch at the N (Neutral) position.
4) While running the engine at high idle, measure torque converter outlet pressure.



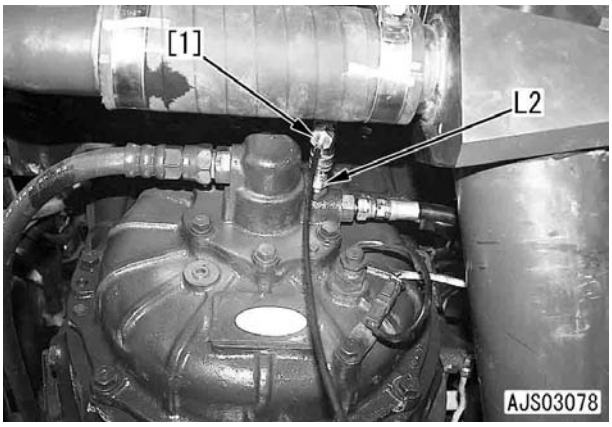
5) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

4. Measuring modulation clutch pressure

1) Remove modulation clutch pickup plug (4).



2) Connect nipple **L2** and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the right brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever at N (Neutral) position, set the gearshift lever in the 4th position.
7) While pressing the right brake pedal, set the directional lever or switch to the F (forward) or R (reverse) position.
   ⚠ **Keep pressing the right brake pedal securely.**
8) While running the engine at high idle, measure the modulation clutch pressure.

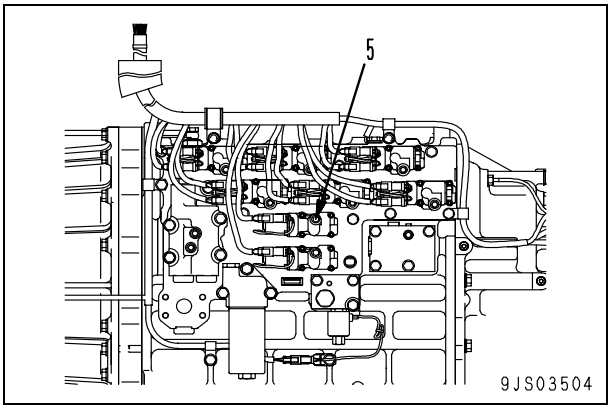


9) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

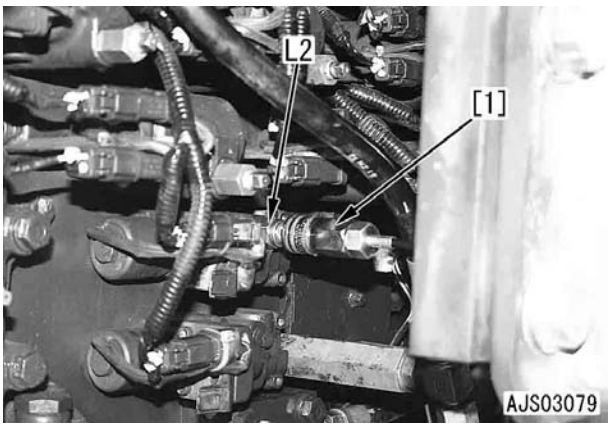
5. Measuring lockup clutch pressure

⚠ This measurement is done in the traveling condition. Reasonable care, therefore, must be paid to safety of surrounding area.

1) Remove lockup clutch pressure pickup plug (5).



2) Connect nipple **L2** and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



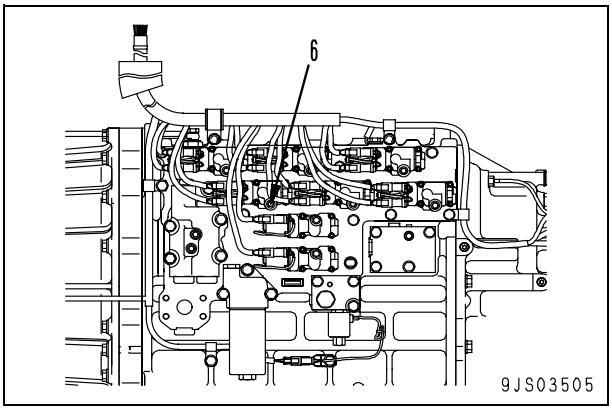
3) Turn the torque converter lockup switch ON.
4) Set the transmission auto shift and manual shift selector switch in the AUTO position.
5) Start the engine and turn the parking brake switch OFF.
6) Set the gear shift lever or gear shift switch to 2nd position.
7) Start traveling while setting the directional lever or switch to the F (forward) or R (reverse) position.
8) Measure the lockup clutch oil pressure as the lockup pilot lamp came on while traveling is continued with the engine at high idle.



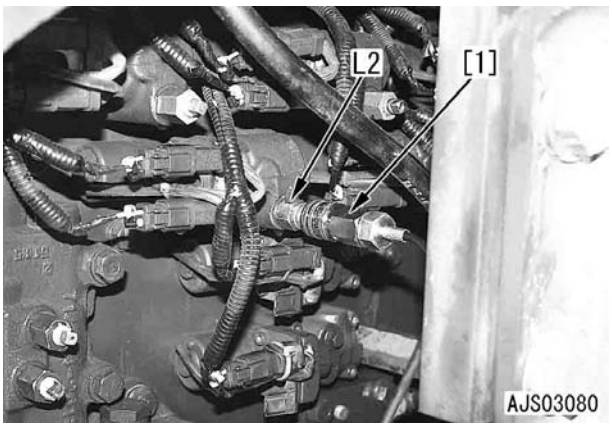
9) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

6. Measuring F (forward) clutch pressure

1) Remove F (forward) clutch oil pressure pickup plug (6).



2) Connect nipple **L2** and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



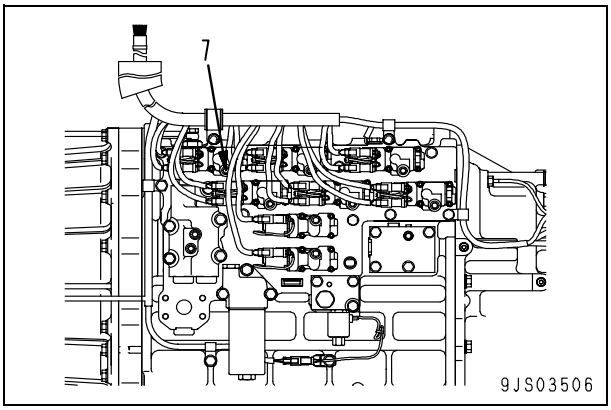
3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever or switch at N (Neutral) position, set the gearshift lever to the 4th position.
7) While pressing the brake pedal, set the directional lever or switch to F (forward).
   ⚠ **Keep pressing the brake pedal securely.**
8) While running the engine at high idle, measure the F clutch oil pressure.



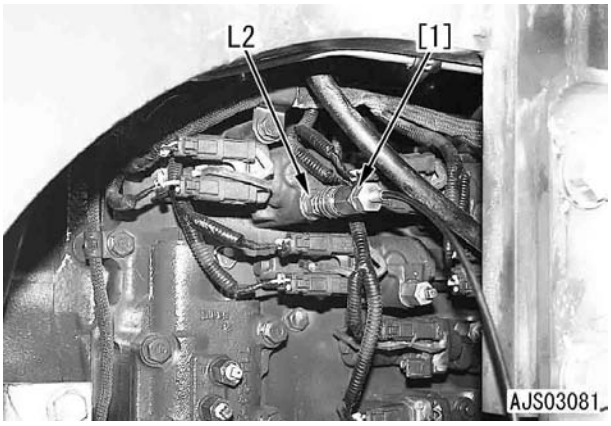
9) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

7. Measuring R (reverse) clutch pressure

1) Remove R (reverse) clutch oil pressure pickup plug (7).



2) Connect nipple **L2** and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



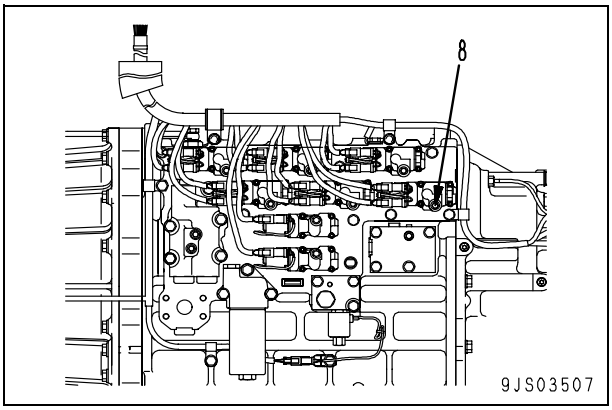
3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever or switch at N (Neutral) position, set the gearshift lever in the 4th position.
7) While pressing the brake pedal, set the directional lever or switch to R (reverse).
   ⚠ **Keep pressing the brake pedal securely.**
8) While running the engine at high idle, measure the R clutch oil pressure.



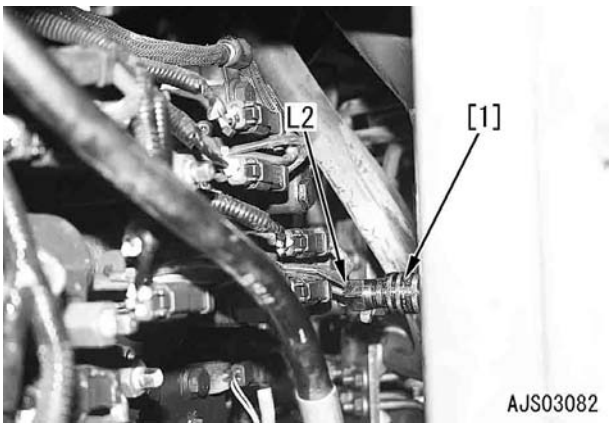
9) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

8. Measuring 1st clutch pressure

1) Remove 1st clutch oil pressure pickup plug (8).



2) Connect nipple **L2** and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



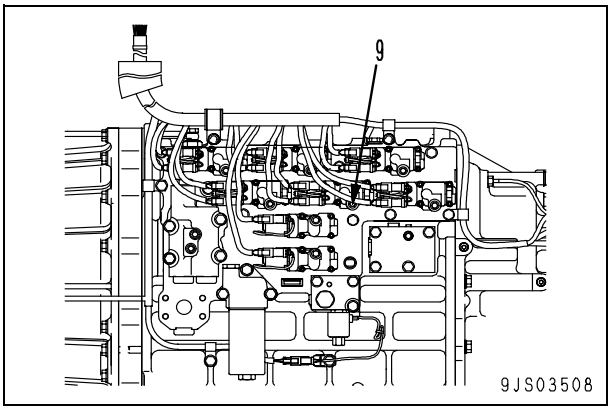
3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever or switch at N (Neutral) position, set the gearshift lever in the 1st position.
   ⚠ **Keep pressing the brake pedal securely.**
7) While running the engine at high idle, measure the 1st clutch oil pressure.



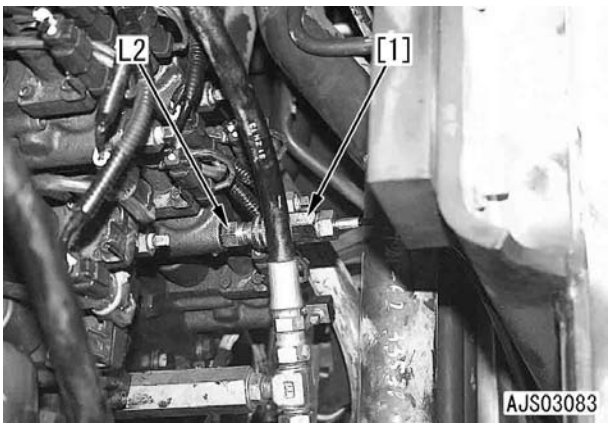
8) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

9. Measuring 2nd clutch pressure

1) Remove 2nd clutch oil pressure pickup plug (9).



2) Connect nipple **L2** and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use the oil pressure gauge with capacity 5.9 MPa {60 kg/cm^2}.



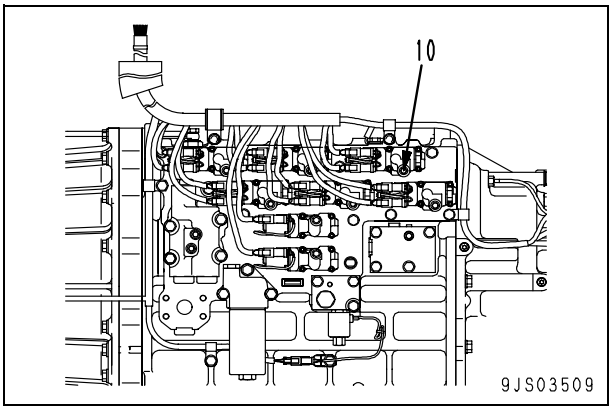
3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever or switch at N (Neutral) position, set the gearshift lever in the 2nd position.
   ⚠ **Keep pressing the brake pedal securely.**
7) While running the engine at high idle, measure the 2nd clutch oil pressure.



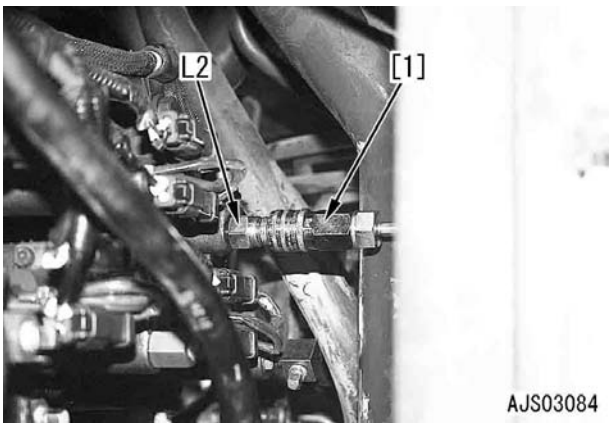
8) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

10. Measuring 3rd clutch pressure

1) Remove 3rd clutch oil pressure pickup plug (10).



2) Connect nipple **L2** and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



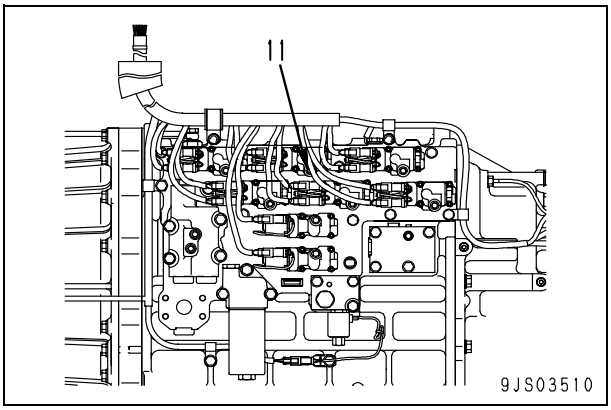
3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever or switch at N (Neutral) position, set the gearshift lever in the 3rd position.
   ⚠ **Keep pressing the brake pedal securely.**
7) While running the engine at high idle, measure the 3rd clutch oil pressure.



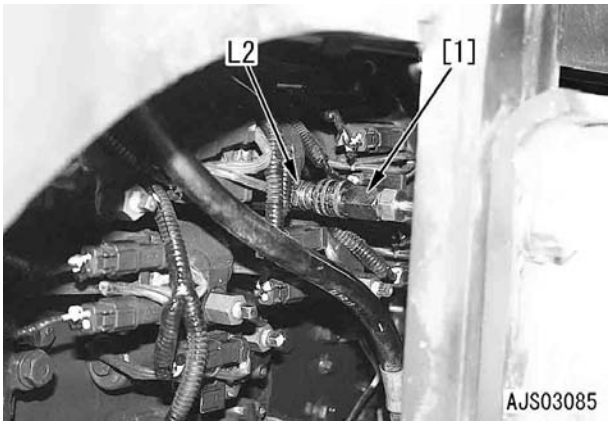
8) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

11. Measuring 4th clutch pressure

1) Remove 4th clutch oil pressure pickup plug (11).



2) Connect nipple **L2** and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



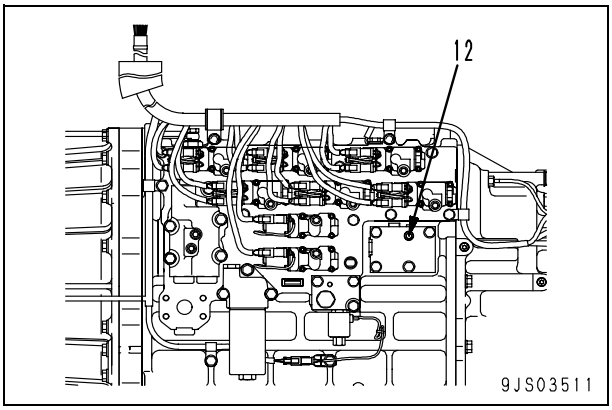
3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever or switch at N (Neutral) position, set the gearshift lever in the 4th position.
   ⚠ **Keep pressing the brake pedal securely.**
7) While running the engine at high idle, measure the 4th clutch oil pressure.



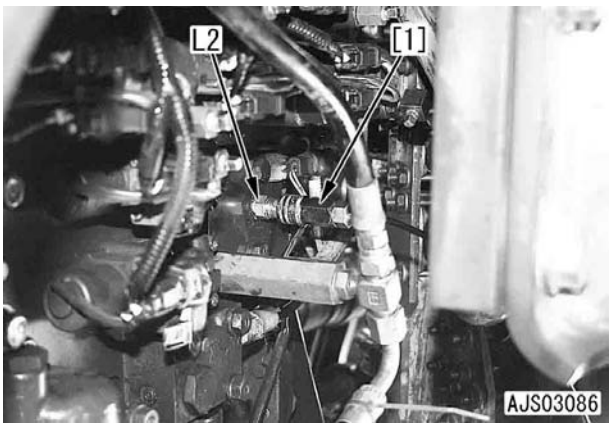
8) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

12. Measuring lubrication pressure

1) Remove lubrication pressure pickup plug (12).



2) Connect nipple **L2** and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use the oil pressure gauge of 0.98 MPa {10 kg/cm^2}.



3) Start the engine and keep the directional lever or switch at the N (Neutral) position.
4) While running the engine at high idle, measure the lubrication pressure.

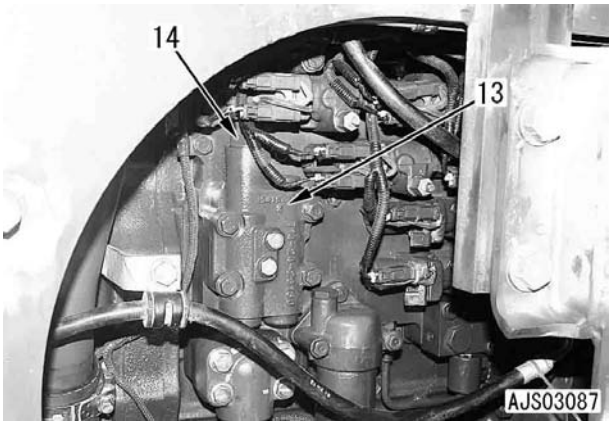
Adjustment

1. Adjusting transmission main relief valve

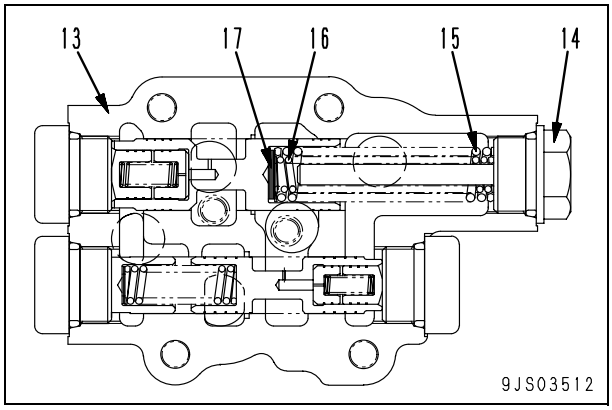
⚠ **Stop the engine before starting adjustment of the transmission main relief valve.**

★ If the transmission main relief pressure is out of the specified range, adjust it according to the following procedure.

1) Remove plug (14) from transmission and torque converter relief valve plug (13).



2) Remove inner spring (15) and outer spring (16).
3) Adjust the torque converter relief pressure by changing the number of shims (17).
   ★ Standard shim thickness:
   3.5 mm (0.5 × 7 piece)
   ★ Quantity of adjustment per shim:
   0.039 MPa {0.39 kg/cm^2}

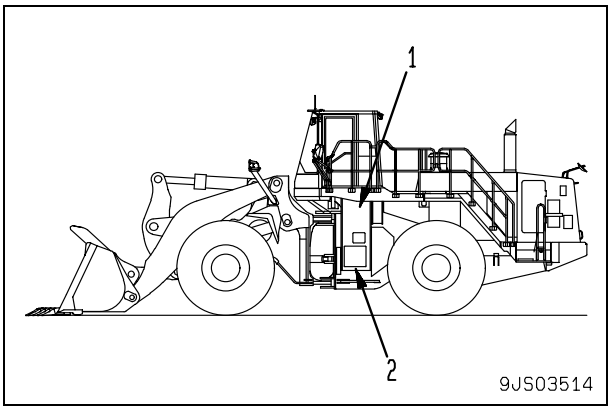


Flushing procedure for torque converter and transmission hydraulic circuit

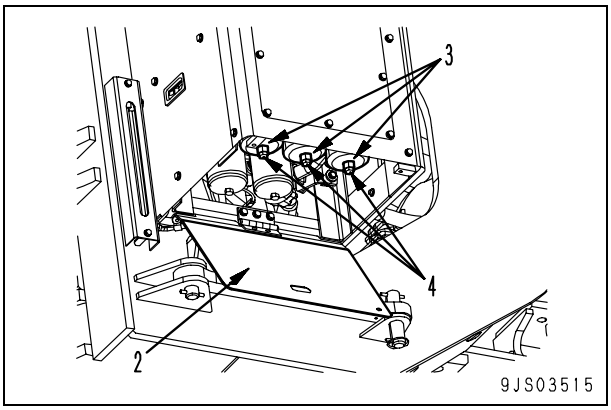
★ Metal chips and dirt in the torque converter and transmission hydraulic circuit shorten the lives of the torque converter and transmission and can cause internal breakage. Accordingly, flush the hydraulic circuit to remove the metal chips and dirt.

1. Flush the hydraulic circuit in the following cases.
   1) When metal chips are circulated in the hydraulic circuit because of damage of the torque converter, transmission, or another hydraulic device.
   2) When the torque converter or transmission is overhauled or repaired.

2. Install the element for flushing.
   1) Open bottom cover (2) provided in accumulator installation position (1) on the left side of the machine body.

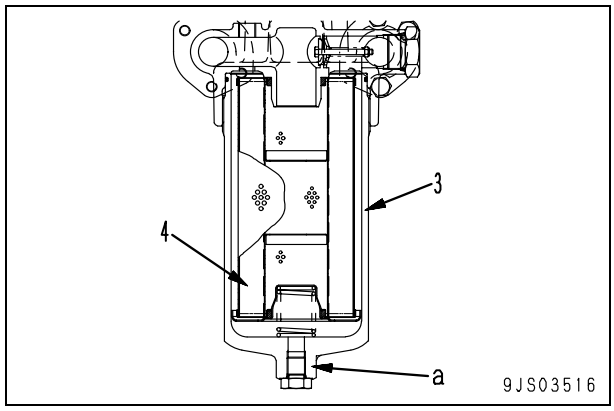


   2) Remove 3 transmission oil filter cases (3) and drain plug (4) to drain oil.
      ★ Before draining oil, prepare an oil pan.



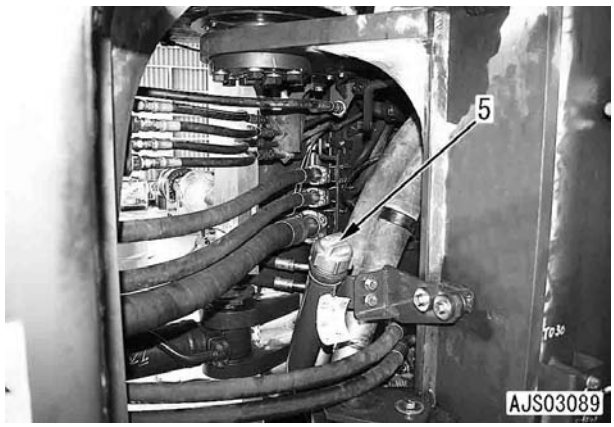
   3) Loosen hexagonal portion (a) of 3 transmission oil filter cases (3) to remove transmission oil filter cases (3).
      ★ After removing the transmission oil filter case, clean inside of the case as well as removed parts other than the filter.
   4) Remove 3 filter elements (4) and replace them with 3 flushing elements (561-15-55670).
   5) Install 3 transmission oil filter cases (3).

      Hexagonal portion (a) of transmission oil filter case:
      58.8 – 78.5 Nm {6 – 8 kgm}
      Drain plug:
      49 – 58.8 Nm {5 – 6 kgm}



3. Fill the transmission case with oil.
   Add oil through oil filler (5) to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

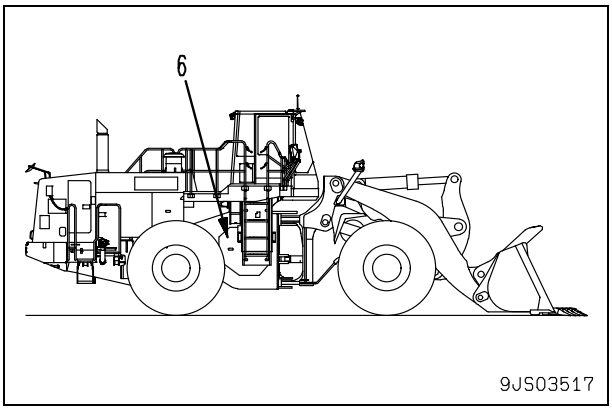
   Transmission case: **83 ℓ (Refill capacity)**



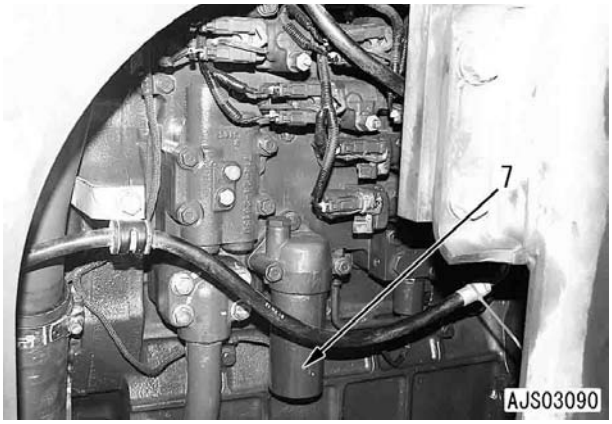
4. Flush the hydraulic circuit according to the following procedure.
   1) Start the engine and run it at low idle without operating the gearshift lever or directional lever for about 20 minutes.
      ★ Increase the engine speed to about 1,500 rpm sometimes.
      ★ If the engine coolant temperature gauge does not rise to the operating range because of low atmospheric temperature, continue the warm-up operation further.
   2) Operate or drive the machine for at least 20 minutes.
      ★ Use all the gear speeds (Forward, reverse, and 1st – 4th, including modulation clutch and lockup clutch).
   3) Run the engine at low idle for about 20 minute, similarly to 4-1).

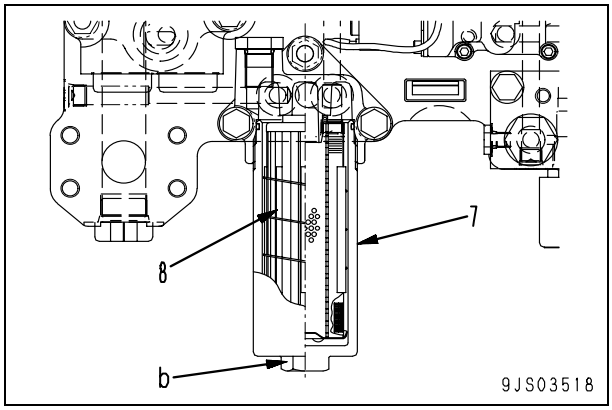
5. Replace the filter cartridge.
   1) Replace cartridge (1) used for flushing with new cartridge (714-07-28712) in the same procedure as 2.
      ⚠ **If the cartridge used for flushing is used for long hours, it is clogged quickly. Accordingly, be sure to replace it with new one.**
      ★ Replace the current O-ring with a new one, coat it with a small amount of oil and then install it.
   2) Add oil and check the oil level again.

6. Replace the transmission last chance filter.
   1) Remove cover (6) on the right side of the rear frame.



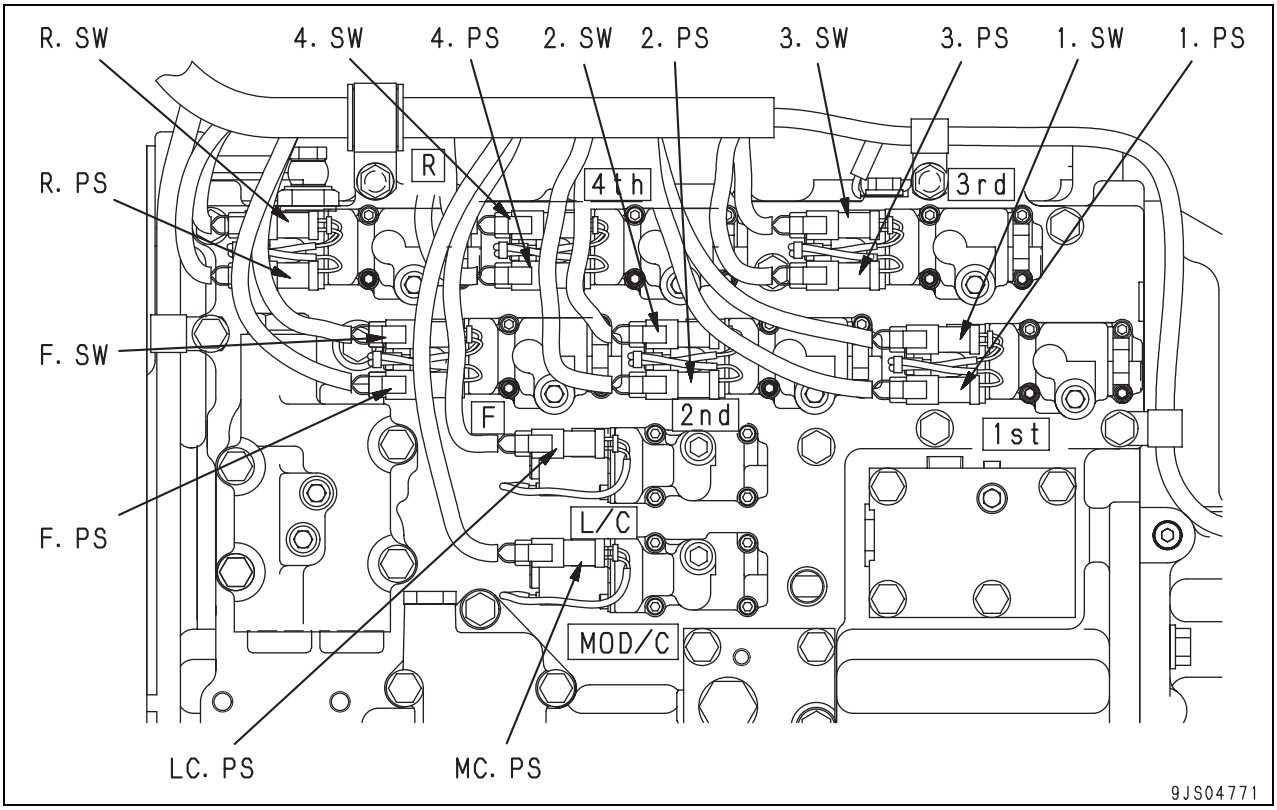
   2) Loosen hexagonal portion (a) of the transmission last chance filter case (7) to remove the cases.
      ★ After removing the transmission oil filter case, clean inside of the case as well as removed parts other than the filter.
   3) Remove filter element (8) and replace it with a new element (561-15-55670).
   4) Install transmission last chance filter case (7).
      ★ Replace the current O-ring with a new one, coat it with a small amount of oil and then install it.
      Hexagonal portion (b) of transmission last chance filter case:
      34.3 – 44.1 Nm {3.5 – 4.5 kgm}





Method of moving machine when transmission valve is broken

★ Locations of ECMV assemblies and connector Nos.



★ Device for moving machine when transmission valve is broken

Symbol	Part No.	Part Name
M	794-423-1190	Plug

★ Even if you cannot move the machine because of breakage of a transmission valve part (electrical system, solenoid valve, spool, etc.), you can move it by installing plugs **M**.

⚠ **Installation of plugs M to the ECMV is a means to move the machine from a dangerous job site to a safe place where you can repair it when you cannot move it at any gear speed because of breakage of the transmission control valve. Accordingly, use this method only when the transmission control valve is broken. Install plugs M only in an emergency where the broken machine cannot be towed and there is no means to move it.**

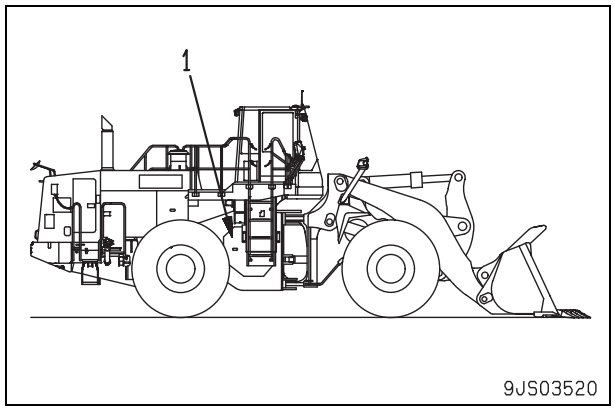
⚠ **When moving the machine by this method, observe the procedure and take care of safety.**

⚠ **Lower the work equipment to the ground fully, apply the parking brake, and put chocks under the tires to prevent the machine from moving.**

⚠ **When working, stop the engine.**

⚠ **When working while the oil temperature is still high, take care not to burn your body.**

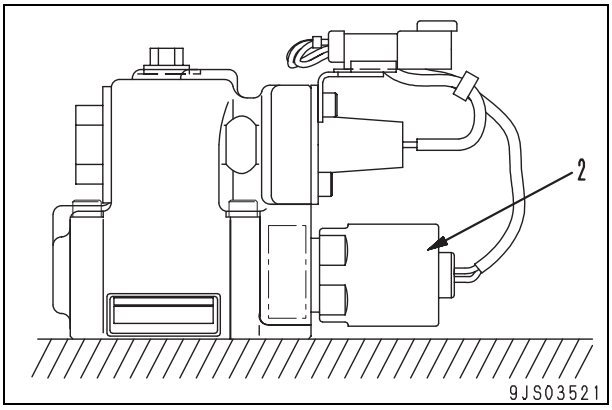
1. Remove cover (1) on the right side of the rear frame.
   ★ Remove mud and dirt from around the ECMV.

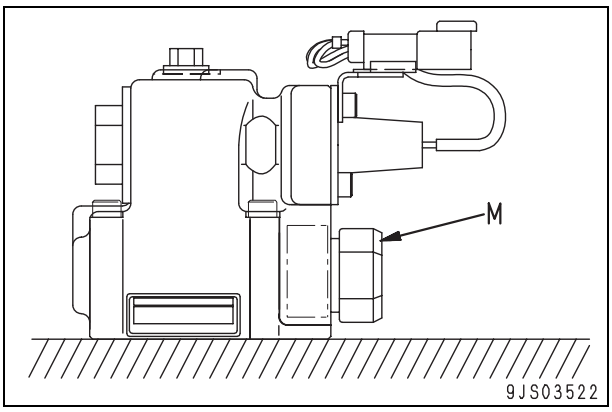


2. Disconnect all the connectors from each ECMV. (14 places)

3. Remove 3 solenoids (2) from the modulated clutch ECMV, 2nd ECMV, and F or R ECMV and install plugs **M**.
   - For forward travel:
     F solenoid and 2nd solenoid
   - For reverse travel:
     R solenoid and 2nd solenoid

   ★ If a wrong solenoid is removed, the transmission may be broken. Take care.
   ★ Install each plug with its projection side toward the ECMV. Check that the O-ring is fitted to the mating face.
   ★ Take care that mud or dirt will not enter the removed solenoids and valves.





4. Press the brake pedal securely.

5. Start the engine, release the parking brake, and then release the brake pedal gradually to start and move the machine.
   ★ If the parking brake cannot be released because of a trouble in the electrical system, see "Method of releasing parking brake manually".

   ⚠ **Remove the chocks.**
   ⚠ **If the engine is started, the transmission is engaged and the machine starts immediately. Accordingly, when starting the engine, check the moving direction of the machine and secure safety around the machine thoroughly and keep pressing the brake pedal.**
   ⚠ **After moving the machine, stop the engine, apply the parking brake, and put chocks under the tires.**

6. After moving the machine, remove the devices and return the removed parts.

Adjusting steering stop valve

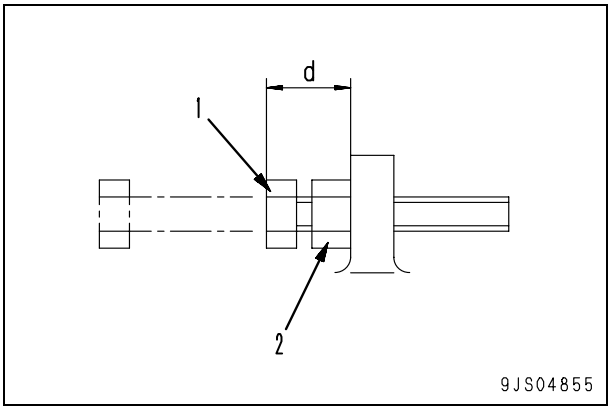
Preparation

Before adjusting the stopper bolt, operate the steering and check that the frame stoppers contact at each steering end.

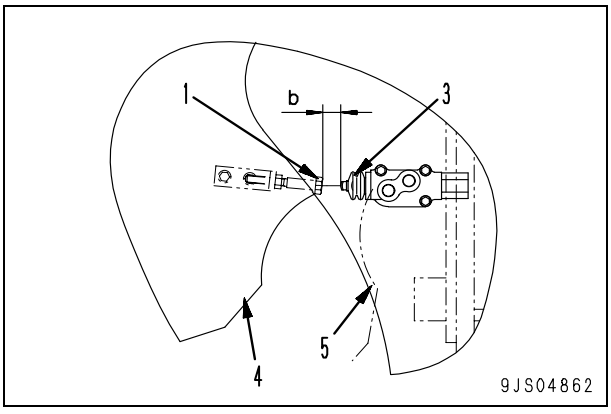
★ If the frame stoppers are damaged or lost, repair them so that the frames will contact against them on each side.

Adjusting

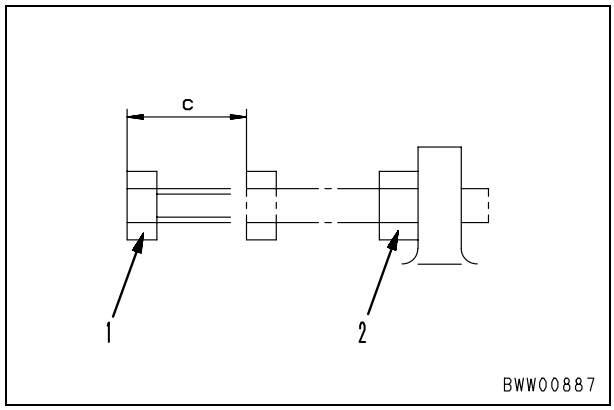
1. Loosen locknut (2) and then tighten stopper bolt (1) to minimum length (d) so that it may not contact against steering stop valve (3) during the steering operation.



2. Run the engine at low idle and then bring front frame (4) and rear frame (5) into contact each other by turning the steering wheel slowly.
   ⚠ **Use care in this operation so that your body or arm may not be caught between the front and rear frames.**
3. Stop the engine and then loosen stop bolt (1) until it touches the contact surface of steering stop valve (3).
4. Run the engine at low idle and return the steering wheel slowly until the clearance between the tip of steering stop valve (3) and head (b) of stopper bolt (1) becomes about 20 to 30 mm.



5. Tighten locknut (2) by rotating stopper bolt (1) in the loosening direction 8 – 8.5 turns (c dimension: 14.0 – 14.9 mm).
   ★ Adjust both the right and left side according to above 1 – 5 methods.



6. Start the engine, turn the machine and then measure clearance (a) between the front and rear frames as the steering is stopped due to the contact of steering stop valve (3) and stopper bolt (1). Make sure clearance (a) is compliant with the standard dimension on both sides.

WA600-6 Wheel loader

Form No. SEN00553-01

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

30 Testing and adjusting

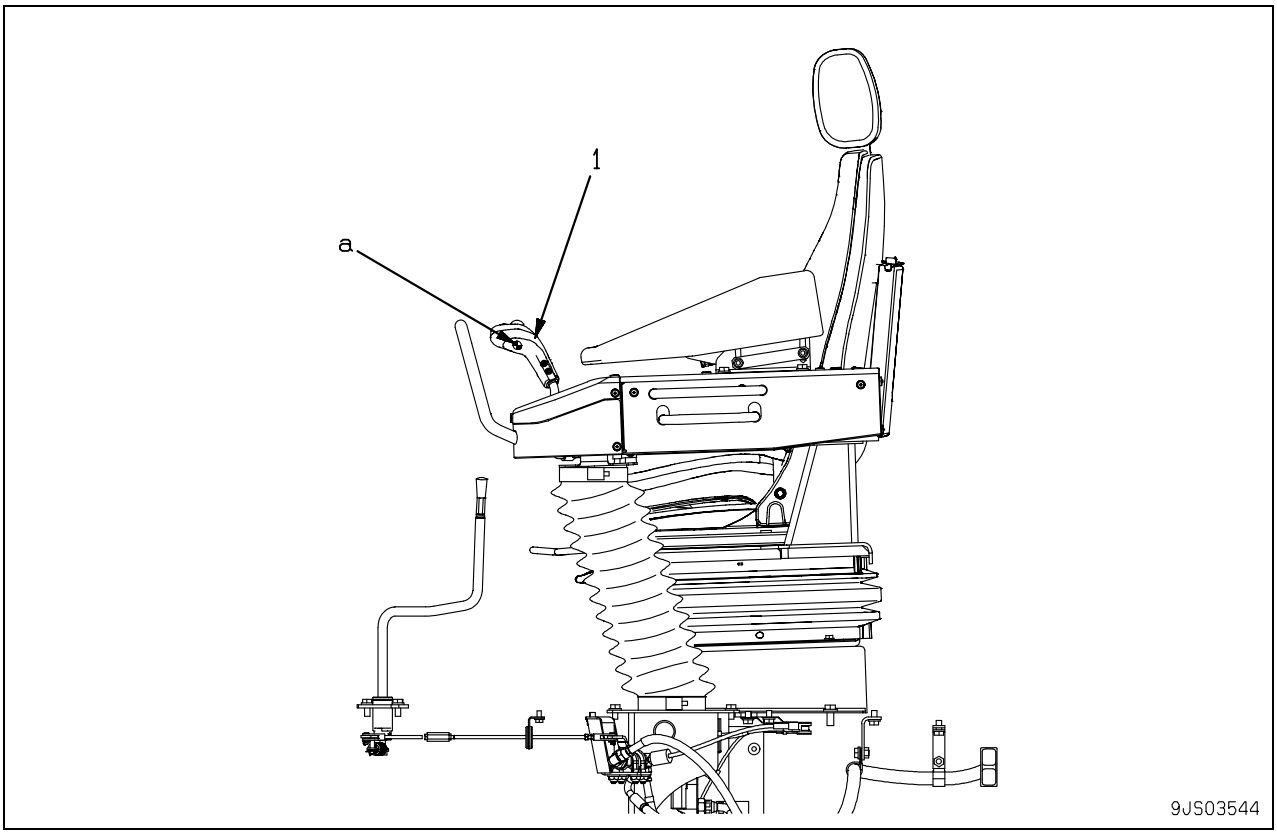
Testing and adjusting, Part 2

Testing and adjusting, Part 2 3
Measuring operating effort of AJSS lever (AJSS specification) 3
Testing and adjusting AJSS lever angle sensor and frame angle sensor (AJSS specification) 4
Testing and adjusting steering stopper bolt (AJSS specification) 6
Testing and adjusting steering wheel (Steering wheel specification) 8
Testing steering oil pressure 10
Bleeding air from steering cylinder circuit 14
Testing hydraulic drive fan 15
Bleeding air from hydraulic drive fan circuit 18
Measuring brake pedal 20
Measuring brake performance 21
Testing and adjusting accumulator charge pressure 22
Testing wheel brake oil pressure 24
Measuring wear of wheel brake disc 26
Bleeding air from wheel brake circuit 27
Releasing residual pressure in brake accumulator circuit 28

Testing parking brake performance 29
Measuring parking brake oil pressure 30
Testing wear of parking brake disc 33
Method of releasing parking brake manually 34
Measuring and adjusting work equipment control lever 35
Measuring work equipment oil pressure 36
Bleeding air from work equipment circuit 41
Releasing residual pressure in work equipment circuit 42
Moving machine for removing operator cab 43
Testing and adjusting bucket positioner 45
Testing and adjusting lift arm position detecting lever 47
Checking proximity switch operation indication lamp 48
Preparations for work on troubleshooting of electric system 49
Procedure for testing diodes 53

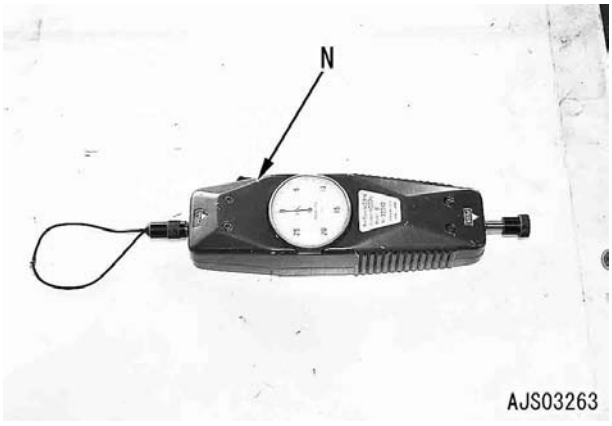
Testing and adjusting, Part 2

Measuring operating effort of AJSS lever (AJSS specification)



★ Measuring instruments for AJSS lever operating effort

Symbol	Part No.	Part Name
N	79A-264-0021	Push-pull scale

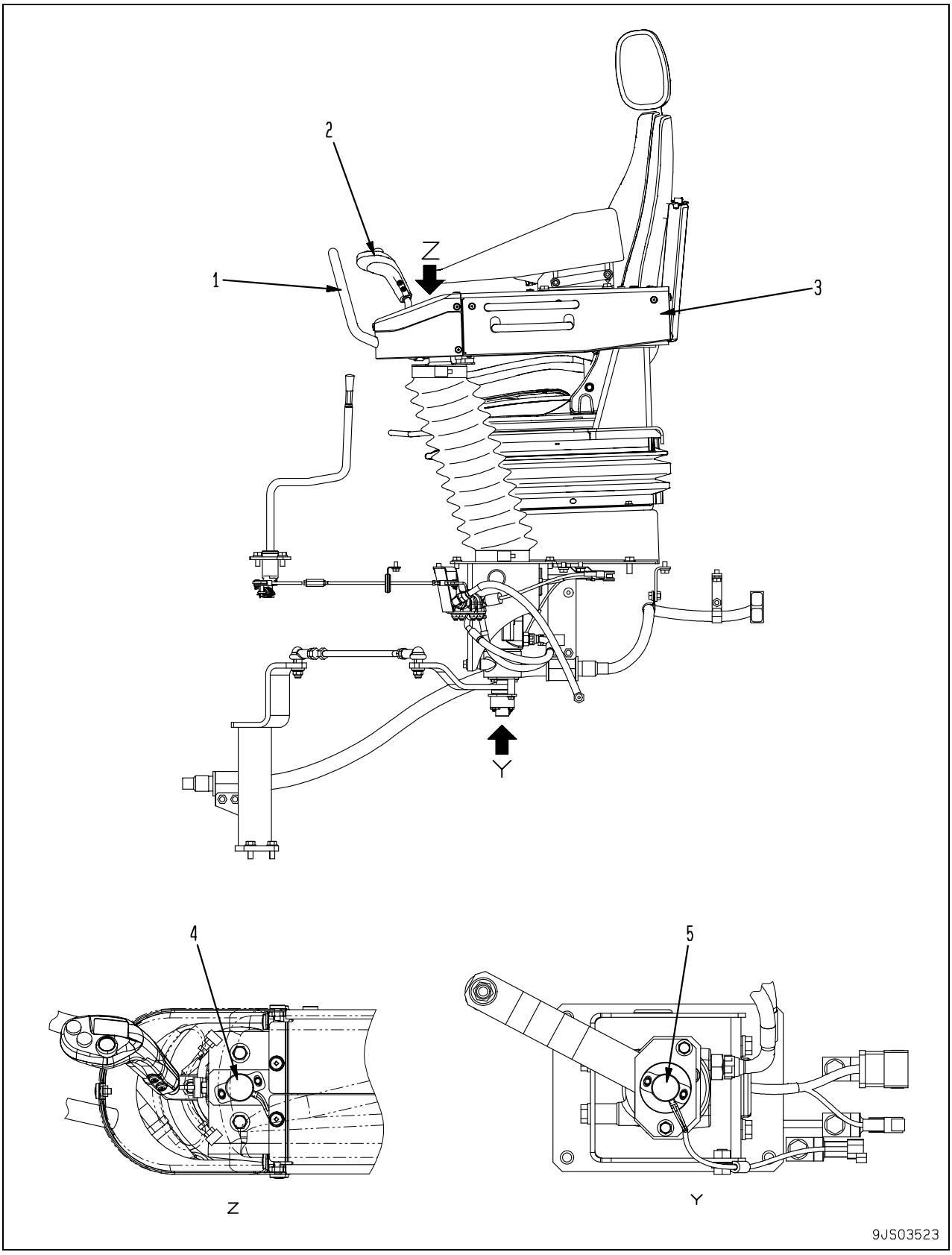


★ Measure the operating effort of AJSS lever under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range
- Engine speed: Low idle

1. Install and fix push-pull scale **N** at operating point (a) of AJSS lever (1).

2. Measure operating effort of AJSS lever (1) by pulling the lever in the right and left using push-pull scale **N**.
   ★ Operate the work equipment control lever at the ordinary operating speed and measure the minimum necessary effort to operate the AJSS lever.

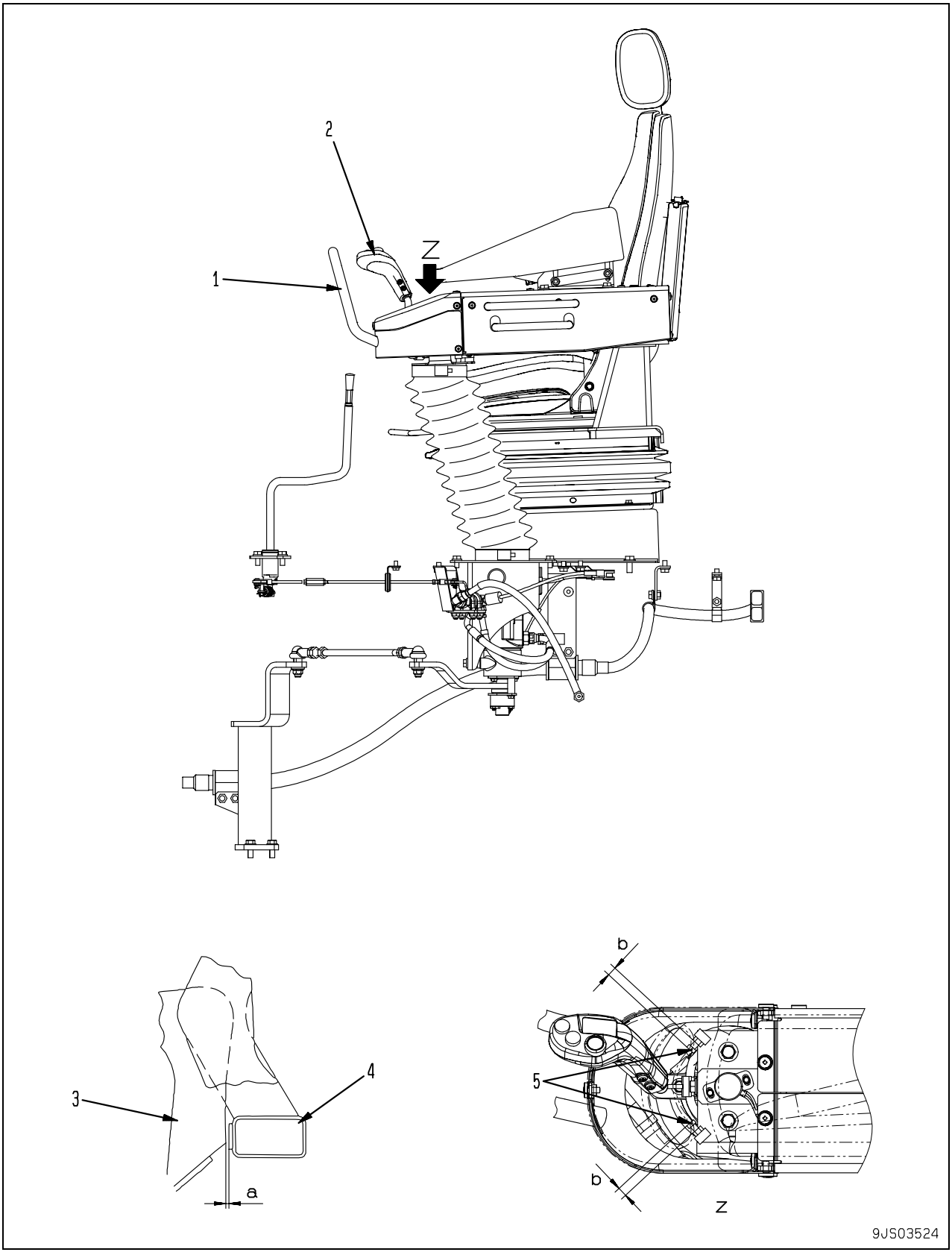
Testing and adjusting AJSS lever angle sensor and frame angle sensor (AJSS specification)



Adjusting

Adjust according to Special functions of machine monitor (EMMS), 7-11 Adjustment of AJSS neutral position.

Testing and adjusting steering stopper bolt (AJSS specification)



Testing

1. Start the engine and set steering lock lever (1) to Free position.

2. Move AJSS lever (2) to the right or left stroke end with the engine running at low idle. Maintain the steering at that position.
   ⚠ **Operate the steering slowly. Use care in this operation so that your body or arm may not be caught between the front and rear frames.**

3. Set steering lock lever (1) to lock position.

4. Make sure that clearance (a) between front frame (3) and rear frame (4) is normal.
   ★ Clearance (a): 20 – 30 mm
   ★ Check the left steering and right steering separately.

Adjusting

★ If clearance (a) is not normal, adjust it according to the following procedure.

1. Set steering lock lever to free position and return the steering to the center position.

2. Set steering lock lever (1) to lock position.

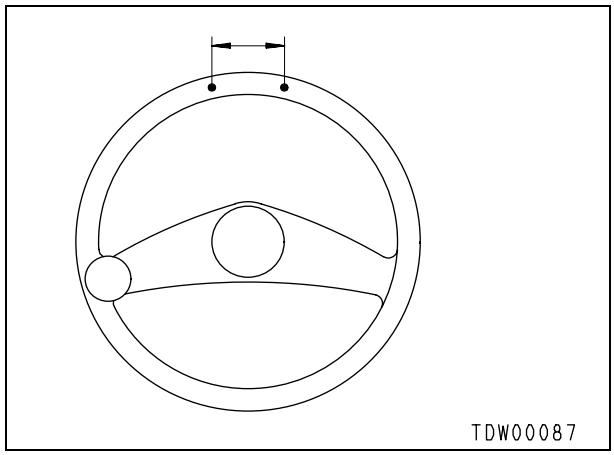
3. Adjust protrusion dimension (b) nonconforming side adjustment bolt (5).
   ★ Protrusion dimension (b):
   Increasing its length increases clearance (a)
   Decreasing it decreases clearance (a)
   ★ Standard protrusion dimension (b) (Reference): 15 mm
   Locknut: **8.8 – 10.8 Nm {0.9 – 1.1 kgm}**

   ★ After the adjustment, check clearance (a) again using the above testing procedure.

Testing and adjusting steering wheel (Steering wheel specification)

★ Testing and adjusting device for steering wheel

Symbol	Part No.	Part name
P	79A-264-0021	Push-pull scale



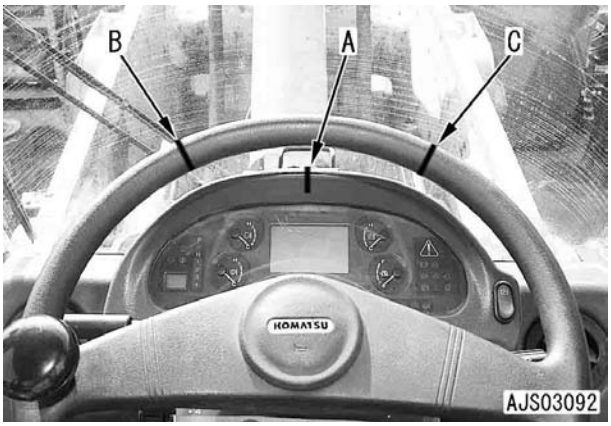
Measuring play of steering wheel

★ Measure the play of the steering wheel under the following condition.
- Engine: Stopped
- Position of machine: Straight travel condition

Measuring method

1. Move the steering wheel to the right and left 2 – 3 times and check that the steering mechanism is in neutral, and then make mark (A) on the machine monitor frame.

2. Turn the steering wheel to the right and make mark (B) at a position where the operating effort becomes heavy.



3. Turn the steering wheel to the left and make mark (C) at a position where the operating effort becomes heavy. Then, measure the straight distance between marks (B) and (C).

Measuring operating effort of steering wheel

★ Measure the operating effort of the steering wheel under the following condition.
- Road: Flat, level, paved, and dry road
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range
- Tire inflation pressure: Specified pressure
- Engine: Low idle (No load on bucket)

Measuring method

1. Install push-pull scale **P** to the steering wheel knob.
   ★ Install push-pull scale **P** to the center.
2. Start the engine.
   ★ After starting the engine, raise the bucket about 400 mm and release the frame lock lever.
3. Pull push-pull scale **P** in the tangential direction and read it while the steering wheel is moving smoothly.
   ★ The operating effort is not the value indicated when the steering wheel starts moving.



Measuring operating time of steering wheel

★ Measure the operating time of the steering wheel under the following condition.
- Road: Flat, level, paved, and dry road
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range
- Tire inflation pressure: Specified pressure
- Engine speed: Low idle and high idle

Measuring method

1. Start the engine.
   ★ After starting the engine, raise the bucket about 400 mm and release the frame lock lever.
2. Turn the steering wheel to the right or left stroke end.
3. Turn the steering wheel to the right or left stroke end and measure the full-stroke time.
   ★ Do not turn the steering wheel forcibly but turn it at the speed of 60 revolutions per minute.
   ★ While running the engine at low idle and high idle, measure the time to turn the steering wheel to the right and left respectively.



Testing steering oil pressure

★ Measuring instruments for steering oil pressure

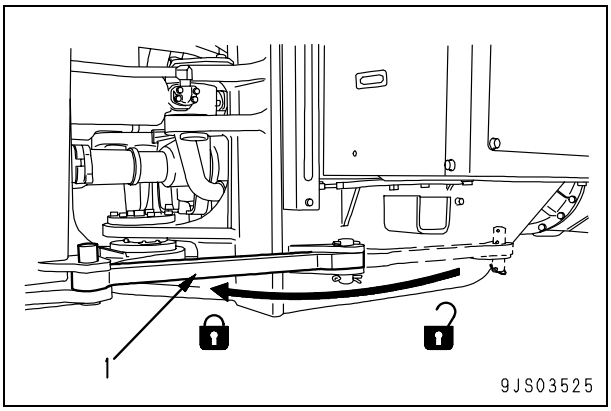
Symbol		Part No.	Part Name
Q	1	799-101-5002	Hydraulic tester
		790-261-1203	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25)
		07002-11023	O-ring
	3	799-401-2701	Differential pressure gauge
	4	799-401-3200	Adapter (Size 03)

★ Measure the steering oil pressure under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range

Measuring

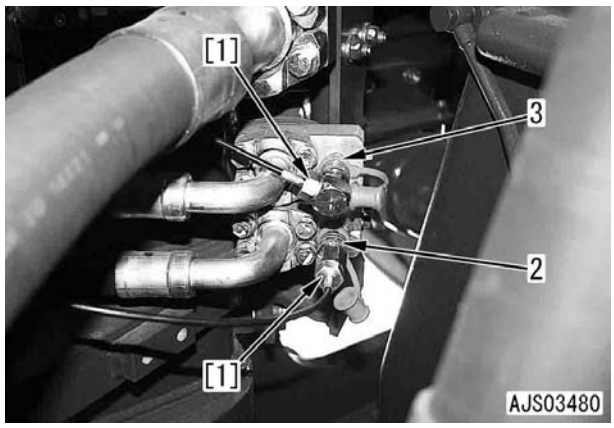
⚠ **Loosen the oil filler cap of the hydraulic tank to release the internal pressure of the hydraulic tank, then operate the steering wheel 2 – 3 times to release the residual pressure from the piping.**

⚠ **Apply frame lock lever (1).**



1. Steering relief pressure

1) Connect oil pressure gauge [1] of hydraulic tester **Q1** to steering circuit oil pressure pickup nipple (2) on the right steering cylinder head side.
★ Use the oil pressure gauge of 39.2 MPa {400 kg/cm^2}.



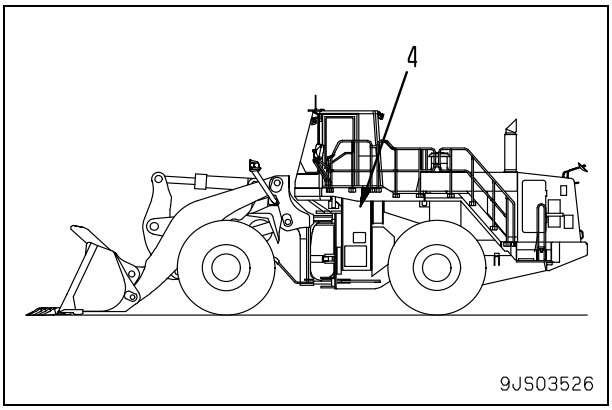
2) Run the engine at high idle and turn the steering wheel to the right. When the steering relief valve operates, measure the oil pressure.
★ When the gauge was connected to steering circuit pickup plug (3) at the bottom of the right side steering cylinder, measure the pressure by turning the steering wheel to the left.



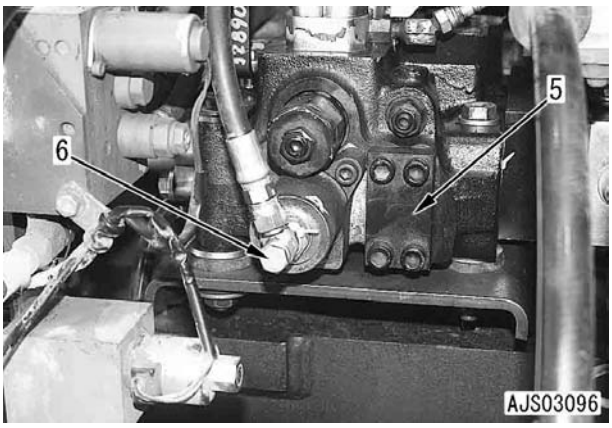
3) After finishing measurement, remove the measuring instruments and return the removed parts.

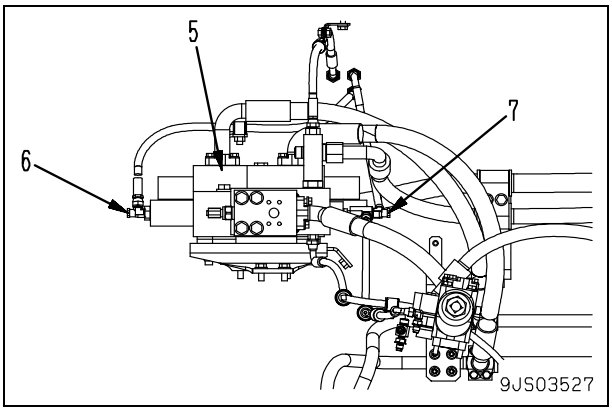
2. Steering pilot circuit pressure

1) Remove cover (4) at the accumulator installation position situated on the left side of the machine.

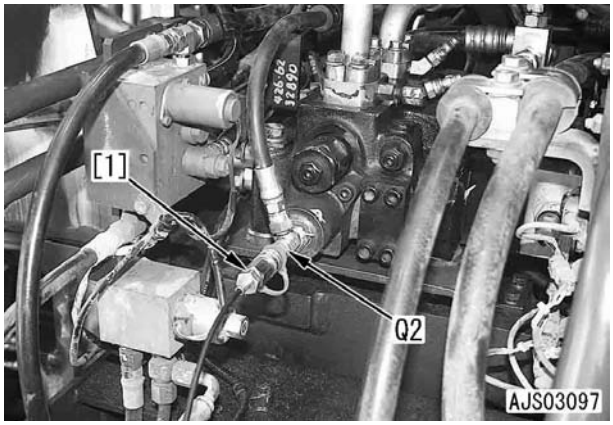


2) Remove the steering control circuit pressure pickup plug (10 × 1.25 mm) (6) or (7) of steering valve assembly (5).





3) Connect nipple **Q2** (10 × 1.25 mm) and oil pressure gauge [1] of hydraulic tester **Q1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



4) While running the engine at high idle, measure the oil pressure as the steering wheel is turned.
   - (6) Plug: Turn the steering wheel right (or shift AJSS lever to right)
   - (7) Plug: Turn the steering wheel left (or shift AJSS lever to left)



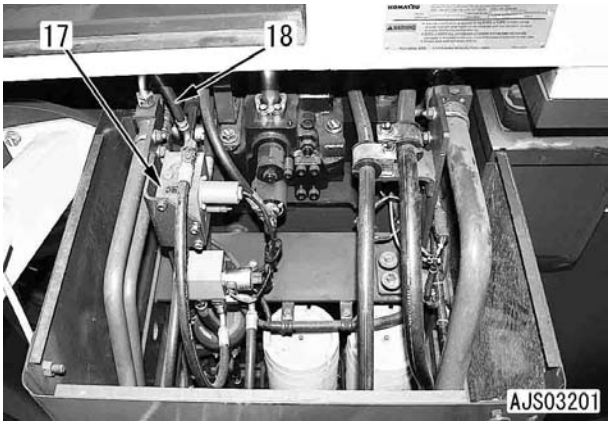
5) After finishing measurement, remove the measuring instruments and return the removed parts.

3. Measuring AJSS EPC solenoid valve output pressure (only for AJSS specification)

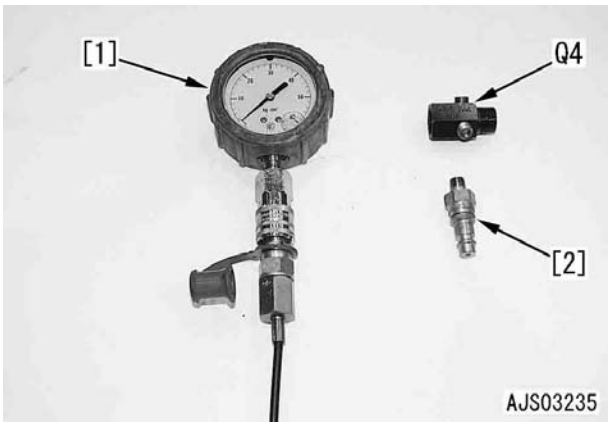
1) Lift and remove step (16).
   Step assembly: **130 kg**



2) Disconnect solenoid output pressure hose (18) from AJSS EPC solenoid valve (17).



3) Connect adapter **Q4** and solenoid output pressure hose (18).
4) Connect nipple [2] and oil pressure gauge [1] in hydraulic tester **Q1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



5) Lock the steering lock lever.
6) Start the engine and then measure AJSS EPC solenoid valve output pressure when the engine is set to high idle with AJSS lever being set at neutral.



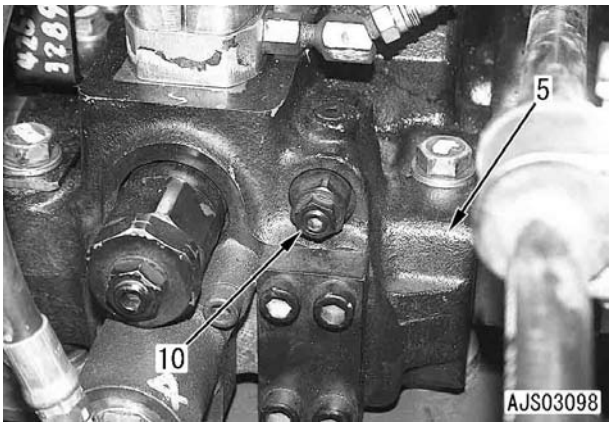
7) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

Adjusting

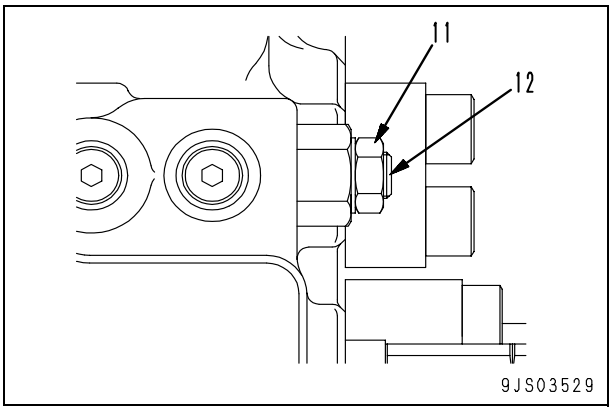
⚠ When adjusting the oil pressure, be sure to stop the engine.

1. Steering relief pressure

1) If the steering relief pressure is abnormal, adjust steering relief valve (10) of steering valve assembly (5) according to the following procedure.

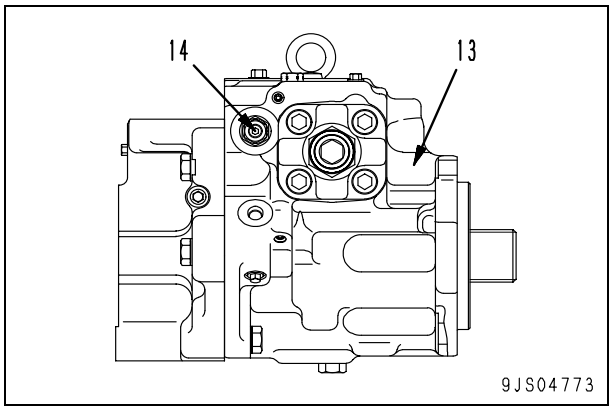


2) Loosen locknut (11) and turn adjustment screw (12) to adjust the pressure.
   - ★ Adjustment screw:
     - Turned to the right, the pressure rises.
     - Turned to the left, the pressure lowers.
   - ★ Quantity of adjustment per turn of adjustment screw:
     Per turn: 17.9 MPa {183 kg/cm^2}
   - Locknut:
     27 – 31 Nm {2.8 – 3.2 kgm}

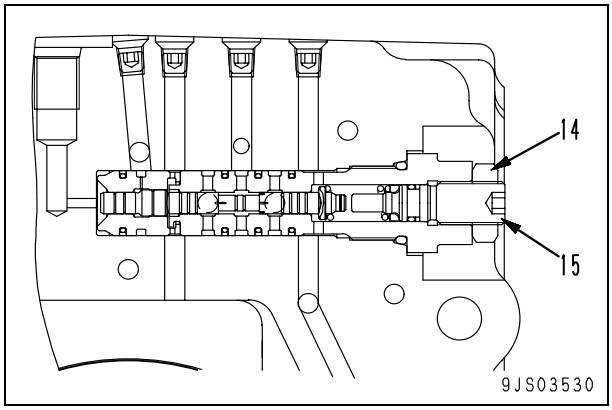


2. Steering LS differential pressure

1) If the steering LS differential pressure is abnormal, adjust LS valve (14) of steering pump assembly (13) according to the following procedure.



2) Loosen locknut (14) and turn adjustment screw (15) to adjust the pressure.
   - ★ Adjustment screw:
     - Turned to the right, the LS differential pressure lowers.
     - Turned to the left, the LS differential pressure rises.
   - ★ Quantity of adjustment per turn of adjustment screw:
     Per turn: 1.3 MPa {13.3 kg/cm^2}
   - Locknut: **49 – 68.6 Nm {5 – 7 kgm}**



3. AJSS EPC solenoid valve output pressure

Adjustment of AJSS EPC solenoid valve output pressure is done by adjusting AJSS EPC output current. For details, see “Special functions of machine monitor”, 7-11 AJSS EPC output current adjustment (AJSS specification).

Bleeding air from steering cylinder circuit

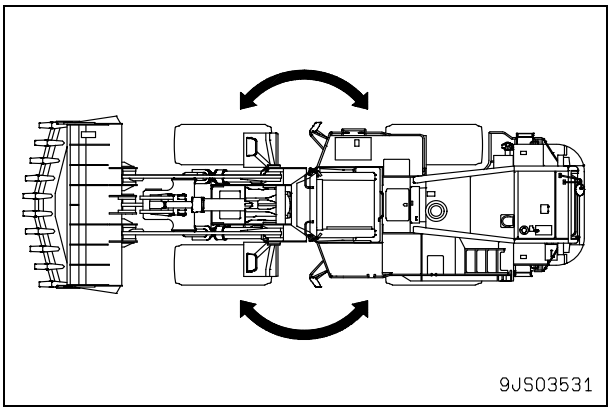
★ Before starting the operation, make sure the specified level of hydraulic oil is provided.
★ If the steering valve or the steering cylinder was removed and installed, bleed air from the steering circuit according to the following procedure.

1. Run the engine at idle for about 5 minutes.

2. While running the engine at low idle, steer the machine to the right and left 4 – 5 times.
   ★ Stop the piston rod about 100 mm before each stroke end and take care not to relieve the circuit.

3. While running the engine at high idle, perform the operation of 2.

4. While running the engine at low idle, move the piston rod to the stroke end and relieve the circuit.



Testing hydraulic drive fan

★ Testing tools for hydraulic drive fan

Symbol		Part No.	Part Name
R	1	799-205-1100	Tachometer kit
	2	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	3	799-101-5220	Nipple (M10 × 1.25)
		07002-11023	O-ring
	4	799-401-3500	Adapter (Size 06)

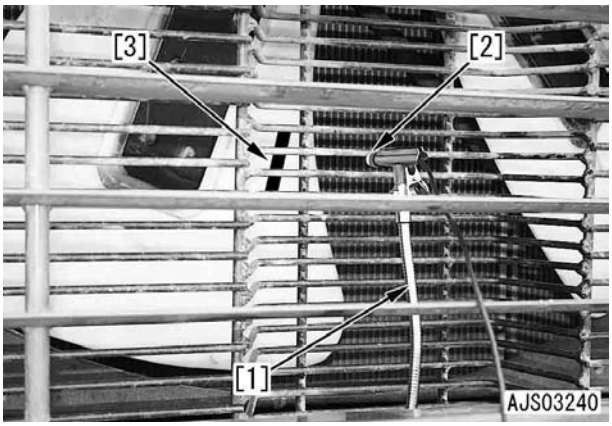
⚠ Set the bucket bottom horizontally and lower it to the ground, and then put chocks under the tires.

⚠ When removing the oil pressure pickup plug and disconnecting the hose, loosen the oil filler cap of the hydraulic tank to release the internal pressure of the tank.

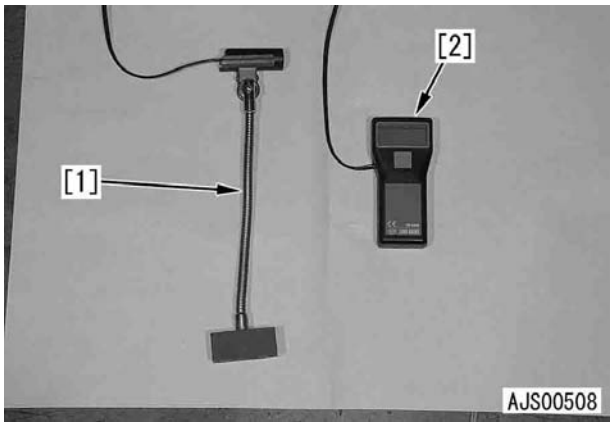
★ Measurement condition
- Engine coolant temperature: Min. 95°C
- Hydraulic oil temperature: Min. 95°C
- Torque converter oil temperature: Min. 105°C

1. Measuring fan speed

1) Set probe [2] to stand [1] of tachometer kit **R1** and stick reflection tape [3] to the fan.



Tachometer kit R1



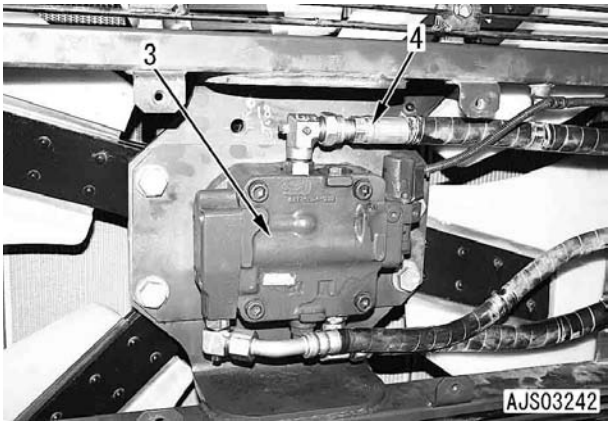
2) While running the engine at high idle and low idle, measure the fan speed.
3) After finishing measurement, remove the measuring instruments and return the removed parts.

2. Measuring fan drive oil pressure

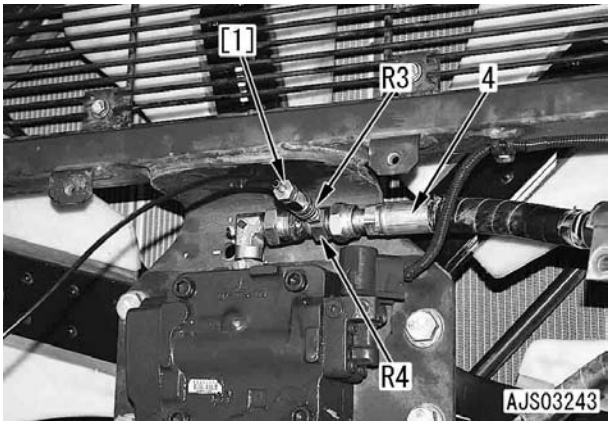
1) Open radiator grille (1).
2) Remove fan net (2) at the center.



3) Disconnect P port hose (4) of fan motor (3).



4) Connect adapter **R4** and hose (4).
5) Connect nipple **R3** (10 × 1.25 mm) and oil pressure gauge [1] in hydraulic tester **R2**.
   ★ Use the oil pressure gauge of 39.2 MPa {400 kg/cm^2}.



6) While running the engine at high idle, measure the fan drive oil pressure.



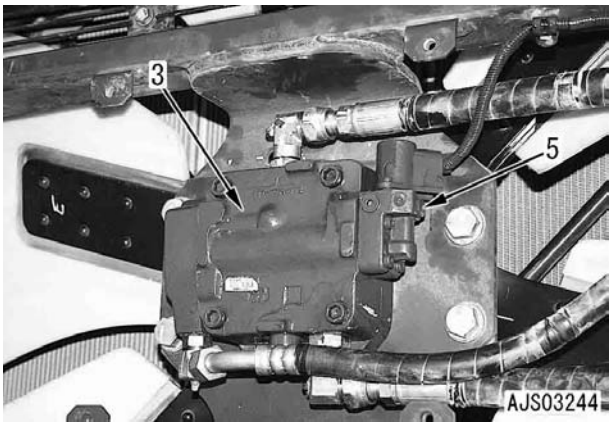
7) After finishing measurement, remove the measuring instruments and return the removed parts.

3. Measuring fan reverse solenoid output pressure

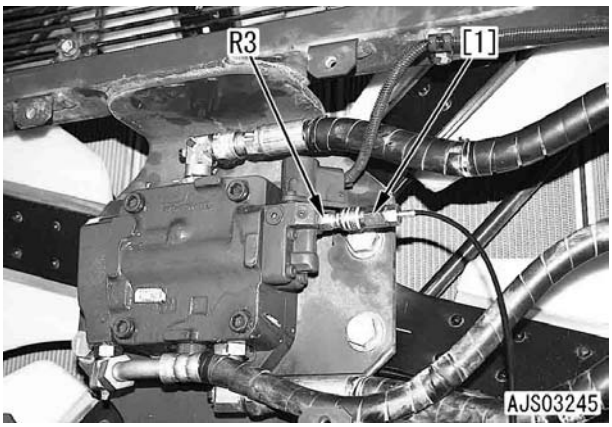
1) Open radiator grille (1).
2) Remove fan net (2) at the center.



3) Remove fan reverse solenoid output pressure pickup plug (10 × 1.25 mm) (5) from fan motor (3).



4) Connect nipple **R3** (10 × 1.25 mm) and oil pressure gauge [1] in hydraulic tester **R2**.
   ★ Use the oil pressure gauge of 39.2 MPa {400 kg/cm^2}.



5) Turn the cooling fan reverse switch ON.
6) While running the engine at high idle, measure the fan reverse solenoid drive oil pressure.
   ★ Measure the fan forward and reverse drive oil pressures. When the fan is reversed, check that the solenoid operates and the specified oil pressure is applied.



7) After finishing measurement, remove the measuring instruments and return the removed parts.

Bleeding air from hydraulic drive fan circuit

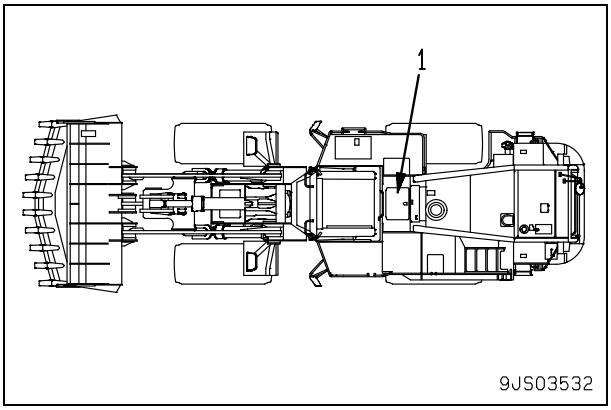
★ Testing tools for bleeding air from hydraulic drive fan circuit

Symbol		Part No.	Part Name
S	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25)
		07002-11023	O-ring
	3	799-401-3500	Adapter (Size 06)
	4	790-261-1130	Coupling

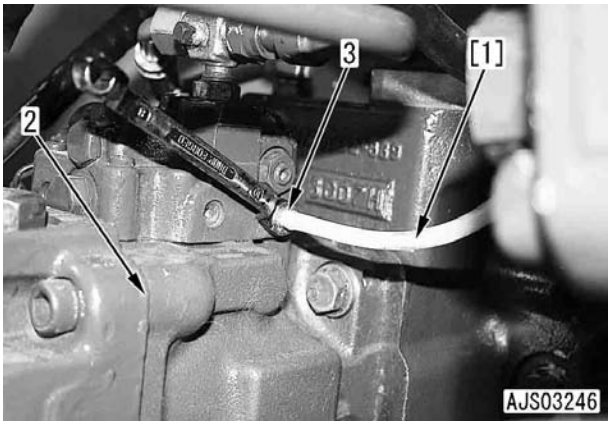
★ Before starting the operation, make sure the specified level of hydraulic oil is provided.

1. Bleeding air from fan pump

1) Open pump top cover (1).



2) Stop the engine and then loosen air bleeder (3) of fan pump (2) to connect air bleeding hose [1].



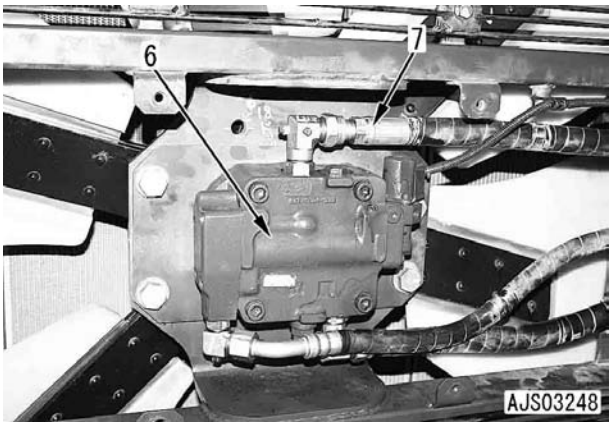
3) As oil free from air started to flow out of air bleeder (3), tighten air bleeder (3).
   Air bleeder:
   7.8 – 9.8 Nm {0.8 – 1.0 kgm}
4) Start the engine and run it at low idle for 5 minutes minimum.

2. Bleeding air from fan motor circuit

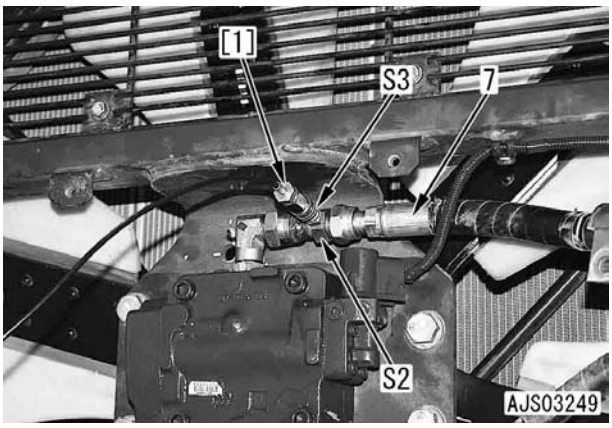
1) Open radiator grille (4).
2) Remove fan net (5) at the center.

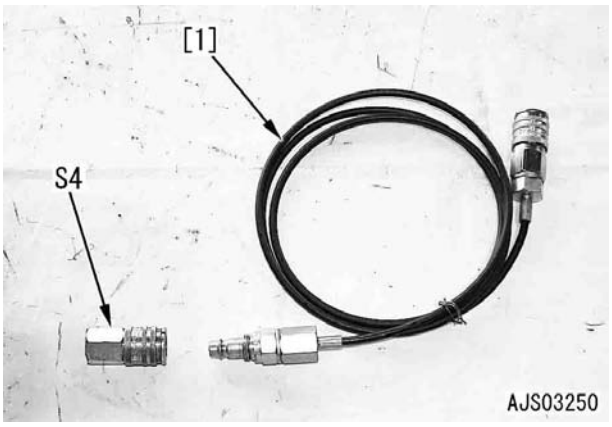


3) Disconnect P port hose (7) of fan motor (6).



4) Connect adapter **S3** and hose (7).
5) Connect nipple **S2** (10 × 1.25 mm) and hose [1] in hydraulic tester **S1** and also connect air bleeder coupling **S4** to the outlet end of hose.
   ★ Put the outlet end of the hose in an oil receiver.





6) Run the engine. When the oil flows out of the outlet end of the hose, stop the engine.
7) After finishing bleeding air, remove the tools and return the removed parts.

Measuring brake pedal

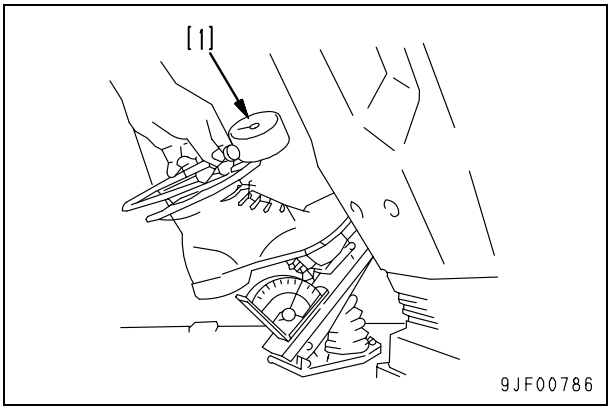
★ Measurement condition
- Engine coolant temperature: Within operating range
- Engine speed: Low idle

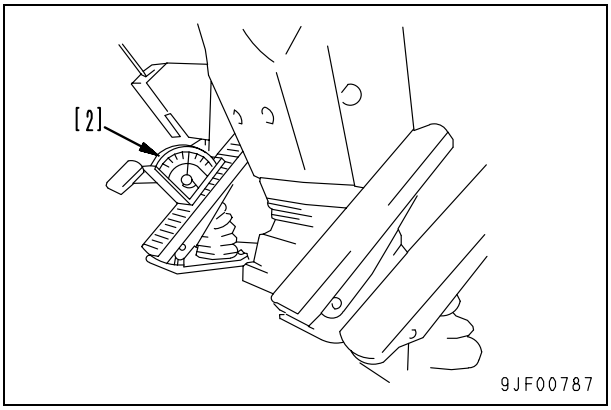
Measuring pressing angle of pedal

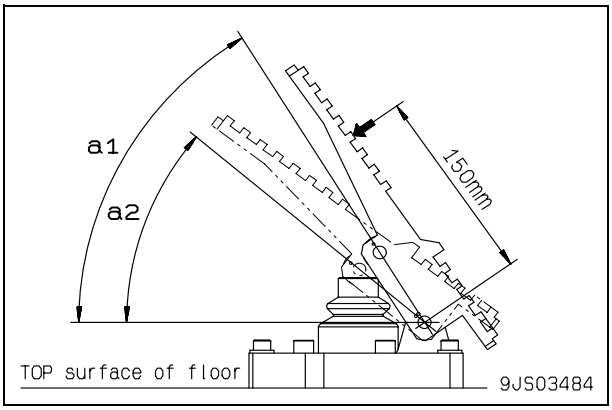
1. Install push gauge [1] to the foot of the measurer.
   ★ Set the push gauge in a position 150 mm from the fulcrum of the pedal.

2. While running the engine at low idle, measure pedal pressing angle (a1).

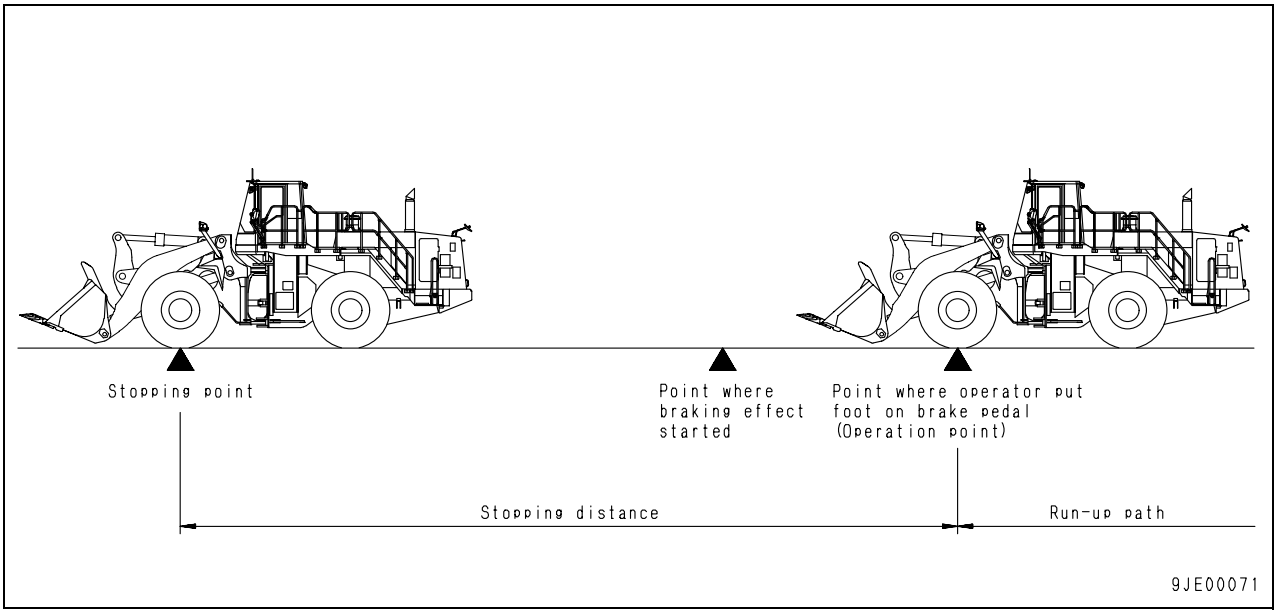
3. Apply angle gauge [2] to the brake pedal and measure pressing angle (a2) from pressing angle a1 to pressing angle (a3) (a2 = a1 – a3).
   - (a2): Pressing angle at pressing effort of 321 ± 32.1 N {32.8 ± 3.3 kg}







Measuring brake performance



★ Measure the brake performance under the following condition.
- Road: Flat, level, paved, and dry road
- Braking initial speed: 20 km/h
- Tire inflation pressure: Specified pressure
- Tire size: 35/65-33-36PR
- Brake pedal pressing force: Specified pressing force
  294 ± 29.4 N {30 ± 3 kg}
- Pressing time lag: 0.1 second

Measuring method

1. Start the engine and drive the machine.
2. Set the gear shift lever or gear shift switch to 4th position for run up.
3. When the travel speed becomes the braking initial speed of 20 km/h, press the left brake pedal with the specified force.
   ★ Decide the approach course and braking point in advance and apply the brake at that braking point.
4. Measure the distance from the braking point to the stop point.
   ★ Perform the above measurement 3 times and obtain the average.

Testing and adjusting accumulator charge pressure

★ Testing and adjusting instruments for accumulator charge pressure

Symbol	Part No.	Part Name
T	799-101-5002	Hydraulic tester
	790-261-1204	Digital hydraulic tester

★ Measure the accumulator charge pressure under the following condition.

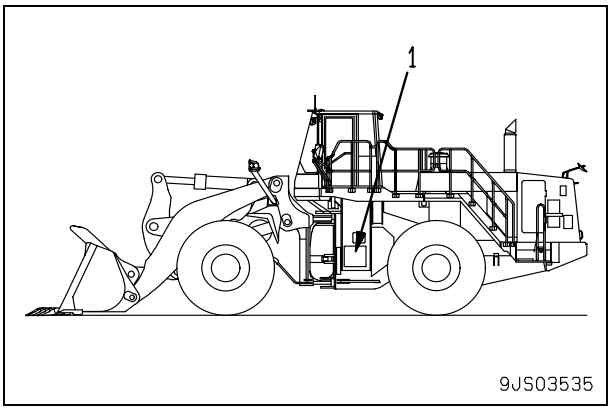
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range

⚠ **Put chocks under the tires securely.**

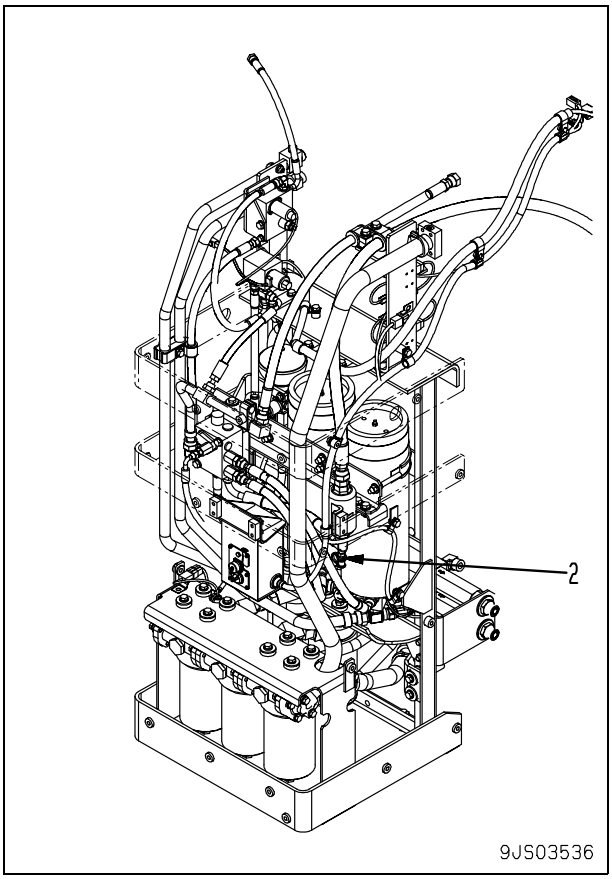
⚠ **While the engine is stopped, press the brake pedal at least 100 times to release the pressure from the accumulator circuit.**

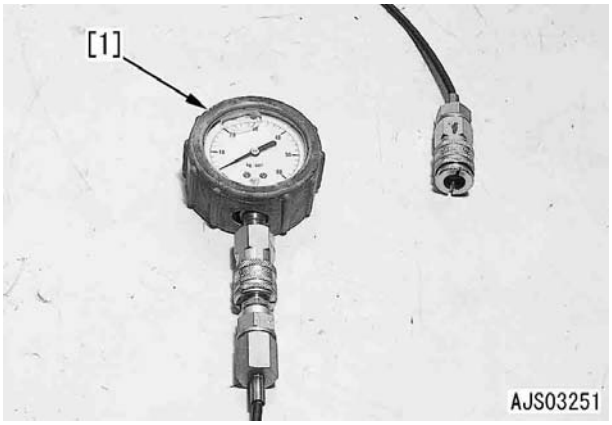
Measuring

1. Remove cover (1) at the accumulator installation position situated on the left side of the machine.



2. After removing cover (1), insert your hand through the opening and connect oil pressure gauge [1] of hydraulic tester **T** to accumulator charge valve measuring nipple [2].
   ★ Use the oil pressure gauge of 39.2 MPa {400 kg/cm^2}.





3. Measure the accumulator charge cut-in pressure.
   While running the engine at low idle, when the brake oil pressure caution lamp on the monitor panel goes off, measure the oil pressure.
   ★ Cut-in pressure:5.9 (+0.5/0) MPa {60 (+5/0) kg/cm^2}

4. Measure the accumulator charge cut-out pressure.
   After the accumulator charge cut-in operation, the rising oil pressure gauge lowers suddenly. Measure the oil pressure at this time.

★ Cut-out pressure:9.8 (+0.98/0) MPa
{100 (+10/0) kg/cm^2}

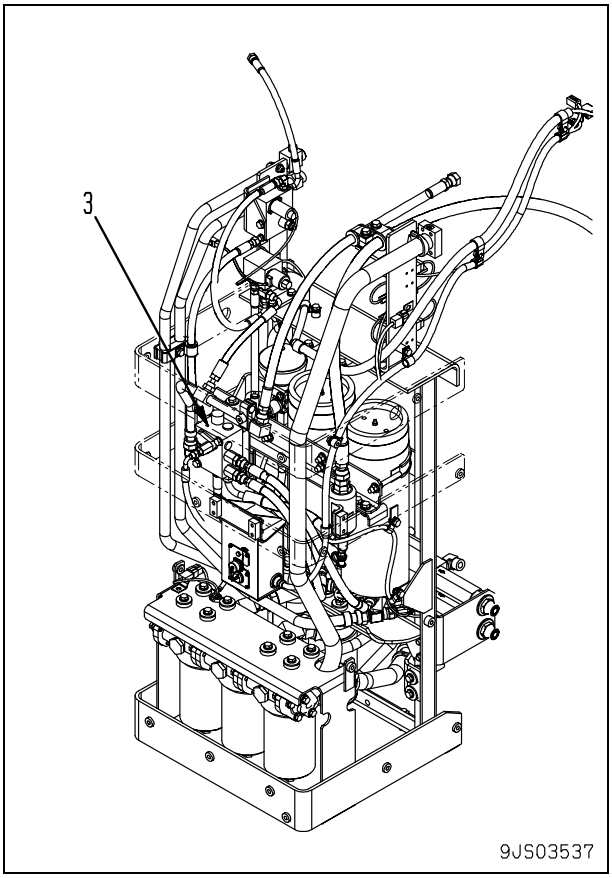


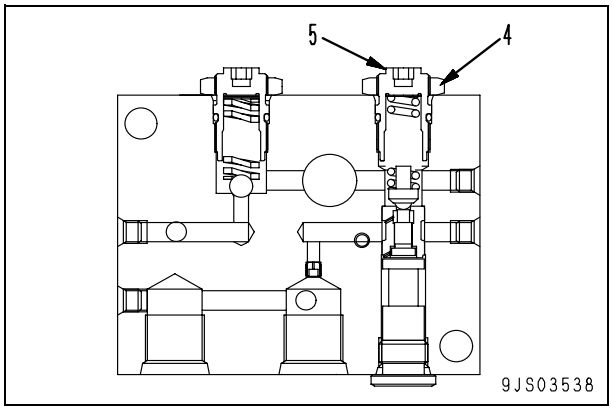
5. Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

Adjusting

★ If the accumulator charge cut-out pressure is adjusted, the cut-in pressure changes according to the valve area ratio.

1. Loosen locknut (4) of unload relief valve (accumulator charge cut-out valve) (3) and turn adjustment screw (5) to adjust the pressure.





★ Adjustment screw:
- Turned to the right, the pressure rises.
- Turned to the left, the pressure lowers.

★ Quantity of adjustment per turn of adjustment screw: 5.59 MPa {57 kg/cm^2}

Locknut: **9.8 – 11.8 Nm {1.0 – 1.2 kgm}**

★ After finishing measurement, check the accumulator charge cut-in and cut-out pressures again according to the above measurement procedure.

Testing wheel brake oil pressure

★ Measuring tools for wheel brake oil pressure

Symbol		Part No.	Part Name
U	1	793-520-1821	Nipple
	2	793-520-1810	Joint
	3	385-10178481	Bleeder screw
	4	793-520-1831	Gauge assembly

⚠ **Even when the brake pedal is not usable due to troubles on brake-related equipment, highly pressurized oil in the accumulator can burst out. Thus, it is required to release pressure in the accumulator circuit by pressing the brake pedal 100 times minimum while maintaining the engine at stopped state.**

⚠ **Apply the parking brake and put chocks under the tires securely.**

★ Measure the oil pressure of the front brakes (right and left) and rear brakes (right and left) similarly.

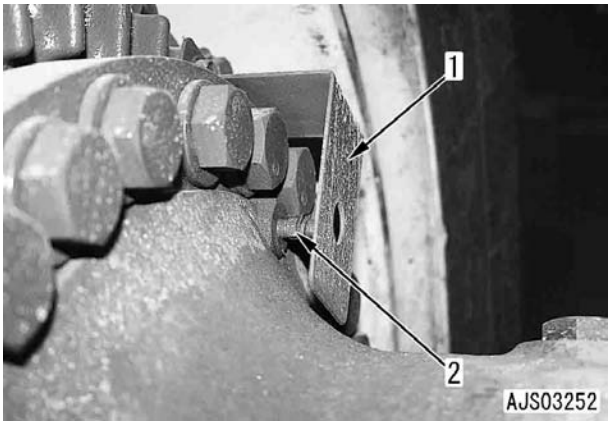
★ Measure the wheel brake oil pressure under the following condition.

- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range

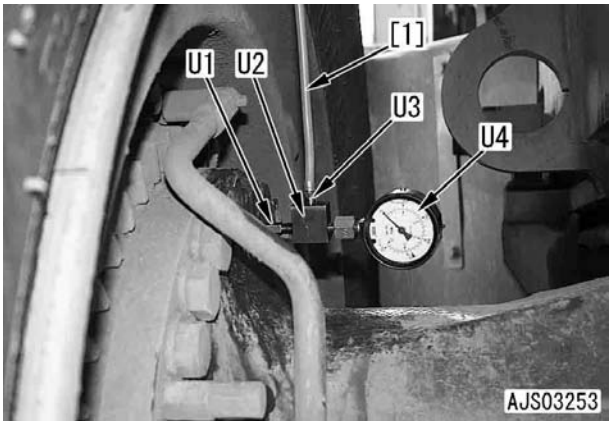
Measuring

1. Wheel brake oil pressure

1) Remove cover (1) and bleeder screw (2).

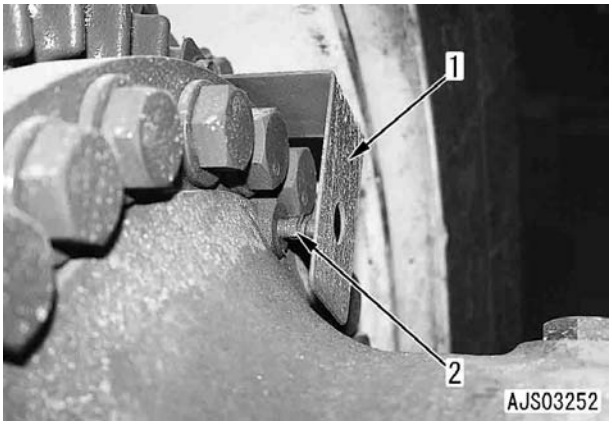


2) Install nipple **U1**, joint **U2**, bleeder screw **U3** and gauge assembly **U4**.
3) Connect hose [1] to bleeder screw **U3** and then bleed air from the brake circuit. For details, see “Bleeding air from brake circuit”.
4) Start the engine and measure the wheel brake oil pressure as the left brake pedal is pressed.

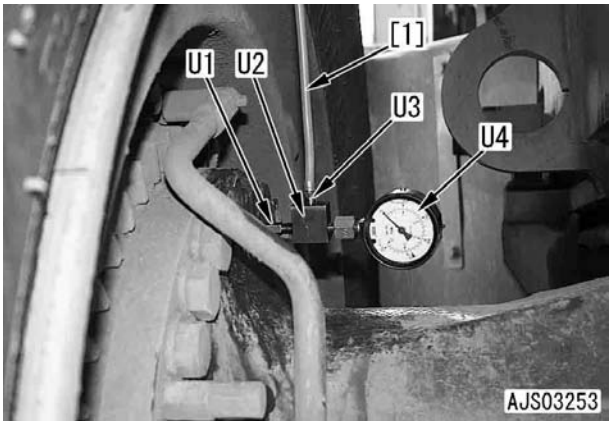


2. Drop in wheel brake oil pressure

1) Remove cover (1) and bleeder screw (2).



2) Install nipple **U1**, joint **U2**, bleeder screw **U3** and gauge assembly **U4**.
3) Connect hose [1] to bleeder screw **U3** and then bleed air from the brake circuit. For details, see “Bleeding air from brake circuit”.



4) Start the engine and accumulate pressure in the accumulator.
5) Stop the engine and press the left brake to set the oil pressure to 5.9 MPa {60 kg/cm^2}. Maintain this state for 5 minutes and then measure the pressure drop.
   ★ Use care so that the brake pedal may not be moved for 5 minutes.
   ★ Remove the measuring instruments after the measurement and return the currently removed parts to their original position. Then bleed air from the wheel brake circuit. For details, see Bleeding air from wheel brake circuit.

Measuring wear of wheel brake disc

Symbol	Part No.	Part name
V	Commercially available	Slide calipers

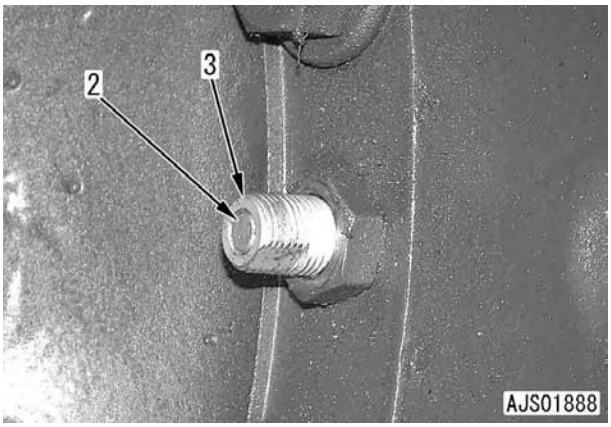
⚠ Stop the machine in a level place and put chocks under the tires.

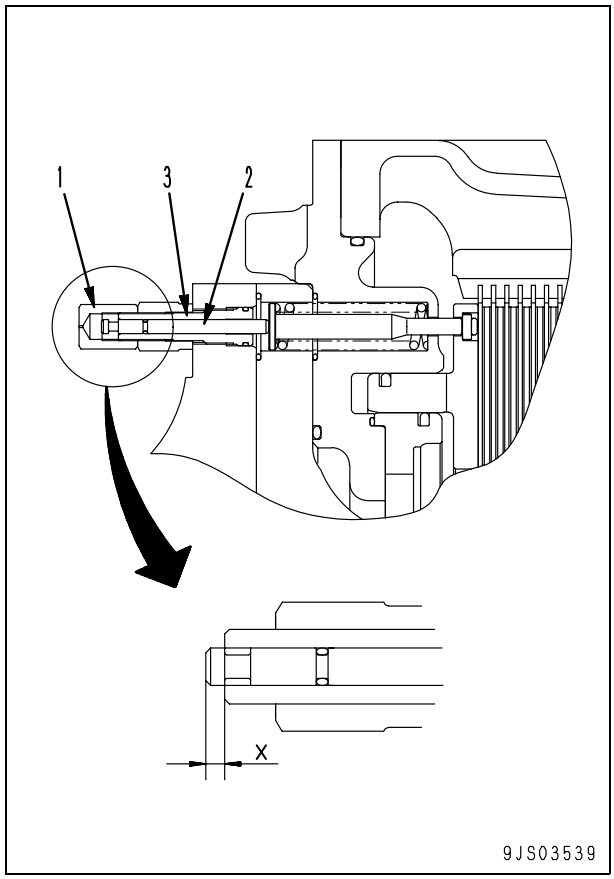
1. Remove cap (1).



2. Lightly press the brake pedal to the stroke end.

3. While shaft (2) is pushed in, measure projection (x) (wear volume) from guide (3) using a slide caliper **V**.
   - ★ Keep pressing the brake pedal during measurement.
   - ★ If shaft (2) is projected from the end of guide (3) to the groove on it, replace the disc.
   - ● Wear (x): **Max. 5.5 mm**





4. After testing, return cap (1).
   - Cap (1): **29.4 – 39.2 Nm {3.0 – 4.0 kgm}**

Bleeding air from wheel brake circuit

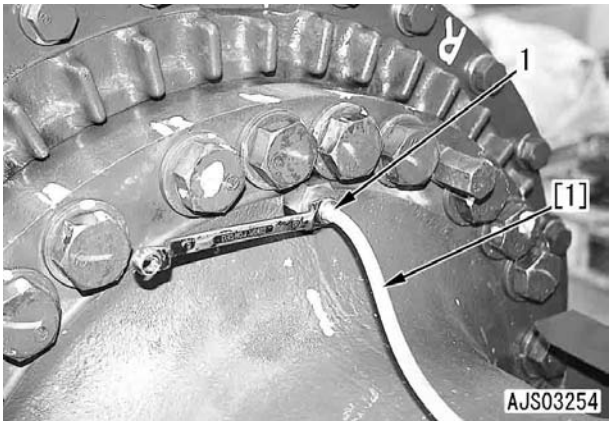
⚠ **Stop the machine in a level place and put chocks under the tires.**

★ If a brake circuit part is removed and installed, bleed air from the brake circuit according to the following procedure.

★ Bleed air from the front brake circuit and rear brake circuit similarly (2 places each).

1. Start the engine to accumulate pressure in the accumulator and then stop the engine.

2. Connect hose [1] to bleeder screw (1) and place hose [1] in the oil pan.



3. Press the brake pedal and then loosen bleeder screw (1) to bleed air.
   ★ Return the brake pedal slowly after tightening bleeder screw (1).
   ★ Use the left brake pedal.

4. Repeat this operation until the oil flowing through hose [1] becomes free from bubbles. Then press the pedal fully and tighten bleeder screw (1) while the oil is flowing.

5. Bleed air from other brake cylinders, too, using the same procedure.
   ★ When a complete bleeding is required, it is advisable to start the operation from the brake cylinder situated farthest from the brake pedal.
   ★ As accumulated pressure in the accumulator is decreased, start the engine to accumulate pressure in the accumulator. Then bleed air using the same procedure as described above.
   ★ After finishing bleeding air, run the engine at low idle and check the oil level in the hydraulic tank. If the level is low, add oil up to the specified level.

Releasing residual pressure in brake accumulator circuit

⚠ **Before disconnecting any of the following brake accumulator circuits, release residual pressure in that brake circuits.**

- Piping between accumulator charge valve and brake accumulator
- Piping between accumulator charge valve and parking brake emergency release valve
- Piping between brake accumulator and brake valve on both sides

1. Stop the engine.

2. Press the brake pedal at least 100 times to release the pressure from the brake accumulator circuit.

Testing parking brake performance

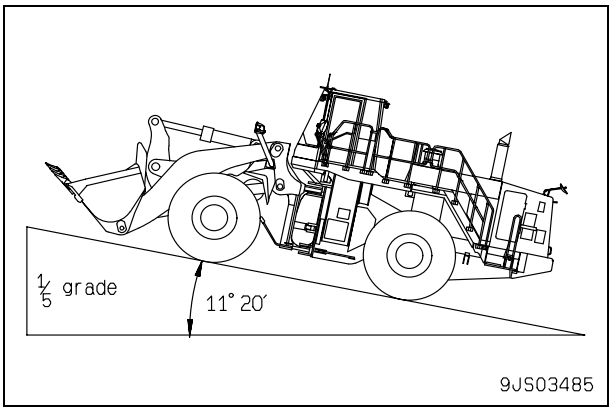
★ Measurement condition
- Tire inflation pressure: Specified pressure
- Road: 1/5 gradient (11° 20'), flat, and dry road
- Machine: Ready for operation

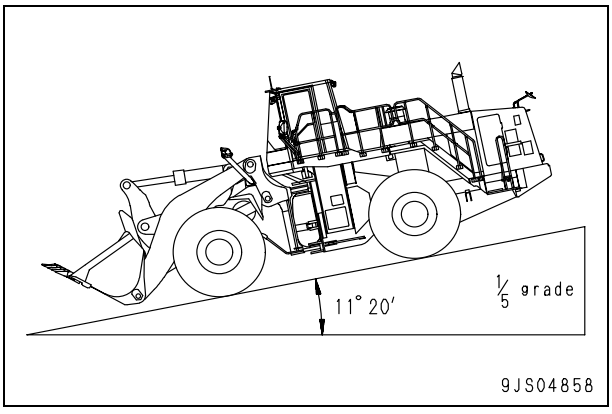
Measuring method

1. Start the engine and set the machine in the straight travel position, and then drive up a slope of 1/5 gradient with no load in the bucket.

2. Press the brake to stop the machine, set the directional lever in the N position, and stop the engine.

3. Turn the parking brake switch ON (to park), and then release the brake gradually. At this time, the machine must not move.
   ★ When the engine is stopped, the parking brake is turned ON (to park) automatically.
   ★ Measure the parking brake performance on an uphill and a downhill.





Measuring parking brake oil pressure

★ Measuring instruments for parking brake oil pressure

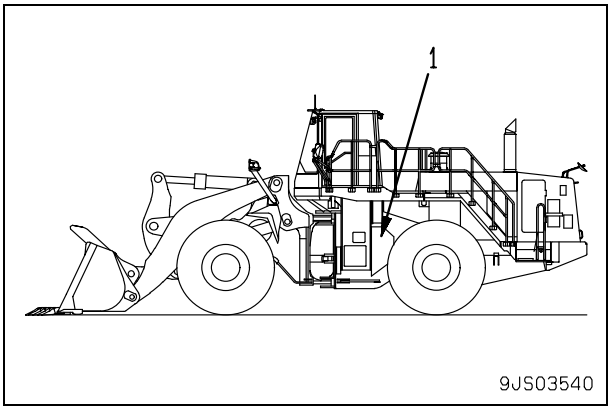
Symbol		Part No.	Part Name
W	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25)
		07002-11023	O-ring
	3	799-401-3100	Adapter (Size 02)

⚠ **Put chocks under the tires.**
⚠ **Install and remove the measuring instruments after the oil temperature lowers fully.**

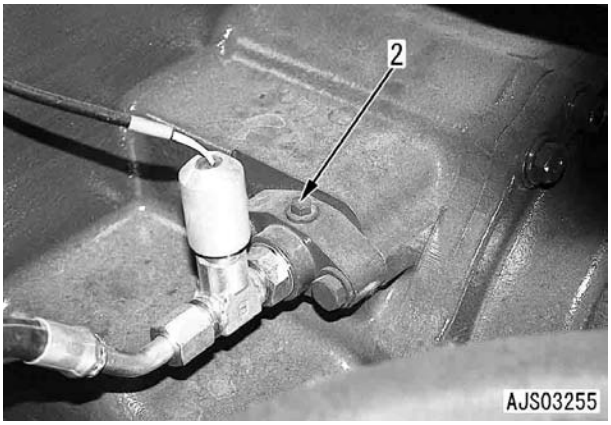
★ Measure the parking brake oil pressure under the following condition.
- Engine coolant temperature: Within operating range
- Power train oil temperature: Within operating range

1. Parking brake inlet pressure

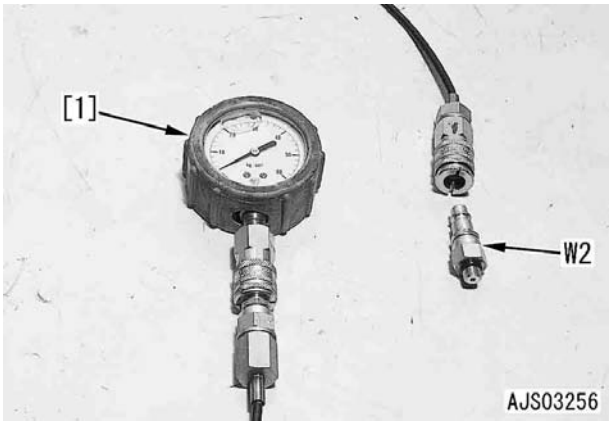
1) Remove rear frame left side cover (1).



2) Remove parking brake inlet pressure pickup plug (10 × 1.25 mm) (2).



3) Connect nipple **W2** and oil pressure gauge [1] of hydraulic tester **W1**.
★ Use the oil pressure gauge with capacity 5.9 MPa {60 kg/cm^2}.



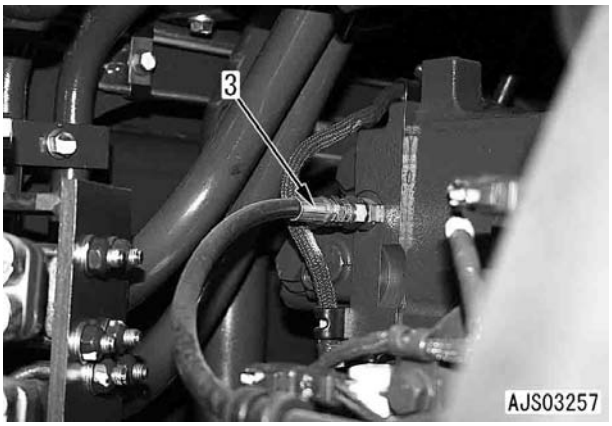
4) While running the engine at low idle, measure the parking brake inlet pressure.
⚠ **Keep pressing the brake pedal for safety.**
★ Measure the oil pressure at turning OFF of the parking brake.
★ If the parking brake solenoid valve output pressure is normal and parking brake inlet pressure is abnormal, failure on the parking brake emergency release valve can be suspected.



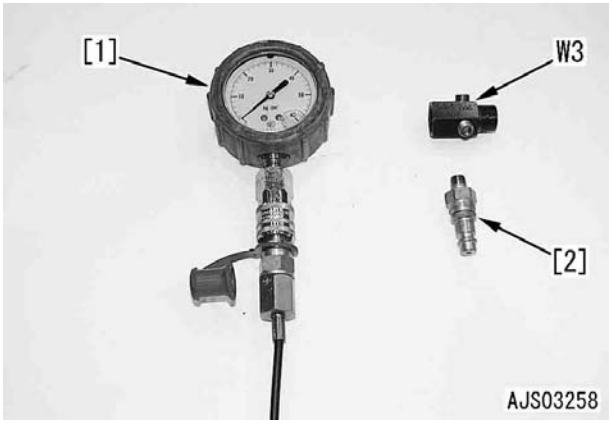
5) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

2. Parking brake pilot pressure (Transmission valve seat pressure)

1) Start the engine and then right-articulate the steering to be maximum.
2) Disconnect parking brake pilot pressure hose (3).



3) Install adapter **W3** and connect parking brake pilot pressure hose (3).
4) Connect nipple [2] and oil pressure gauge [1] in hydraulic tester **W1**.
   ★ Use the oil pressure gauge with capacity 5.9 MPa {60 kg/cm^2}.



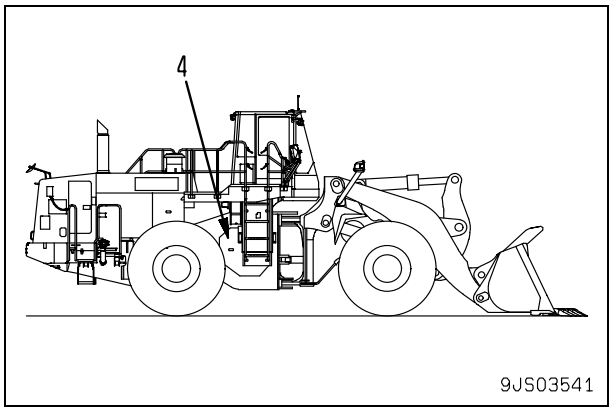
5) While running the engine at low idle, measure the parking brake pilot pressure.
   ⚠ **Keep pressing the brake pedal for safety.**
   ★ Measure the oil pressure at turning OFF of the parking brake.



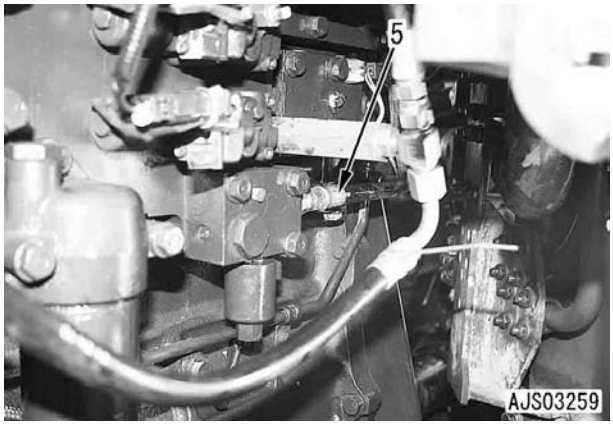
6) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

3. Parking brake solenoid valve output pressure

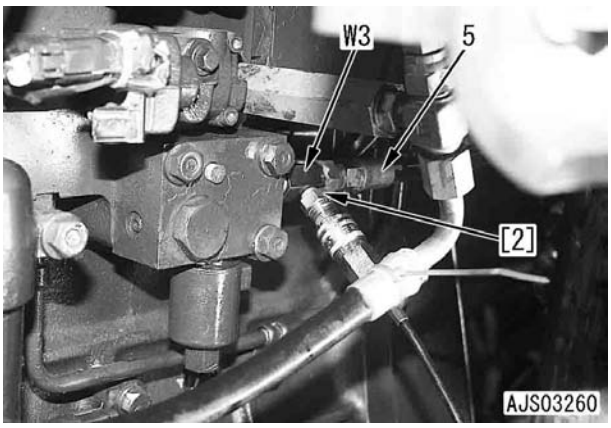
1) Remove rear frame right side cover (4).



2) Disconnect parking brake solenoid valve output pressure hose (5).



3) Install adapter **W3** and connect parking brake solenoid valve output pressure hose (5).
4) Connect nipple [2] and oil pressure gauge [1] in hydraulic tester **W1**.
   ★ Use the oil pressure gauge with capacity 5.9 MPa {60 kg/cm^2}.



5) While running the engine at low idle, measure the parking brake solenoid valve output pressure.
   ⚠ **Keep pressing the brake pedal for safety.**
   ★ Measure the oil pressure at turning OFF of the parking brake.
   ★ If the parking brake pilot pressure is normal and parking brake solenoid valve output pressure is abnormal, failure on the check valve on the parking brake solenoid inlet side or failure on the parking brake solenoid can be suspected.



6) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

Testing wear of parking brake disc

Measuring instruments

Symbol	Part No.	Part Name
X	Commercially available	Slide calipers

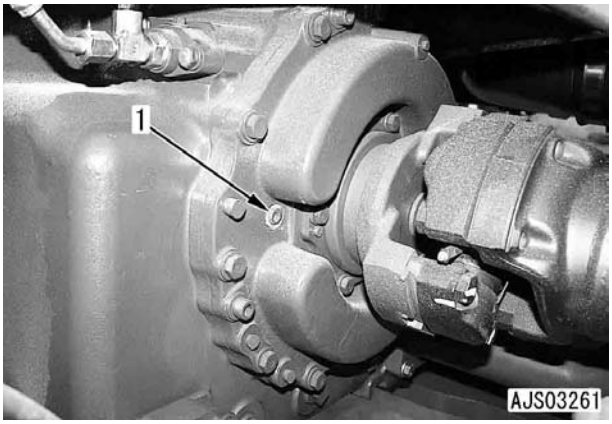
★ If the parking brake does not work effectively, check the parking brake disc for wear according to the following procedure.

⚠ **Lower the work equipment fully and put chocks under the tires.**

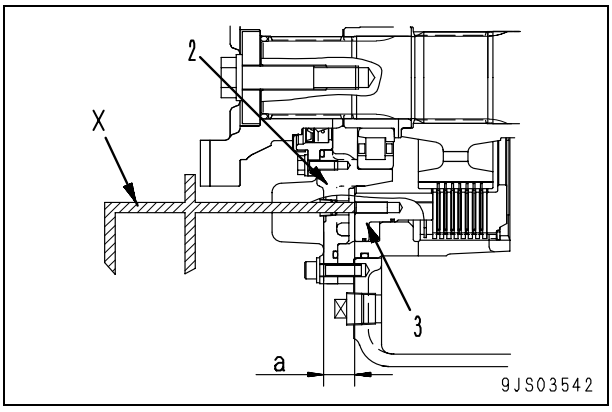
⚠ **When checking, stop the engine.**

1. Drain the oil from the transmission case.
   Transmission case: **83 ℓ**

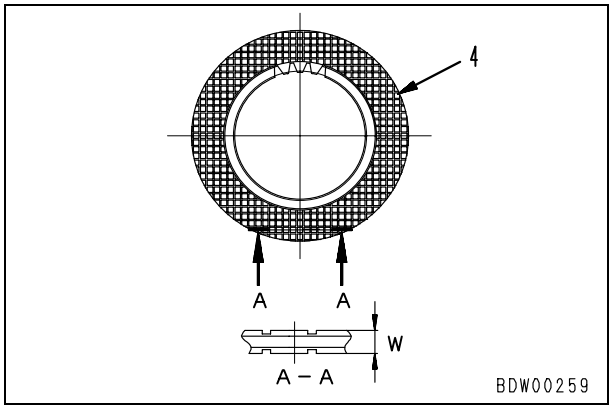
2. Remove either of 2 plugs (1).



3. Measure depth (a) from the end of cage (2) to piston (3) with slide calipers **X**.
   - Limit depth (a): Max. 30.5 mm



4. If depth (a) is above the limit, remove parking brake disc (4) and measure its thickness (W), referring to Disassembly and assembly, “Removal of parking brake disc”.
   - Service limit thickness (W): Min. 2.97 mm
   ★ If the parking brake disc thickness is below the service limit, replace the disc.



- **Refilling with oil (Transmission case)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

Method of releasing parking brake manually

★ The parking brake is controlled hydraulically. If you cannot release the parking brake because of a trouble in the transmission, emergency release solenoid valve, etc., you can move the machine by releasing the parking brake manually.

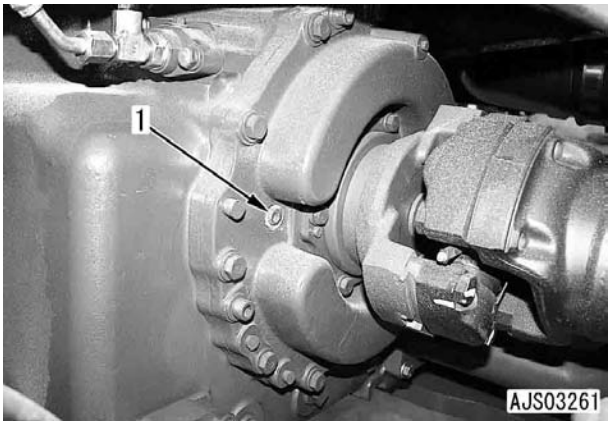
⚠ **Releasing the parking brake manually is a means to move the machine from a dangerous job site to a safe place. Apply this means only in an emergency.**

⚠ **Lower the work equipment to the ground and put chocks under the tires to prevent the machine from moving.**

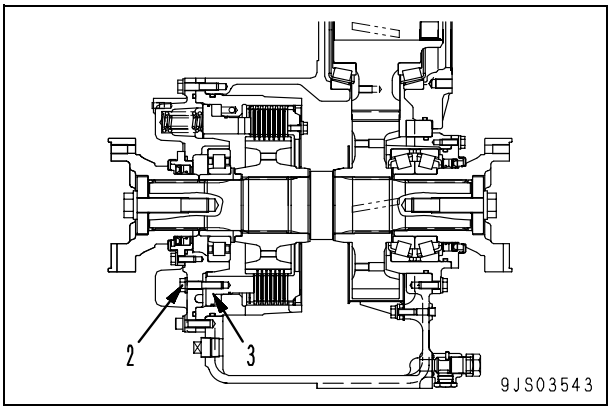
⚠ **When applying this means, stop the engine.**

1. Drain the oil from the transmission case.
   Transmission case: **83 ℓ**

2. Remove 2 plugs (1). (Right and left)



3. Prepare 2 cage mounting bolts (2) and tighten them alternately in plug (1) installation position.
   ★ Remove 2 bolts (2) on the diagonal positions.
   ★ Tighten 2 bolts (2) to pull piston (3) and release the parking brake.
   ★ Tighten the 2 bolts gradually and evenly. (After they reached the seats, give about 3 +1/4 turns further to them.)



4. After moving to a safe place, restore the machine to the original condition.
   Mounting bolt (2): **Adhesive (LT-2)**
   Mounting bolt (2): **98 – 123 Nm {10 – 12.5 kgm}**
   Plug (1): **Gasket sealant (LG-5)**

- **Refilling with oil (Transmission case)**
  After releasing the parking brake manually, add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

Measuring and adjusting work equipment control lever

★ Measuring and adjusting tools for work equipment control lever

Symbol		Part No.	Part name
Y	1	79A-264-0021	Push-pull scale
	2	Commercially available	Scale

★ Measure and test the work equipment control lever under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range
- Engine speed: Low idle

⚠ **Apply the safety bar to the frame.**

Measuring

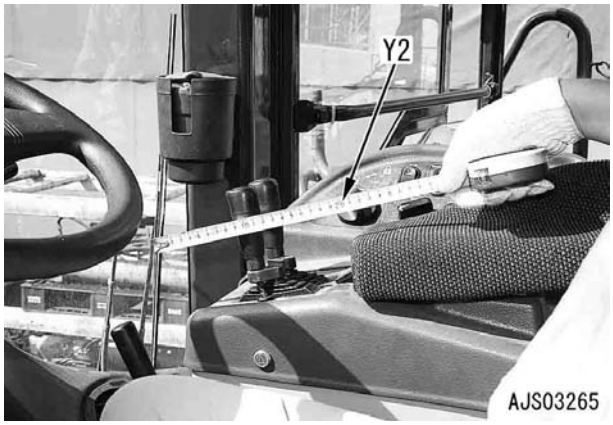
1. Operating effort of work equipment control lever

1) Install and fix tool **Y1** to the work equipment control lever.
   ★ Install tool **Y1** to the center of the knob.
   ★ Operate the work equipment control lever at the ordinary operating speed and measure the minimum necessary effort to operate the knob.



2. Stroke of work equipment control lever

1) Operate the work equipment control lever and measure its stroke at each position.
   ★ Apply a mark to the lever knob and measure the stroke with scale **Y2**.
   ★ If the stroke is out of the standard range, check for play of the linkage and wear of the bushing.



Measuring work equipment oil pressure

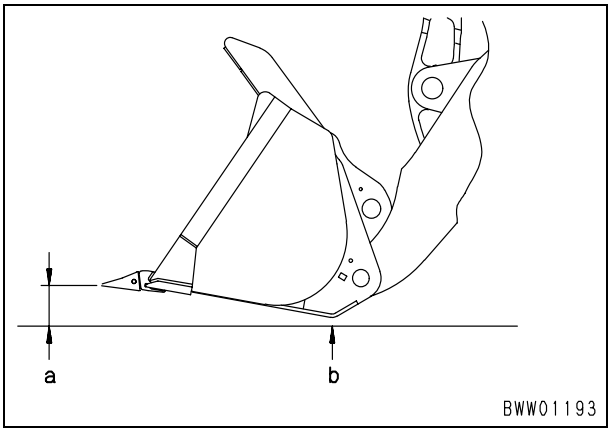
★ Measuring instruments for work equipment oil pressure

Symbol		Part No.	Part name
Z	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25)
		07002-11023	O-ring
	3	799-401-2701	Differential pressure gauge

Measuring

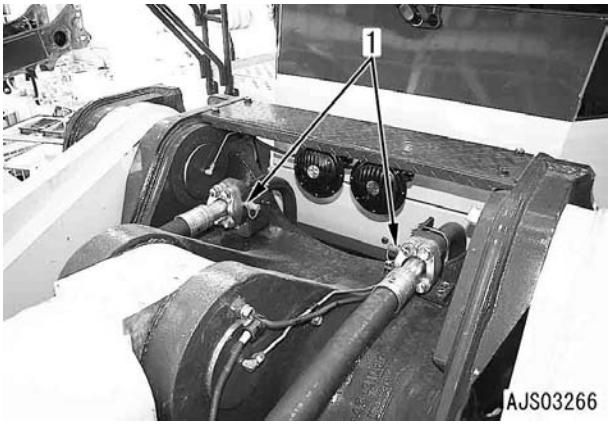
1. Preparation work

1) Lower section (b) to the ground keeping (a) of bucket 30 – 50 mm off the ground.
2) After stopping the engine, lower bucket bottom (a) and (b) to the ground operating the work equipment lever. Make sure they are on the ground.
   ★ After the bucket is grounded, release residual pressure in the piping operating the work equipment lever 2 – 3 times.

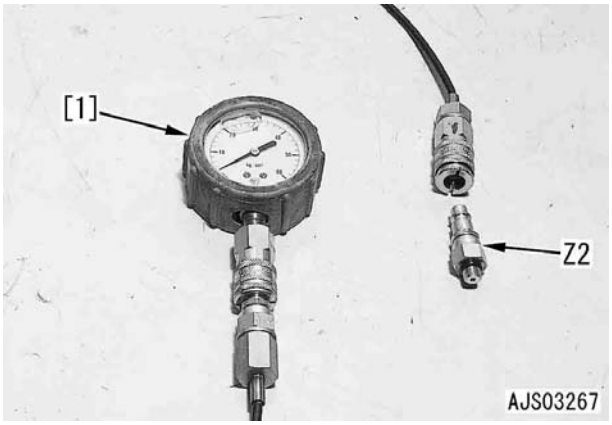


2. Measurement of work equipment relief pressure

1) Remove work equipment relief pressure pickup plug (10 x 1.25 mm) (1).



2) Connect nipple **Z2** and oil pressure gauge [1] of hydraulic tester **Z1**.
   ★ Use the oil pressure gauge of 39.2 MPa {400 kg/cm^2}.



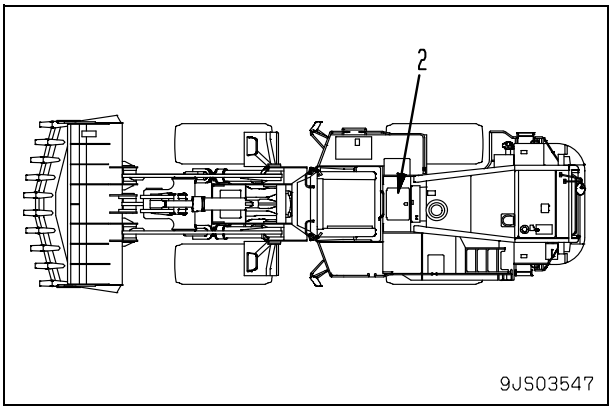
3) Start the engine and raise the lift arm up about 400 mm. Then measure the oil pressure when the bucket is tilted back at high idle.



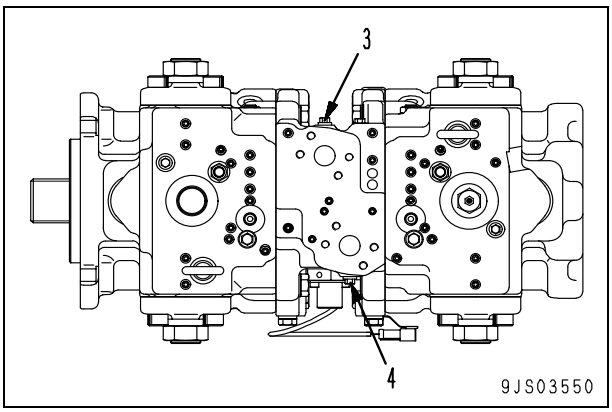
4) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.
   ⚠ **After measuring the oil pressure, release pressure in the circuit and then remove the oil pressure gauge and nipple using the same procedure as 1. Preparations for work.**

3. Measuring unload oil pressure

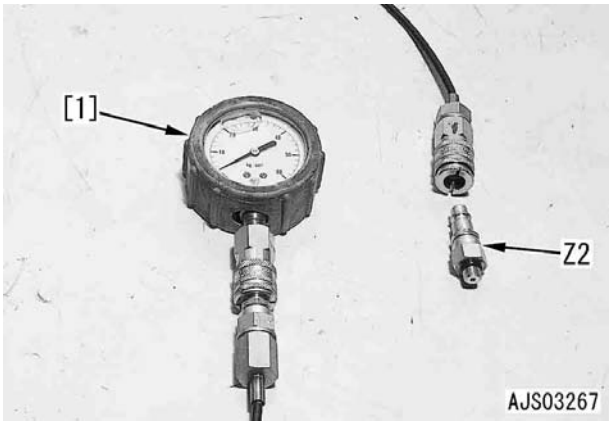
1) Open pump top cover (2).



2) Remove pump pressure pickup plugs (M10 × 1.25 mm) (3) and (4) from the work equipment pump.
   - Pump pressure pickup plug (3): F pump
   - Pump pressure pickup plug (4): R pump



3) Install nipple **Z2** and then connect oil pressure gauge [1] of hydraulic tester **Z1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



4) Measure the oil pressure when the engine is run at high idle and all levers are set to neutral.



5) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

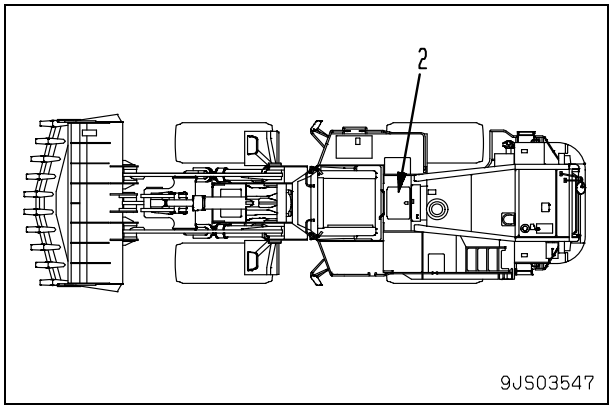
⚠ **After measuring the oil pressure, release pressure in the circuit and then remove the oil pressure gauge and nipple using the same procedure as 1. Preparations for work.**

4. Measuring LS differential pressure

★ Before measuring oil pressure of the LS control circuit, make sure that the work equipment relief oil pressure and work equipment PPC oil pressure are normal.

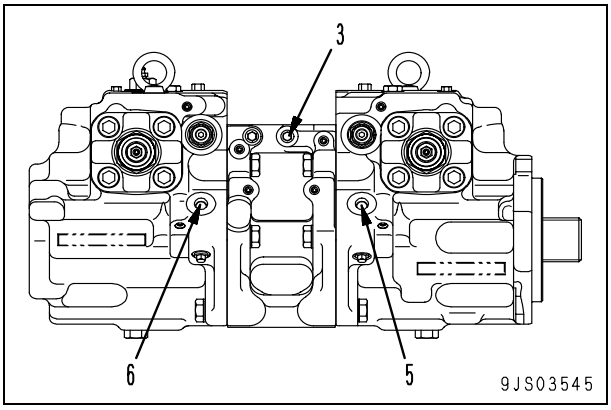
★ LS differential pressure is calculated from the pump discharge pressure and LS pressure (actuator negative pressure) being measured at the same time.

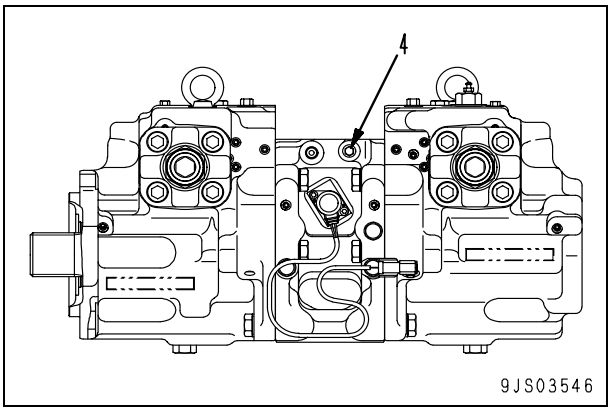
1) Open pump top cover (2).



2) Remove pump pressure pickup plugs (M10 × 1.25) (3) and (4), and LS pressure pickup plugs (M10 × 1.25) (5) and (6) from the work equipment pump.
   - Pump pressure pickup plug (3): For F pump
   - Pump pressure pickup plug (4): For R pump
   - LS pressure pickup plug (5): For F pump
   - LS pressure pickup plug (6): For R pump

   ★ Measurement shall be conducted using the combination of pump pressure pickup plug (3) and LS pressure pickup plug (5) as well as pump pressure pickup plug (4) and LS pressure pickup plug (6).

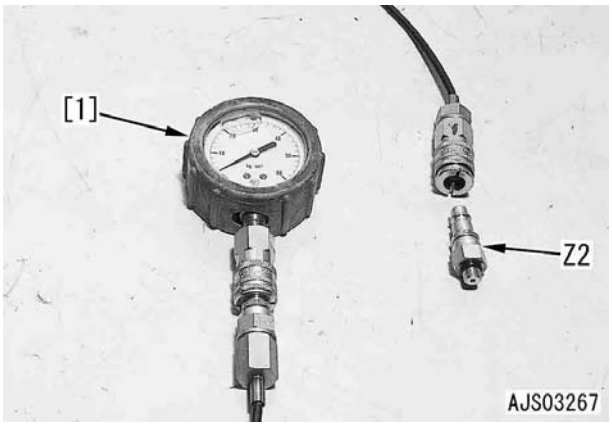




3) Install nipple **Z2** and then connect oil pressure gauge [1] of hydraulic tester **Z1** or differential pressure gauge **Z3**.

   ★ When using the differential pressure gauge, connect its high-pressure side to the pump pressure side and low-pressure-side to LS pressure side. The differential pressure gauge requires 12 V power supply. Thus, connect a battery.

   ★ Use the oil pressure gauge of 39.2 MPa {400 kg/cm^2}.
   Since the differential pressure is 2.4 MPa {25 kg/cm^2} at maximum, the same gauge can be used throughout the measurement.



4) Start the engine and raise the lift arm upward about 400 mm.
5) While running the engine at high idle, measure the pump pressure and LS pressure (actuator negative pressure) at the same time under the following conditions.
   - When the lift arm lever set to half stroke

   ★ Prevent the lift arm cylinder from turning to full stroke as long as measurement is continued.

   ★ Calculation of LS differential pressure: LS differential pressure = Pump discharge pressure – LS pressure



6) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

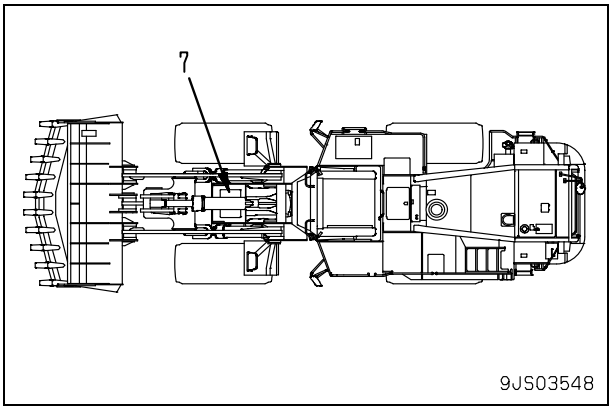
   ⚠ **After measuring the oil pressure, release pressure in the circuit and then remove the oil pressure gauge and nipple using the same procedure as 1. Preparations for work.**

Adjusting

★ Adjustment of the unload valve is not available.

1. Adjusting work equipment relief pressure

1) Remove inspection cover (7) on the front frame.

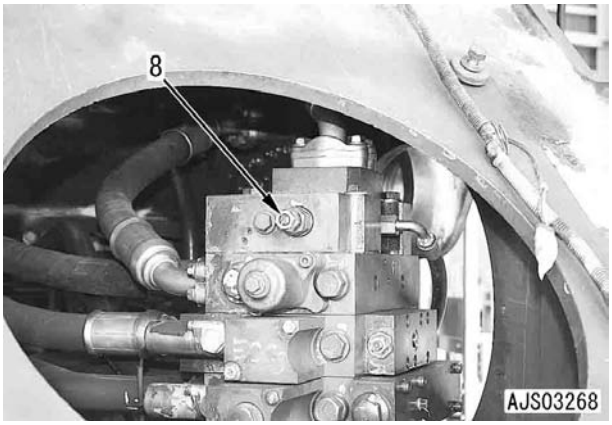


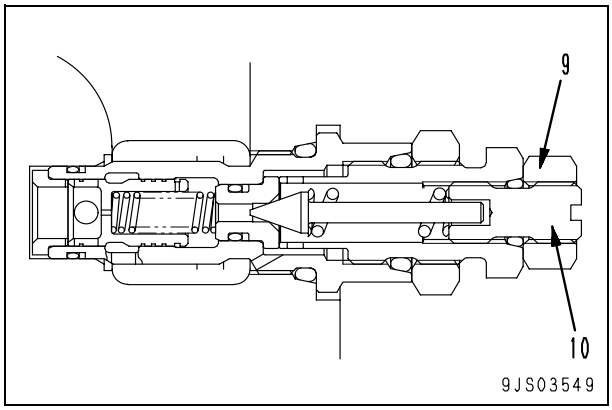
2) Loosen locknut (9) of main relief valve (8) of the work equipment control valve and turn adjustment screw (10) to adjust the pressure.

★ Adjustment screw:
- Turned to the right, the pressure rises.
- Turned to the left, the pressure lowers.

★ Quantity of adjustment per turn of adjustment screw:
12.55 MPa {128 kg/cm^2}

Locknut: **29.4 – 39.2 Nm {3 – 4 kgm}**





★ After the adjustment, measure the work equipment relief pressure again using the procedure for measurement.

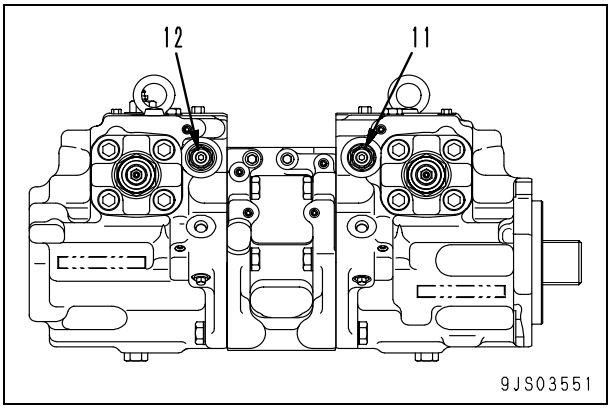
2. Adjusting LS differential pressure

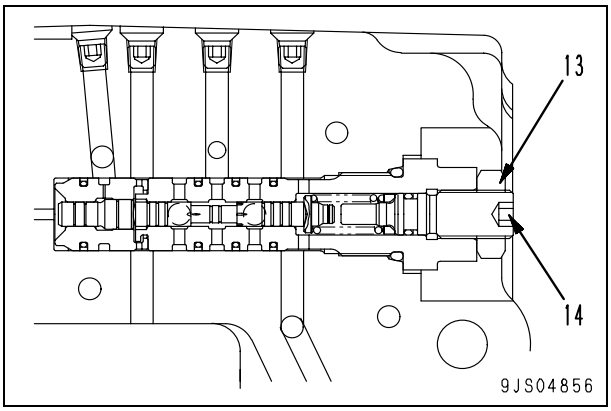
1) Loosen locknut (13) of LS valves (11) and (12) of the work equipment pump and then turn adjustment screw (14) to adjust the pressure.
   - LS pressure pickup plug (11): For F pump
   - LS pressure pickup plug (12): For R pump

   ★ Adjustment screw:
   - Turned to the right, the LS differential pressure lowers.
   - Turned to the left, the LS differential pressure rises.

   ★ Quantity of adjustment per turn of adjustment screw:
   1.3 MPa {13.3 kg/cm^2}

   Locknut: **49 – 68.6 Nm {5 – 7 kgm}**



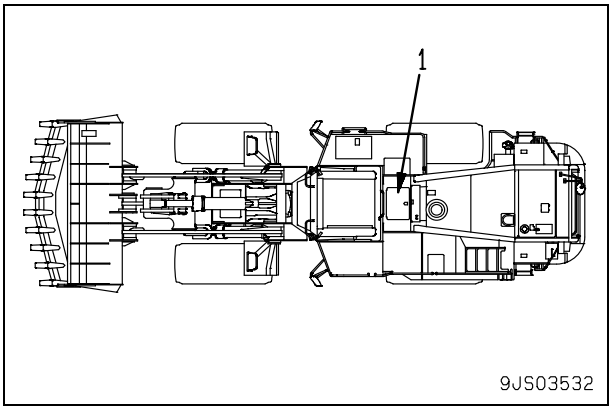


   ★ After the adjustment, measure LS differential pressure again using the procedure for measurement.

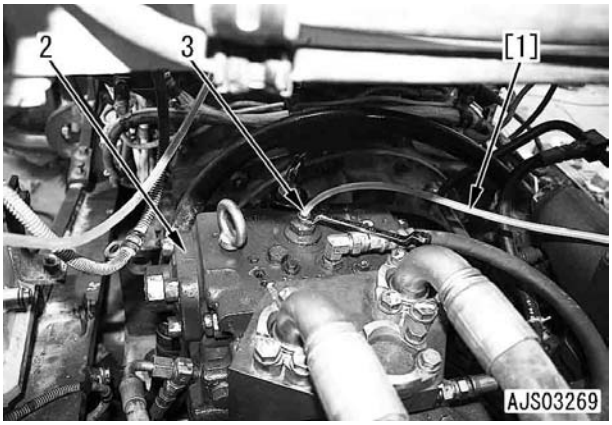
Bleeding air from work equipment circuit

1. Bleeding air from work equipment pump (piston pump)

1) Remove pump top cover (1).



2) Stop the engine and then loosen air bleeder (3) of work equipment pump (2) to connect air bleeding hose [1].



3) As oil free from air started to flow out of air bleeding hose [1] of work equipment pump (2), tighten air bleeder.
   Air bleeder:
   7.8 – 9.8 Nm {0.8 – 1.0 kgm}
4) Start the engine and run it at low idle for 5 minutes minimum.

2. Air bleeding from hydraulic cylinder

1) Start the engine and run it at low idle for 5 minutes minimum.
2) While running the engine at low idle, repeat raising and lowering of the lift arm 4 – 5 times.
   ★ Do not operate the piston rod beyond a position 100 mm in front of the stroke end to prevent relieving.
3) Implement operation of 2) above with the engine at high idle. Then operate the piston rod to the stroke end at low idle to relieve it.
4) Implement the same operation as 2) and 3) above for the bucket and steering, too.
   ★ When a cylinder is replaced, this operation should be implemented before connecting the piston rod.

Releasing residual pressure in work equipment circuit

1. Releasing residual pressure from the circuit between respective hydraulic cylinders and control valve

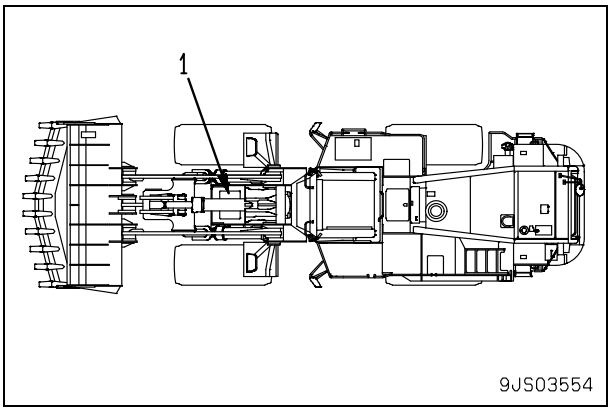
★ When disconnecting the pipes between respective hydraulic cylinders and work equipment, release the residual pressure in the circuit according to the following procedure.

1) Stop the engine.
2) Loosen the oil filler cap gradually to release the internal pressure of the hydraulic tank
3) Set the work equipment lock lever to free position.
4) Turn the starting switch ON.
5) Release residual pressure operating the work equipment lever.

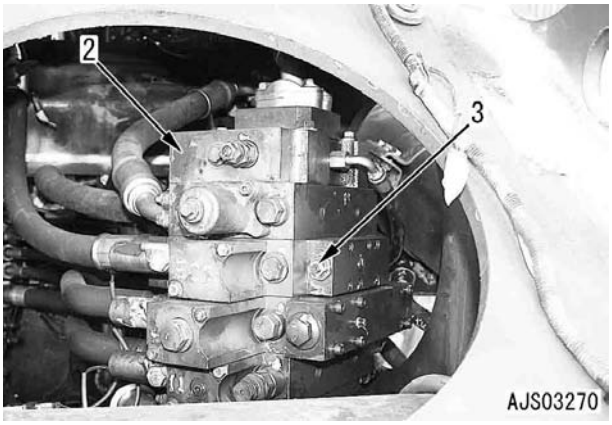
2. Releasing residual pressure from ECSS (travel damper) circuit

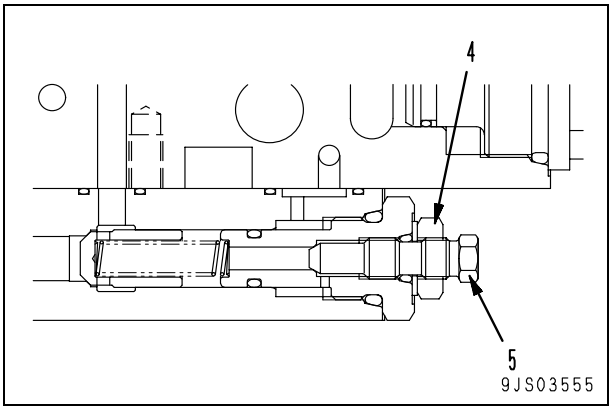
⚠ **When disconnecting the piping of the travel damper circuit (between the accumulator for travel damper and work equipment control valve), release pressure of the accumulator for the travel damper according to the following procedure.**

1) Remove inspection cover (1) on the front frame.



2) Loosen locknut (4) of travel damper pressure relief plug (3) on work equipment control valve (2).
3) Loosen adjustment plug (5) 1/2 – 1 turn to release the accumulator pressure.





4) After releasing residual pressure, tighten plug (5) and locknut (4) securely in this order.

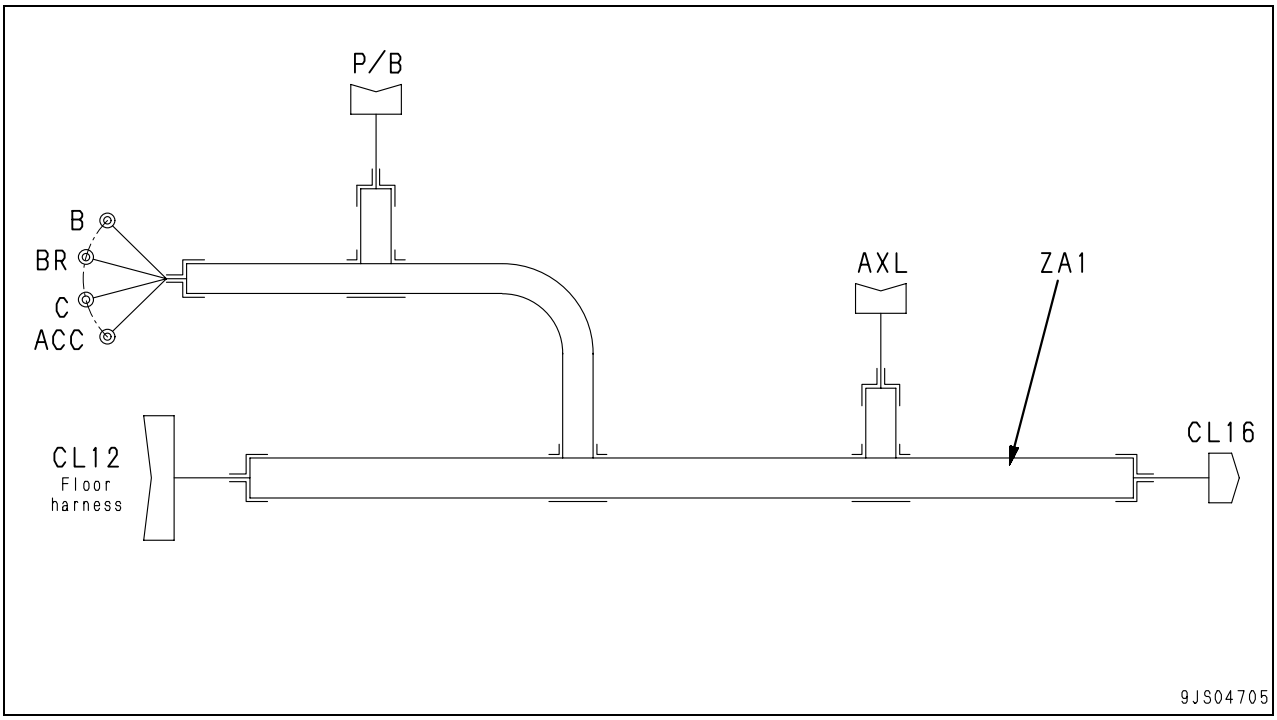
★ Loosen locknut (4) to the maximum before tightening plug (5). After tightening plug (5), tighten locknut (4).

Plug:
19.6 – 27.5 Nm {2.0 – 2.8 kgm}

Locknut:
19.6 – 27.5 Nm {2.0 – 2.8 kgm}

Moving machine for removing operator cab

★ Wiring harness **ZA1**



★ **Machine moving device for removing operator cab**

Symbol		Part No.	Part Name
ZA	1	426-06-32171	Wiring harness
	2	08086-10000	Starting switch
	3	421-06-36142	Parking brake switch

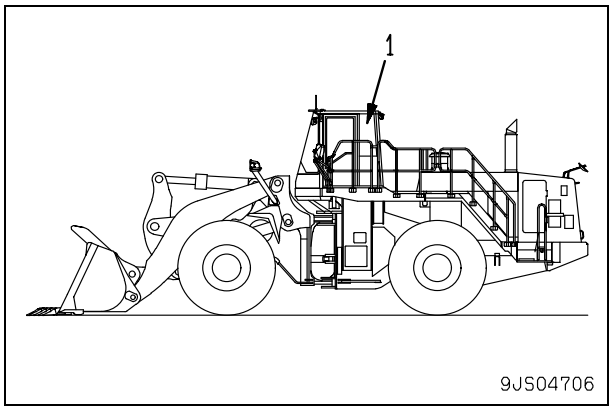
★ When it is impossible to move a machine into the maintenance shop without removing the operator cab or when moving a machine to a safe place with the operator cab being removed, using wiring harness **ZA1** allows moving the machine.

★ In this case, starting switch **ZA2** and parking brake **ZA3** are used in place of the starting switch and parking brake switch used on the machine body.

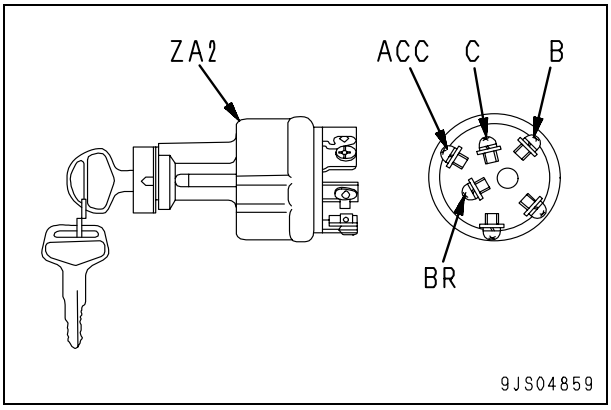
⚠ **The harness is prepared only for moving the machine in to a maintenance shop or moving it from a work site to a safer place. It should not be used for any purpose other than above.**

⚠ **Lower the work equipment to the ground fully, apply the parking brake, and put chocks under the tires so that the machine will not move.**

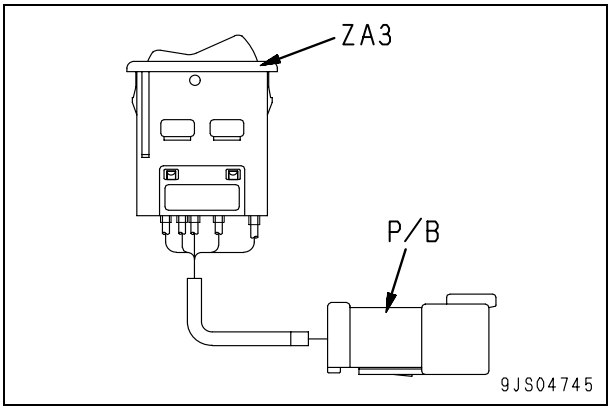
1. Remove the operator cab assembly (1). For details, see Disassembly and assembly, “Removal and installation of operator cab assembly”.



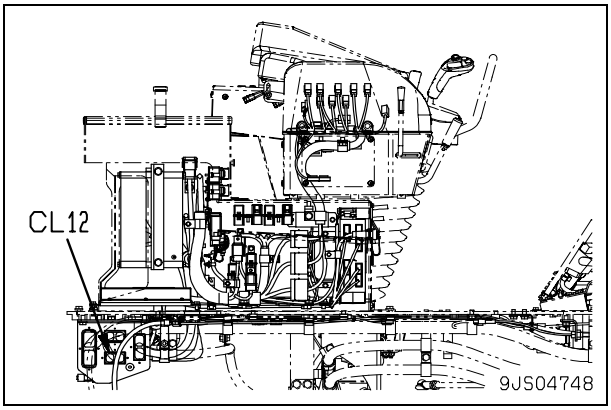
2. Connect B, BR, C and ACC of wiring harness **ZA1** to B, BR, C and ACC terminals of starting switch **ZA2**.
   ★ Use care so that an improper connection may not occur.
   ★ Figure shows starting switch **ZA2**.



3. Connect P/B of wiring harness **ZA1** to connector P/B of parking brake switch **ZA3**.
   ★ Figure shows parking brake switch **ZA3**.

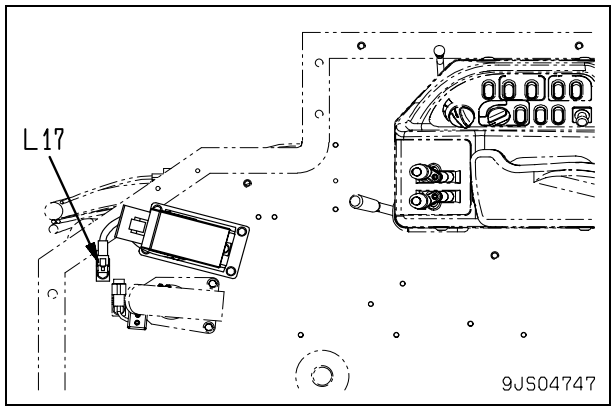


4. Connect **CL12** of wiring harness **ZA1** to connector **CL12** (male side) that has been disconnected as the operator cab has been removed.

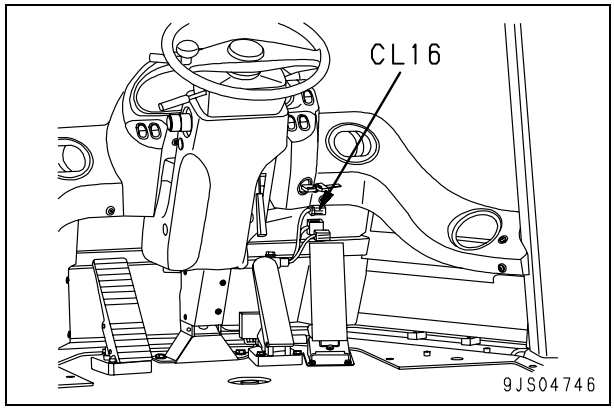


5. Disconnect axle pedal connector **L17**.

6. Connect AXL of wiring harness **ZA1** to axle pedal connector **L17** (male side).



7. Connect **CL16** of wiring harness **ZA1** to connector **CL16** (female side) that has been disconnected as the operator cab has been removed.
   ★ Only for steering wheel specification



8. Start the engine and move the machine to a maintenance shop or a safe place.
   ⚠ **Remove the chocks.**

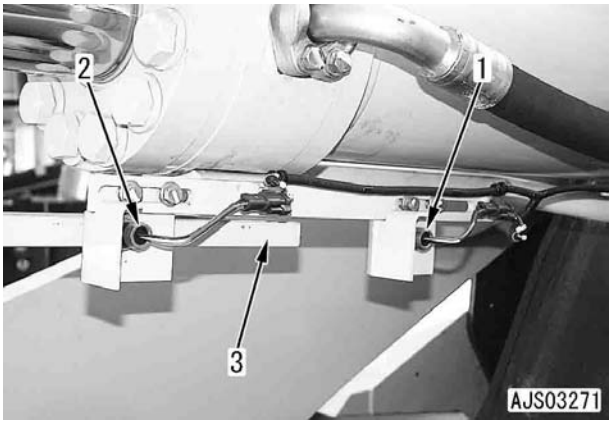
9. After removing the machine, restore it to the original condition.

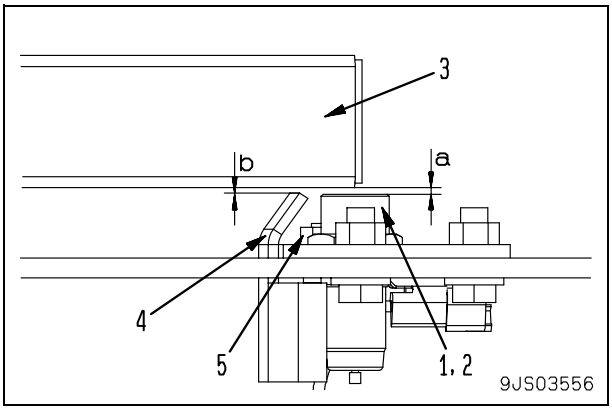
Testing and adjusting bucket positioner

★ Engine coolant temperature:
Within operating range
★ Hydraulic oil temperature: Within operating range

Testing

1. Stop the engine and make sure clearance (a) between bucket-levelness detecting proximity switch (1) and detection bar (3), and between maximum tilt detecting proximity switch (2) and detection bar (3) is within the standard value.
   ★ Clearance (a): 3 – 5 mm



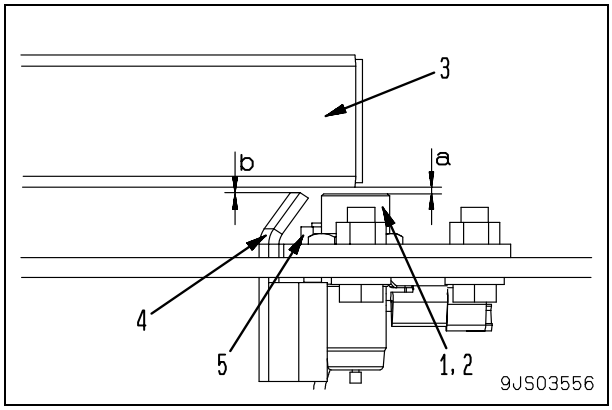


2. While running the engine at high idle, check the operating position.
   (Calculate the mean repeating above operation 3 times.)

Adjusting

1. Adjusting clearance

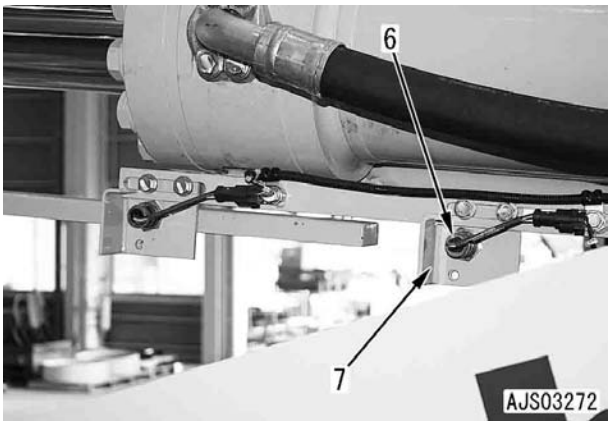
1) Adjust switch nut (5) so that clearance (b) between the tip of switch protector (4) and switch (1) and sensing surface (2) may conform to the standard value. Then fix them to adjusted positions.
   ★ Standard clearance (b): 0.6 – 1.0 mm
   Switch nut:
   14.7 – 19.6 Nm {1.5 – 2.0 kgm}



2) Using shims and the proximity switch bracket mounting bolt, adjust clearance (a) between proximity switch (1) and sensing surface (2) and detection bar (3) to the standard value. Then fix them to the adjusted positions.
   ★ Clearance (a): 3 – 5 mm
   ★ Using shims, adjust detection bar (3) so that clearance (a) may conform to the standard value along every stroke of the detection bar.

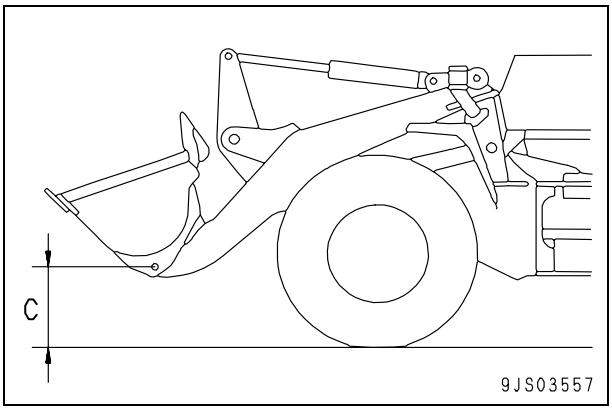
2. Adjusting bucket-levelness detecting proximity switch

1) Start the engine and raise the bucket.
2) Activate bucket-levelness detecting proximity switch (6) while operating the bucket at 1,500 rpm.
3) Lower the bucket to the ground.
4) Make sure the bucket angle is set in the range of 0° – 1° downward to the ground. Repeat above 3 times and if the angle does not conform to the above angle, adjust it according to the following procedure.
5) Loosen 2 mounting bolts of bucket-levelness detecting proximity switch bracket (7) and adjust it by changing the installing position.
6) Make sure 3 times that the bucket angle is set in the range of 0° – 1° downward to the ground.

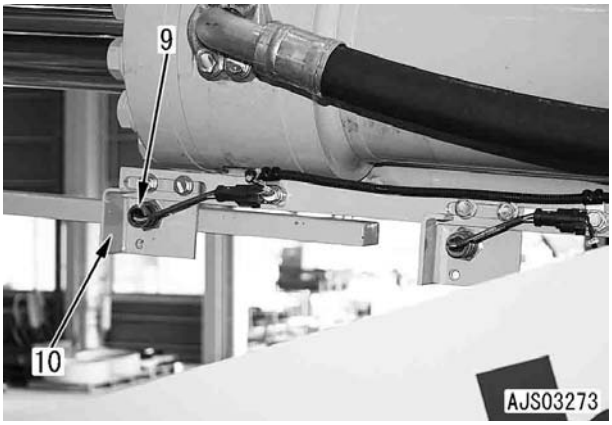


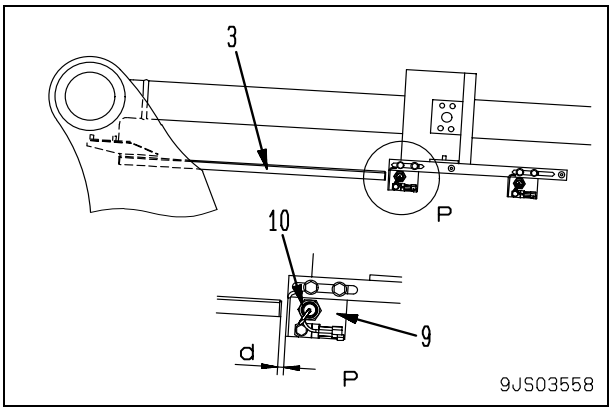
3. Adjusting maximum tilt detecting proximity switch

1) Set height (c) of pin center of the lift arm end to 1,000 mm from the ground surface.



2) Tilt the bucket to the maximum position.
3) Loosen 2 mounting bolts of maximum tilt detecting proximity switch bracket (9) and adjust it by changing installing position.
   - Set the distance (d) between the end of detection bar (3) and the center of maximum tilt detecting proximity switch (10) to 50 mm.

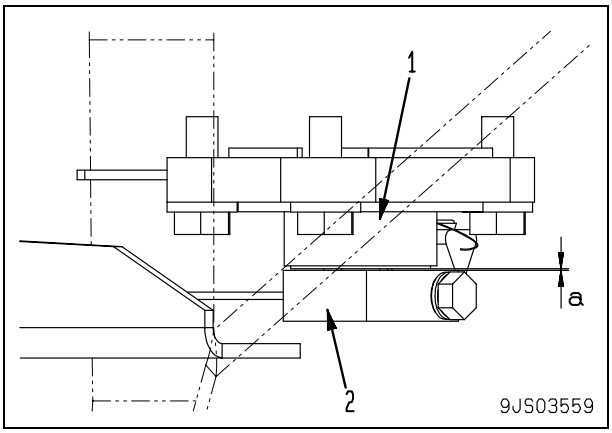




Testing and adjusting lift arm position detecting lever

Testing

1. Make sure that clearance (a) between lift arm angle sensor (1) and detection lever (2) is within the standard value.
   - Clearance (a): **0.5 – 1 mm**

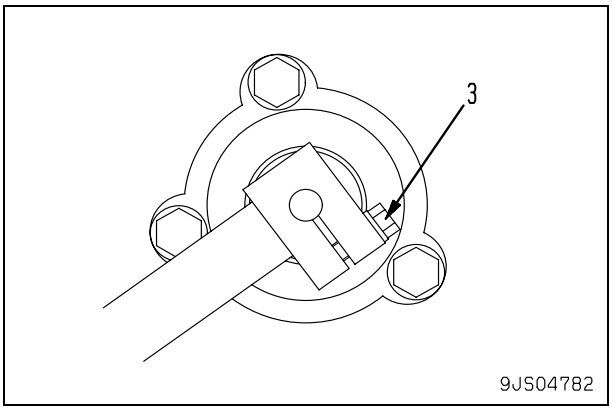


Adjusting

★ If clearance (a) does not conform to the standard value, adjust it according to the following procedure.

1. Loosen bolt (3).

2. Adjust position of detection bar (2) so that clearance (a) between lift arm angle sensor (1) and detection lever (2) to the standard value. Then tighten bolt (3).

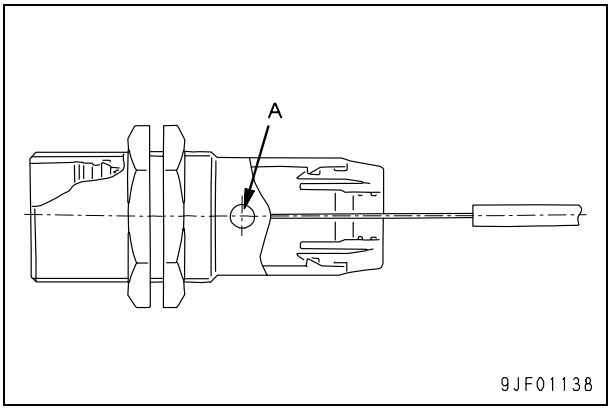


Checking proximity switch operation indication lamp

Proximity switch operation indication lamp (red)

The proximity switch is provided with the lamp for indicating the switch operating status. Use this lamp for the adjustment.

- A: Operation indication lamp (red)



Proximity switch	Relative position of the proximity switch sensing surface and the sensed object	Operation indication lamp	Remarks
Bucket-levelness detecting proximity switch and maximum tilt detecting proximity switch	Placed in vicinity	ON	Operated as the switch center approaches
	Placed apart	OFF	

Preparations for work on troubleshooting of electric system

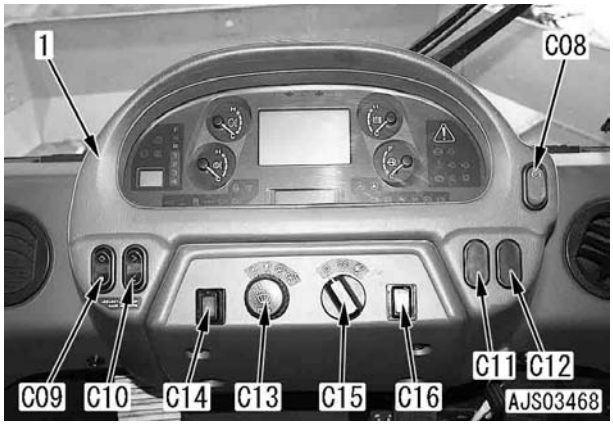
★ When carrying out troubleshooting of an electric circuit related to the machine monitor, transmission controller, work equipment controller or VHMS controller, expose the related connectors according to the following procedure.

1. Machine monitor

1) Disconnect the following connectors from cover (1).
   - ★ Steering wheel specification
   - C08 connector: Parking brake switch
   - C09 connector: Character display mode selector switch
   - C10 connector: Character display item selector switch
   - C11 connector: Load meter mode selector switch (if equipped)
   - C12 connector: Load meter display selector switch (if equipped)
   - ★ Pull out switches from the cover and then disconnect the connectors.
   - ★ Don't try to forcibly disconnect the connectors inserting your hand through the bottom of the cover. Such action can damage the connectors or switches.



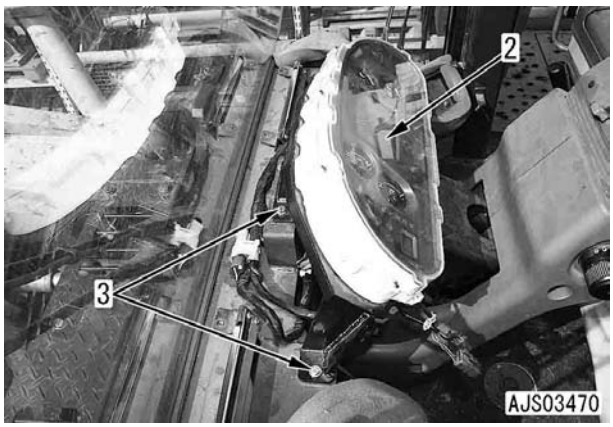
2) Pull out switches from the cover (1) and then disconnect the connectors in the same manner as 1) above.
   - ★ AJSS specification
   - C08 connector: Parking brake switch
   - C09 connector: Character display mode selector switch
   - C10 connector: Character display item selector switch
   - C11 connector: Load meter mode selector switch (if equipped)
   - C12 connector: Load meter display selector switch (if equipped)
   - C13 connector: Front wiper switch
   - C14 connector: Hazard switch
   - C15 connector: Lamp switch
   - C16 connector: Dimmer switch



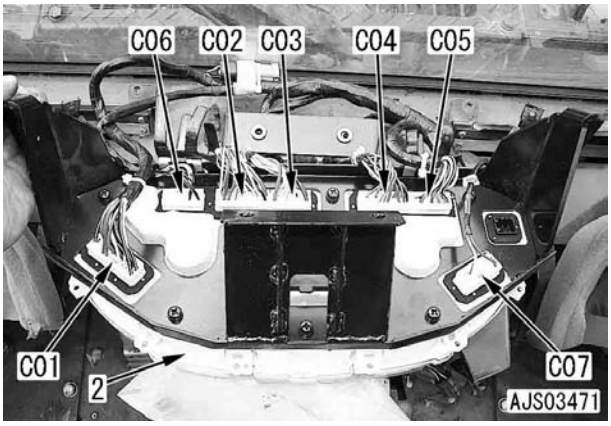
3) Remove cover (1).



4) Remove 4 bracket mounting bolts (3) of machine monitor (2) and turn over the machine.
   - ★ Use care in this operation so that the wiring harness may not be forcibly pulled.



5) Connect T-adapter used for troubleshooting to connectors C01, C02, C03, C04, C05 and C06 of machine monitor (2).

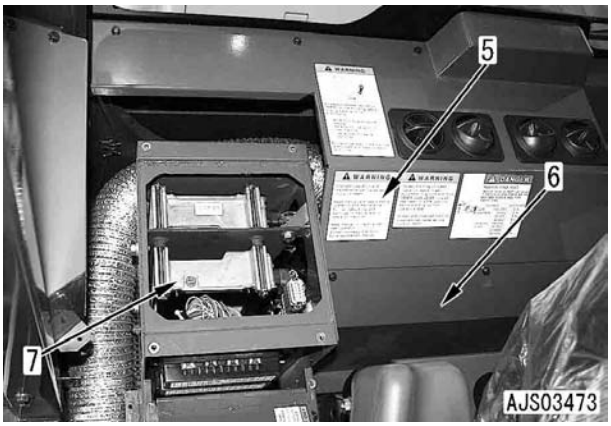


2. Transmission controller

1) Remove tray (4) from the right rear side of the operator seat.

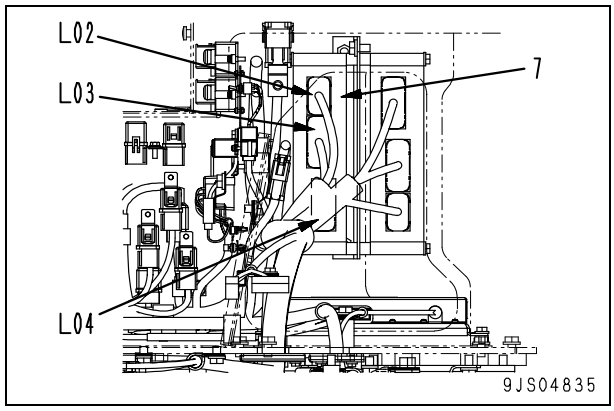


2) Remove rear covers (5) and (6) of the operator seat.



3) Connect T-adapter used for troubleshooting to connectors L02, L03 and L04 of transmission controller (7).
   - ★ When it is difficult to remove or install the connectors, do it after removing the transmission controller first.
   - ★ The connectors are fixed in place with the screw. Loosen the screw before disconnecting the connector.
   - ★ When the connectors were returned to the original position, tighten the screw to the specified torque.

   Screw: **2.82 Nm {0.288 kgm}**

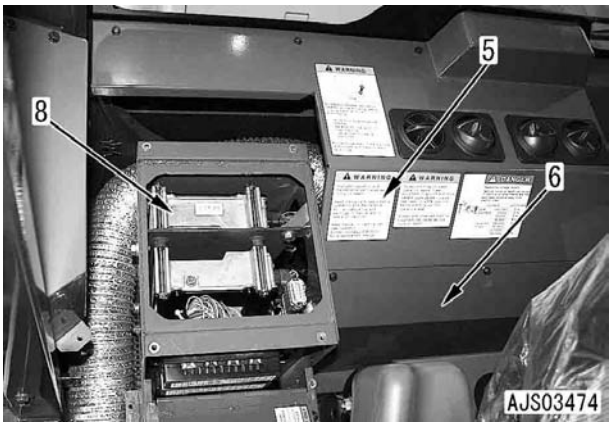


3. Work equipment controller

1) Remove tray (4) from the right rear side of the operator seat.

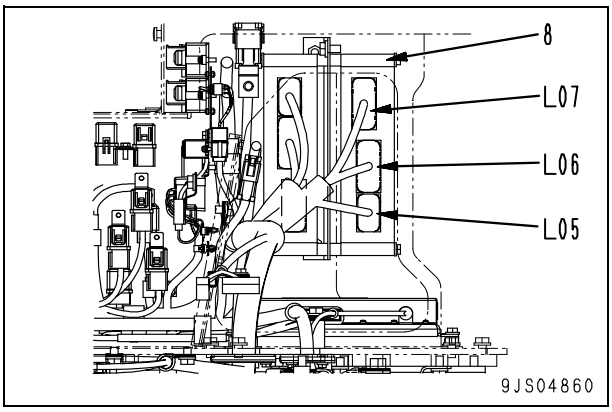


2) Remove rear covers (5) and (6) of the operator seat.



3) Connect T-adapter used for troubleshooting to connectors L05, L06 and L07 of work equipment controller (8).
   - ★ When it is difficult to remove or install the connectors, do it after removing the work equipment controller first.
   - ★ The connectors are fixed in place with the screw. Loosen the screw before disconnecting the connector.
   - ★ When the connectors were returned to the original position, tighten the screw to the specified torque.

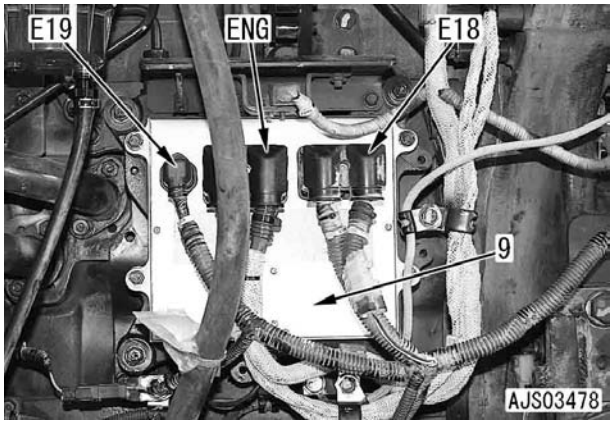
   Screw: **2.82 Nm {0.288 kgm}**



4. Engine controller

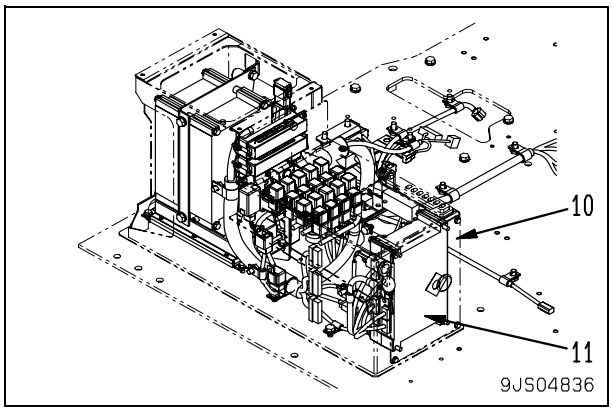
1) Open the right side cover.
2) Connect T-adapter used for troubleshooting to connectors E18, E19 and ENG of engine controller (9).
   - ★ When it is difficult to remove or install the connectors, do it after removing the work equipment controller first.
   - ★ The connectors are fixed in place with the screw. Loosen the screw before disconnecting the connector.
   - ★ When the connectors were returned to the original position, tighten the screw to the specified torque.

   Screw: **3 ± 1 Nm {0.3 ± 0.1 kgm}**

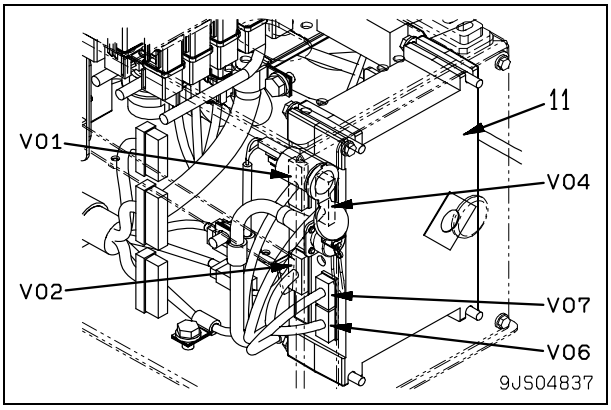


5. VHMS controller

1) Remove front console cover (10) situated in the right side of the operator seat.
2) Pull out the VHMS controller fixed to the back side of cover (10).

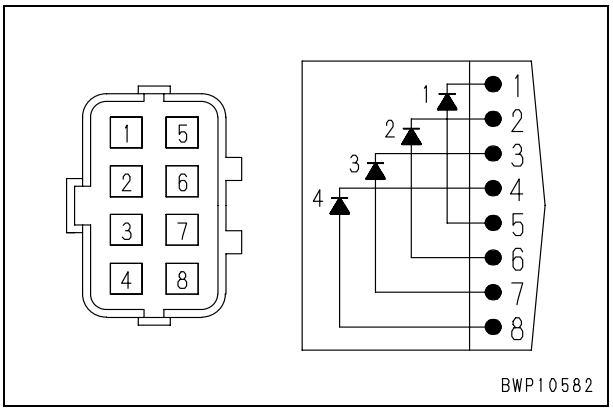


3) Connect T-adapter used for troubleshooting to connectors V01, V02, V04, V06 and V07 of VHMS controller (11).
   ★ When it is difficult to remove or install the connectors, do it after removing VHMS controller first.

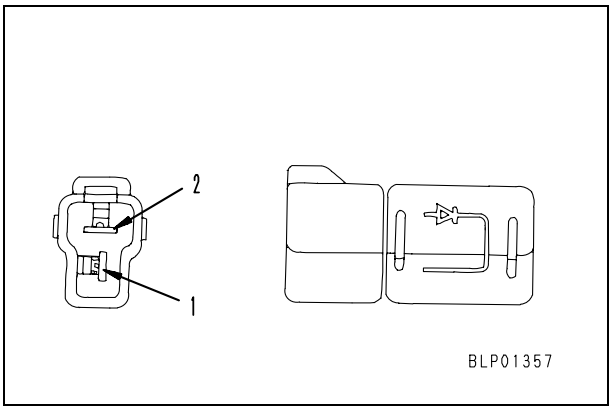


Procedure for testing diodes

★ Check an assembled-type diode (8 pins) and independent diode (2 pins) in the following manner.
★ The conductive directions of the assembled-type diode are indicated on the surface of the diode as shown in the following figure.

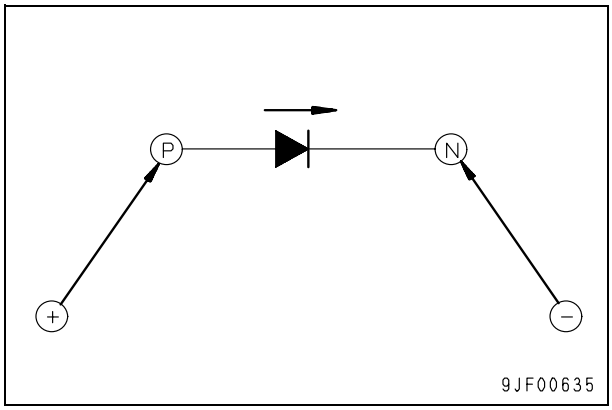


★ The conductive directions of the single diode is indicated on the surface of the diode as shown in the following figure.



1. When using digital type circuit tester

1) Switch the testing mode to diode range and confirm the indicated value.
   ★ Voltage of the battery inside is displayed with conventional circuit testers.
2) Put the red probe (+) of the test lead to the anode (P) of and the black probe (-) to the cathode (N) of diode, and confirm the indicated value.
3) Determine acceptability of the diode from the indicated value.
   - Indicated value remains unchanged: Conduction is absent (Failure)
   - The indicated value changes: The diode has conductivity (Normal) (See ★ below.)
   ★ A value between 460 to 600 is indicated for silicon diodes.



2. When using analog type circuit tester

1) Switch the testing mode to resistance range.
2) Apply the leads of the tester as explained below and check the movement of the pointer.
   1] Put the red probe (+) of the test lead to the anode (P) and the black probe (–) to the cathode (N) of diode.
   2] Apply the red (+) lead of the tester to the cathode (N) side of the diode and apply the black (–) lead to the anode (P) side.
3) Determine if a specific diode is good or no good by the way the pointer swings.
   - With the connection 1] above, the pointer is not moved. It swings, however, when the connection 2] is employed. Normal (However, magnitude of the pointer's move (indicating the resistance value) varies depending on the given tester model and the measurement range selected).
   - The pointer swings with both the connections of 1] and 2]: Defective (Internal short circuit)
   - The pointer does not swing with both the connections of 1] and 2]: Defective (Internal breaking of wire)

WA600-6 Wheel loader

Form No. SEN00554-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

30 Testing and adjusting

Testing and adjusting, Part 3

Testing and adjusting, Part 3 2
Machine monitor-based adjustment at replacement, disassembly and assembly, and additional installation for each sensor and controller 2
Special functions of machine monitor (EMMS) 4

Testing and adjusting, Part 3

Machine monitor-based adjustment at replacement, disassembly and assembly, and additional installation for each sensor and controller

1) Setting items that are necessary for replacement and disassembly and assembly as well as additional installation of sensors and controllers.
   ★ When any of the following devices or parts was replaced, disassembled or assembled, the machine monitor-based initialization of the sensors and solenoids is required.
   ★ The machine monitor-based adjustment shall be implemented in the ascending order of the item numbers (starting from (A)).

Devices or optional parts being replaced, disassembled, assembled or added	Adjustment item
Machine monitor	A, B, C, L, M, (N)
Transmission main body	D, E, F
Transmission controller	A, B, D. E, F
Transmission ECMV solenoid	D, E, F
Lift arm angle sensor	G, L, M, (N)
Work equipment control valve	I
Work equipment neutral lock EPC solenoid	I
Work equipment electric lever	H
Work equipment controller	A, B, G, H, I, J
AJSS follow up link	J
AJSS frame angle sensor	J
AJSS lever angle sensor	J
AJSS rotary valve	J
Work equipment bucket horizontal proximity switch	K
Bucket	K, L, M, (N)
Lift arm	B, G, K, L, M, (N)
VHMS	O
Adding and removing an optional device	B

Adjustment item	Contents of adjustment
A	Selection of model
B	Selection of an optional device
C	Input of serial number
D	Adjustment of transmission ECMV current
E	Reset of transmission initial learning
F	Transmission initial learning
G	Adjustment of work equipment controller lift arm angle
H	Adjustment of work equipment EPC lever position before detent
I	Adjustment of work equipment EPC starting current
J	Adjustment of AJSS neutral position
K	Adjustment of bucket positioner
L	Adjustment of load meter lift arm angle
M	No load calibration of load meter
N	Loaded calibration of load meter
O	Initial setting of VHMS

2) User needs-based adjustment
When user pointed out a trouble or requested solution for a trouble, the following setting change shall be conducted by the machine monitor.

Contents of user's remarks or request	Adjustment item
Want to change the display unit of the speedometer.	P
Want to use the short ton for the load meter weight display unit.	Q
Want to turn off display of the economy lamp.	R
Want to limit the machine maximum speed.	S, T
Want to suppress hunting.	U
Want to change the gearshift travel speed in the auto shift.	U
Fine control is not available in the lift arm raise/lower operation or the response in this operation is poor.	V
Fine control is not available in the bucket tilt/dump operation or the shock damp effort is weak.	W
Large shocks result at stopping the lift arm raise/lower or a substantial overrun occurs at stopping.	X
Large shocks result from changeover of AJSS or follow to the lever is slow.	Y, Z
Matching at loading to dump truck is poor.	ZA
Travel speed indication is too fast/slow.	ZB
Want to turn off the character display-based travel speed/engine speed indication.	ZC
Want the power mode to turn on as the starting switch is turned on. (Power mode priority)	ZG
Want to decrease fuel consumption during high-speed travel (F4 lockup).	T

Adjustment item	Contents of adjustment	Description No. (*)
P	Optional device selecting: Selection of speed unit	11
Q	Optional device selecting: Selection of weight unit	11
R	Optional device selecting: Selection economy lamp display	11
S	Optional device selecting: Selection of no 4th position	11
T	Adjustment of sensor: Adjustment of maximum travel speed	7-20
U	Adjustment of sensor: Adjustment of L mode shift point	7-30
V	Adjustment of sensor: Change of lift arm lever pattern	7-13
W	Adjustment of sensor: Change of bucket lever pattern	7-14
X	Adjustment of sensor: Adjustment of lift arm lower stop modulation	7-15
Y	Adjustment of sensor: Change of AJSS lever pattern	7-11
Z	Adjustment of sensor: Change of AJSS EPC current	7-12
ZA	Adjustment of sensor: Change of pump cut-off pressure	7-16
ZB	Optional device selecting: Correction of travel peed (change of tire size)	11
ZC	Optional device selecting: Change of travel peed/engine speed display	11
ZG	Optional setting and change of power mode priority	11

*: Description No. of “Service mode” in “Special functions of machine monitor (EMMS)”
★ Change of the display unit of the speed meter as well as the weight is not available when the specification is prepared for a country where SI unit is employed.

Special functions of machine monitor (EMMS)

Normal functions and special functions of machine monitor

The machine monitor is equipped with the normal functions and special functions. Various items of data are displayed on the character display in the middle of the machine monitor.
Depending on the internal setting of the machine monitor, the display items are divided into automatic display items and items displayed when the machine monitor switches are operated.

3) Normal functions: Operator mode

Functions for which the content is normally displayed or which can be displayed and operated by the operator operating the switches.

★ See the Operation and maintenance manual for details of the operator mode.

4) Special functions: Service mode

Functions which the serviceman can display and operate with the special switches to carry out inspection, maintenance, and troubleshooting.

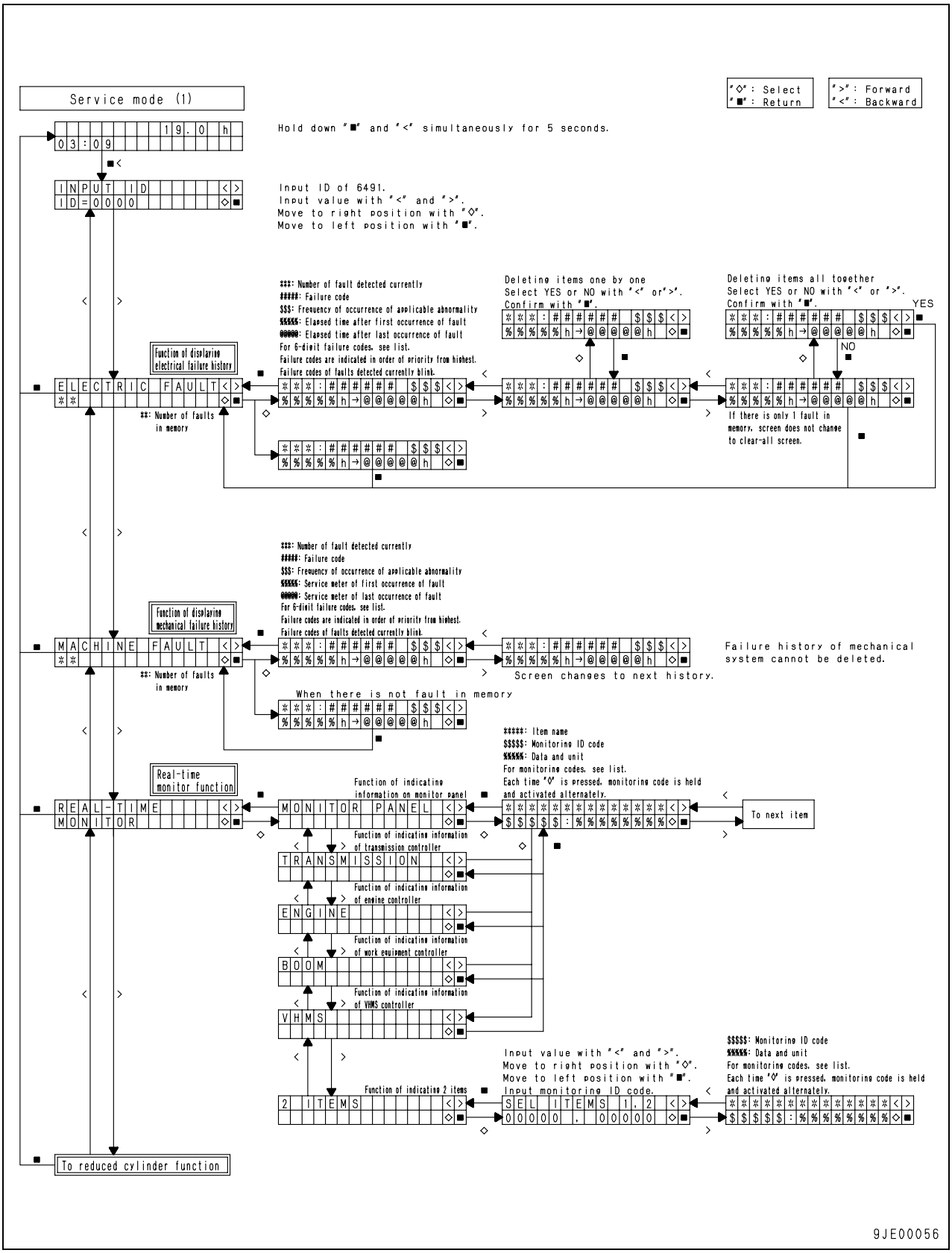
Operator mode	
1	Service meter/clock display function (*2)
2	Load meter function (*1)
3	Odometer display function
4	Maintenance monitoring function
5	Telephone number input function
6	Language selection function
7	Monitor brightness adjustment function
8	Time adjustment function (*2)
9	Travel speed/engine speed display selecting function
10	Travel speed/engine speed display/non-display selecting function (*2)
11	Action code display function
12	Failure code display function

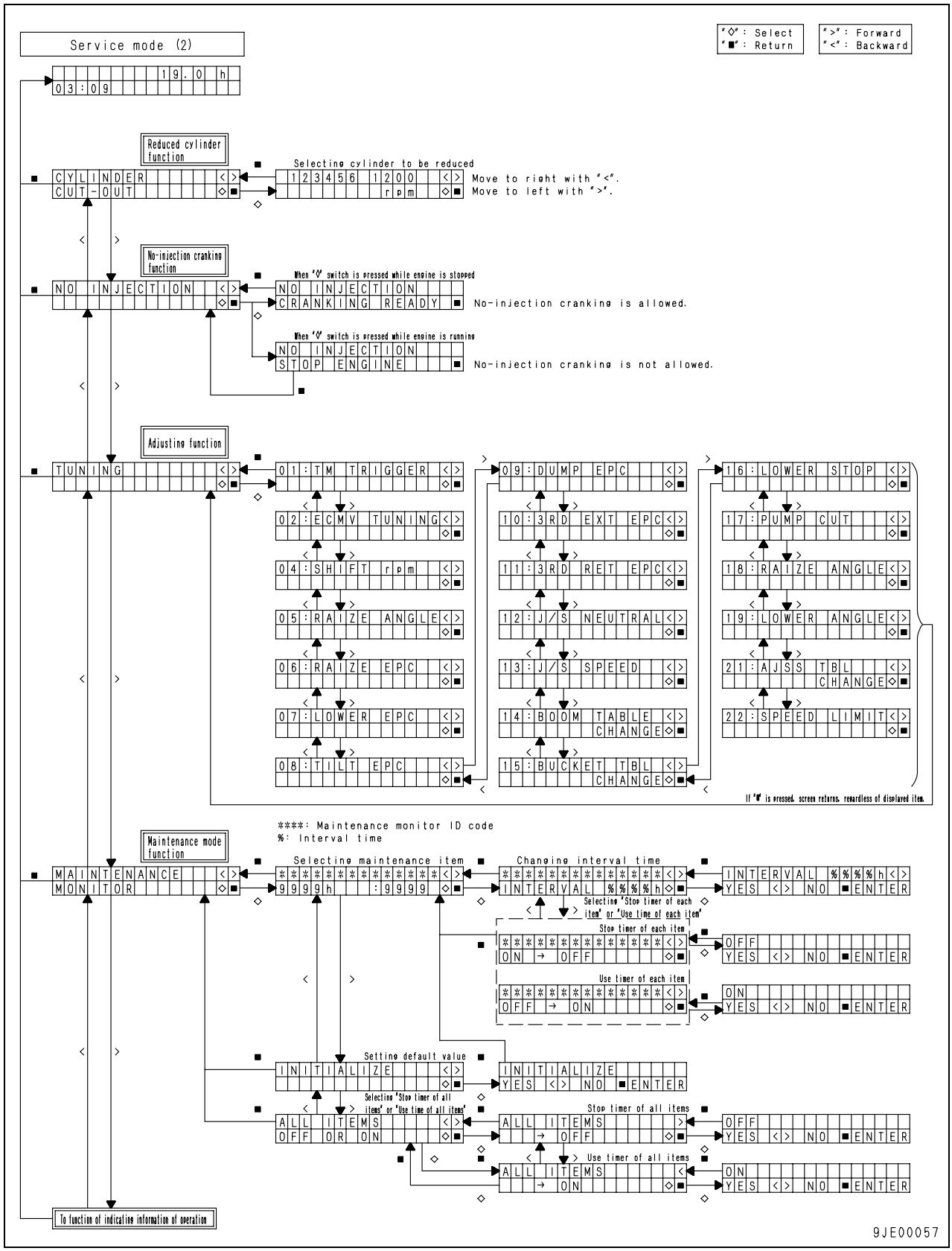
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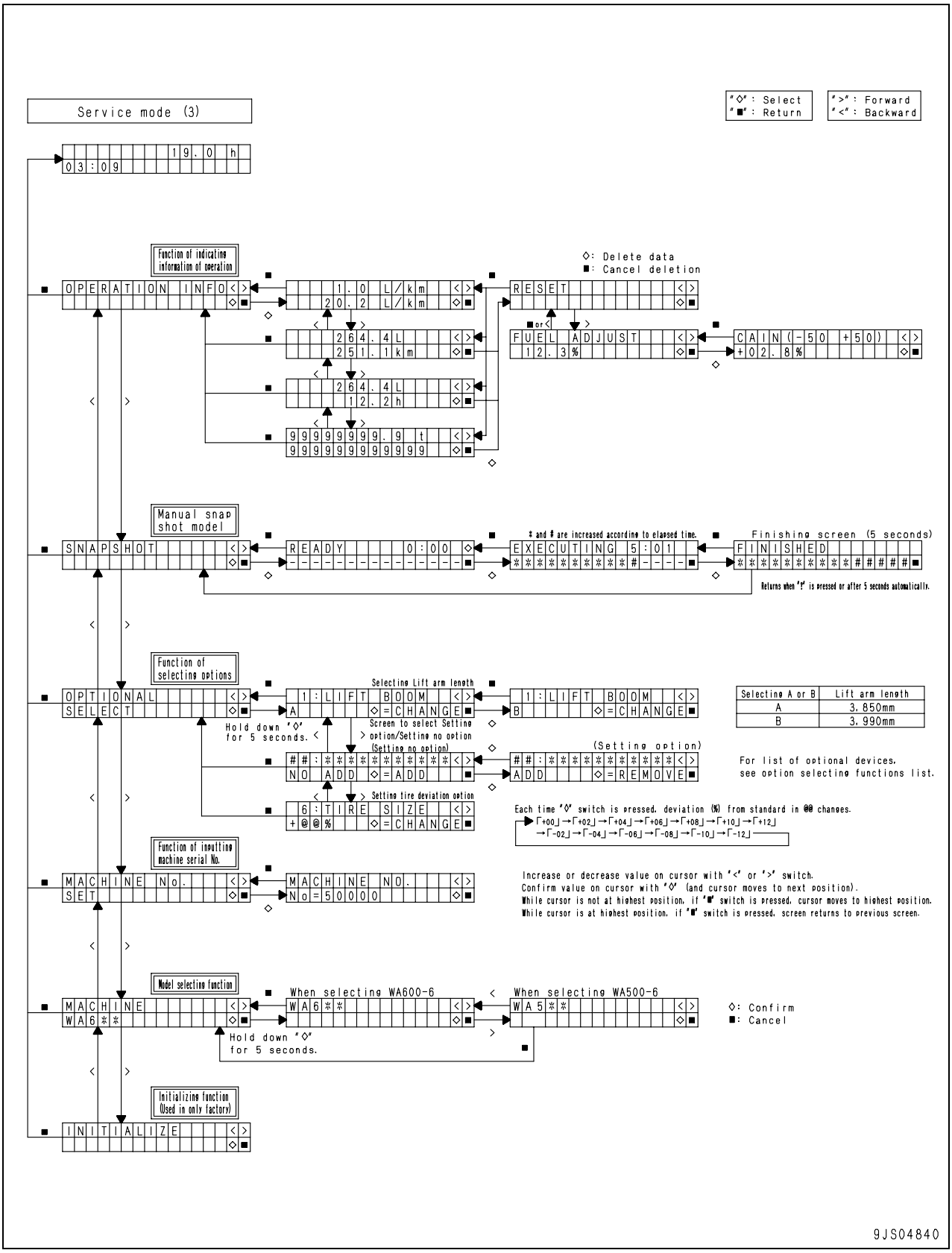
Service mode	
1	Electrical system fault history display function
2	Mechanical system fault history display function
3	Real-time monitoring function
4	Engine reduced-cylinder function
5	No injection cranking function
6	Adjustment function
7	Maintenance monitoring function
8	Operating information display function
9	Manual snapshot function
10	Optional device selecting function
11	Machine serial number input function
12	Model selection function
13	Initialize function

*1: This display is not available when the load meter function is turned off through OPT selection of service mode.
*2: This display is not available when the travel speed/engine speed display selecting function is turned off through OPT selection of service mode.

Functions and flow of the service mode




Service mode (2)
"◇": Select
"■": Return
">": Forward
"<": Backward
19.0 h
03:09
Reduced cylinder function
CYLINDER CUT-OUT
Selecting cylinder to be reduced
123456 1200 rpm
Move to right with "<".
Move to left with ">".
No-injection cranking function
NO INJECTION
When '◇' switch is pressed while engine is stopped
NO INJECTION CRANKING READY
No-injection cranking is allowed.
When '◇' switch is pressed while engine is running
NO INJECTION STOP ENGINE
No-injection cranking is not allowed.
Adjusting function
TUNING
01:TM TRIGGER
02:ECMV TUNING
04:SHIFT rpm
05:RAIZE ANGLE
06:RAIZE EPC
07:LOWER EPC
08:TILT EPC
09:DUMP EPC
10:3RD EXT EPC
11:3RD RET EPC
12:J/S NEUTRAL
13:J/S SPEED
14:BOOM TABLE CHANGE
15:BUCKET TBL CHANGE
16:LOWER STOP
17:PUMP CUT
18:RAIZE ANGLE
19:LOWER ANGLE
21:AJSS TBL CHANGE
22:SPEED LIMIT
If '■' is pressed, screen returns, regardless of displayed item.
****: Maintenance monitor ID code
%: Interval time
Maintenance mode function
MAINTENANCE MONITOR
Selecting maintenance item
Changing interval time
INTERVAL %%%%h
YES <> NO ■ENTER
Selecting 'Stop timer of each item' or 'Use time of each item'
Stop timer of each item
ON → OFF
OFF
Use timer of each item
OFF → ON
ON
Setting default value
INITIALIZE
Selecting 'Stop timer of all items' or 'Use time of all items'
ALL ITEMS OFF OR ON
Stop timer of all items
Use timer of all items
To function of indicating information of operation
9JE00057

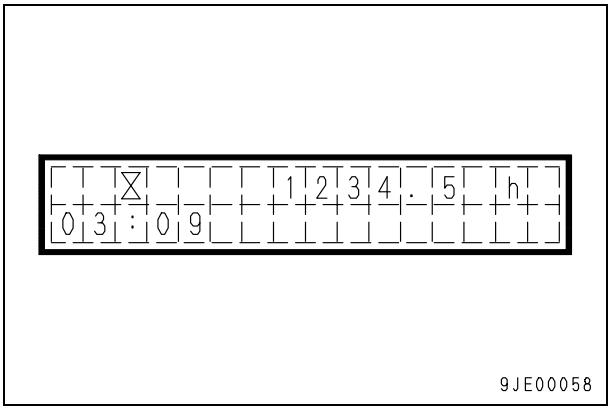

Service mode (3)
"◇": Select
"■": Return
">": Forward
"<": Backward
19.0 h
03:09
Function of indicating information of operation
OPERATION INFO
1.0 L/km
20.2 L/km
264.4L
251.1km
264.4L
12.2h
99999999.9 t
◇: Delete data
■: Cancel deletion
RESET
FUEL ADJUST
12.3%
CAIN (-50 +50)
+02.8%
Manual snap shot model
SNAPSHOT
READY 0:00
EXECUTING 5:01
FINISHED
* and # are increased according to elapsed time.
Finishing screen (5 seconds)
Returns when "!" is pressed or after 5 seconds automatically.
Function of selecting options
OPTIONAL SELECT
A
B
1:LIFT BOOM
=CHANGE
Selecting Lift arm length
Hold down "◇" for 5 seconds.
Screen to select Setting > option/Setting no option
(Setting no option)
NO ADD
ADD
=ADD
=REMOVE
(Setting option)
6:TIRE SIZE
+@@%
Setting tire deviation option
Each time "◇" switch is pressed, deviation (%) from standard in @@ changes.
Γ+00」→Γ+02」→Γ+04」→Γ+06」→Γ+08」→Γ+10」→Γ+12」
→Γ-02」→Γ-04」→Γ-06」→Γ-08」→Γ-10」→Γ-12」
Selecting A or B | Lift arm length
A | 3,850mm
B | 3,990mm
For list of optional devices, see option selecting functions list.
Function of inputting machine serial No.
MACHINE No.
SET
No=50000
Increase or decrease value on cursor with "<" or ">" switch.
Confirm value on cursor with "◇" (and cursor moves to next position).
While cursor is not at highest position, if "■" switch is pressed, cursor moves to highest position.
While cursor is at highest position, if "■" switch is pressed, screen returns to previous screen.
Model selecting function
MACHINE
WA6**
When selecting WA600-6
When selecting WA500-6
WA5**
Hold down "◇" for 5 seconds.
◇: Confirm
■: Cancel
Initializing function (Used in only factory)
INITIALIZE
9JS04840

Operator mode

★ Following overviews the operator mode.
★ See the section "Structure, function and maintenance standard" or the Operation and maintenance manual for details of the operator mode.

1. Service meter/clock display function

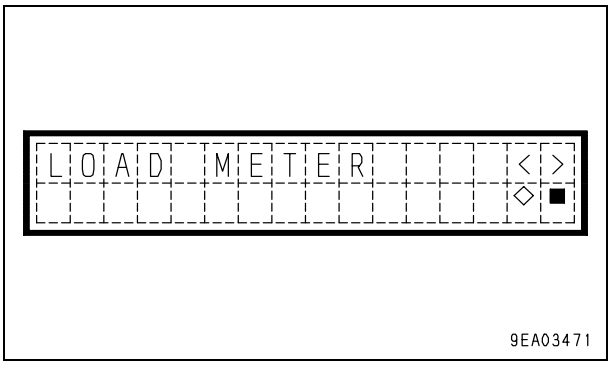
Turning on the starting switch displays the service meter in the upper space and the clock in the lower space.



2. Load meter function (if equipped)

Press [◇] switch from the ordinary service meter and clock display screen to display the load meter function.

★ For more information, see the section Structure, function and maintenance standard, "Load meter function", and Attachment options, "Using load meter" of the Operation and maintenance manual.

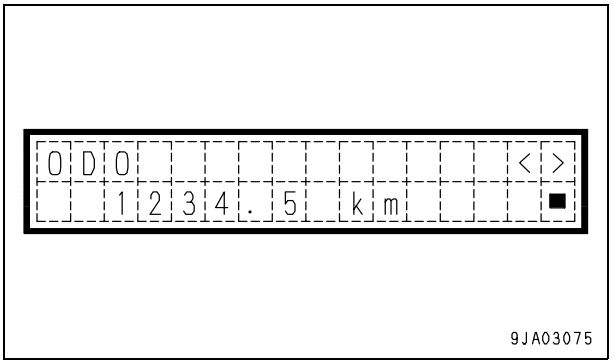


3. Odometer display function

Press [◇] switch from the ordinary service meter and clock display screen to display the odometer.

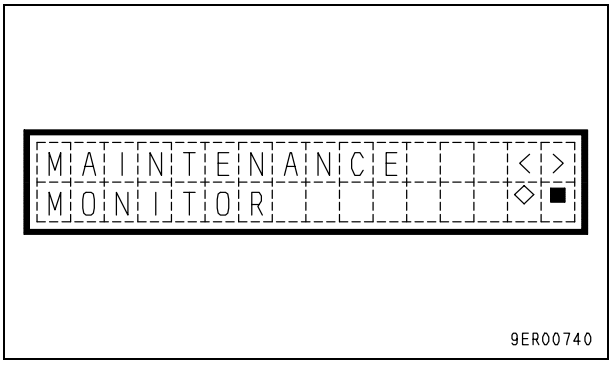
The load meter specifications displays the odometer as [<] switch is pressed succeeding to display of the load meter function.

★ For details, see the "Other functions of machine monitor" of the "Operation" section in the Operation and maintenance manual.



4. Maintenance monitoring function

1) Filter, oil replacement time display (automatic display)
As the filter or oil replacement time draws close, the machine monitor automatically displays its information to alert operator's attention.
2) Resetting replacement time (selection menu)
As maintenance operation for a filter or oil is completed, the machine monitor allows resetting the time interval through the switch operation.

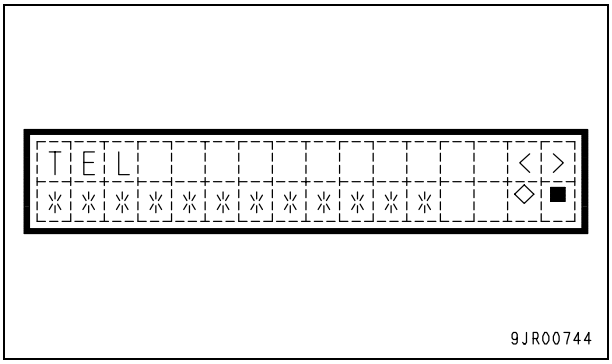


5. Telephone number input function

Telephone numbers are entered through the switch operation. And modification or cancellation of the phone numbers in the machine monitor is also available through the switch operation.

★ When action code [E03] is displayed, a phone number is displayed along with [CALL].

★ For details, see the "Other functions of machine monitor" of the Operation section in the Operation and maintenance manual.



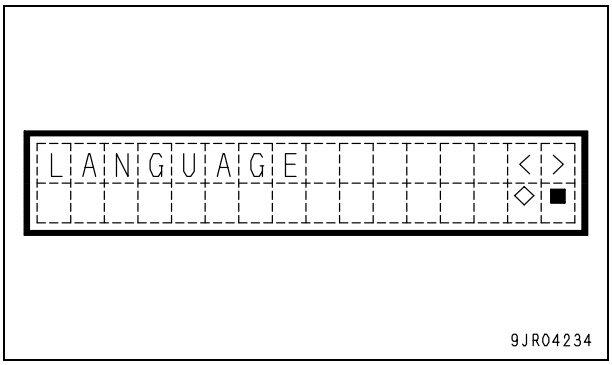
6. Language selection function

Switch operation allows selecting a display language of the machine monitor.

★ Functions of the service mode are constantly displayed in English since they are exempted from the display selection function.

★ A desired language is selectable from English, Japanese, German, French, Italian, Spanish and Swedish.

★ For details, see the "Other functions of machine monitor" of the Operation section in the Operation and maintenance manual.

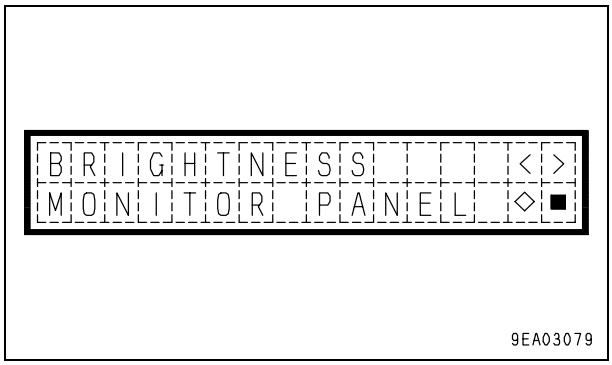


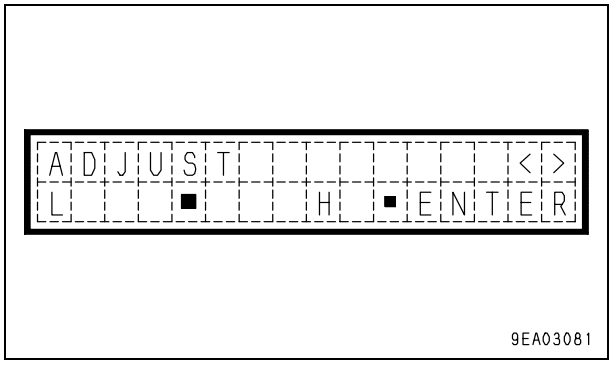
7. Monitor brightness adjustment function

Brightness of the machine monitor is adjustable in seven levels through the switch operation.

★ Adjustment of brightness is available in two approaches – adjustment of the monitor alone and separate adjustment of the monitor and liquid crystal.

★ For details, see the "Other functions of machine monitor" of the Operation section in the Operation and maintenance manual.

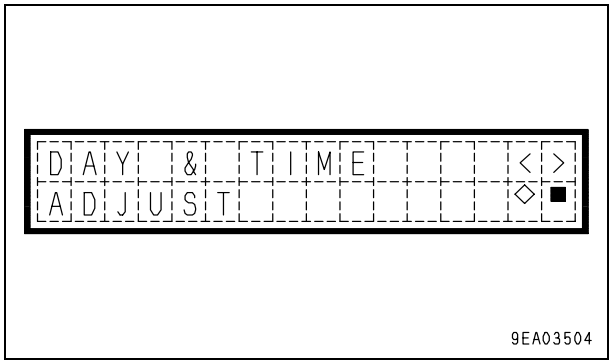




8. Time adjustment function

The time indicated by the clock of the machine monitor is adjustable.

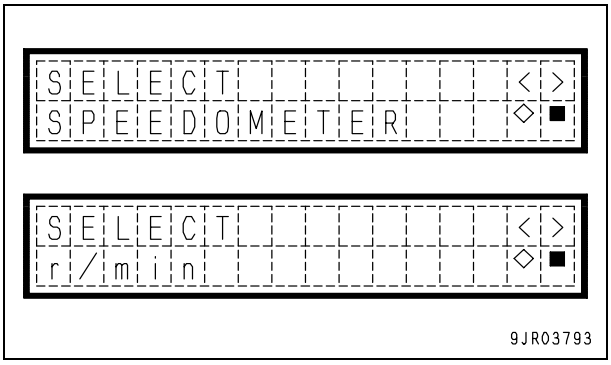
★ For details, see the "Other functions of machine monitor" of the Operation section in the Operation and maintenance manual.



9. Travel speed/engine speed display selecting function

A unit to be used for the machine monitor speed display is selectable from km/h and MPH. It is also possible to turn on or off the display of the travel speed and engine speed.

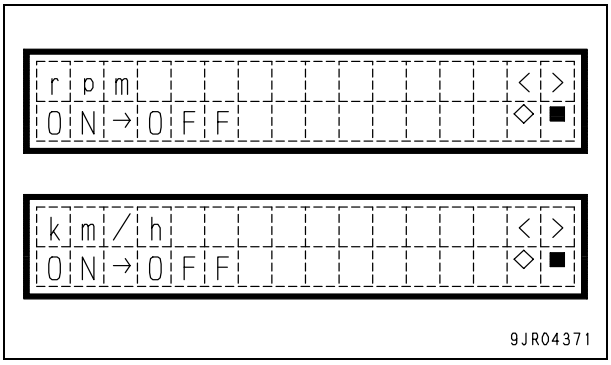
★ For details, see the "Other functions of machine monitor" of the Operation section in the Operation and maintenance manual.



10. Travel speed/engine speed display/non-display selecting function

A unit for the machine monitor speed display is selectable from km/h and MPH. It is also possible to turn on or off display of the travel speed and engine speed.

★ For details, see the "Other functions of machine monitor" of the Operation section in the Operation and maintenance manual.

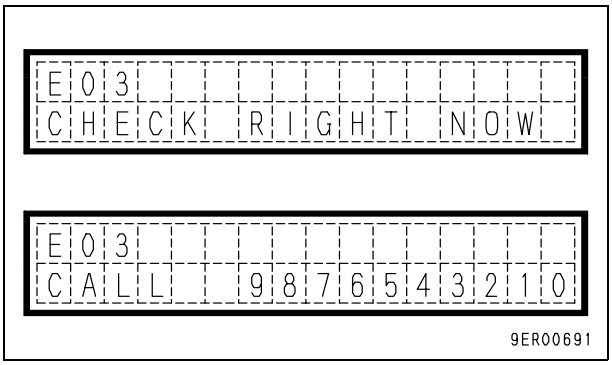


11. Action code display function

If a trouble occurs, the machine monitor displays an action code corresponding to the seriousness of the trouble to alert the operator for appropriate actions.

★ The figure below shows an example of the screen on which action code [E03] and [CALL + Telephone number] are alternately displayed.

★ When action code [E01] or [E02] is displayed, [CALL + Telephone number] is not displayed.



★ **Action codes and actions alerted to operator**

Action code	CALL + Telephone number	Actions recommended to operator
E01	Not displayed	• Do necessary testing and/or servicing as the current work is over or at shift of the operator.
E02	Not displayed	• When an overrun-related item is displayed Slow down the engine or machine speed. • When an overheat-related item is displayed Stop the machine and run the engine at mid speed with no load.
E03	Displayed	• Stop the engine and machine immediately and contact a serviceman.

12. Failure code display function

Pressing [>] switch once while an action is displayed on the machine monitor displays the failure code corresponding to the failure currently warned.

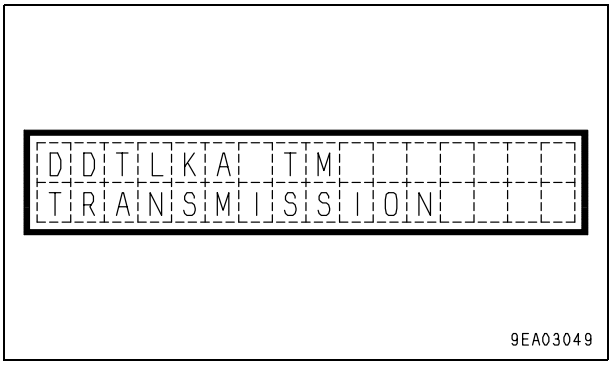
★ The failure codes detected in the past are divided into failures of the electrical system and the mechanical system and are recorded as fault history. (For details, see "Service mode".)

★ When two or more failures are involved, pressing [>] switch displays further codes.

★ If [>] switch is pressed again after it was pressed to display every involved failure code, the service meter display screen will be restored.

Pressing [>] switch one more time displays the failure codes from the first.

If [>] switch is not touched for 3 seconds, the action code display screen is automatically displayed.

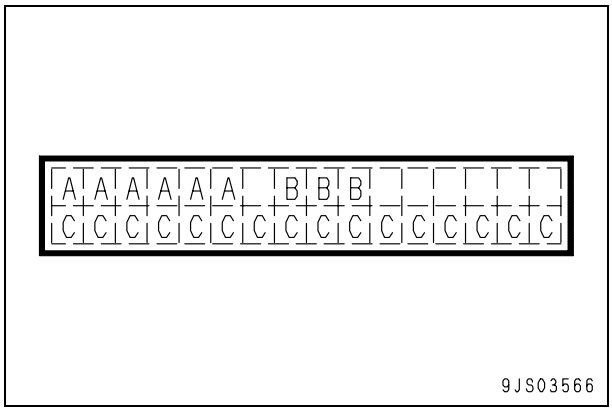


★ The service code display function displays the following information.

A: Failure code (location code + problem code)

B: Controller code
MON: Machine monitor
TM: Transmission controller
WRK: Work equipment controller
ENG: Engine controller
VHMS: VHMS controller

C: The system where failure occurred



★ For details of a displayed failure code, see "Failure code list".

★ If any switch operation is not done for 30 seconds or more on the failure code display screen, the action code display screen is automatically turned on.

Monitoring code list

MONITOR PANEL [Mechanical monitor system]					
No.	Monitoring codes	Monitoring items (*1)	Displayed items (*2)	Data display range (*3)	Unit (*4)
1	20200	Monitor ROM part number	VERSION	Arabic numerals	Status display
2	20221	Application version	VERSION (APP)	Arabic numerals	Status display
3	20222	Data version	VERSION (DATA)	Arabic numerals	Status display
4	01001	Engine speed	ENG SPEED	0 – 3000	rpm
5	40000	Travel speed	SPEED	0 – 50	km/h
6	04202	Fuel level	FUEL SENSOR	0 – 100	%
7	04207	Fuel level	FUEL SENSOR	0.00 – 5.00	V
8	04103	Engine coolant temperature	COOLANT TEMP	–40 – 210	°C
9	40100	Torque converter oil temperature	TC OIL TEMP	24 – 131	°C
9	40101	Torque converter oil temperature	TC OIL TEMP	0.00 – 5.00	V
10	04401	Hydraulic oil temperature	HYD TEMP	24 – 131	°C
11	04404	Hydraulic oil temperature	HYD TEMP	0.00 – 5.00	V
12	30202	Rear brake oil temperature	R BRAKE OIL	24 – 131	°C
13	30205	Rear brake oil temperature	R BRAKE OIL	0.00 – 5.00	V
14	04302	Charge level	ALTERNATOR R	0.00 – 30.00	V
15	40200	Small lamp voltage	SMALL LAMP	0.00 – 30.00	V
16	40300	Battery electrolyte level A	BATTERY A	0.00 – 30.00	V
17	40301	Battery electrolyte level B	BATTERY B	0.00 – 30.00	V
18	06001	Lift arm angle	BOOM ANG	–90 – 90	Degree (°)
19	06003	Lift arm angle	BOOM ANG	0.00 – 5.00	V
20	40400	Lift arm bottom pressure	BOOM BTM PRESS	0.00 – 50.00	MPa
21	40402	Lift arm bottom pressure	BOOM BTM PRESS	0.00 – 5.00	V
22	40500	Lift arm head pressure	BOOM HED PRESS	0.00 – 50.00	MPa
23	40501	Lift arm head pressure	BOOM HED PRESS	0.00 – 5.00	V
24	40600	Calibration pressure	CAL PRESS	0.00 – 50.00	MPa
25	40800	Load meter calculated weight	MES LOAD	0.00 – 50.00	ton
26	30802	Rotary switch setting state	SW1, SW2, SW3	F, F, F	Status display
27	30904	DIP switch setting state	SW5-1, SW5-2	ON/OFF, ON/OFF	Status display
28	30905	DIP switch setting state	SW5-3, SW5-4	ON/OFF, ON/OFF	Status display
29	30906	DIP switch setting state	SW6-1, SW6-2	ON/OFF, ON/OFF	Status display
30	30907	DIP switch setting state	SW6-3, SW6-4	ON/OFF, ON/OFF	Status display
31	40900	Input signal D_IN_0-7	D-IN--0------7	See attached table	Status display
32	40901	Input signal D_IN_8-15	D-IN--8------15	See attached table	Status display
33	40902	Input signal D_IN_16-23	D-IN--16------23	See attached table	Status display
34	40903	Input signal D_IN_24-31	D-IN--24------31	See attached table	Status display
35	40904	Input signal D_IN_32-39	D-IN--32------39	See attached table	Status display
36	40952	Output signal D_OUT_0-3	D-OUT--0--3	See attached table	Status display

*1: All items are displayed including those for which sensors are not provided depending on the given model or option.
*2: Abbreviated expression is employed because of number of characters usable is restricted.
*3: If a value is below (or above) the display range, it will be displayed as the lowest (highest) value in the range.
*4: SI units alone are employed whenever a unit is needed.
★ Note that the following monitoring items display information involving two to three systems at a time.
No.18: Rotary switch setting state (displays threes switches at a time)
No.19: DIP switch setting state (displays two switches at a time)
No.20: DIP switch setting state (displays two switches at a time)
No.21: DIP switch setting state (displays two switches at a time)
No.22: DIP switch setting state (displays two switches at a time)

MON [Mechanical monitor system]				
No.	Monitoring codes	Input/Output signal	Displayed items	Description of ON/OFF switch
1	40900	D-IN-0	Head lamp high beam	Lighting of head lamp = ON (24 V)/OFF (OPEN)
		D-IN-1	Starting motor BR	Starting switch = ON (24 V)/OFF (OPEN)
		D-IN-2	Starting switch C	Starting switch = ON (24 V)/OFF (OPEN)
		D-IN-3	—	—
		D-IN-4	Auto grease A (Applicable to a machine equipped with optional auto grease)	Tank empty or failed = ON (24 V)/OFF (OPEN)
		D-IN-5	Auto grease B (Applicable to a machine equipped with optional auto grease)	In operation or failed = ON (24 V)/OFF (OPEN)
		D-IN-6	—	—
		D-IN-7	—	—
2	40901	D-IN-8	—	—
		D-IN-9	—	—
		D-IN-10	Load meter mode selector switch (A/B) (Applicable to a machine equipped with optional load meter)	Pressing of switch = ON (24 V)/OFF (OPEN)
		D-IN-11	Load meter mode selector switch (+/–) (Applicable to a machine equipped with optional load meter)	Pressing of switch = ON (24 V)/OFF (OPEN)
		D-IN-12	Turn signal right	Lighting of turn signal right lamp = ON (GND)/ OFF (OPEN)
		D-IN-13	Turn signal left	Lighting of turn signal left lamp = ON (GND)/ OFF (OPEN)
		D-IN-14	◇ switch	Pressing of switch = ON (24 V)/OFF (OPEN)
		D-IN-15	■ switch	Pressing of switch = ON (24 V)/OFF (OPEN)
3	40902	D-IN-16	Brake oil pressure (front)	Normal oil pressure = ON (GND)/OFF (OPEN)
		D-IN-17	Brake oil pressure (rear)	Normal oil pressure = ON (GND)/OFF (OPEN)
		D-IN-18	—	—
		D-IN-19	—	—
		D-IN-20	Clogged air cleaner	No clogging = ON (GND)/OFF (OPEN)
		D-IN-21	—	—
		D-IN-22	Parking brake emergency release switch	Pressing of switch = ON (24 V)/OFF (OPEN)
		D-IN-23	Load meter display selector switch	Pressing of switch = ON (GND)/OFF (OPEN)
4	40903	D-IN-24	Transmission filter clogging	No clogging = ON (GND)/OFF (OPEN)
		D-IN-25	—	—
		D-IN-26	Parking brake	Parking brake operation = ON (GND)/OFF (OPEN)
		D-IN-27	Engine coolant level	Normal coolant level = ON (GND)/OFF (OPEN)
		D-IN-28	—	—
		D-IN-29	Engine oil level	Low oil level = ON (GND)/OFF (OPEN)
		D-IN-30	Operation of emergency steering (Applicable to a machine equipped with the optional emergency steering)	Operation of emergency steering = ON (GND)/ OFF (OPEN)
		D-IN-31	—	—

MON [Mechanical monitor system]				
5	40904	D-IN-32	Load meter subtotal switch (Applicable to a machine equipped with optional load meter)	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-33	Load meter cancel switch (Applicable to a machine equipped with optional load meter)	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-34	High beam (dimmer switch)	High beam = ON (GND)/OFF (OPEN)
		D-IN-35	Working fuel consumption display switch	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-36	Service 2 mode	ON = ON(GND)/OFF(OPEN)
		D-IN-37	[>] switch	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-38	[<] switch	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-39	—	—
6	40952	D-OUT-0	Alarm buzzer	Output ON = (24 V)/OFF (OPEN)
		D-OUT-1	—	—
		D-OUT-2	—	—
		D-OUT-3	—	—

TM [Transmission controller system]						
No.	Monitoring code	Monitoring items (*1)	Displayed items (*2)	Data display range (*3)	Unit (*4)	Remarks (*5)
1	20201	Transmission controller ROM part number	VERSION	Arabic numerals	Status display	
2	20223	Application version	VERSION APP	20223	Status display	
3	20224	Data version	VERSION DATA	20224	Status display	
4	41600	Selection of engine mode	ENGINE MODE	0: Power mode 2: Economy mode	Status display	
5	41400	Fan pump EPC current value (Command)	FAN EPC DIR	0 – 1000	mA	
6	93400	Fan reverse switch input	FAN REVERSE SW	0: OFF 1: ON (CLOSE)	Status display	
7	41501	Torque converter inlet oil temperature	T/C IN OIL TEMP	–30 – 100°C	°C	
8	41502	Torque converter inlet oil temperature	T/C IN OIL TEMP	0.00 – 5.00	V	
9	93500	Torque converter input shaft speed	T/C SPEED:IN	0 – 32767	rpm	
10	93501	Torque converter output shaft torque	T/C TORQUE:OUT	0 – 400000	Nm	
11	31200	Transmission output shaft speed	CT/M SPEED IN	—	rpm	Not used
12	31400	Transmission output shaft speed	T/M SPEED:OUT	0 – 32767	rpm	
13	31404	Transmission output shaft speed 2	T/M SPEED:OUT2	0 – 32767	rpm	
14	41203	Torque converter speed ratio	TC SPEED RATIO	0 – 200	%	
15	41201	Transmission cut-off operation setting	T/M CUT SET	0.00 – 50.00	MPa	
16	41202	Transmission cut-off (left brake) pressure	T/M CUT OFF P	0.00 – 50.00	MPa	
17	93700	Transmission cut-off (left brake) pressure	T/M CUT OFF P	0.00 – 5.00	V	
18	93600	Transmission oil temperature	T/M OIL TEMP	0 – 150	°C	
19	93601	Transmission oil temperature sensor input voltage	T/M OIL TEMP	0.00 – 5.00	V	
20	92400	Modulation clutch oil pressure input	MOD/C PRESS	0.00 – 50.00	MPa	
21	92401	Modulation clutch oil pressure input voltage	MOD/C PRESS	0.00 – 5.00	V	
22	92500	Modulation clutch calorific value	MOD/C Q	0 – 25.5	100J/cm^2	
23	92501	Modulation clutch calorific rate	MOD/C q	0 – 2.55	0.1 kW/cm^2	
24	95500	Throttle correction command output	THROTTLE MOD	–100 – 100	%	
25	95501	Throttle opening upper limit output	THROT LIMIT UP	0 – 100.0	%	
26	95400	Throttle opening lower limit output	THROT LIMIT LO	0 – 100.0	%	
27	44200	RPM idle-up/down selector switch (idle-up)	THROT LOCK A	0: OFF 1: ON	Status display	
28	44201	RPM idle-up/down selector switch (idle-down)	THROT LOCK B	0: OFF 1: ON	Status display	

TM [Transmission controller system]						
29	93801	Accelerator mode	THROTTLE MODE	0: Accelerator pedal open 1: Accelerator pedal partial pressing (open side) 2: Accelerator pedal partial pressing (pressing side) 3: Accelerator pedal full pressing	Status display	
30	94000	Traction setting input value	TRACTION DIAL	0 – 100	%	
31	94001	Traction setting input voltage	TRACTION DIAL	0.00 – 5.00	V	
32	95000	Lockup selector switch input signal	LOCK UP SW	0: OFF 1: ON	Status display	
33	31602	1st ECMV current value (Command)	ECMV 1 DIR	0 – 1000	mA	
34	31603	2nd ECMV current value (Command)	ECMV 2 DIR	0 – 1000	mA	
35	31604	3rd ECMV current value (Command)	ECMV 3 DIR	0 – 1000	mA	
36	31605	4th ECMV current value (Command)	ECMV 4 DIR	0 – 1000	mA	
37	31608	F (forward) ECMV current value (Command)	ECMV F DIR	0 – 1000	mA	
38	31609	Lockup clutch ECMV current value (Command)	ECMV LU DIR	0 – 10000	mA	
39	31640	Modulation clutch ECMV current value (Command)	ECMV MOD/C DIR	0 – 1000	mA	
40	31606	R (reverse) ECMV current value (Command)	ECMV R DIR	0 – 1000	mA	
41	93300	ECSS (travel damper) solenoid valve current value (Command)	ECSS V DIR	0 – 1000	mA	
42	41802	1st fill time	FILL TIME 1	0 – 2.55 (When fill is not provided: 0)	sec	
43	41803	2nd fill time	FILL TIME 2	0 – 2.55 (When fill is not provided: 0)	sec	
44	41804	3rd fill time	FILL TIME 3	0 – 2.55 (When fill is not provided: 0)	sec	
45	41805	4th fill time	FILL TIME 4	0 – 2.55 (When fill is not provided: 0)	sec	
46	41808	F (forward) fill time	FILL TIME F	0 – 2.55 (When fill is not provided: 0)	sec	
47	41806	R (reverse) fill time	FILL TIME R	0 – 2.55 (When fill is not provided: 0)	sec	
48	40905	Input signal D_IN_0-7	D-IN--0------7	See attached table	Status display	
49	40906	Input signal D_IN_8-15	D-IN--8-----15	See attached table	Status display	

TM [Transmission controller system]						
50	40907	Input signal D_IN_16-23	D-IN-16-----23	See attached table	Status display	
51	40908	Input signal D_IN_24-31	D-IN-24-----31	See attached table	Status display	
52	40942	Input signal D_IN_32-39	D-IN-32-----39	See attached table	Status display	
53	40949	Output signal D_OUT_0-7	D-OUT-0------7	See attached table	Status display	
54	40950	Output signal D_OUT_8-15	D-OUT-8-----15	See attached table	Status display	Not used
55	40951	Output signal D_OUT_16-23	D-OUT-16----23	See attached table	Status display	Not used
56	94100	Clutch trigger initial learning flag	TRIG FR1234	0/1(ON/OFF)	Status display	

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*3: If a value is below (or above) the display range, it will be displayed as the lowest (highest) value in the range.
*4: SI units alone are employed whenever a unit is needed.
*5: An item that does not allow monitoring is indicated as "Not used" though its code and item name may be displayed on the machine monitor.

TM [Transmission controller system]				
No.	Monitoring code	Input/ Output signal	Displayed items	Description of ON/OFF switch
1	40905	D-IN-0	Engine mode selector switch	Engine mode selector switch (Power mode) = ON (GND)/OFF (OPEN)
		D-IN-1	—	—
		D-IN-2	—	—
		D-IN-3	Air conditioner compressor operation	Air conditioner compressor operation = ON (GND)/OFF (OPEN)
		D-IN-4	Shift mode L	Shift mode L = ON (GND)/OFF (OPEN)
		D-IN-5	Shift mode H	Shift mode H = ON (GND)/OFF (OPEN)
		D-IN-6	Modulation clutch direct connection signal	Modulation clutch direct connection signal present = ON (24 V)/OFF (OPEN)
		D-IN-7	C terminal signal	Starting switch = ON (24 V)/OFF (OPEN)
2	40906	D-IN-8	—	—
		D-IN-9	—	—
		D-IN-10	Kick-down switch	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-11	Shift hold switch	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-12	—	—
		D-IN-13	RPM set ON/OFF switch	Pressing of switch = ON (24 V)/OFF (OPEN)
		D-IN-14	RPM set idle-up/down switch selector switch	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-15	Throttle lock release right brake pedal switch	Pressing right brake pedal = ON (GND)/ OFF (OPEN)

TM [Transmission controller system]				
3	40907	D-IN-16	• Joystick steering shift-up (Normally open) (Joystick steering specification) • Shift range 1st (Steering wheel specification)	• Shift-up switch = ON (24 V)/OFF (OPEN) (Joystick steering specification) • Shift lever 1st = ON (24 V)/OFF (OPEN) (Steering wheel specification)
		D-IN-17	• Joy stick steering shift-up (Normally closed) (Joystick steering specification) • Shift range 2nd (Steering wheel specification)	• Shift-up switch = ON (OPEN)/OFF (24 V) (Joystick steering specification) • Shift lever 2nd =ON (24 V)/OFF (OPEN) (Steering wheel specification)
		D-IN-18	• Joy stick steering shift-up (Normally open) (Joystick steering specification) • Shift range 3rd (Steering wheel specification)	• Shift-up switch = ON (OPEN)/OFF (24 V) (Joystick steering specification) • Shift lever 3rd = ON (24 V)/OFF (OPEN) (Steering wheel specification)
		D-IN-19	• Joy stick steering shift-up (Normally closed) (Joystick steering specification) • Shift range 4th (Steering wheel specification)	• Shift-up switch = ON (OPEN)/OFF (24 V) (Joystick steering specification) • Shift lever 4th = ON (24 V)/OFF (OPEN) (Steering wheel specification)
		D-IN-20	Directional lever F (forward) or directional selector switch F (forward)	Directional lever F (forward) or directional selector switch F (forward) = ON (24 V)/ OFF (OPEN)
		D-IN-21	Directional lever N (neutral) or directional selector switch N (Neutral).	Directional lever N (neutral) or directional selector switch N (neutral) = ON (24 V)/OFF (OPEN)
		D-IN-22	Directional lever R (reverse) or directional selector switch R (reverse)	Directional lever R (reverse) or directional selector switch R (reverse) = ON (24 V)/ OFF (OPEN)
		D-IN-23	Parking brake signal	Parking brake = ON (24 V)/OFF (OPEN)
4	40908	D-IN-24	—	—
		D-IN-25	F ECMV fill switch F (forward)	ECMV fill switch F (forward) = ON (GND)/ OFF (OPEN)
		D-IN-26	F ECMV fill switch R (reverse)	ECMV fill switch R (reverse) = ON (GND)/OFF (OPEN)
		D-IN-27	ECMV fill switch 1st	ECMV fill switch 1st = ON (GND)/OFF (OPEN)
		D-IN-28	ECMV fill switch 2nd	ECMV fill switch 2nd = ON (GND)/OFF (OPEN)
		D-IN-29	ECMV fill switch 3rd	ECMV fill switch 3rd = ON (GND)/OFF (OPEN)
		D-IN-30	ECMV fill switch 4th	ECMV fill switch 4th = ON (GND)/OFF (OPEN)
		D-IN-31	Steering lever lock detection pressure switch (Joystick steering specification)	Steering lever lock pressure switch = ON (GND)/OFF (OPEN)

TM [Transmission controller system]				
5	40942	D-IN-32	Brake pressure switch	Brake pressure switch = ON (5V)/OFF (OPEN)
		D-IN-33	—	—
		D-IN-34	—	—
		D-IN-35	—	—
		D-IN-36	—	—
		D-IN-37	—	—
		D-IN-38	—	—
		D-IN-39	—	—
6	40949	D-OUT-0	Modulation clutch cut-off release solenoid	Output ON = (24 V)/OFF (OPEN)
		D-OUT-1	—	—
		D-OUT-2	—	—
		D-OUT-3	Fan reverse solenoid	Output ON = (24 V)/OFF (OPEN)
		D-OUT-4	Fan neutral solenoid (option)	Output ON = (24 V)/OFF (OPEN)
		D-OUT-5	Low temperature bypass solenoid	Output ON = (24 V)/OFF (OPEN)
		D-OUT-6	—	—
		D-OUT-7	—	—

WRK [Work equipment controller system]						
No.	Monitoring code	Monitoring items (*1)	Displayed items (*2)	Data display range (*3)	Unit (*4)	Remarks (*5)
1	20202	Work equipment controller software version	VERSION	XXXXRYYY [3rd – 10th digits of part number are displayed] Example: When the number is 7831-46-R110 → "3146R110"	—	
2	20225	Application version	VERSION APP	Arabic numerals	Status display	
3	20226	Data version	VERSION DATA	Arabic numerals	Status display	
4	94700	Loader pump pressure	PUMP PRESS	0.00 – 50.00	MPa	
5	94701	Loader pump pressure	PUMP PRESS	0.00 – 5.00	V	
6	94500	Loader pump EPC current (Command)	PUMP EPC DIR	0 – 1000	mA	
7	94600	Pump delivery flow rate	PUMP FLOW	0 – 264	cc/r	
8	06002	Lift arm angle	BOOM ANG	–180.0 – +180.0	Degree (°)	
9	06005	Lift arm angle	BOOM ANG	0.00 – 5.00	V	
10	94400	Frame angle	FRAME ANGLE	–180.0 – +180.0	Degree (°)	
11	42100	Lift arm lever operation frequency	BOOM LVR	0 – 256000 (On thousand-time basis)	—	
12	42000	Lever potentiometer voltage lift arm 1	BOOM POT1	0.00 – 5.00	V	
13	42001	Lever potentiometer voltage lift arm 2	BOOM POT2	0.00 – 5.00	V	
14	42101	Bucket lever operation frequency	BUCKET LVR	0 – 256000 (In a thousand of times)	—	
15	42002	Lever potentiometer voltage bucket 1	BUCKET LVR	0.00 – 5.00	V	
16	42003	Lever potentiometer voltage bucket 2	BUCKET POT2	0.00 – 5.00	V	
17	41900	Lift arm raise EPC current (Command)	RAISE EPC DIR	0 – 1000	mA	
18	41901	Lift arm lower EPC current (Command)	LOWER EPC DIR	0 – 1000	mA	
19	41902	Bucket tilt EPC current (Command)	TILT EPC DIR	0 – 1000	mA	
20	41903	Bucket dump EPC current (Command)	DUMP EPC DIR	0 – 1000	mA	
21	41908	AJSS EPC current (Command)	AJSS EPC DIR	0 – 1000	mA	
22	41904	AJSS right EPC current (Command)	J/S EPC DIR RH	0 – 1000	1mA	
23	41905	AJSS left EPC current (Command)	J/S EPC DIR LH	0 – 1000	1mA	
24	42004	Lever potentiometer voltage AJSS 1	J/S POT1	0.00 – 5.00	V	
25	42005	Lever potentiometer voltage AJSS 2	J/S POT2	0.00 – 5.00	V	
26	41906	3-spool valve 1, ECMV and current value (Command)	3RD EPC1 DIR	0 – 1000	1mA	
27	41907	3-spool valve 2, ECMV and current value (Command)	3RD EPC2 DIR	0 – 1000	1mA	
28	42102	3rd lever operation frequency	3RD LVR	0 – 256000 (In a thousand of times)	—	

WRK [Work equipment controller system]						
29	42006	Lever potentiometer voltage 3-spool valve 1	3RD POT1	0.00 – 5.00	0.01V	
30	42007	Lever potentiometer voltage 3-spool valve 2	3RD POT2	0.00 – 5.00	0.01V	
31	94300	AJSS lever operation angle	AJSS LEVER	–180.0 – +180.0	Degree (°)	
32	94301	AJSS lever potentiometer voltage	AJSS LEVER	0.00 – 5.00	V	
33	94401	AJSS frame potentiometer voltage	FRAME ANGLE	0.00 – 5.00	V	
34	94800	AJSS steering deviation angle	S/T DEFLEC-TION	–180.0 – +180.0	Degree (°)	
35	94900	Digging-in-progress flag	WORK FLAG	ON/OFF	Status display	
36	40910	Input signal D_IN_0-7	D-IN--0------7	See attached table	Status display	
37	40911	Input signal D_IN_8-15	D-IN--8-----15	See attached table	Status display	
38	40912	Input signal D_IN_16-23	D-IN-16-----23	See attached table	Status display	
39	40913	Input signal D_IN_24-31	D-IN-24-----31	See attached table	Status display	
40	40961	Input signal D_IN_32-39	D-IN-32-----39	See attached table	Status display	Not used
41	40952	Output signal D_OUT_0-7	D-OUT-0------7	See attached table	Status display	
42	40953	Output signal D_OUT_8-15	D-OUT-8-----15	See attached table	Status display	Not used
43	40954	Output signal D_OUT_16-23	D-OUT-16----23	See attached table	Status display	

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*3: If a value is below (or above) the display range, it will be displayed as the lowest (highest) value in the range.
*4: SI units alone are employed whenever a unit is needed.
*5: An item that does not allow monitoring is indicated as "Not used" though its code and item name may be displayed on the machine monitor.

WRK [Work equipment controller system]				
No.	Monitoring codes	Input/Output signal	Displayed items	Description of ON/OFF switch
1	40910	D-IN-0	Semiautomatic digging lock mode switch	Pressing of switch ON = ON (24 V)/OFF (OPEN)
		D-IN-1	Semiautomatic digging loose mode switch	Pressing of switch ON = ON (24 V)/OFF (OPEN)
		D-IN-2	—	—
		D-IN-3	—	—
		D-IN-4	—	—
		D-IN-5	—	—
		D-IN-6	—	—
2	40911	D-IN-8	Bucket full stroke proximity switch	Bucket dump ON = ON (24 V)/OFF (OPEN)
		D-IN-9	Bucket tilt horizontal proximity switch	Bucket horizontal ON = ON (24 V)/OFF (OPEN)
		D-IN-10	Remote positioner bucket angle set switch (facing upward)	Remote positioner bucket angle set switch (facing upward) = ON (GND)/OFF (OPEN)
		D-IN-11	Remote positioner bucket angle set switch (facing downward)	Remote positioner bucket angle set switch (facing upward) = ON (GND)/OFF (OPEN)
		D-IN-12	—	—
		D-IN-13	—	—
		D-IN-14	—	—
		D-IN-15	—	—
3	40912	D-IN-16	Work equipment neutral lock switch	Work equipment neutral lock switch (Working position) ON = (24 V)/OFF (OPEN)
		D-IN-17	Starting motor C terminal signal	Starting switch START = ON (24 V)/OFF (OPEN)
		D-IN-18	—	—
		D-IN-19	—	—
		D-IN-20	—	—
		D-IN-21	—	—
		D-IN-22	—	—
		D-IN-23	—	—
4	40913	D-IN-24	—	—
		D-IN-25	—	—
		D-IN-26	—	—
		D-IN-27	—	—
		D-IN-28	Lift arm positioner raise/lower set switch (raise)	Lift arm positioner raise/lower switch (raise) = ON (GND)/OFF (OPEN)
		D-IN-29	Lift arm positioner raise/lower set switch (lower)	Lift arm positioner raise/lower set switch (lower) = ON (GND)/OFF (OPEN)
		D-IN-30	Turn signal right switch	Turn signal right switch = ON (GND)/OFF (OPEN)
		D-IN-31	Turn signal left switch	Turn signal left switch = ON (GND)/OFF (OPEN)

WRK [Work equipment controller system]				
5	40952	D-OUT-0	Work equipment neutral lock solenoid	Output ON = ON (24 V)/OFF (OPEN)
		D-OUT-1	Lift arm raise detent solenoid	Output ON = ON (24 V)/OFF (OPEN)
		D-OUT-2	Lift arm float detent solenoid	Output ON = ON (24 V)/OFF (OPEN)
		D-OUT-3	Bucket tilt detent solenoid	Output ON = ON (24 V)/OFF (OPEN)
		D-OUT-4	—	—
		D-OUT-5	—	—
		D-OUT-6	—	—
		D-OUT-7	—	—
6	40954	D-OUT-16	Operation of turn signal right	Output ON = ON (24 V)/OFF (OPEN)
		D-OUT-17	Operation of turn signal left	Output ON = ON (24 V)/OFF (OPEN)
		D-OUT-18	Remote positioner top indicator ON	Output ON = ON (24 V)/OFF (OPEN)
		D-OUT-19	Remote positioner bottom indicator ON	Output ON = ON (24 V)/OFF (OPEN)
		D-OUT-20	Safety relay operation	Output ON = ON (24 V)/OFF (OPEN)
		D-OUT-21	—	—
		D-OUT-22	—	—
		D-OUT-23	—	—

ENG [Engine controller system]						
No.	Monitoring code	Monitoring items (*1)	Displayed items (*2)	Data display range (*3)	Unit (*4)	Remarks (*5)
1	20400	Hardware serial No.	ECM S/N	Arabic numerals	Status display	
2	03200	Battery voltage	POWER SUPPLY	0.0 – 480.0	V	
3	01002	Engine speed	ENG SPEED	0 – 4000	rpm	
4	04104	Engine coolant temperature	COOLANT TEMP	–40 – 210	°C	
5	04105	Engine coolant temperature sensor voltage	COOLANT TEMP	0.00 – 5.00	V	
6	37200	Oil pressure sensor	ENG OIL PRESS	–99.9 – 999.9	kPa	
7	37201	Oil pressure sensor voltage	ENG OIL PRESS	0.00 – 5.00	V	
8	42700	Engine oil temperature	ENG OIL TEMP	–40 – 210	°C	
9	42702	Engine oil temperature sensor voltage	ENG OIL TEMP	0.00 – 5.00	V	
10	36400	Common rail pressure	RAIL PRESS	0 – 400	MPa	
11	36402	Common rail pressure sensor voltage	RAIL PRESS	0.00 – 5.00	V	
12	37400	Atmospheric pressure	AMBIENT PRESS	–99.9 – 999.9	kPa	
13	37402	Atmospheric pressure sensor voltage	AMBIENT PRESS	0.00 – 5.00	V	
14	18400	Air intake temperature	INTAKE TEMP	–50 – 200	°C	
15	18401	Air intake temperature sensor voltage	INTAKE TEMP	0.00 – 5.00	V	
16	04204	Fuel temperature	FUEL TEMP	–40 – 210	°C	
17	14201	Fuel temperature sensor voltage	FUEL TEMP	0.00 – 5.00	V	
18	18500	Boost temperature	CHG TEMP	–50 – 200	°C	
19	18501	Boost temperature sensor voltage	CHG TEMP	0.00 – 5.00	V	
20	36500	Boost pressure	CHG PRESS-A	–99.9 – 999.9	kPa	
21	36502	Boost pressure sensor voltage	CHG PRESS-A	0.00 – 5.00	V	
22	17900	EGR valve differential pressure	EGR DIF PRESS	–99.9 – 999.9	kPa	
23	17901	EGR valve differential pressure sensor voltage	EGR DIF PRESS	0.00 – 5.00	V	
24	18000	EGR valve inlet pressure	EGR IN PRESS-A	–99.9 – 999.9	kPa	
25	18002	EGR valve inlet pressure sensor voltage	EGR IN PRESS-A	0.00 – 5.00	V	
26	18100	EGR valve position	EGR VALVE POS	0.00 – 99.99	mm	
27	18101	EGR valve position sensor voltage	EGR VALVE POS	0.00 – 5.00	V	
28	18700	Engine output torque	OUTPUT TORQUE	–24000 – 24000	Nm	
29	36700	Equivalent torque	TORQUE RATIO	0 – 100	%	
30	31706	Final accelerator position	FINAL THROTTLE	0 – 100	%	
31	37300	Momentary fuel consumption	FUEL RATE	0.0 – 999.9	l/h	
32	18600	Final injection volume command (in weight)	INJECT COMMAND	0 – 1000	mg	
33	36300	Final injection timing command TFIN	INJECT TIMING	–180.0 – 180.0	CA	

ENG [Engine controller system]						
34	31701	Accelerator pedal position	THROTTLE POS	0 – 100	%	
35	31707	Accelerator pedal sensor voltage	THROTTLE POS	0.00 – 5.00	V	
36	18200	Bypass valve position	BPS VALVE POS	0.00 – 99.99	mm	
37	18202	Bypass valve position sensor voltage	BPS VALVE POS	0.00 – 5.00	V	
38	18300	Idle validation signal	IVS 1	ON/OFF	Status display	
39	18301	Idle validation signal	IVS 2	ON/OFF	Status display	
40	18900	Engine controller internal temperature	ECM IN TEMP	–40 – 210	°C	
41	36200	Final common rail pressure command PFIN	PRESS COMMAND	0 – 400	MPa	
42	17201	PCV valve close timing (BTDC standard)	PCV TIMING	180.0 – 180.0	CA	
43	17500	Selection of engine mode	POWER MODE	0 – 4	Status display	
44	00400	Name of selected model (upper 8 digits)	MACHINE ID (H)	Incoming value is displayed as is (Upper 8 digits of 16 characters)	Status display	
45	00401	Name of selected model (lower 8 digits)	MACHINE ID (L)	Incoming value is displayed as is (Lower 8 digits of 16 characters)	Status display	
46	20216	Build version	BUILD VER	Incoming value is displayed as is (8 characters)	Status display	
47	20217	Calibration data version	CAL VER	Incoming value is displayed as is (8 characters)	Status display	

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VHMS [VHMS controller system]						
No.	Monitoring code	Monitoring items (*1)	Displayed items (*2)	Data display range (*3)	Unit (*4)	Remarks
1	37501	Atmospheric temperature	ATR TEMP	–30 + 100	°C	
2	42801	Blow-by pressure	BLOWBY PRESS	0.0 – 20.0	kPa	
3	42703	Engine oil temperature	ENG OIL TEMP	0 – 180	°C	
4	42610	Exhaust gas temperature (F)	EXHAUST TEMP F	200 – 950	°C	
5	42611	Exhaust gas temperature (R)	EXHAUST TEMP R	200 – 950	°C	
6	92800	Brake oil temperature (F)	BRAKE PRESS F	0.00 – 50.00	MPa	
7	92801	Brake oil temperature (R)	BRAKE PRESS R	0.00 – 50.00	MPa	
8	92900	Brake signal	BRAKE SIG	ON/OFF	Status display	
9	93000	Steering oil pressure	S/T OIL PRESS	0.00 – 50.00	MPa	
10	93100	Start signal	START SIG	ON/OFF	Status display	
11	40944	Input signal D_IN_0-7	D-IN--0------7	See attached table	Status display	
12	40948	Output signal D_OUT_0-3	D-OUT--0--3	See attached table	Status display	
13	90947	SEL signal D_SEL_0-3	D-SEL--0--3	See attached table	Status display	

*1: All items are displayed including those for which sensors are not provided depending on the given model or option.
*2: Abbreviated expression is employed because of number of characters usable is restricted.
*3: If a value is below (or above) the display range, it will be displayed as the lowest (highest) value in the range.
*4: SI units alone are employed whenever a unit is needed.
*5: An item that does not allow monitoring is indicated as "Not used" though its code and item name may be displayed on the machine monitor.

VHMS [VHMS controller system]				
No.	Monitoring codes	Input/Out-put signal	Displayed items	Description of ON/OFF switch
1	40944	D-IN-0		
		D-IN-1		
		D-IN-2		
		D-IN-3		
		D-IN-4		
		D-IN-5		
		D-IN-6		
		D-IN-7		
5	40947	D-SEL-0		
		D-SEL-1		
		D-SEL-2		
		D-SEL-3		
6	40958	D-OUT-0		
		D-OUT-1		
		D-OUT-2		
		D-OUT-3		

Service mode

1. Procedure for switching to Service mode and screen display

When using Service mode, carry out the following special operation to switch the screen display.

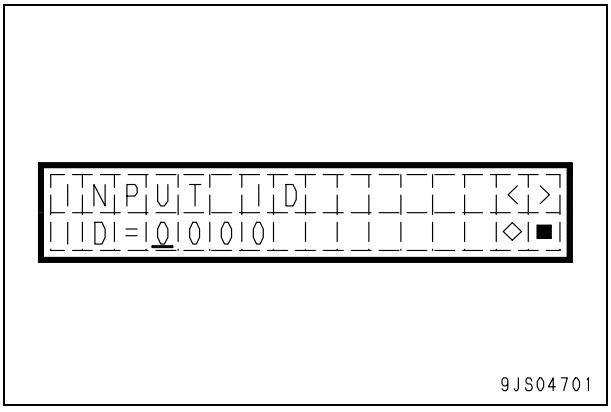
1-1. Checking screen display

Make sure that the machine monitor is set to the operator mode and any of "Service meter", "Action code" or "Failure code" is displayed on the screen.

1-2. Displaying ID input initial screen

Hold down [■] switch and [<] switch simultaneously for 5 seconds minimum to open ID input initial screen.

★ Holding down the two switches for 5 seconds or more makes the entire screen blank. As this state is recognized, release the buttons.



1-3. Inputting and confirming ID

Operate the buttons to input the ID.

- ID: 6491

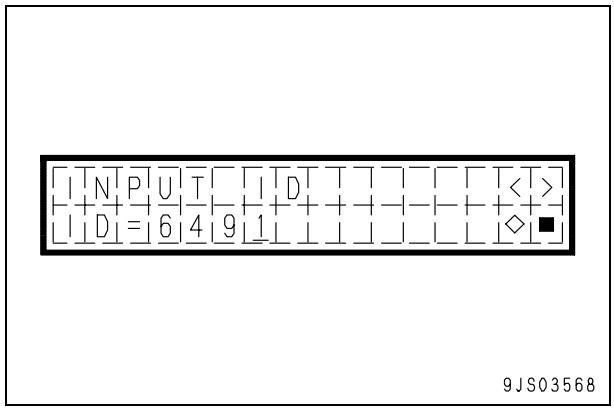
1) Cursor (C) is positioned at the highest-order digit. Pressing [<] and [>] switches changes the value of this digit in the range of 0 – 9.
2) Press [◇] switch when the intended value appeared to specify it.

★ The cursor moves to the 2nd digit.

3) Set the value in the same order and then press [◇] switch.

★ When you have entered a wrong value to a position except the highest-order digit, move to the highest-order digit using [■] switch to repeat the procedure from the first. In this case, values that had been entered remain as they are until modified. When the cursor is at the highest-order digit, it can move to the higher layer using [■] switch.(*1).

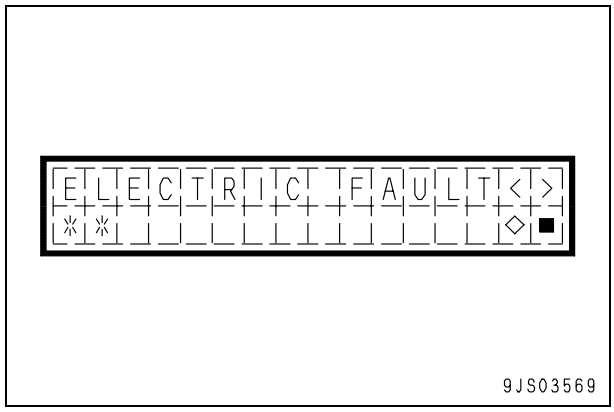
(*1): When the cursor is located at the leftmost position, pressing the switch restores the normal screen (Operator mode).
When the cursor is at a location other than the leftmost position, pressing the switch returns the cursor to the leftmost position.
If any switch operation is not done for 60 seconds or more from ID input screen, the normal screen is automatically turned on.



1-4. Displaying menu initial screen

★ After settling 4-digit ID, turn on the menu initial screen of Service mode.

★ Once entered and settled, an ID remains effective until the starting switch is turned off.



1-5. Selecting service mode menu

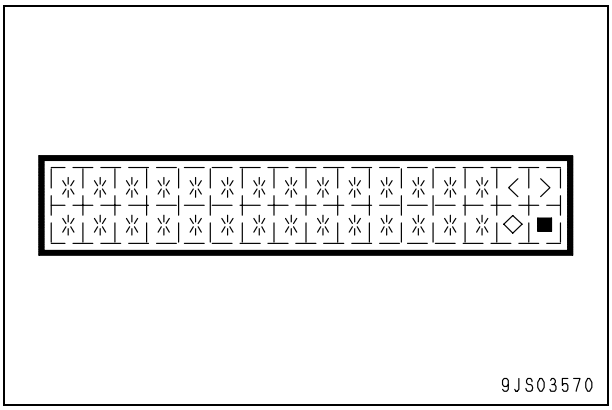
★ Pressing [<] and [>] switches from the menu screen displays Service mode menus endlessly in the following order.

★ The menus are displayed in the field indicated with [*] mark.

[1] ELECTRIC FAULT: Electrical system fault history display function
[2] MACHINE FAULT: Mechanical system fault history display function

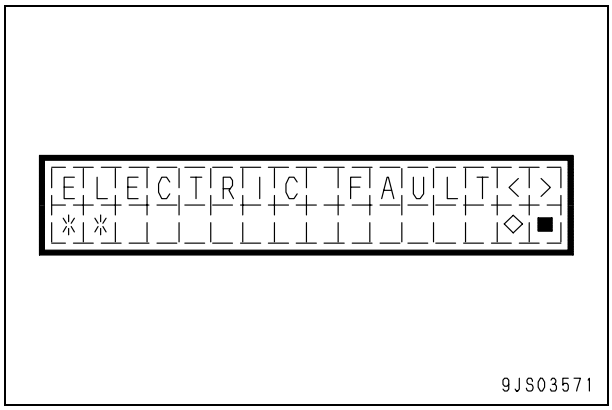
[3] REAL-TIME MONITOR: Real-time monitoring function
[4] CYLINDER CUT-OUT: Engine reduced-cylinder function
[5] NO INJECTION: No injection cranking function
[6] TUNING: Adjustment function
[7] MAINTENANCE MONITOR: Maintenance monitoring function
[8] OPERATION INFO: Operating information display function
[9] SNAPSHOT: Manual snapshot
[10] OPTIONAL SELECT: Optional device selecting function
[11] MACHINE No. SET: Machine serial number input function
[12] MACHINE WA6**: Model selection function
[13] INITIALIZE: Initialize function (Function specialized for plant)

1-6. Completion of mode and function
Either of the following procedures ends a mode or function independent of the function being selected and the layer in which it is used.
1) When the operation is to be continued using another mode or function: Press [■] switch to return to the menu screen.
★ Note, however, that [■] switch functions as an execution key on [YES/NO] screen.
★ When the normal screen (Operator mode) was inadvertently turned on, repeat above steps from 1) (input of the ID is not necessary).
2) When ending an operation completely: Turn the starting switch off from the current state.

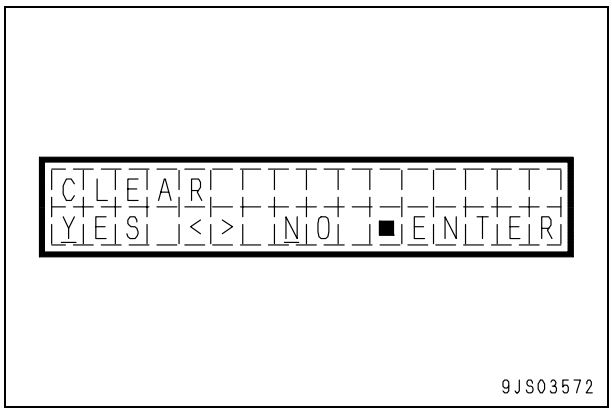


2. Electrical system fault history display function (ELECTRIC FAULT)
The machine monitor records the past failures in the electrical system as the failure codes. The failure codes are displayed from the following operations.

2-1. Selecting the menu
Select the ELECTRIC FAULT from the menu screen of Service mode.
★ [**] field displays total number of the fault history currently recorded (up to 20 cases).

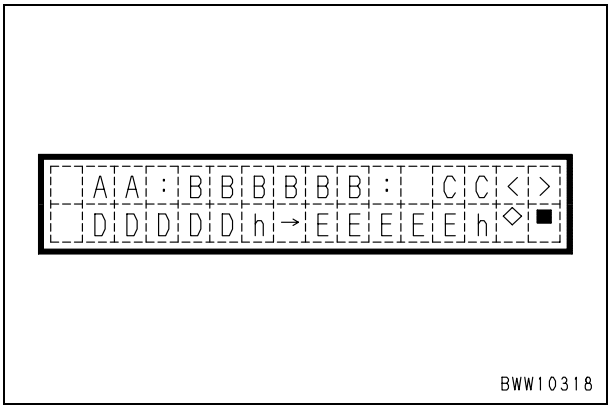


2-2. Displaying fault history
Press [◇] button while the menu is selected to display the recorded fault history.



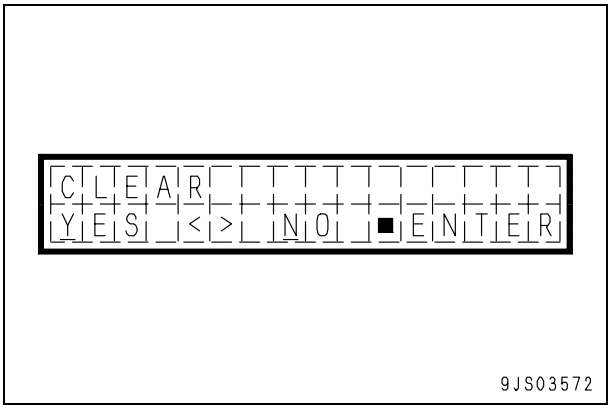
2-3. Displayed fault history
The electric system fault history display function displays the following information.
A: Record number
B: Failure code (Location code in four digits + Problem code in two digits)
C: Number of occurrences (number of occurrences of same code in past)
D: Elapsed time 1 (Elapsed time on service meter from the first occurrence)
E: Elapsed time 2 (Elapsed time on service meter from the last occurrence)
★ The code of a failure currently occurring is indicated in flashing.

★ For details of a displayed failure code, see "Failure code list" of the failure code display function.
★ Note that part of the information displayed from the electrical system fault history display function and the failure code display function is not identical.
★ When the requested fault history is not recorded, [-] is indicated in the display space.

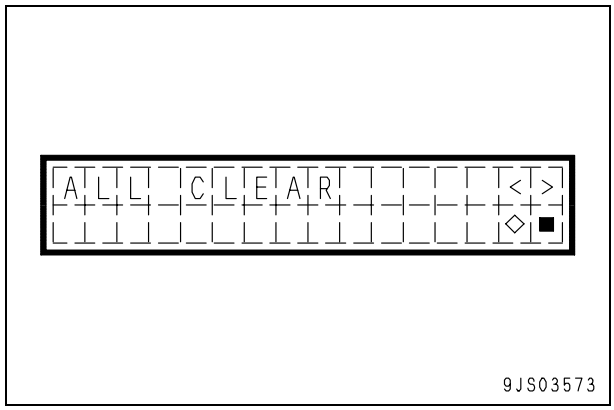


2-4. Switching fault history display
Pressing [<] or [>] switch while a set of fault history is on the screen displays another set of recorded fault history.

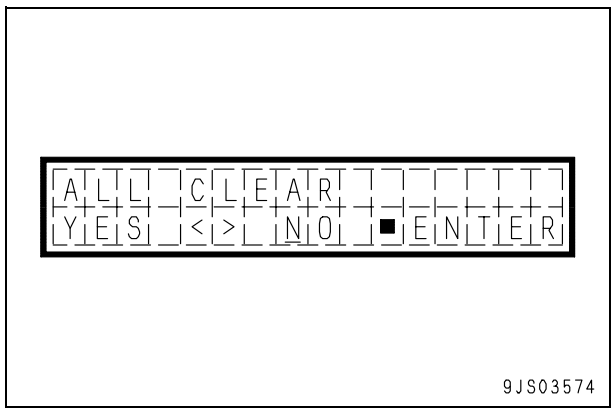
2-5. Deleting individual fault history
1) Press [◇] switch while the target fault history of deletion is on the screen to turn on CLEAR screen.
2) Select "YES" or "NO" using [<] or [>] switch.
★ The selected cursor will start flashing. If "YES" is selected and [■] switch is pressed, the information will be deleted. If "NO" is selected and [■] switch is pressed, deletion is cancelled and the "Maintenance interval change item" screen is restored.
★ By default, the cursor is set to NO (cancel) to prevent resetting error.
★ Information of the currently occurring failure is not deletable.



2-6. Deleting all fault history
1) Press [<] or [>] switch while the fault history is on the screen to display the ALL CLEAR menu screen.



2) Press [◇] switch to display the ALL CLEAR screen.
3) Select "YES" or "NO" using [<] or [>] switch.
★ The selected cursor will start flashing. If "YES" is selected and [■] switch is pressed, the information will be deleted. If "NO" is selected and ■ switch is pressed, deletion is cancelled and the "Maintenance interval change item" screen is restored.
★ By default, the cursor is set to NO (cancel) to prevent resetting error.
★ Information of the currently occurring failure is not deletable.



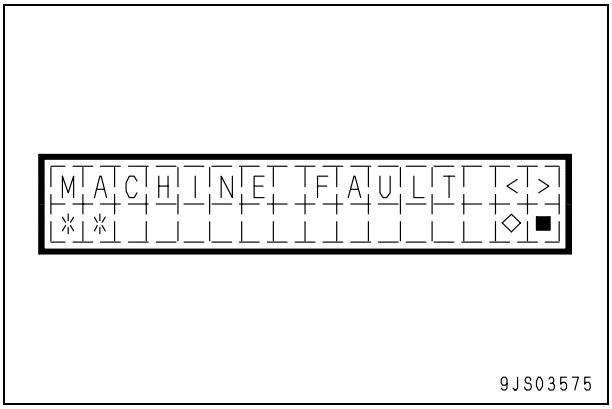
3. Mechanical system fault history display function (MACHINE FAULT)

The machine monitor records the past failures in the mechanical system as the failure codes. The failure codes are displayed from the following operations.

3-1. Selecting the menu

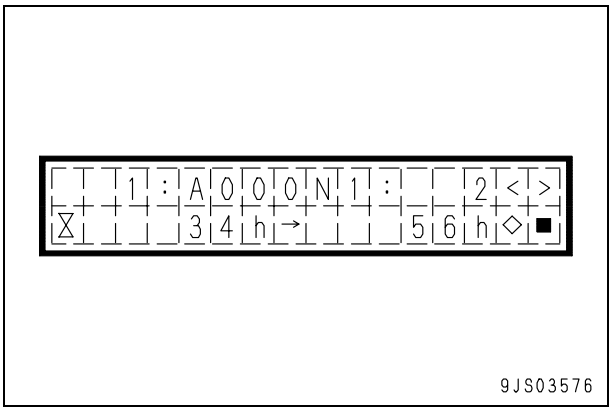
★ Select MACHINE FAULT from the menu screen of Service mode.

★ [**] field displays total number of the fault history currently recorded.



3-2. Displaying fault history

Press [◇] switch while the menu is selected to display the recorded fault history.



3-3. Displayed fault history

The electrical system fault history display function displays the following information.

A: Record number

B: Failure code (Location code in four digits + Problem code in two digits)

C: Number of occurrences (number of occurrences of same code in past)

D: Elapsed time 1 (Elapsed time on service meter from the first occurrence)

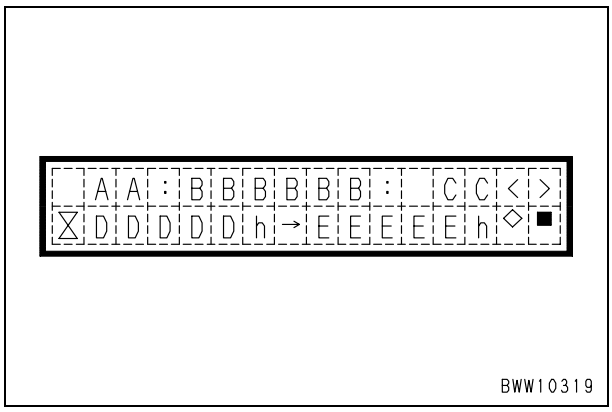
E: Elapsed time 2 (Elapsed time on service meter from the last occurrence)

★ The code of a failure currently occurring is indicated in flashing.

★ For details of a displayed failure code, see "Failure code list" of the failure code display function.

★ Note that part of the information displayed from the mechanical system fault history display function and the failure code display function is not identical.

★ When the requested fault history is not recorded, [-] is indicated in the display space.



3-4. Switching fault history display

Pressing [<] or [>] switch while a set of fault history is on the screen displays another set of recorded fault history.

3-5. Deleting fault history (Not available)

The fault history of the mechanical system is not deletable.

4. Real-time monitoring function (REAL-TIME MONITOR)

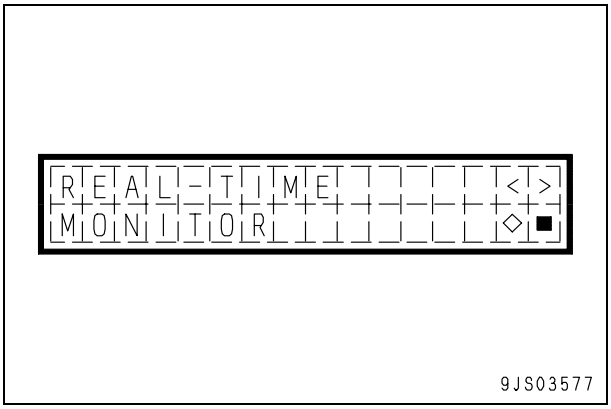
The machine monitor checks state of the machine on real-time basis referencing signals of the sensors being installed in various parts of the machine.

The real-time monitoring functions displays following two types of information.

- 1 item independent display (for each controller)
- 2 items simultaneous display (code input)

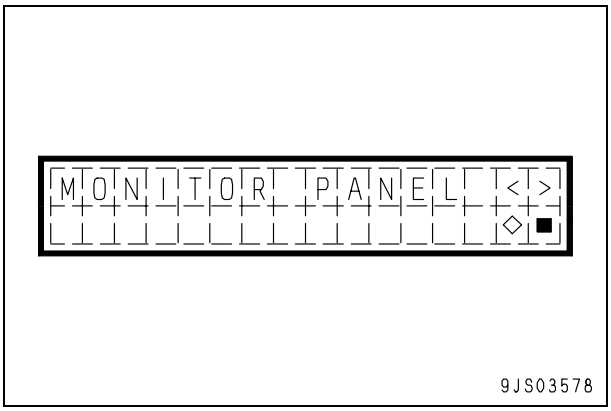
4-1. Selecting the menu

Select REAL-TIME MONITORING from the menu screen of Service mode.



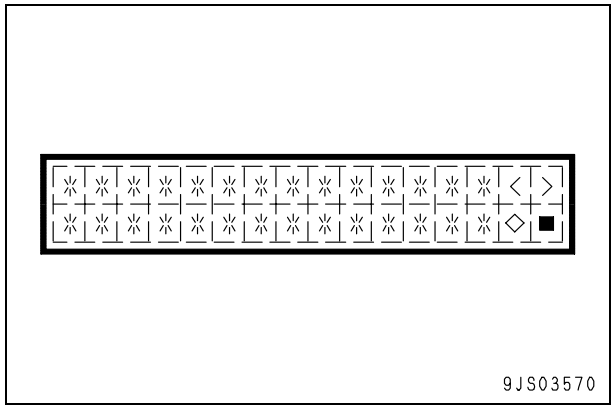
4-2. Displaying sub menu

Press [◇] switch while the menu is selected to display the sub menu initial screen.



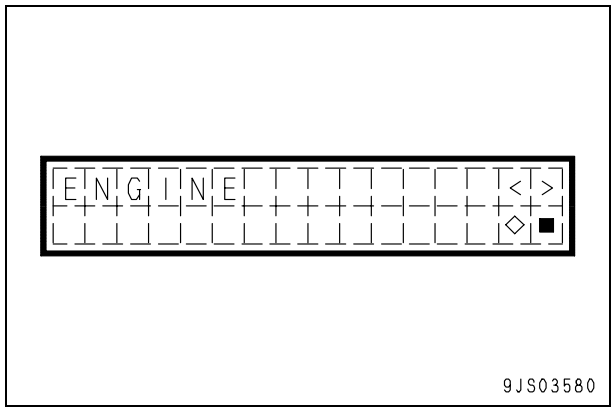
4-3. Selecting sub menu

- ★ Press [<] or [>] switch from the sub menu screen to display the sub menus endlessly in the following order.
- ★ The sub menus are displayed in the field indicated with [*] mark.
  - [1] MONITOR PANEL: Machine monitor system
  - [2] TRANSMISSION: Transmission controller system
  - [3] BOOM: Work equipment controller system
  - [4] ENGINE: Engine controller system
  - [5] VHMS: VHMS controller system
  - [6] 2 ITEMS: 2 items display



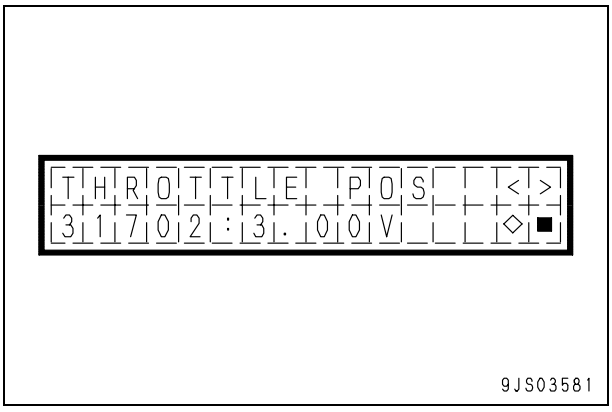
4-4. Setting the 1 item individual monitoring

1) Select the target controller system of monitoring from the sub menu screen.



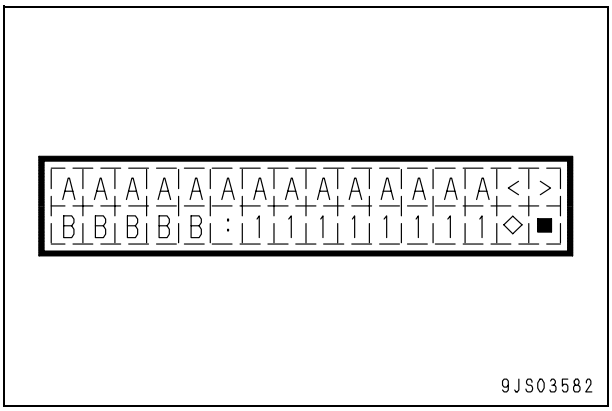
2) Press [◇] switch while the sub menu is selected to display the MONITOR PANEL screen.

3) Press [<] or [>] switch to select a monitoring item.
★ The monitoring items are scrolled according to the internally set order.
★ Holding down [◇] switch turns on high-speed scrolling.
★ Holding and cancelling the monitoring data: Pressing [◇] switch while the monitoring is in progress holds the monitoring data and [◇] mark starts flashing.Pressing [◇] switch again restores the active state.



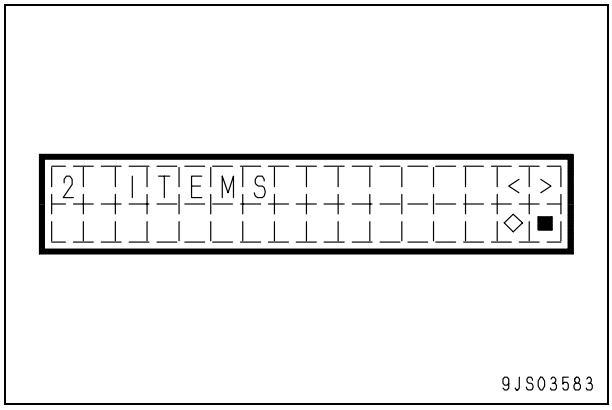
9JS03581

4) Display data for 1 item individual monitoring
The 1 item individual monitoring screen displays the following information.
A: Item display
B: Monitoring codes (5 digits)
1: Monitoring data (including the unit used)
★ See the "Monitoring code list" for details.



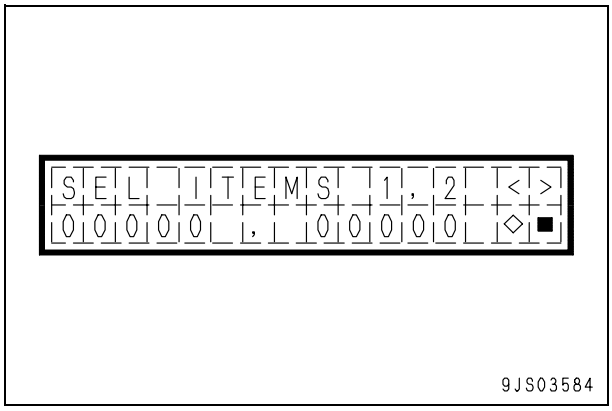
9JS03582

4-5. Setting 2 items simultaneous monitoring
1) Select 2 ITEMS from the sub menu screen.
2) Press [◇] switch while the sub menu is selected to display the monitoring code input screen.



9JS03583

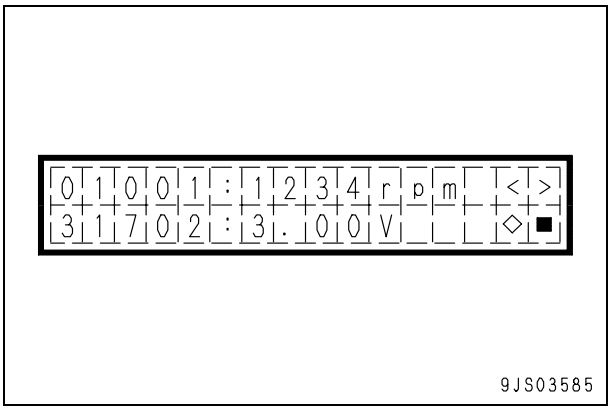
1] This cursor (C) is located at the highest-order digit. Pressing [<] or [>] switch changes the value of this digit in the range of 0 – 9.
2] Press [◇] switch when the intended value appeared to specify it as the set value.
★ The cursor moves to the 2nd position.
3] Set the value in the same order and then press [◇] switch.
★ When you have entered a wrong value to a position except the highest-order digit, the cursor can move to the highest-order digit using [■] switch and repeat the procedure from the first. In this case, values that had been entered remain as they are until modified. When the cursor is at the highest-order digit, it can move to the higher layer using [■] switch.



9JS03584

3) As both monitoring codes are settled, the 2 ITEMS screen will be turned on.

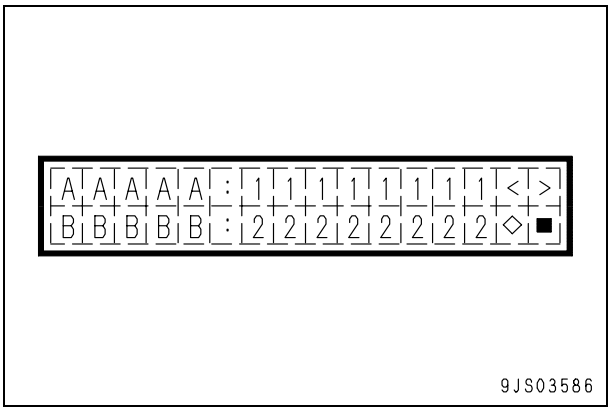
★ Holding and cancelling the monitoring data:
Pressing [◇] switch while the monitoring is in progress holds the monitoring data and [◇] mark starts flashing.Pressing [◇] switch again restores the active state.



4) Display data for 2 items simultaneous monitoring

★ The 2 items simultaneous monitoring screen displays the following information.
A: Monitoring code 1
1: Monitoring data 1 (including the unit used)
B: Monitoring code 2
2: Monitoring data 2 (including the unit used)

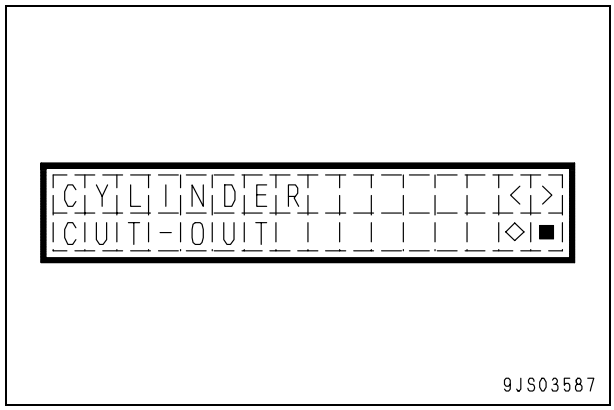
★ See the "Monitoring code list" for details.



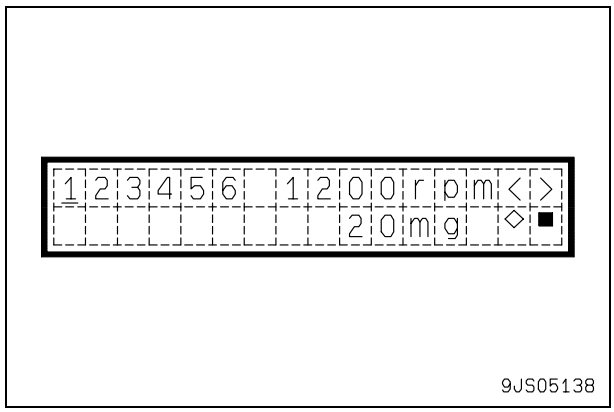
5. Engine reduced-cylinder function

The engine reduced-cylinder function denotes setting the injector of a single cylinder or two or more cylinders to electrically no injection state and turns on the operation on reduced-cylinder condition. When any cylinders of the engine were suspected for abnormal output (combustion), this approach is used to single out the failed cylinder.

1) Selecting the menu
Display the CYLINDER CUT-OUT screen from the menu screen of Service mode.



2) Displaying sub menu
Press [◇] switch while the menu is selected to display the sub menu.

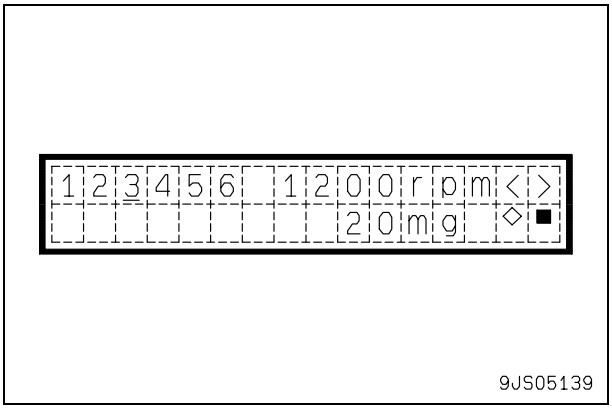


★ The cylinder No. and engine speed are displayed on the upper line and the final injection rate command is displayed on the lower line simultaneously.

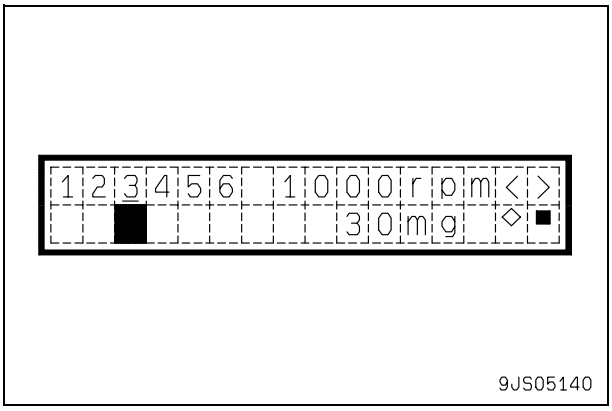
3) Selecting a cylinder to be reduced
Using [<] or [>] switch, select a cylinder to be reduced from No. 1 – No. 6 cylinders and then settle the selected cylinder using [◇] switch.

★ The cylinder to be reduced is selectable while the engine is run.

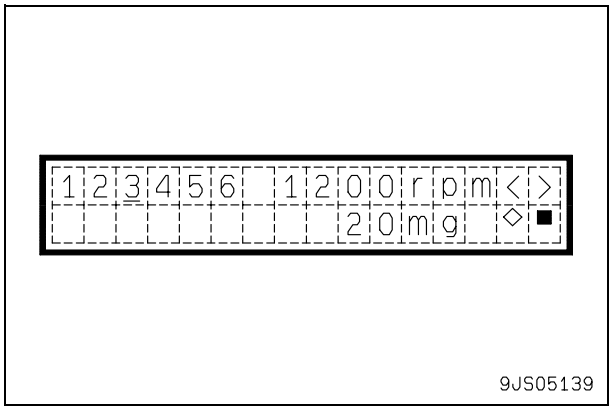
★ Any number of cylinders can be reduced – a single unit or two or more units.
- [>] switch: Advances the cursor rightward
- [<] switch: Advances the cursor leftward
- [◇] switch: Settles the cylinder to be reduced (the cursor starts flashing after the settlement)
- [■] switch: Restores the CYLINDER CUT-OUT screen



★ As the reduced-cylinder command is issued from the engine controller to the cylinder to be reduced, the bottom of the stopped cylinder number turns to black.

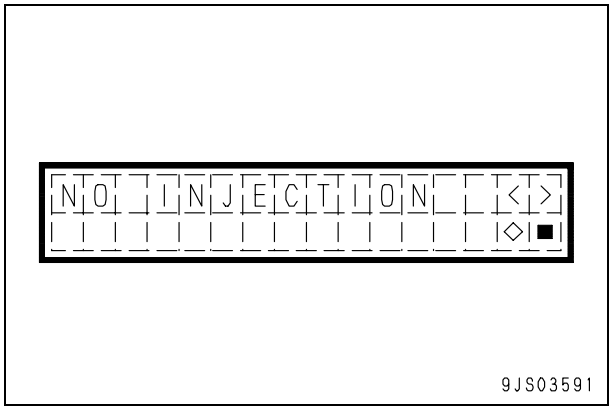


4) Cancelling a reduced cylinder
Using [<] or [>] switch, select the currently stopped cylinder and then press [◇] switch to cancel the reduced-cylinder command from the engine controller. The black display will disappear.

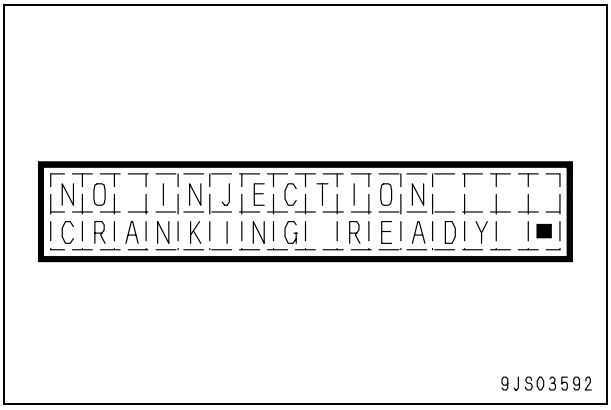


6. No injection cranking function
The machine monitor is equipped with the function capable of lubricating the engine through no injection cranking. When a machine has been stored for a long time, this function is used to lubricate the engine prior to its restart in order to prevent its wear or damages out of oil. The no injection cranking must be set up while the engine is stopped.

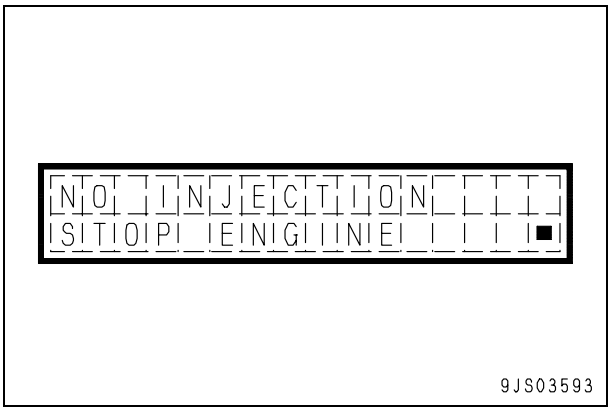
1) Selecting menu
Display the NO INJECTION screen from menu screen of Service mode.



2) Pressing [◇] switch sets up the no injection cranking.
★ If this screen does not appear as [◇] switch is hit, a communication error should be suspected.



★ If the no injection cranking is selected as the engine is running, the engine stop instruction screen will appear.
★ In such case, stop the engine once and then do the set up again.



7. Adjustment function

The machine monitor implements initial setting after disassembly or replacement of the transmission, or after replacement or addition of sensor and EPC valve or controller. Through the initial setting, the machine monitor corrects and adjusts the installation error or manufacturing variations of individual parts.

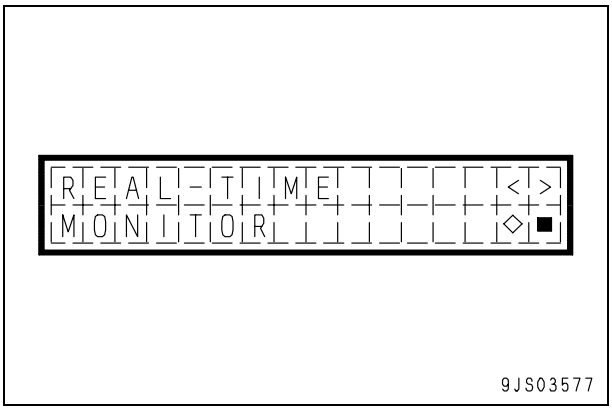
★ Adjustment function

No.	Adjustment item
7-1	Adjustment of transmission ECMV current
7-2	Setting of transmission initial learning
7-3	Adjustment of transmission shift point
7-4	Adjustment of lift arm angle sensor (Raise) (for EPC lever)
7-5	Adjustment of lift arm raise lever position before detent and variations in the dead zone of EPC
7-5-1. Adjusting variation correcting calibration of lift arm raise lever before detent	
7-5-2. Adjusting lift arm raise EPC starting current	
7-6	Adjustment of lift arm lower (float) lever and variations in the dead zone of EPC
7-6-1. Adjusting variation correcting calibration of lift arm lower (float) EPC lever	
7-6-2. Adjusting lift arm lower EPC starting current	
7-7	Adjustment of bucket tilt lever position before detent and variations in the dead zone
7-7-1. Adjusting variation correcting calibration of bucket tilt lever position before detent	
7-7-2. Adjusting bucket tilt EPC starting current	
7-8	Adjustment of bucket dump EPC starting current
7-9	Adjustment of 3-spool valve EPC cylinder extraction lever and variations in the dead zone of EPC
7-10	Adjustment of 3-spool valve EPC cylinder retraction lever and variations in the dead zone of EPC
7-11	Adjustment of AJSS neutral position (AJSS specification)
7-12	Adjustment of AJSS EPC output current (AJSS specification)
7-13	Modification of lift arm lever pattern
7-14	Modification of bucket lever pattern
7-15	Adjustment of lift arm raise/lower stop modulation
7-16	Adjustment of pump cut-off pressure in lift arm raise
7-17	Adjustment of lift arm angle sensor (raise) (For load meter)
7-18	Adjustment of lift arm angle sensor (lower) (For load meter)
7-19	Modification of AJSS oil pressure command table pattern
7-20	Adjustment of maximum speed limit

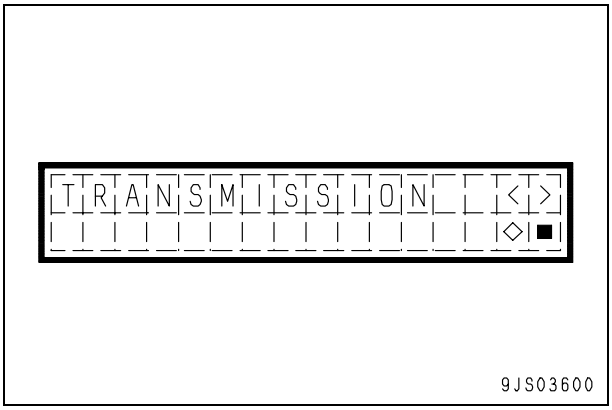
7-1. Adjustment of transmission ECMV current

7-1-1. Preparations for transmission ECMV current adjustment

1) Display the REAL-TIME MONITOR from the menu screen of Service mode.



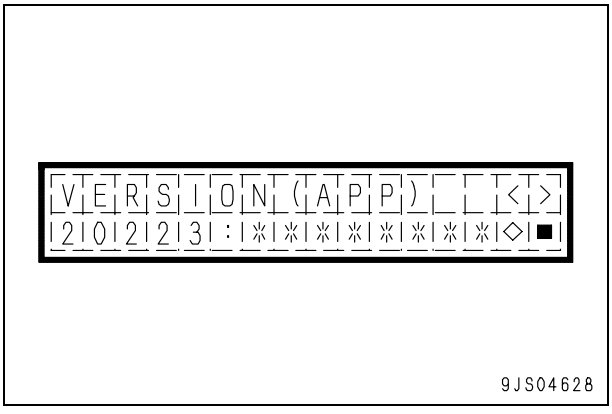
2) Press [◇] switch to display the sub menu and then select TRANSMISSION using [<] or [>] switch. (TRANSMISSION screen)



3) Press [◇] switch to settle the real-time monitoring of the transmission controller.

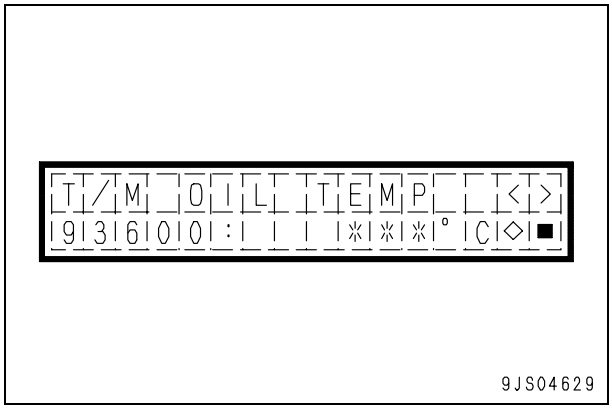
★ As the selection is settled, the application program version of the transmission controller will be displayed.

- [20223] : ID number of display item
- [******]: Display of data (Program version)



4) Using [<] or [>] switch, move the cursor to the T/M OIL TEMP screen.

- [93600]: ID number of transmission control oil temperature
- [******]: Display of transmission control oil temperature



7-1-2. Conformation of transmission oil temperature control

1) Start the engine, press the brake pedal fully and then release the parking brake.
2) Set the transmission shift mode to the Manual, directional lever or directional selector switch to F (forward) and shift lever or switch to 4th.
3) Make sure from "7-1-1 Preparations for transmission ECMV current adjustment" that the transmission controlled oil temperature is 70 – 80°C.If it is out of the range, stall the torque converter and adjust the temperature to 70 – 80°C.
4) Return the directional lever or directional selector switch to N (neutral) and maintain it in that position. After 3 minutes, make sure the oil temperature is still in the 70 – 80°C range.
5) Let the oil pervade in the transmission by operating the reverse lever or directional selector switch, or the gearshift lever or switch in the following manner.
   ★ When executing the operation, the engine shall be set to low idle, manual switch to ON and lockup switch to OFF.
   ★ Make sure the machine is normal (failure is not detected).
   ★ When stalling the torque converter, use care it may not be overheated.

Operating order	1	2	3	4
Gear speed	N2	F2	F1	F2
Holding time	Min. 2 sec.	Min. 2 sec.	Min. 2 sec.	Min. 2 sec.

Operating order	5	6	7	8
Gear speed	F3	F4	F3	F2
Holding time	Min. 2 sec.	Min. 2 sec.	Min. 2 sec.	Min. 2 sec.

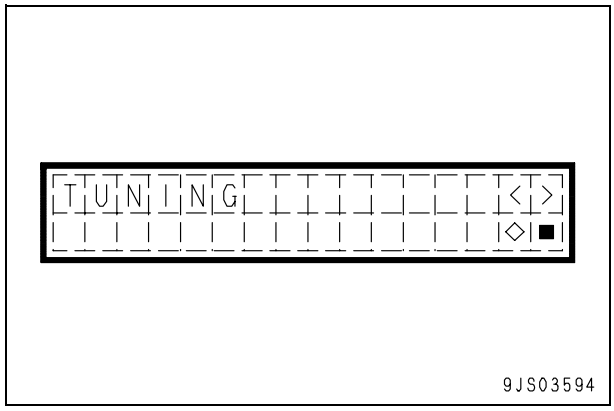
Operating order	9	10	11
Gear speed	N2	R2	N2
Holding time	Min. 2 sec.	Min. 2 sec.	Min. 2 sec.

7-1-3. Adjustment of transmission ECMV current

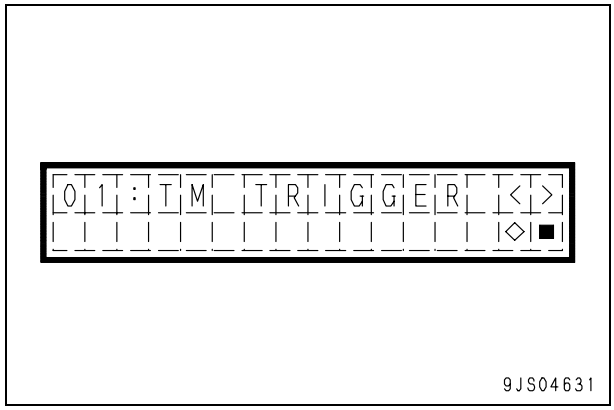
★ Targets of correction are 6 types – F (forward), R (reverse), 1st, 2nd, 3rd and 4th. As the engine is started, correction of all of above clutches is started automatically.

★ Since the learning operation requires the specified oil temperature, the oil temperature must be adjusted to 70 – 80°C range.

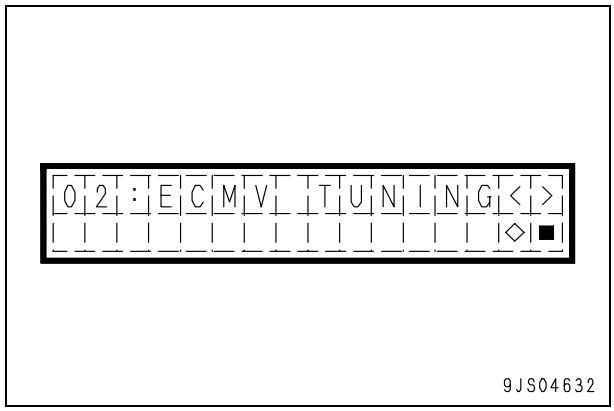
1) Turn on the starting switch (engine is not started) and then display T/M OIL TEMP referencing "7-2-1 Preparations for transmission ECMV current adjustment".
2) Make sure the transmission controlled oil temperature is in the 70 – 80°C range when the engine is set to low idle, accelerator pedal to OFF, directional lever or directional selector switch to neutral and parking brake to ON.
3) Display the TUNING screen from the menu screen of Service mode.



4) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.

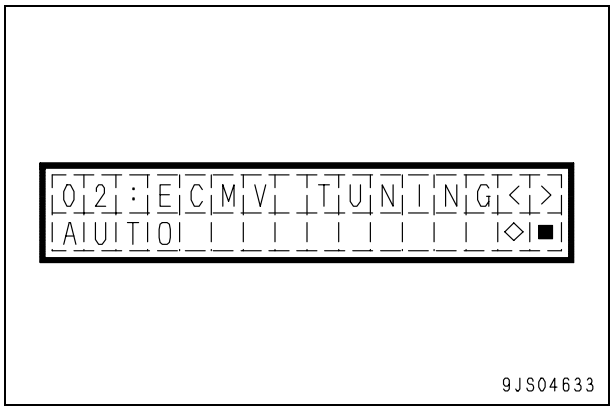


5) Using [<] or [>] switch from the sub menu, select 02: ECMV TUNING.

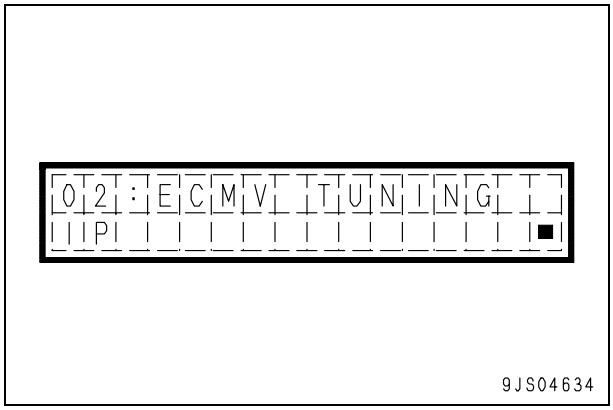


6) Press [◇] switch to settle the adjustment item.

7) Using [◇] switch, select AUTO from the automatic correction (AUTO) and manual correction (MANUAL) selection screen to settle the automatic correction.



★ Selecting ECMV TUNING AUTO displays IP in the character display, automatically starting transmission ECMV current adjustment.



Operating order	1	2	3	4
IP	[IP F-1]	[IP F-2]	[IP F-3]	[IP F-4]
ECMV/ frequency	F/1st time	F/2nd time	F/3rd time	F/4th time

Operating order	5	6	7	8
IP	[IP R-1]	[IP R-2]	[IP R-3]	[IP R-4]
ECMV/ frequency	R/1st time	R/2nd time	R/3rd time	R/4th time

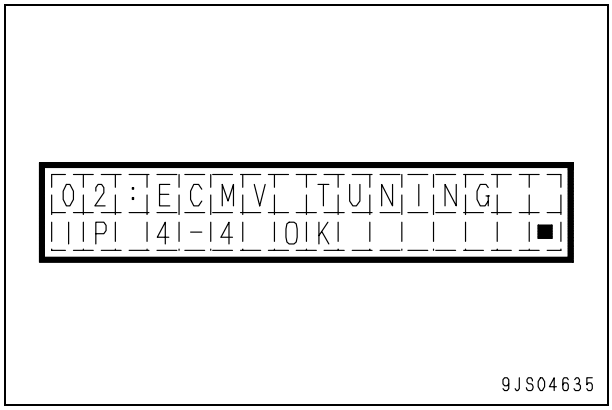
Operating order	9	10	11	12
IP	[IP 1-1]	[IP 1-2]	[IP 1-3]	[IP 1-4]
ECMV/ frequency	1st/1st time	1st/2nd time	1st/3rd time	1st/4th time

Operating order	13	14	15	16
IP	[IP 2-1]	[IP 2-2]	[IP 2-3]	[IP 2-4]
ECMV/ frequency	2nd/1st time	2nd/2nd time	2nd/3rd time	2nd/4th time

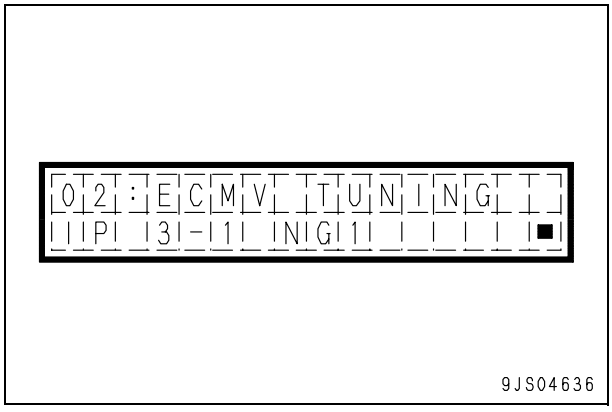
Operating order	17	18	19	20
IP	[IP 3-1]	[IP 3-2]	[IP 3-3]	[IP 3-4]
ECMV/ frequency	3rd/1st time	3rd/2nd time	3rd/3rd time	3rd/4th time

Operating order	21	22	23	24
IP	[IP 4-1]	[IP 4-2]	[IP 4-3]	[IP 4-4]
ECMV/ frequency	4th/1st time	4th/2nd time	4th/3rd time	4th/4th time

8) As the correction is normally completed, OK is displayed in the character display.



★ If the correction is not normally ended, the code for abnormal end will be indicated. (Following shows an example of the operation in which the 1st time correction of the 3rd position has ended abnormally).



★ Codes for abnormal end

Reason	CODE
Deviation from correction condition	1
Absence of fill	2
In excess of correction value	3

★ If abnormal end code "1" (NG1: Deviation from correction condition) was displayed, set the condition again referencing "7-1-1 Preparations for transmission ECMV current adjustment" and repeat the correction.

★ If abnormal end code "2" (NG2: Absence of fill) was displayed, implement troubleshooting of the failure codes 15S□LH and DXH□KA. If the state is normal, repeat the operation starting from "7-1-1 Preparations for transmission ECMV current adjustment" and repeat the correction. (The value of □ depends on the applicable gear speed.)

★ If the abnormal end code "3" (NG3: In excess of correction value) was displayed, execute the troubleshooting of failure code 15S□L1. Then after making sure the condition is normal, implement "7-1-1 Preparations for transmission ECMV current adjustment" again. (The value of □ depends on the applicable gear speed.)

9) As the operation ended normally, turn the starting switch off and the corrected value will be stored on the transmission controller after 3 seconds.

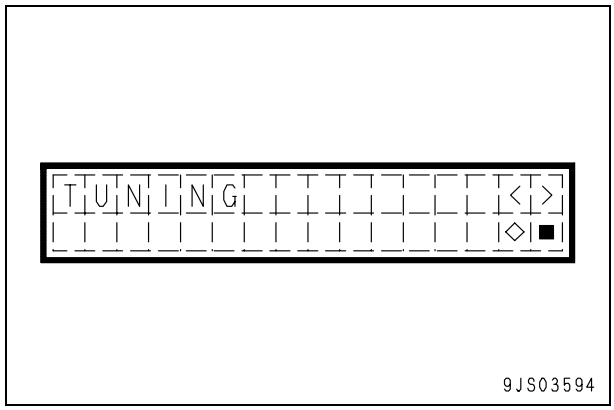
★ When it is required to turn on the starting switch immediately after the adjustment, maintain the starting switch, just in case, at off position for 10 seconds minimum and then turn it on.

7-2. Setting of transmission initial learning

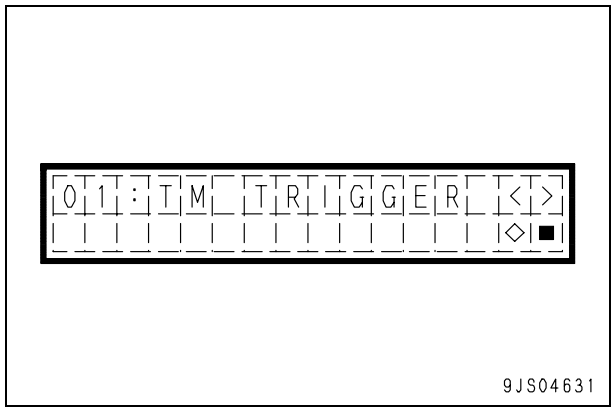
When initializing all the past initial trigger learning data stored on the transmission controller, employ the following procedure.

7-2-1. Reset of initial learning

1) Turn on the starting switch. (Engine does not start)
2) Set the directional lever (directional selector switch for AJSS specification) to the neutral.
3) Display the TUNING screen from the menu screen of Service mode.

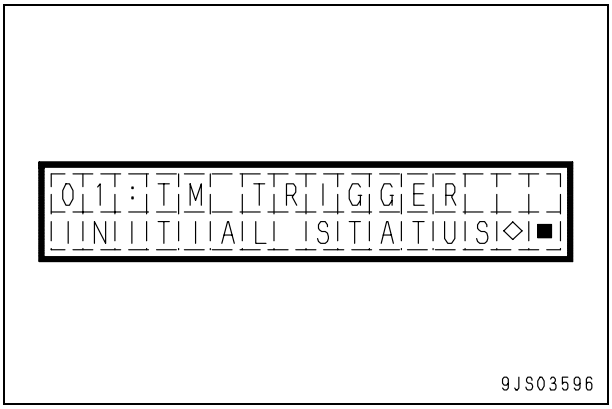


4) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



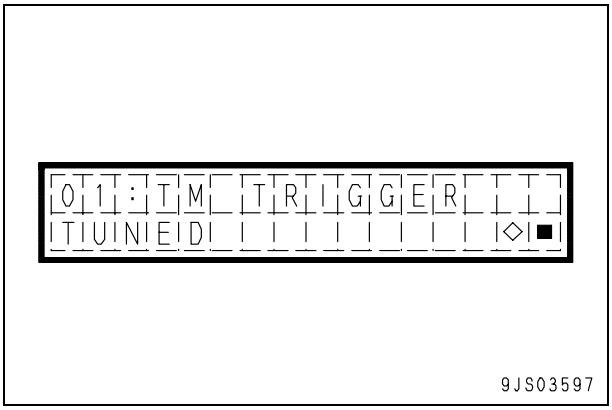
5) Press [◇] switch to settle the adjustment item. As the item is settled, the initial learning reset screen appears.

★ If the initial learning is not done, INITIAL STATUS will be displayed.



9JS03596

★ When the initial learning is completed, TUNED will be displayed.



9JS03597

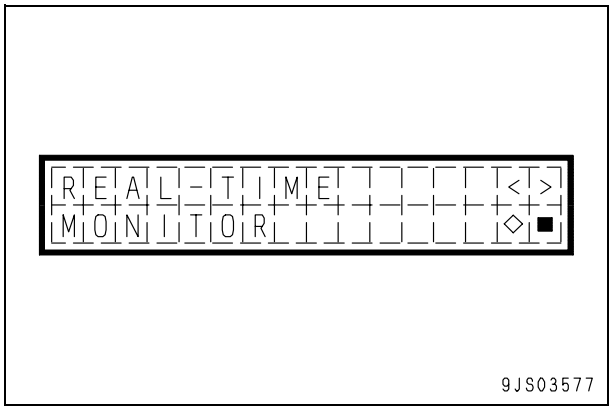
1] When TUNED is displayed, press [◇] switch to display the initial learning reset screen.

2] Press [<] or [>] switch from the initial learning reset screen to move the cursor to YES position and then press [■] switch to reset the initial learning.

3] When suspending the reset operation, select NO from above 2] or press [■] switch on TUNED screen.

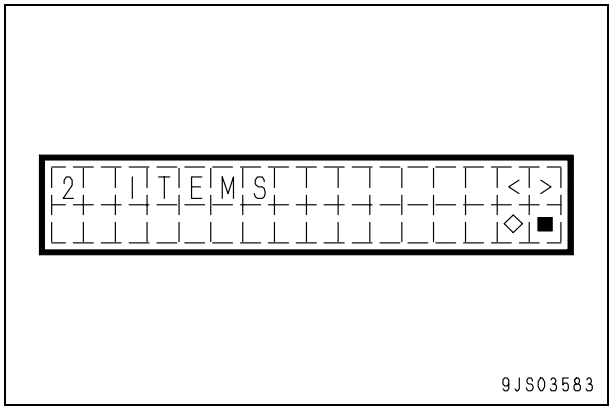
7-2-2. Preparations for transmission initial learning

1) Display the REAL-TIME MONITOR from the menu screen of Service mode.



9JS03577

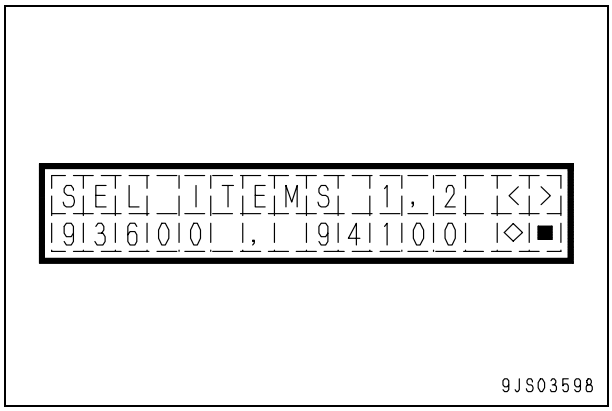
2) Press [◇] switch to display the sub menu, select 2 ITEMS using [<] or [>] switch and then settle the selection using [◇] switch. (SEL ITEMS 1,2 screen)



9JS03583

3) From the SEL ITEMS 1,2 screen, enter ID number 93600 of the transmission control oil temperature and ID number 94100 for displaying the trigger learning.

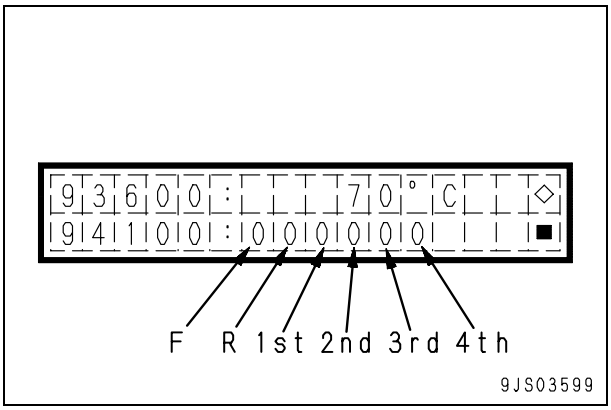
★ Referring to "4-5. Setting 2 items simultaneous monitoring".



9JS03598

4) Using [◇] switch, settle 2 items display of the transmission control oil temperature and the trigger learning display.

★ Content of the trigger learning is displayed for each of F, R, 1st, 2nd, 3rd and 4th clutch in the figure.
- 0: Learning not done yet
- 1: Learning completed



7-2-3. Implementation of transmission initial learning

★ Before starting the transmission initial learning, be sure to implement "7-1 Adjustment of transmission ECMV current" and "7-2-1 Reset of initial learning". Then start the initial learning according to the following procedure.

★ Implement the gearshift operation using actual travel, bench travel or while pressing the wheel brake.

⚠ **When actual travel is employed for the operation, be sure to choose a spacious field while paying reasonable care to the environment.**

★ When executing the operation, the engine shall be set to low idle, manual switch to ON and lockup switch to OFF.

1) Start the engine, press the brake pedal fully and then release the parking brake.
2) Set the transmission shift mode to the Manual, directional lever or directional selector switch to F (forward) and shift lever or switch to 4th.
3) Make sure from "7-2-2 Preparations for transmission initial learning" that the transmission control oil temperature is 70 – 80°C. If it is out of the range, stall the torque converter and adjust the temperature to 70 – 80°C. (If the initial learning is performed while the oil temperature is out of the specified range, time lags and gearshift shocks can result).
4) Execute the initial learning by operating the reverse lever or directional selector switch, or the gearshift lever or switch in the following manner.

Operating order	1	2	3	4
Gear speed	N2	F2	F1	F2
Holding time	Min. 6 sec.	Min. 6 sec.	Min. 6 sec.	Min. 4 sec.

Operating order	5	6	7	8
Gear speed	F3	F4	F3	F2
Holding time	Min. 4 sec.	Min. 4 sec.	Min. 4 sec.	Min. 4 sec.

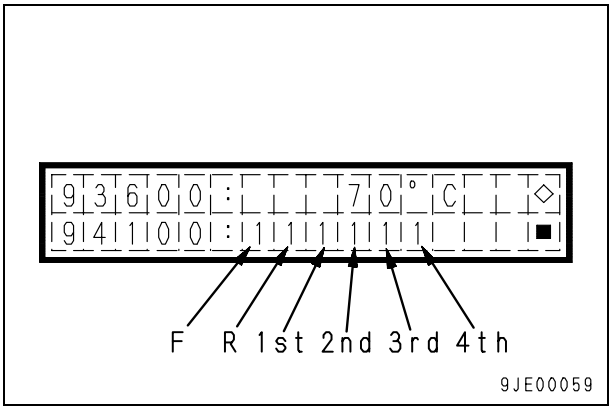
Operating order	9	10	11
Gear speed	N2	R2	N2
Holding time	Min. 4 sec.	Min. 4 sec.	Min. 4 sec.

★ Hold the gearshift lever in each gear speed for more than the specified time.

★ If the gearshift lever is operated before the specified time is reached, the initial learning is not completed (TUNED is not displayed).

7-2-4. Conformation of completion of transmission initial learning

1) Referencing "7-2-2 Preparations for transmission initial learning", make sure 111111 is marked on ID number 94100, indicating that the initial learning is completed.
2) Press [■] switch to end confirmation of the initial learning.



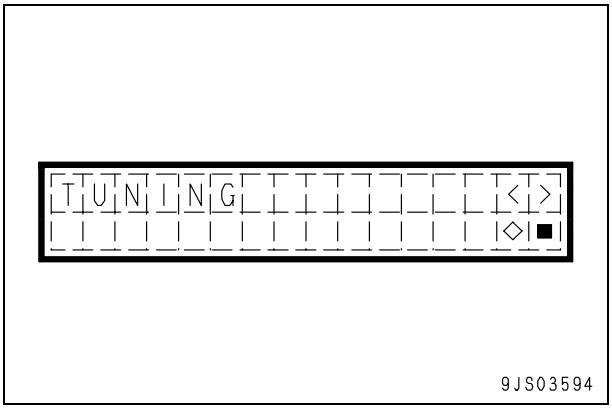
7-3. Adjustment of transmission shift point

★ This function is used for modifying the shift point when the shift mode switch is at L position by adding a correction amount.
★ The factory default setting of the correction amount shall be 0.
★ The shift point depends on the engine mode. When this function is used, however, the same correction value is applied independent of the engine mode.
★ Some of the shift points being adjusted with the shift point adjustment function may not include the following shift patterns.
- The shift point that is used when the hunting prevention function is turned on.
- The shift down point that is used when the accelerator is set to idle.

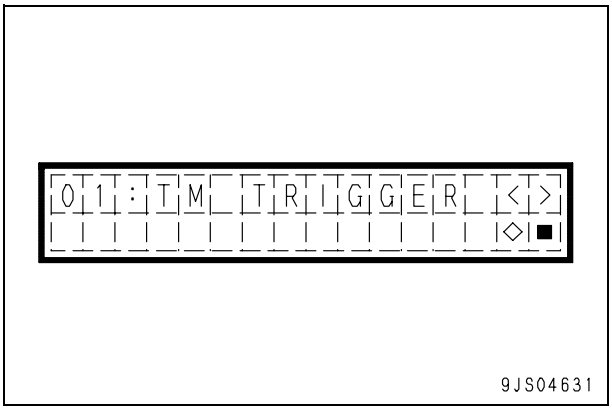
★ After a shift point adjustment is done, confirmation on the machine must be done.

7-3-1. Clearing an adjusted shift point

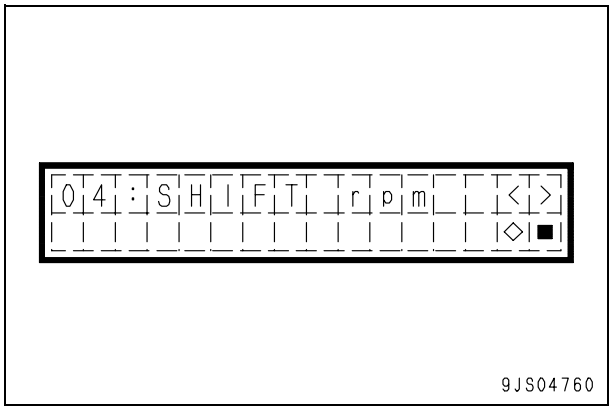
1) Display the TUNING screen from the menu screen of Service mode.



2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



3) Using [<] or [>] switch, select 04: SHIFT rpm screen from the sub menu.



4) Press [◇] switch to settle the selection.
★ As the selection is settled, 0: ALL CLEAR will be displayed in the lower space.
5) Press [◇] switch to settle ALL CLEAR.
★ As all the stored values are cleared, the set value is returned to the default and the screen returns to the shift point adjustment item.
★ If [■] switch is pressed in place of [◇] switch, the stored value is not cleared and the screen returns to the adjustment items.

7-3-2. Adjusting a shift point

★ This operation allows changing a gear shift travel speed when L auto-shift mode is selected.
★ Gear shift patterns are changed as shown below.

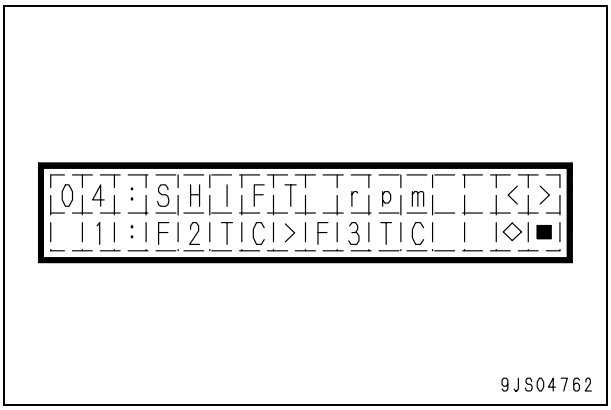
No.	Gear shift pattern to be changed
0	ALL CLEAR
1	F2 T/C → F3 T/C
2	F2 L/U → F3 L/U
3	F3 T/C → F4 T/C
4	F3 L/U → F4 L/U
5	F4 L/U → F3 L/U
6	F4 T/C → F3 T/C
7	F3 T/C → F2 T/C
8	F3 L/U ON
9	F3 L/U OFF
10	F4 L/U ON
11	F4 L/U OFF

- T/C: Torque converter travel
- L/U: Lockup travel

<Gear shift pattern change procedure>

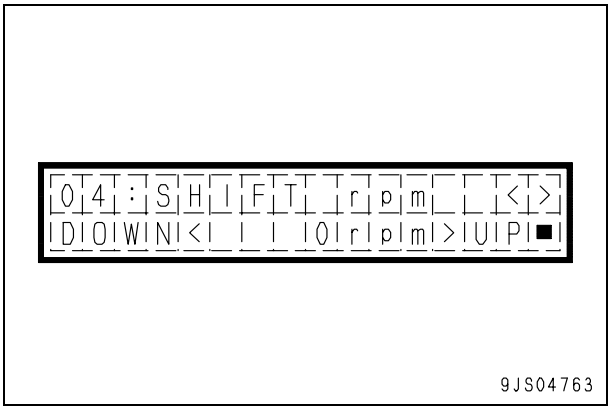
★ As an example of a gear shift pattern change, following describes the procedure for changing the gear shift travel speed pattern from F2T/C to F3T/C. (The same applies to other gear shift patterns, too.)

1) Select 04: SHIFT rpm screen using [◇] switch and then select 01:F2T/C → F3T/C using [<] or [>] switch.



9JS04762

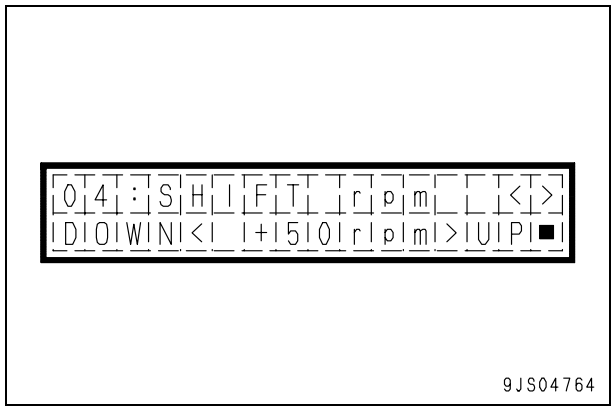
2) Press [◇] switch to settle the selection.
   ★ As the selection is settled, the Shift point adjusting value input screen will appear.
   ★ This screen displays the currently entered shift point adjusting value.
   ★ Adjusting value input screen when Adjusting value = 0



9JS04763

3) Press [<] or [>] switch to select a desired adjusting value.
   ★ When adjusting a shift point, 50 rpm of the transmission output shaft speed is used as a unit.
   ★ Adjusting the transmission output shaft speed by 50 rpm changes the travel speed by approximately 0.727 km/h.
   ● Selecting +50 rpm increases the speed by approximately 0.7 km/h.
   ● Selecting –50 rpm decreases the speed by approximately 0.7 km/h.

4) After selecting a desired setting data, press [■] switch to end the setup procedure.

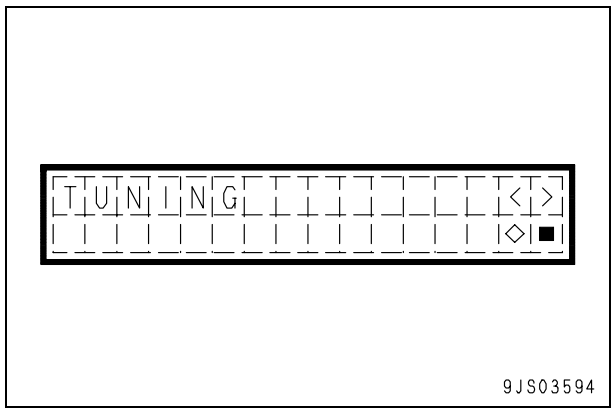


9JS04764

7-4. Adjustment of lift arm angle sensor (Raise) (for EPC lever)

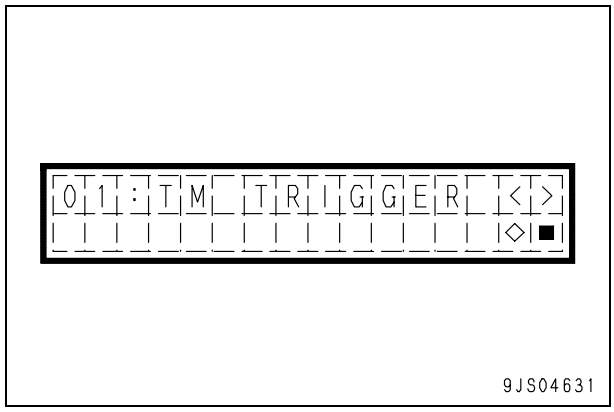
Following procedure is employed for adjusting lift arm angle of the work equipment.

1) Display the TUNING screen from the menu screen of Service mode.



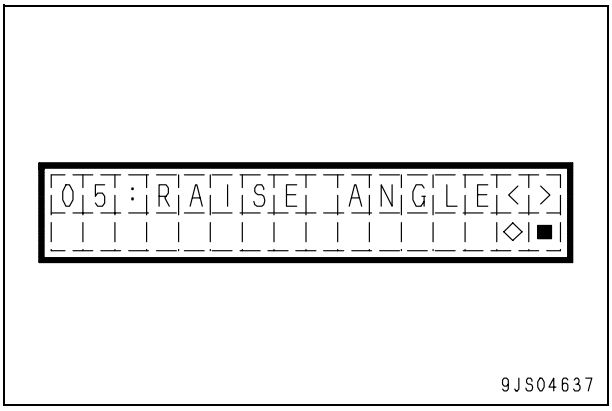
9JS03594

2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



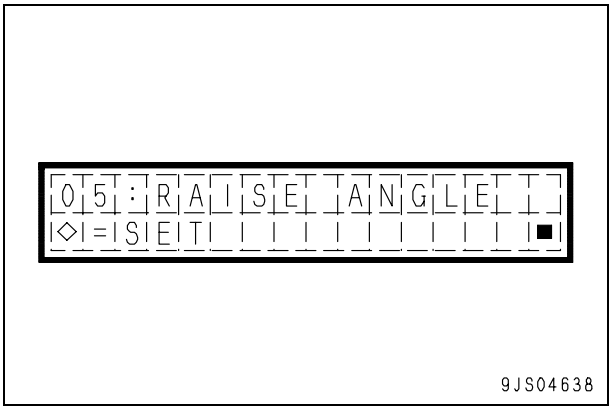
9JS04631

3) Using [<] or [>] switch, move the cursor to item of 05: RAISE ANGLE.



4) Press [◇] switch to settle the selection.

★ As the selection is settled, the RAISE ANGLE screen will be displayed.



5) Press [◇] switch while the lift arm being raised to the upper limit (cylinder stroke end).
6) 2 times of buzzer beep notify completion of the setting.
7) 1 second-long beep indicates that the set lift arm angle voltage is not conforming to the specified value. In this case, adjustment does not start.
8) Press [■] switch to end the adjustment mode.

★ If [■] switch is pressed while the calibration is continued, the calibration currently taking place will be stopped even if it is not completed.

9) When the adjustment did not end successfully, check the lift arm angle sensor voltage from the real time monitor.
10) Adjust the lift arm angle sensor mounting position so that the voltage displayed on the real time monitor may fall within the following range and then implement the sensor adjustment again.

★ Lift arm length by lift arm specification

Lift arm specification	Lift arm position	Voltage range
A	Upper limit position (Stroke end of raised cylinder)	3.80 ± 0.3 V
B		3.87 ± 0.3 V

★ Lift arm length by machine model

Machine model	A	B
WA600-6	3850 mm	3990 mm
WA500-6	3250 mm	3636 mm

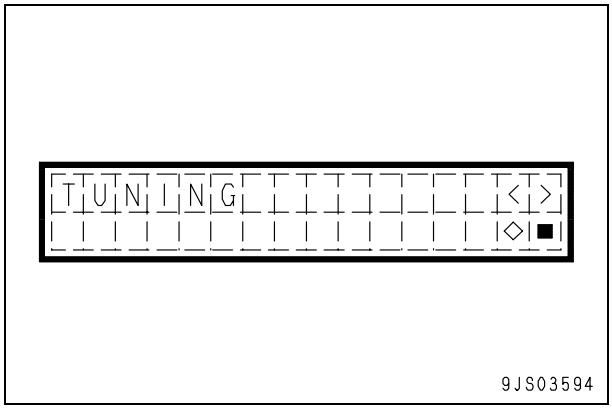
7-5. Adjustment of lift arm raise lever position before detent and variations in the dead zone of EPC

7-5-1. Adjusting variation correcting calibration of lift arm raise lever before detent

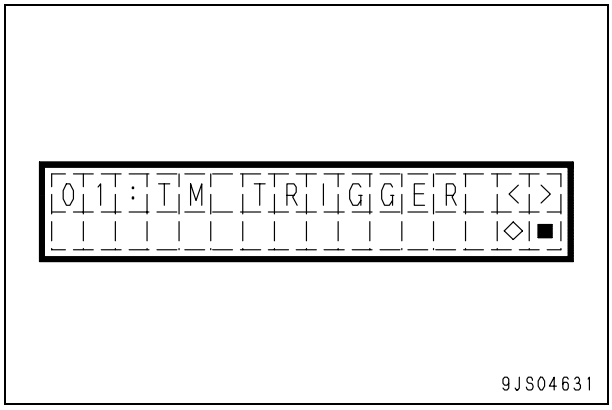
★ This adjustment is needed when the electric (EPC) work equipment lever or the work equipment controller is disassembled or replaced.

★ Before starting the adjustment, lower the lift arm to the ground and stop the engine.

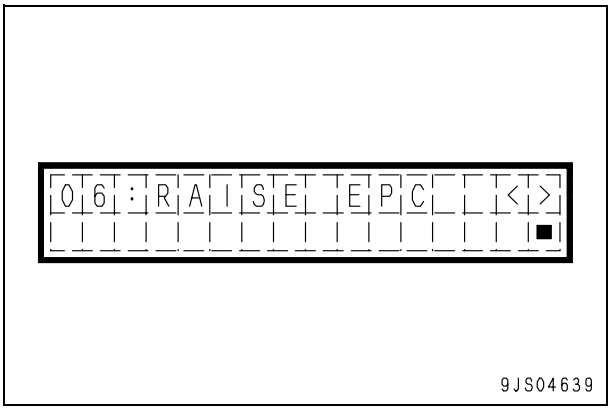
1) Display the TUNING screen from the menu screen of Service mode.



2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



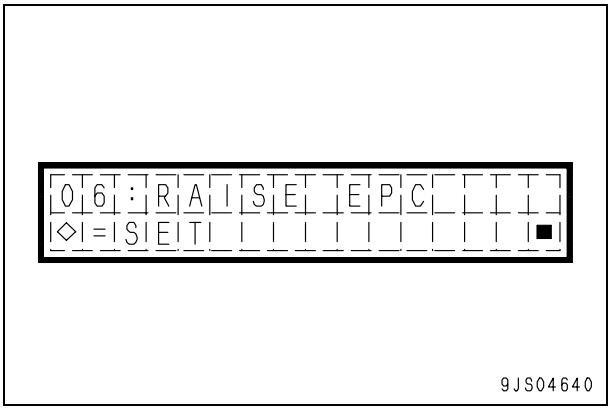
3) Using [<] or [>] switch, move the cursor to item of 06: RAISE EPC.



4) Raise the lift arm EPC lever to a position just before the raise detent position and maintain the lever at this position.

★ Take care so that the raise detent operation will not start.

5) Pressing [◇] switch turns on reading of lever voltage and then stores the read voltage replacing the currently stored standard value.



★ The setting is complete as 06: RAISE EPC screen was restored succeeding to 2 times of buzzer beep.

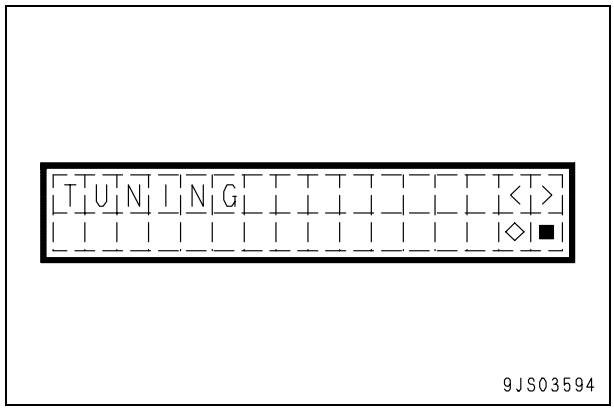
★ If the lever output voltage at this point is below the standard value (off the design range), pressing [◇] switch sounds the buzzer for 1 second and the screen remains unchanged as ◇ = SET like shown in the above figure. In this case, the adjustment is cancelled and 06: RAISE EPC screen will be restored.

★ If [■] switch is pressed at this point, correction of variations in the work equipment EPC lever detent position is stopped even if it is not completed.

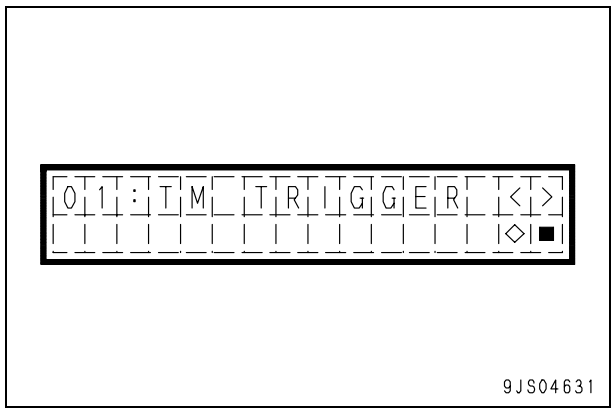
7-5-2. Adjusting lift arm raise EPC starting current

★ Start the engine prior to the setup operation.

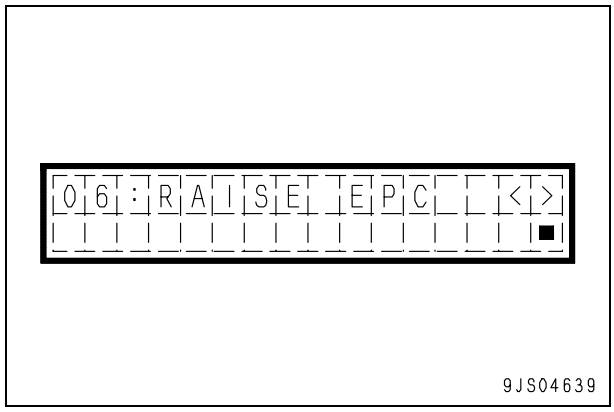
1) Display the TUNING screen from the menu screen of Service mode.



2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.

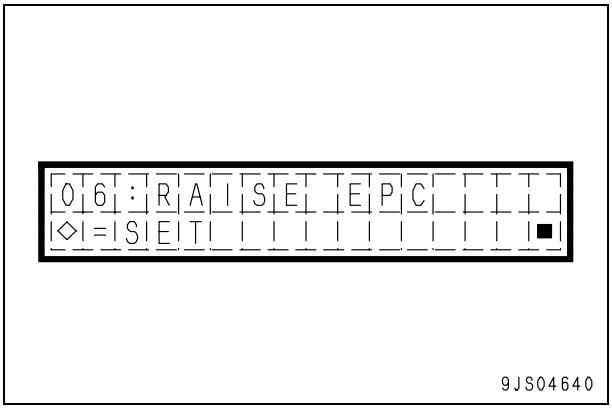


3) Using [<] or [>] switch, move the cursor to item of 06: RAISE EPC.



4) Lower the lift arm by dumping the bucket and then lift the front wheel.

5) Start raising the lift arm gradually while setting the engine to high idle (the machine body is lowered).
6) Return the lever through fine operation. As the lift arm is stopped, maintain the lever at that position (front wheel is floated).
7) Pressing [◇] switch turns on reading of the commanded value of EPC and then stores the difference between it and the standard value as the offset value.



8) The setting is complete as 06: RAISE EPC screen was restored succeeding to 2 times of buzzer beep.

★ If [◇] switch is pressed when the lever is at neutral, the adjusted value is cleared. In this case, 06: RAISE EPC screen will be restored succeeding to 2 times of buzzer beep.

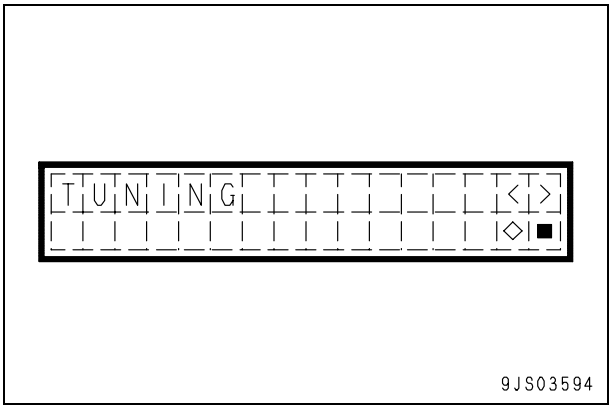
7-6. Adjustment of lift arm lower (float) lever and variations in the dead zone of EPC

7-6-1. Adjusting variation correcting calibration of lift arm lower (float) EPC lever

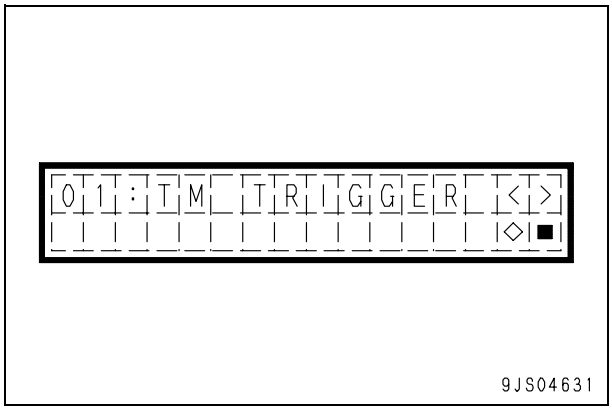
★ This adjustment is needed when the electric (EPC) work equipment lever or the work equipment controller is disassembled or replaced.

★ Before starting the adjustment, lower the lift arm to the ground and stop the engine.

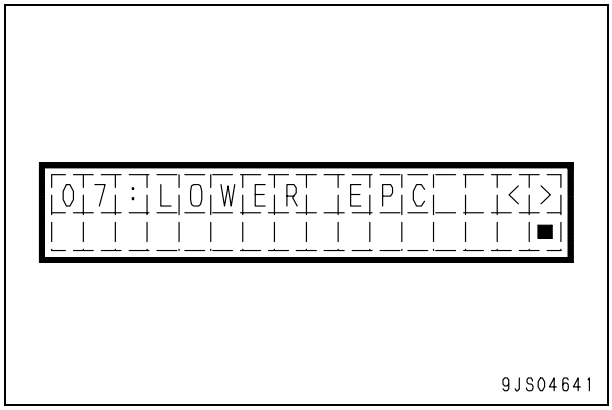
1) Display the TUNING screen from the menu screen of Service mode.



2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



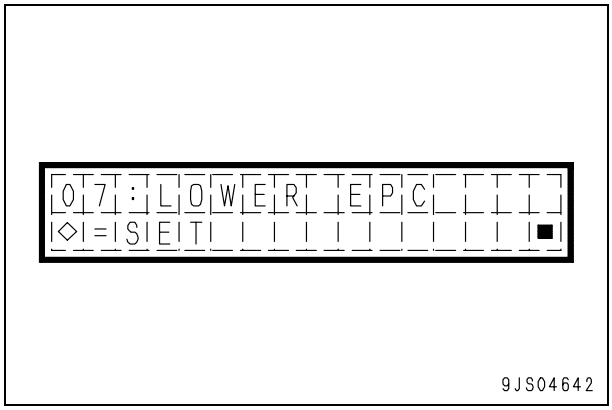
3) Using [<] or [>] switch, move the cursor to item of 07: LOWER EPC.



4) Stop the lift arm EPC lever in a position just before the float detent position and maintain the lever at this position.

★ Take care so that float detent operation may not turn on.

5) Pressing [◇] switch turns on reading of lever voltage and then stores the read voltage replacing the currently stored standard value.

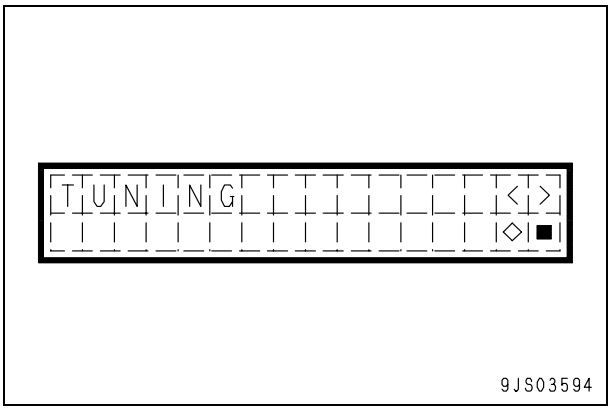


★ The setting is complete as 07: LOWER EPC screen was restored after 2 times of buzzer beep.
★ If the lever output voltage at this point is below the standard value (off the design range), pressing [◇] switch sounds the buzzer for 1 second and the screen remains unchanged as ◇ = SET like shown in the above figure. In this case, the adjustment is cancelled and 07: LOWER EPC screen will be restored.
★ If [◆] switch is pressed at this point, correction of variations in the work equipment EPC lever detent position is stopped even if it is not completed.

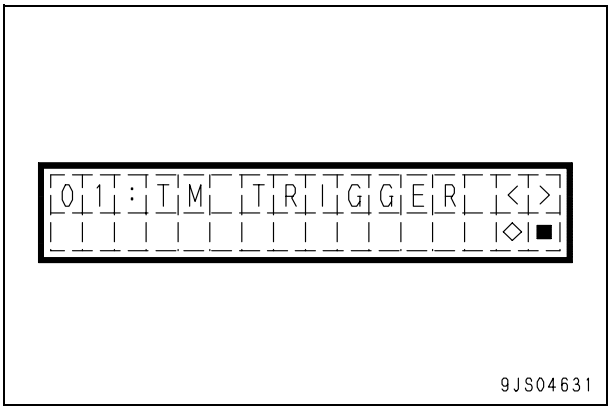
7-6-2. Adjusting lift arm lower EPC starting current

★ Start the engine prior to the setup operation.

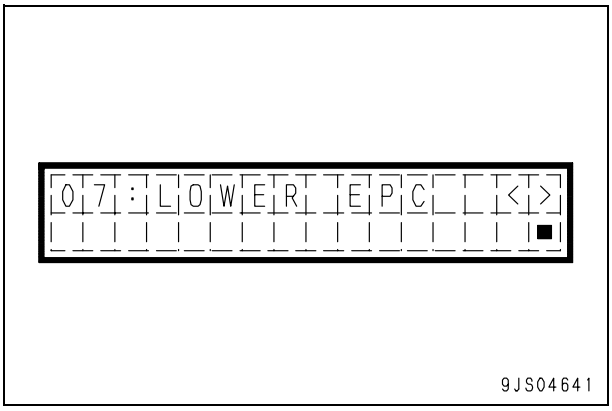
1) Display the TUNING screen from the menu screen of Service mode.



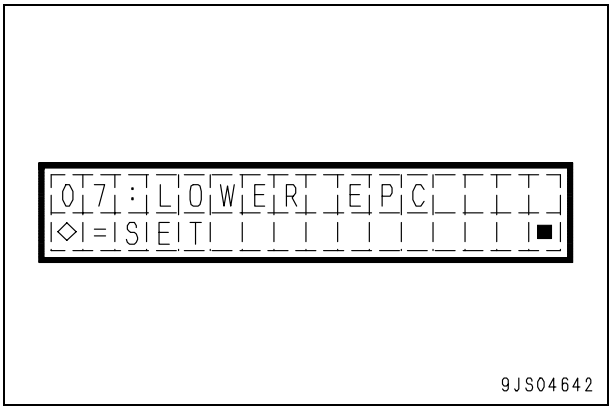
2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



3) Using [<] or [>] switch, move the cursor to item of 07: LOWER EPC.



4) Set the lift arm roughly horizontal without applying any load.
5) Start lowering the lift arm gradually while maintaining the engine at high idle.
6) Return the lever through fine operation. As the lift arm is stopped, maintain the lever at that position.
7) Pressing [◇] switch turns on reading of the commanded value of EPC and then stores the difference between it and the standard value as the offset value.



8) The setting is complete as 07: LOWER EPC screen was restored after 2 times of buzzer beep.

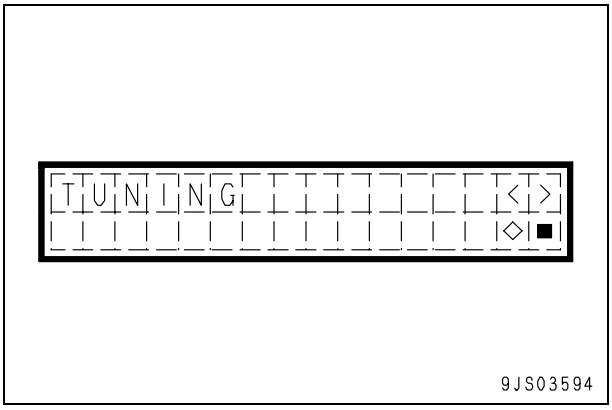
★ If [◇] switch is pressed when the lever is at neutral, the adjusted value is cleared. In this case, 07: LOWER EPC screen will be restored after 2 times of buzzer beep.

7-7. Adjustment of bucket tilt lever position before detent and variations in the dead zone

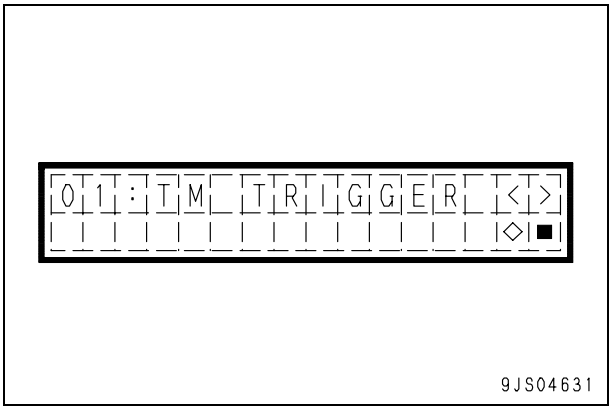
7-7-1. Adjusting variation correcting calibration of bucket tilt lever position before detent

★ This adjustment is needed when the electric (EPC) work equipment lever is used or when the work equipment controller was replaced.

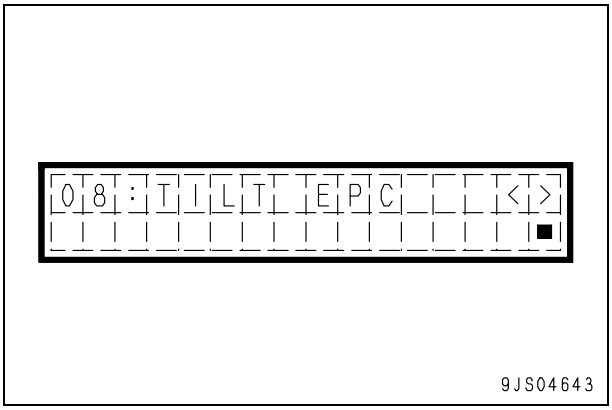
★ Before starting the adjustment, lower the lift arm to the ground and stop the engine.



1) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



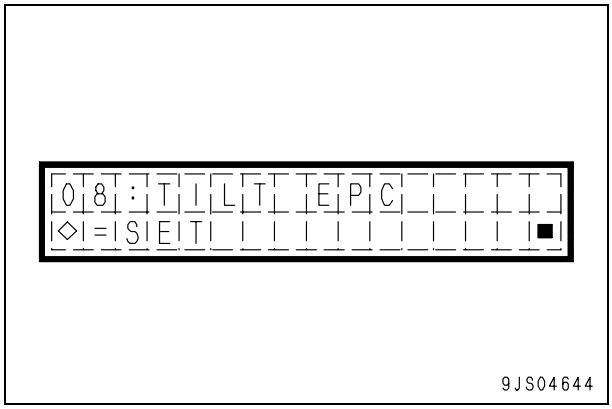
2) Using [<] or [>] switch, move the cursor to item of 08: TILT EPC.



3) Stop the bucket EPC tilt lever in a position just before the tilt detent notch position and maintain the lever at the position.

★ Take care so that the tilt detent operation may not be turned on.

4) Pressing [◇] switch turns on reading of lever voltage and then stores the read voltage replacing the currently stored standard value.



★ The setting is complete as 08: TILT EPC screen was restored after 2 times of buzzer beep.

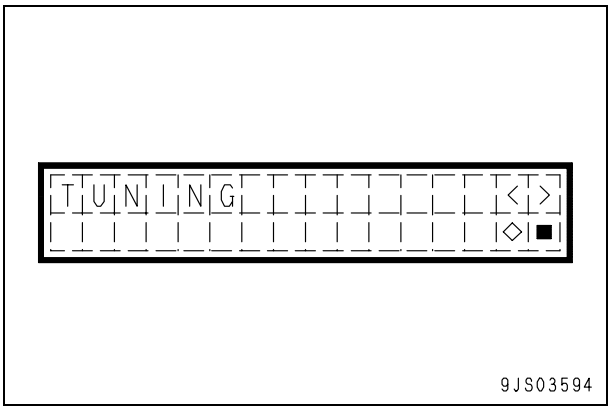
★ If the lever output voltage at this point is below the standard value (off the design range), pressing [◇] switch sounds the buzzer for 1 second and the screen remains unchanged as ◇ = SET like shown in the above figure. In this case, the adjustment is cancelled and 08: TILT EPC screen will be restored.

★ If [■] switch is pressed at this point, correction of variations in the work equipment EPC lever detent position is stopped even if it is not completed.

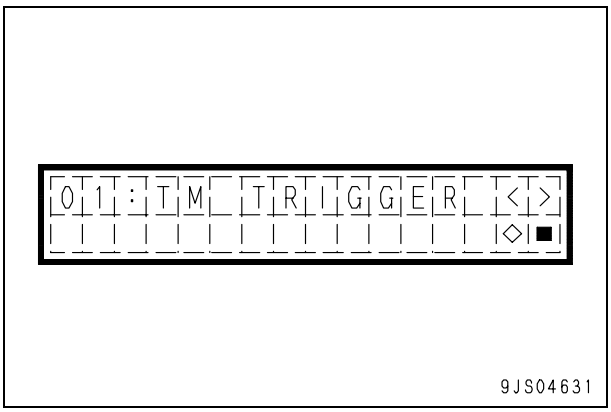
7-7-2. Adjusting bucket tilt EPC starting current

★ Start the engine prior to the setup operation.

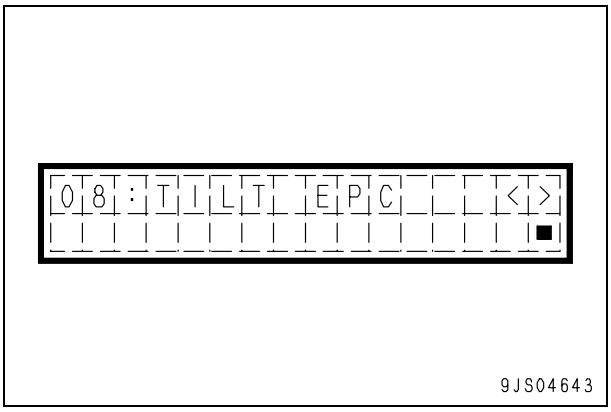
1) Display the TUNING screen from the menu screen of Service mode.



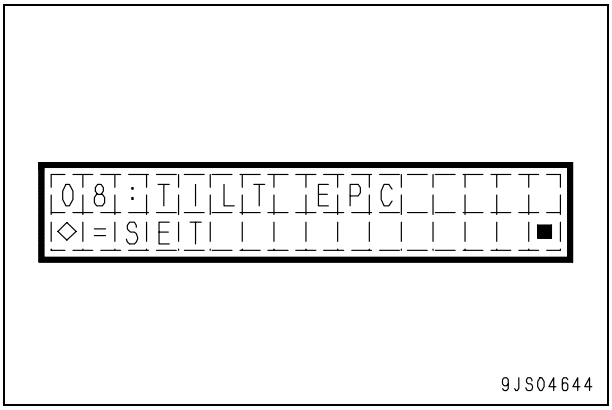
2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



3) Using [<] or [>] switch, move the cursor to item of 08: TILT EPC.



4) Lower the lift arm by dumping the bucket and then lift the front wheel.
5) Start lowering the bucket gradually while maintaining the engine at high idle (the machine body is lowered).
6) Return the lever through fine operation. As the bucket is stopped, maintain the lever at that position.
7) Pressing [◇] switch turns on reading of the commanded value of EPC and then stores the difference between it and the standard value as the offset value.



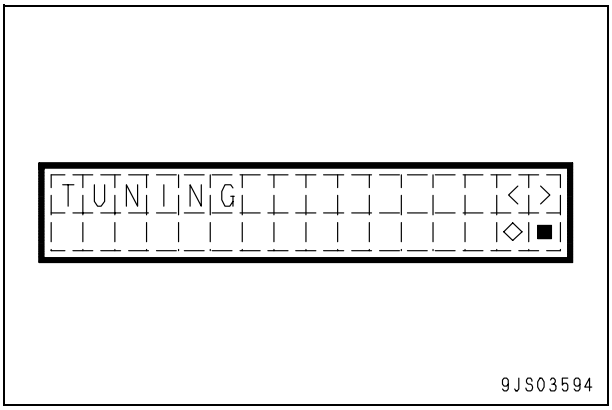
8) The setting is complete as 08: TILT EPC screen was restored after 2 times of buzzer beep.

★ If [◇] switch is pressed when the lever is at neutral, the adjusted value is cleared. In this case, 08: TILT EPC screen will be restored after 2 times of buzzer beep.

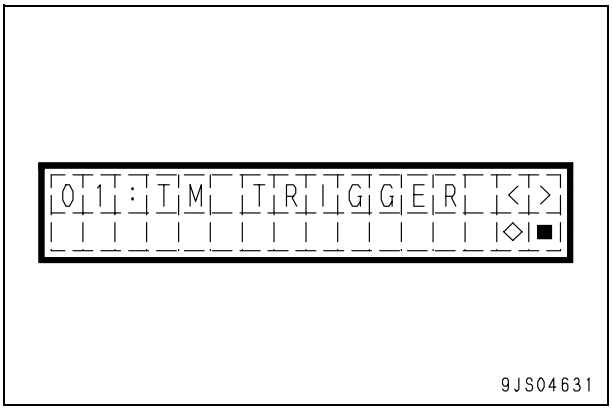
7-8. Adjustment of bucket dump EPC starting current

★ Start the engine prior to the setup operation.

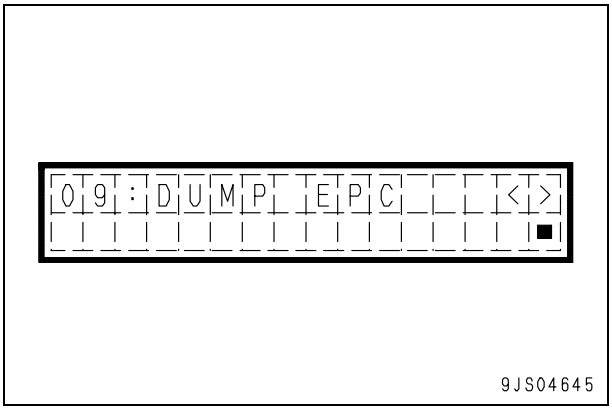
1) Display the TUNING screen from the menu screen of Service Mode.



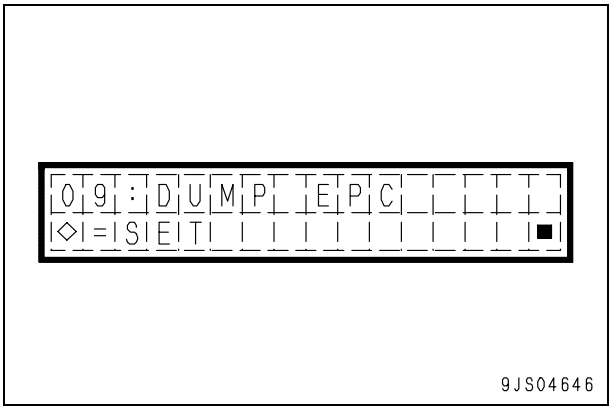
2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



3) Using [<] or [>] switch, move the cursor to item of 09: DUMP EPC.



4) Set the bucket roughly horizontal without applying any load.
5) Start dumping the bucket gradually while maintaining the engine at high idle.
6) Return the lever through fine operation. As the bucket is stopped, maintain the lever at that position.
7) Pressing [◇] switch turns on reading of the commanded value of EPC and then stores the difference between it and the standard value as the offset value.



8) The setting is complete as 09: DUMP EPC screen was restored after 2 times of buzzer beep.

★ If [◇] switch is pressed when the lever is at neutral, the adjusted value is cleared. In this case, 09: DUMP EPC screen will be restored after 2 times of buzzer beep.

7-9. Adjustment of 3-spool valve EPC cylinder extraction lever and variations in the dead zone of EPC

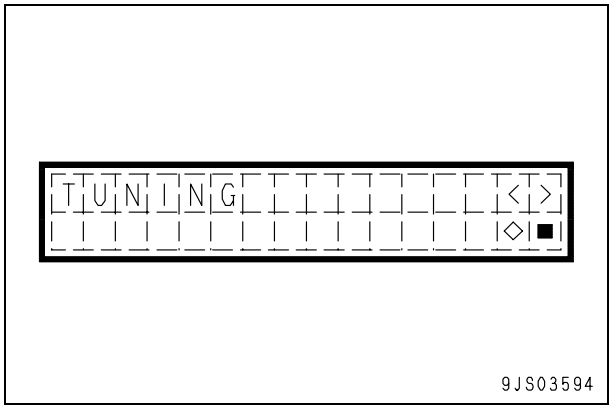
★ This item shall not be operated.

7-10. Adjustment of 3-spool valve EPC cylinder retraction lever and variations in the dead zone of EPC

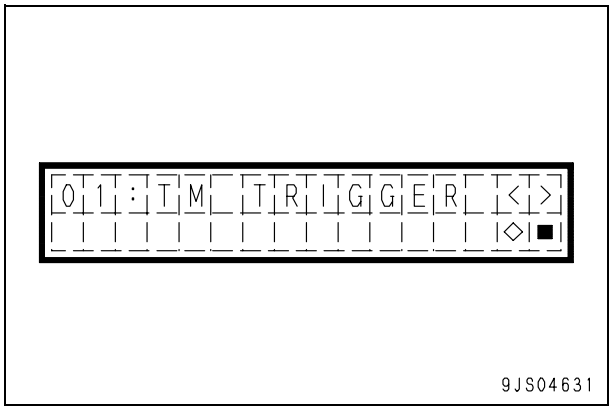
★ This item shall not be operated.

7-11. Adjustment of AJSS neutral position (AJSS specification)

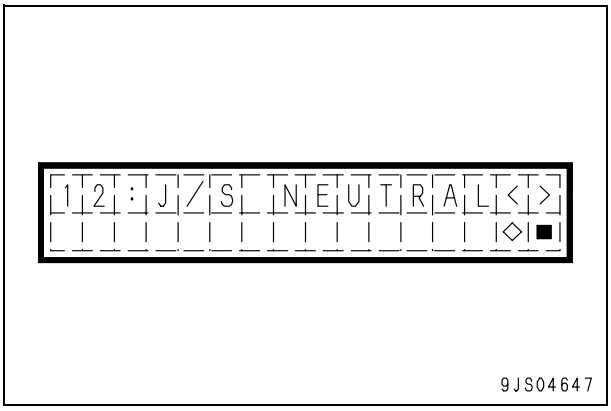
1) Display the TUNING screen from the menu screen of Service mode.



2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.

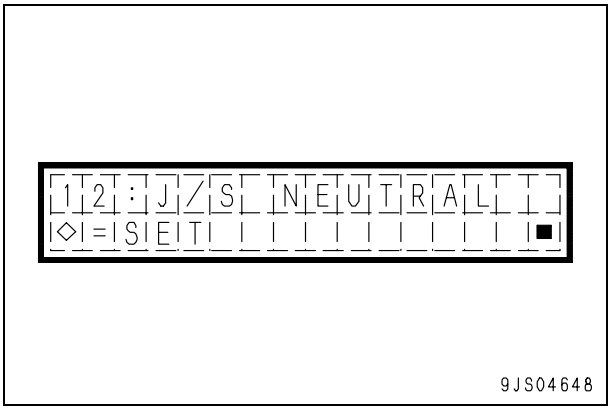


3) Using [<] or [>] switch, move the cursor to item of 12: J/S NEUTRAL.



4) Set the machine to the straight travel position and also set AJSS lever to neutral.
5) Press [◇] switch from this state.

★ If AJSS lever is not movable from the current neutral position to the straight travel position, adjust AJSS follow-up link.



6) 2 times of buzzer beep notify completion of the setting.

★ 1 second-long beep indicates that the set frame and lever angle voltage is not conforming to the specified value. In this case, adjustment does not start.

7) Press [■] switch to end the adjustment mode.

★ If [■] switch is pressed while the calibration is continued, the calibration currently underway will be stopped even if it is not completed.

8) When the adjustment was not successfully executed, check the frame and lever angle sensor voltages from the real time monitoring.

★ Adjust the frame and lever angle sensor mounting position so that the voltage displayed on the real-time monitoring may fall in within the following range and then implement the sensor adjustment again.

Angle sensor	Lift arm position	Voltage range
Frame angle sensor	Straight travel position	2.50 ± 0.3 V
Lever angle sensor	Neutral state	2.50 ± 0.3 V

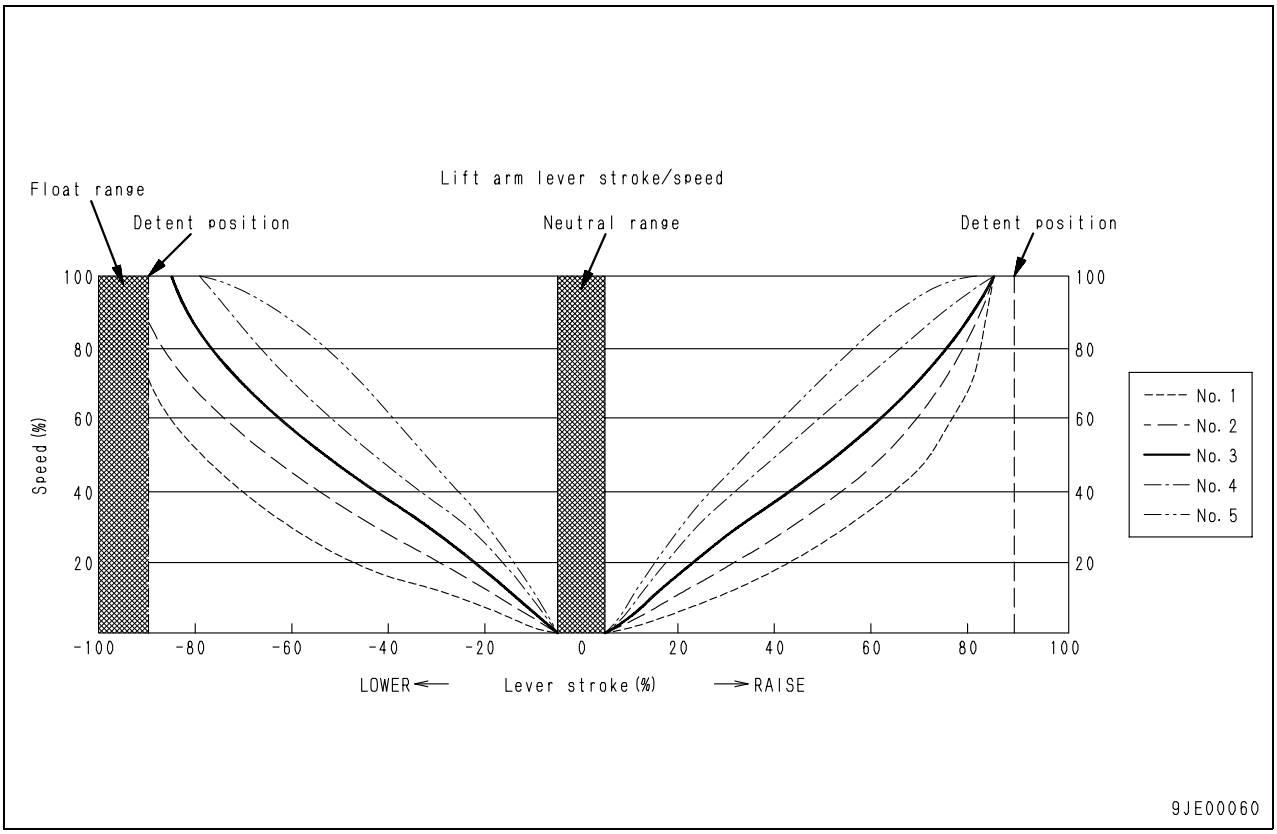
7-12. Adjustment of AJSS EPC output current (AJSS specification)

★ If this adjustment is necessary, consult the factory before performing it.

7-13. Modification of lift arm lever pattern

★ This function is intended for modifying the fine-controllability and response of the lift arm by changing the data on EPC output current to the lift arm lever stroke.

★ Characteristics of tables 1 – 5 are summarized as shown in the table below. (Factory-set table: 3)



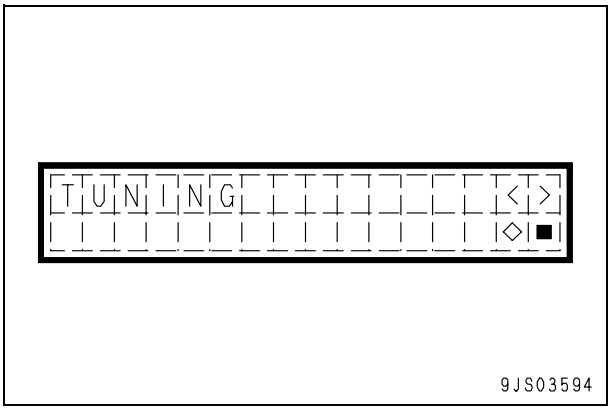
★ Table No. and function

Table No.	Function	General
1	Fine control priority	• In the lowering operation, the lift arm is lowered at approximately 70% of the maximum speed. (Floating speed remains the same) • In the raising operation, speed change becomes more drastic as the stroke grows bigger.
2	Fine control priority	• In the lowering operation, the lift arm is lowered at approximately 85% of the maximum speed. (Floating speed remains the same) • In the raising operation, controllability at fewer strokes is enhanced.
3	Standard	• This table allows compatibility between controllability and response in both the raise and lower operations.
4	Response priority	• Fewer and faster lever strokes enhance the response.
5	Response priority	• Response is further improved because of the lever strokes fewer and faster than that of No. 4. • This table allows a greater speed change at fewer strokes than others. Thus, if reasonable care is not exercised, substantial shocks can result at stopping.

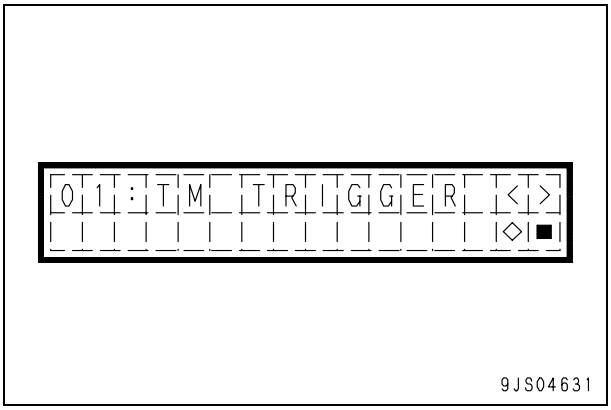
★ Normally, change to tables No. 2 to No. 4 is made. When selecting No. 1 or No. 5 table, therefore, thorough preliminary performance check and operator evaluation are required.

★ The maximum lowering speed is not available from the data of Tables No. 1 and No. 2. Thus, when measuring the lift arm lowering speed, Tables No. 3 – No. 5 must be used.

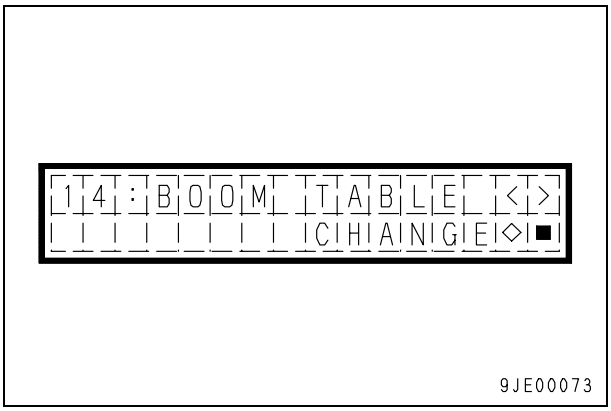
1) Display the TUNING screen from the menu screen of Service mode.



2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.

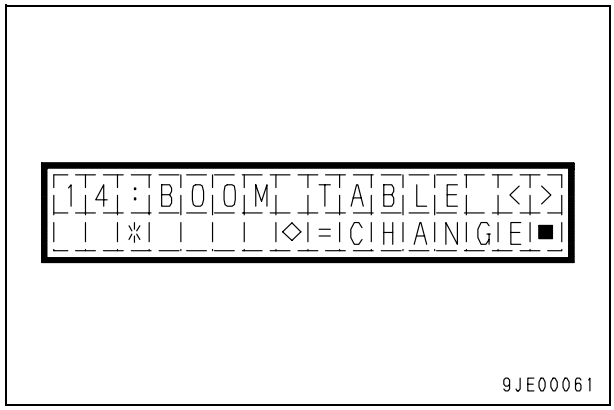


3) Using [<] or [>] switch, move the cursor to item of 14: BOOM TABLE.



4) Press [◇] switch to settle the selection.

★ As the selection is settled, the BOOM TABLE screen will be displayed.



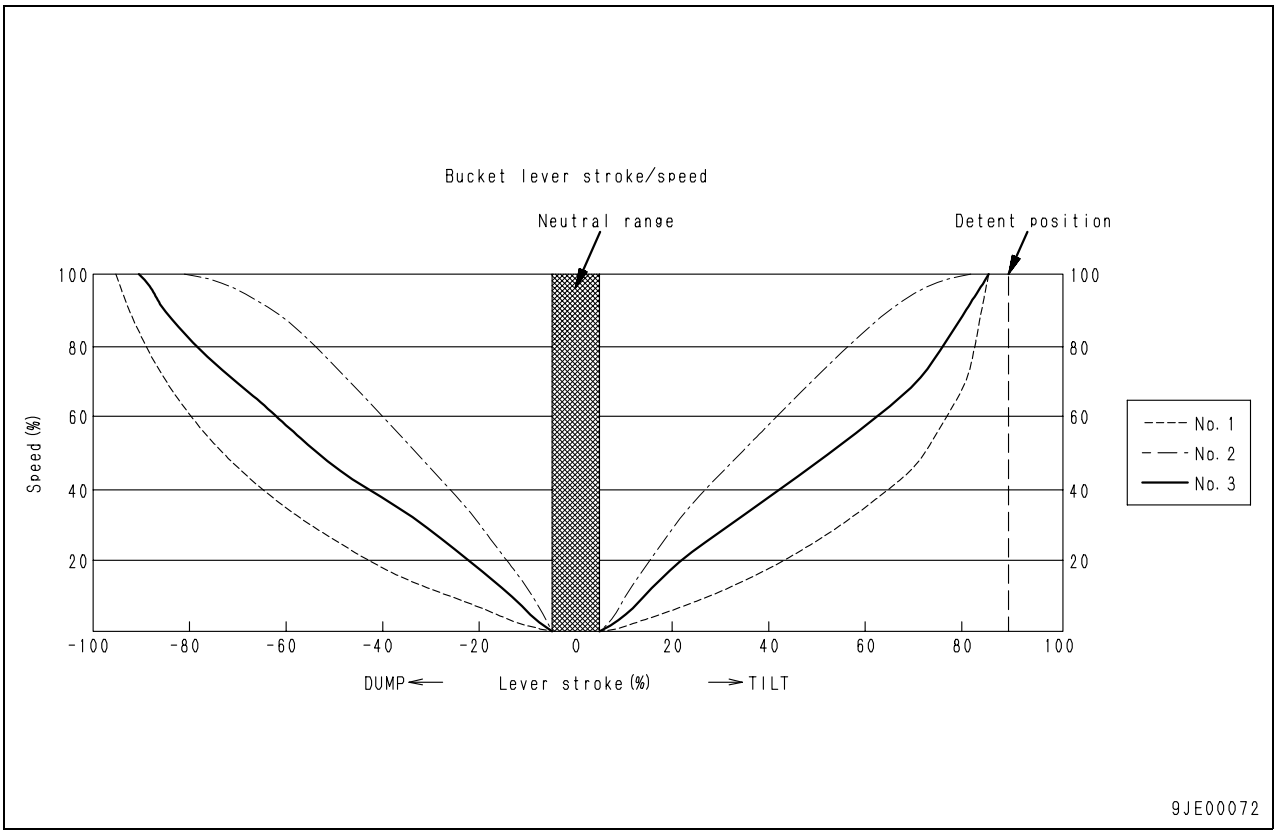
5) Select a desired table from No. 1 – No. 5 by use of [<] or [>] switch.

6) Press [■] switch to settle the adjustment.

7-14. Modification of bucket lever pattern

★ This function is intended for modifying the fine controllability, response and shock dump of the bucket by changing the data on EPC output current to the bucket lever stroke.

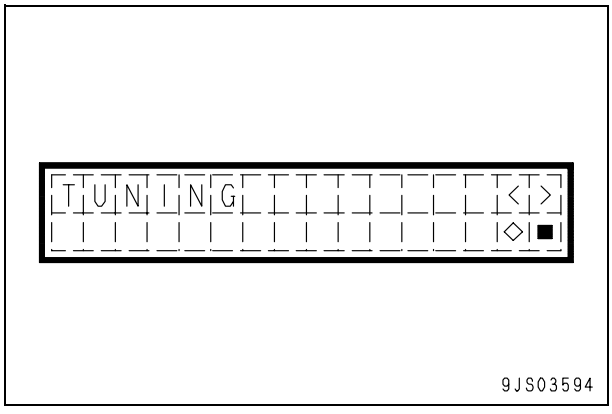
★ Characteristics of tables 1 – 3 are summarized as shown in the table below. (Factory-set table: 2)



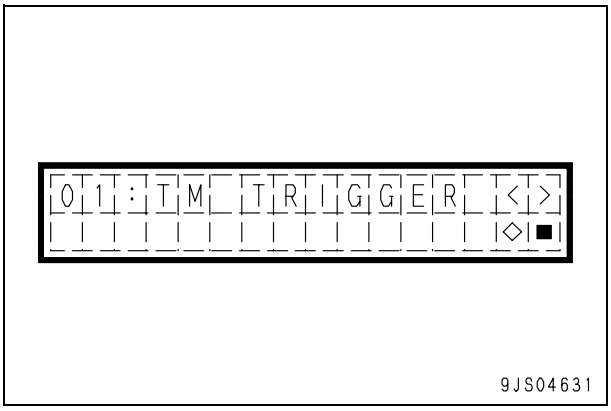
★ Table No. and function

Table No.	Function	General
1	Fine control priority	• In the dump and tilt operation, controllability at fewer strokes is enhanced.
2	Standard	• This table allows compatibility between controllability and response in both the dump and tilt operations.
3	Response priority	• Fewer and faster lever strokes enhance the response. • This table makes it easier to dumping load by swinging the bucket as well as shock dump and leveling of load at the tilt end.

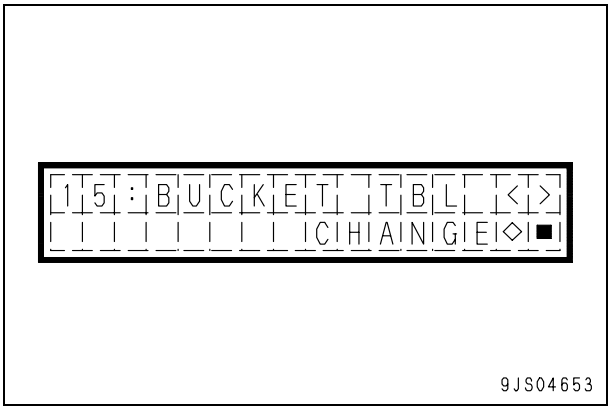
1) Display the TUNING screen from the menu screen of Service mode.



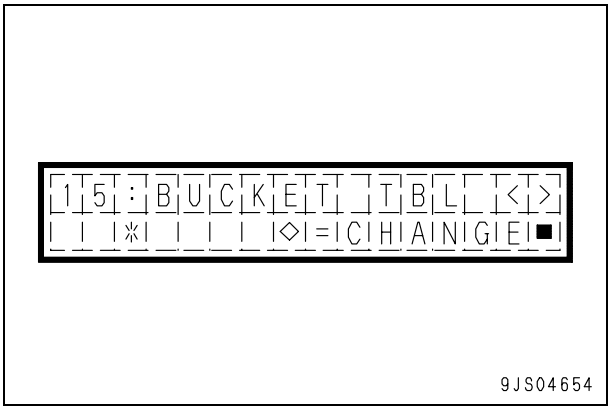
2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



3) Using [<] or [>] switch, move the cursor to item of 15: BUCKET TBL.



4) Press [◇] switch to settle the selection.
★ As the selection is settled, the bucket lever adjustment screen will be displayed.



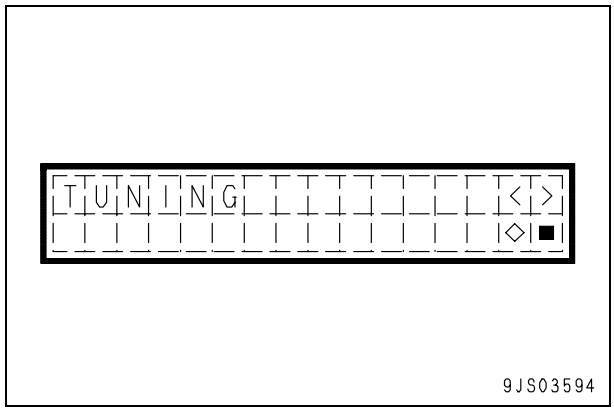
5) Select a desired table from No. 1 – No. 3 by use of [<] or [>] switch.
6) Press [■] switch to settle the adjustment.

7-15. Adjustment of lift arm raise/lower stop modulation

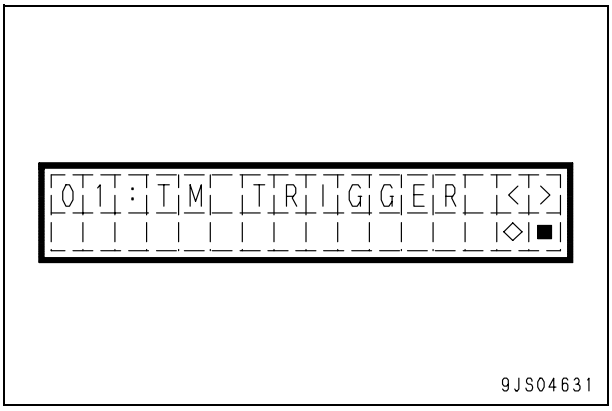
★ When the lift arm lever is operated for sudden stop, this function modifies the speed reduction rate of the stop modulation, which is prepared for alleviating shocks resulting from stopping, by applying the stop modulation to EPC output current.
★ The modulation used for an automatic stop with the remote positioner or due to kickout does not depend on this data.
★ Before starting a modification of the modulation by use of this function, "7-12 Adjustment of AJSS EPC output current (AJSS specification)" and operator's evaluation must be done first.
★ The stop modulation function acts the same way in both the raise and lower directions.
★ The data at delivery is set to 100% of the standard.

Modulation quantity	State	Remarks
0%	The stop modulation is not activated. The lift arm is stopped without delaying to the lever stroke.	Stopping shocks can result if the operator does not pay reasonable care.
100%	It allows compatibility between delay in response at stop and stopping shocks	—
200%	It alleviates stopping shocks that can result from operator's sudden stop operation.	The lift arm overruns the target stop position because its stopping is delayed even when the lever is set at neutral.

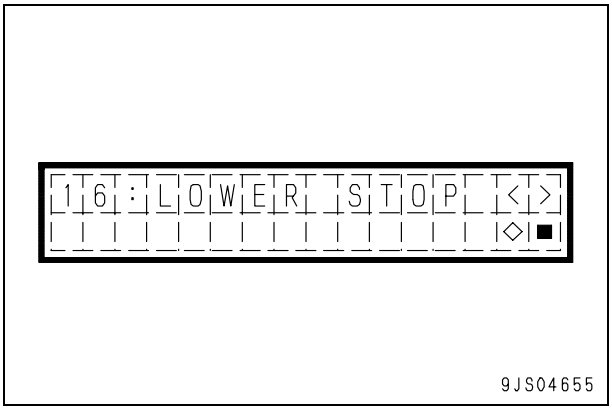
1) Display the TUNING screen from the menu screen of Service mode.



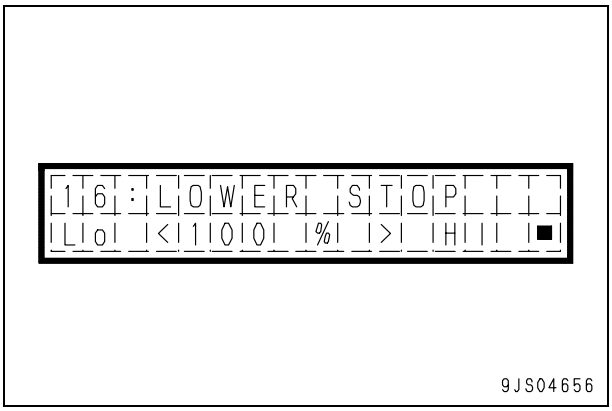
2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



3) Using [<] or [>] switch, move the cursor to item of 16: LOWER STOP.



4) Press [◇] switch to settle the selection.
★ As the selection is settled, the LOWER STOP screen will appear.
5) Select a desired table from 0, 100 and 200 by use of [<] or [>] switch.
6) Press [■] switch to settle the adjustment.



7-16. Adjustment of pump cut-off pressure in lift arm raise

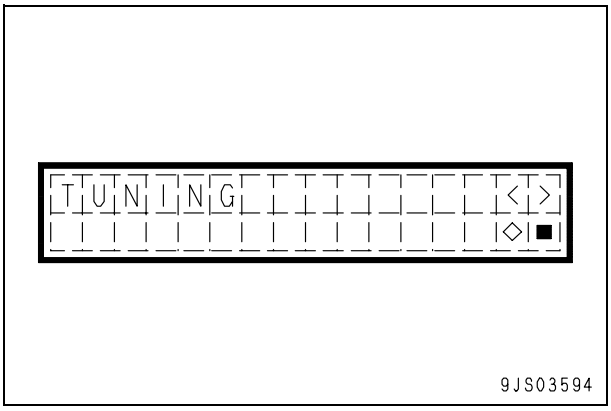
★ This function modifies matching of the travel speed and work equipment speed at dump approach and hopper charge by changing the condition of the lift arm bottom pressure, which is used as a pump flow rate restricting condition when lifting given load.
★ The following lists the pump flow rate restricting conditions applicable to load lifting operation.
If the lift arm is operated under the following initial conditions, its speed is restricted to approximately 70% and the remaining torque is used for the travel.
- Lift arm angle > 0° (Horizontal)
- Bucket tilt end detecting proximity switch signal
  = Present (Tilt end detection available)
- Lift arm bottom pressure > 20 MPa

★ Modifying the lift arm bottom pressure changes the matching as shown in the table.
- The following data shows, when the machine is loaded, the time required for the lift arm to reach the lift arm top when the raise operation was started simultaneously with start of the machine and the travel distance at that time.
- Decreasing the currently set pressure activates the cut-off earlier, thereby lengthening the lift arm rising time as well as extending the travel distance.

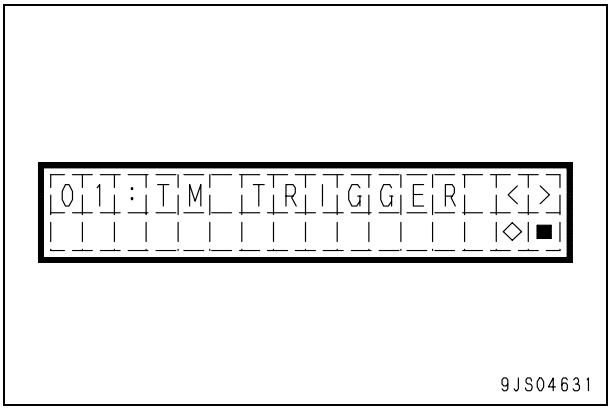
Working mode	Lift arm bottom pressure during rising MPa {kg/cm^2}	F1		F2	
		Distance (m)	Time (sec)	Distance (m)	Time (sec)
Economy	10 {102}	16.5	11	25.1	11.2
	20 {204}	15.5	10.7	24.7	10.7
	25 {255}	15	10.2	24.5	10.6
Power	10 {102}	17.8	10.7	26.7	11.1
	20 {204}	16.3	10.3	24.4	10.5
	25 {255}	15.3	9.8	24.2	10.2

★ The pressure at delivery is 20 MPa {204 kg/cm^2}.
★ Modifying the set value changes the lift arm rising time.
★ When measuring the lift arm rising time for troubleshooting purpose, be sure to return the current setting to (20 MPa {204 kg/cm^2}).

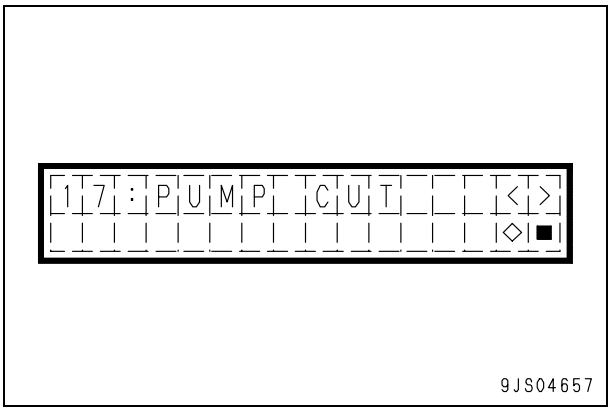
1) Display the TUNING screen from the menu screen of Service mode.



2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



3) Using [<] or [>] switch, move the cursor to item of 17: PUMP CUT.

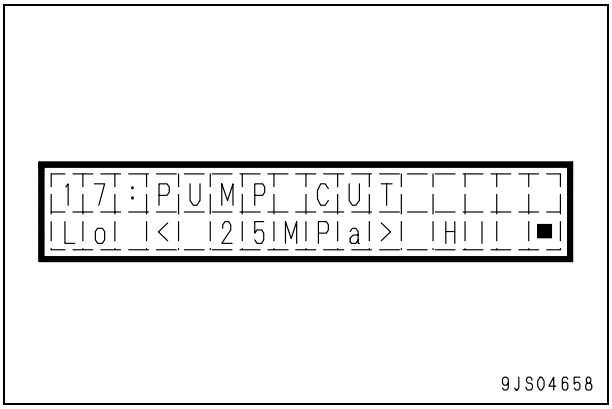


4) Press [◇] switch to settle the selection.

★ As the selection is settled, the pump cutoff pressure adjustment screen will be displayed.

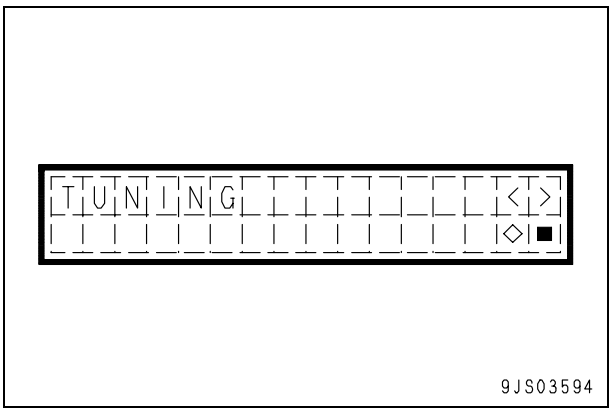
5) Select a desired pressure in the range of 5 – 45 (Unit: MPa) by use of [<] or [>] switch.

6) Press [■] switch to settle the adjustment.

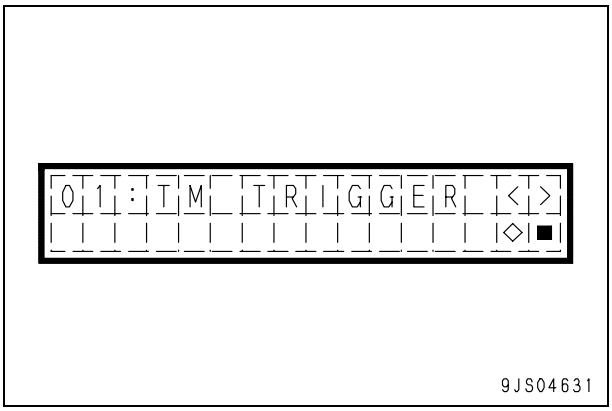


7-17. Adjustment of lift arm angle sensor (raise) (For load meter)

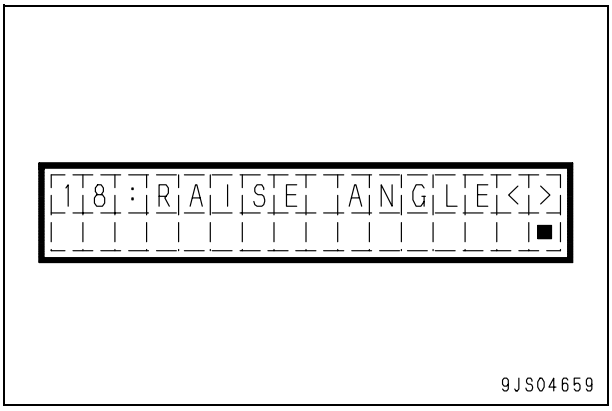
1) Display the TUNING screen from the menu screen of Service mode.



2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.

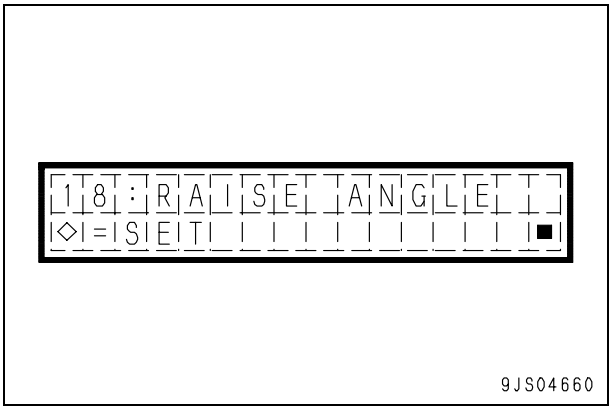


3) Using [<] or [>] switch, move the cursor to item of 18: RAISE ANGLE.



4) Press [◇] switch to settle the selection.

★ As the selection is settled, the RAISE ANGLE screen will appear.



5) Press [◇] switch after raising the lift arm to the upper limit position (cylinder stroke end).
6) 2 times of buzzer beep notify completion of the setting.

★ 1 second-long beep indicates that the set lift arm angle voltage is not conforming to the specified value. In this case, adjustment does not start.

7) Press [◆] switch to end the adjustment mode.

★ If [■] switch is pressed while the calibration is continued, the calibration currently underway will be stopped even if it is not completed.

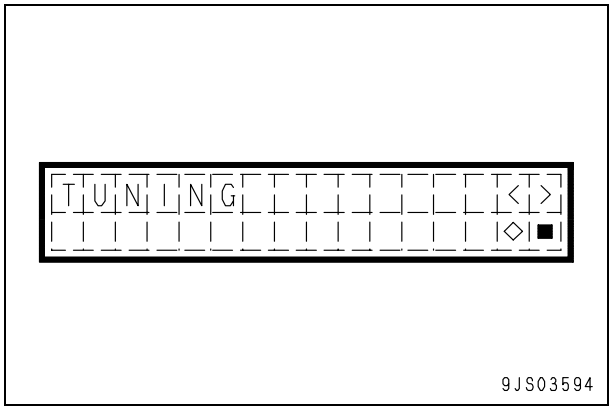
8) When the adjustment did not end successfully, check the lift arm angle sensor voltage from the real time monitoring.

★ Adjust the lift arm angle sensor mounting position so that the voltage displayed on the real time monitoring may fall within the following range and then implement the sensor adjustment again.

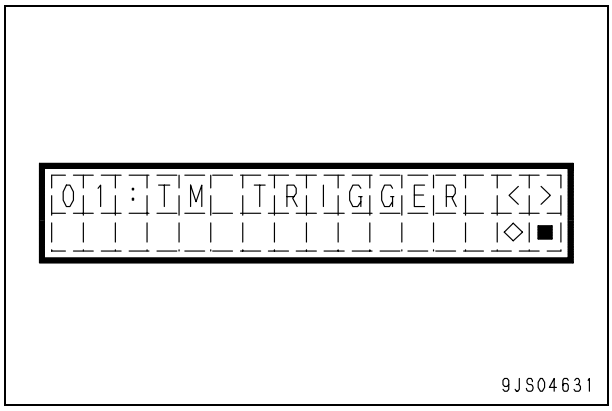
Lift arm position	Voltage range
Upper limit position (Stroke end of raised cylinder)	0.5 – 4.5 V

7-18. Adjustment of lift arm angle sensor (lower) (For load meter)

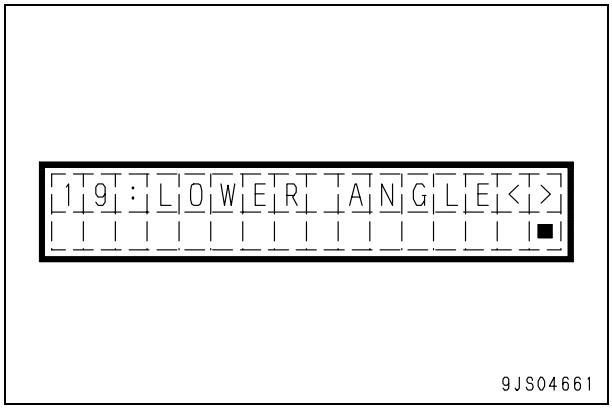
1) Display the TUNING screen from the menu screen of Service mode.



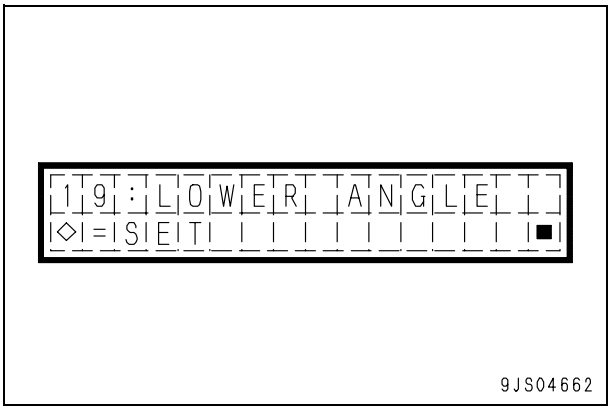
2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



3) Using [<] or [>] switch, move the cursor to item of 19: LOWER ANGLE.



4) Press [◇] switch to settle the selection.
★ As the selection is settled, the LOWER ANGLE screen will appear.



5) Press [◇] switch after lowering the lift arm to the lower limit position (cylinder stroke end).
6) 2 times of buzzer beep notify completion of the setting.
★ 1 second-long beep indicates that the set lift arm angle voltage is not conforming to the specified value. In this case, adjustment does not start.
7) Press [■] switch 2 times to end the adjustment mode.
★ If [■] switch is pressed while the calibration is continued, the calibration currently underway will be stopped even if it is not completed.
8) When the adjustment did not end successfully, check the lift arm angle sensor voltage from the real time monitoring.
★ Adjust the lift arm angle sensor mounting position so that the voltage displayed on the real time monitoring may fall within the following range and then implement the sensor adjustment again.

Lift arm position	Voltage range
Lower limit position (Stroke end of lowered cylinder)	0.5 – 4.5 V

7-19. Modification of AJSS oil pressure command table pattern

★ This function modifies stopping shock and response of AJSS by changing the data on EPC output current to the AJSS lever stroke.
★ The table at delivery is Table No. 2.
★ Following summarizes characteristics of respective tables.

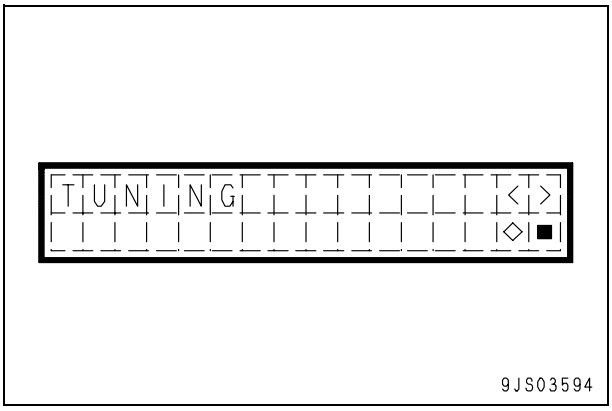
<Table No. 1>
- It offers the fine control priority level. In order to support the operators who have switched from CAT J/S specification machine, this mode sets the maximum swing speed lower than the default value and alleviates shocks resulting from sudden steering lever operation without sacrificing operability of AJSS.
- In this table, difference between the high-speed travel range and low-speed working range is reduced.
- With the traveling speed at 25 km/h or below and the lever angle at 17° or above, it assures the maximum swing speed of approximately 90% of the default (Table No. 2).

<Table No. 2>
- This table offers the default level. It strikes a balance between the machine performance and steering performance.
- It is the table when delivered.
- It assures the maximum swing speed when the traveling speed is set to 7 km/h or below and the lever angle to 17° or above.

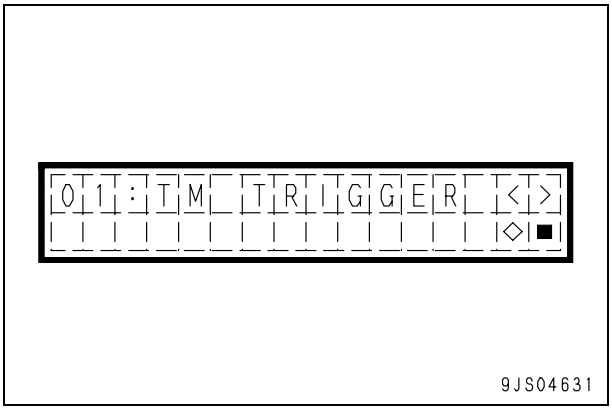
<Table No. 3>
- This table offers the response priority level. It decreases the sense of catch-up by turning on the maximum swing speed, in the low-speed working range, before the steering lever reaches the stroke end.
- It, however, allows greater shocks to result from sudden steering lever operation – a contradictory phenomenon.
- V shape workload priority mode
- It assures the maximum swing speed when the traveling speed is set to 15 km/h or below and the lever angle to 15° or above. This table sets a swing angle faster than the default (Table No. 2) in the lever angle range of 10 – 17° in order to alleviate the sense of catch-up.

★ The maximum swing speed is not available from the data of Table No. 1. Thus, Table No. 2 or 3 shall be used for measuring the swing speed.

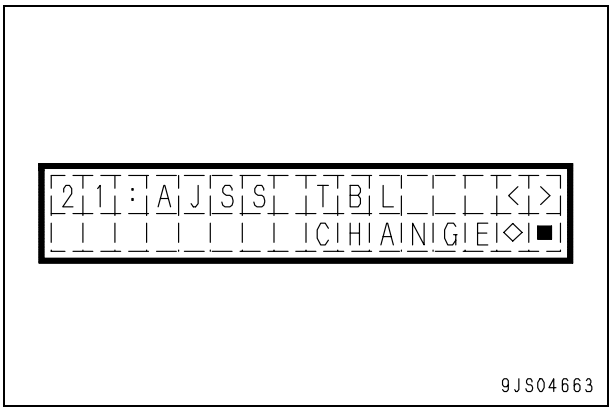
1) Display the TUNING screen from the menu screen of Service mode.



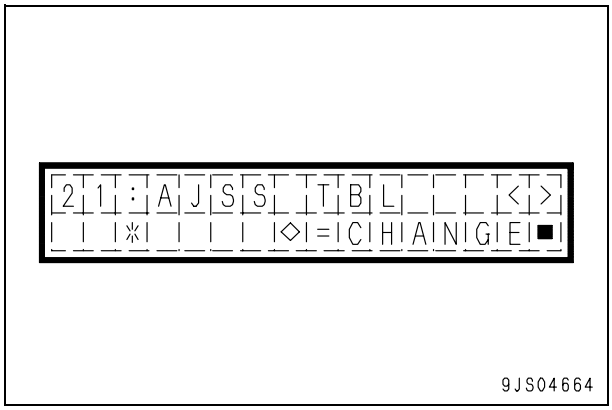
2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



3) Using [<] or [>] switch, move the cursor to item of 21: AJSS TBL.



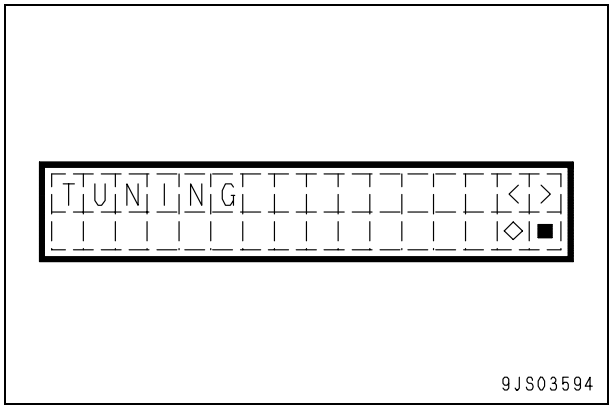
4) Press [◇] switch to settle the selection.
★ As the selection is settled, the AJSS TBL screen will be displayed.



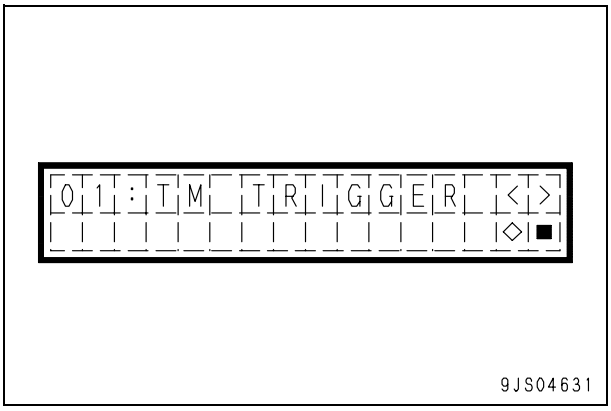
5) Select a desired table from 1, 2 and 3 by use of [<] or [>] switch.
6) Press [■] switch to settle the adjustment.

7-20. Adjustment of maximum speed limit

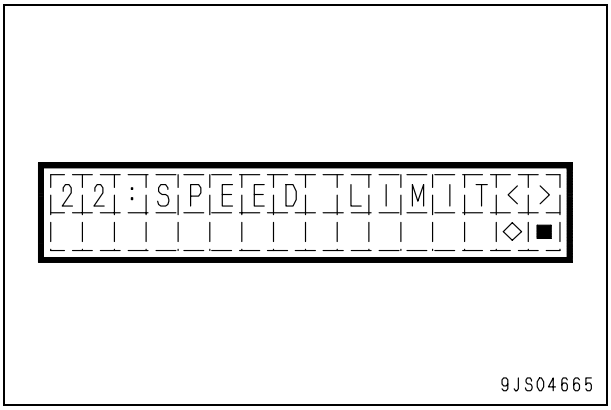
★ This maximum speed limit adjusting function is used to enhance fuel consumption in the forward 4th lockup travel.
★ First select the maximum travel speed (selected from three levels). Then set the upper limit of the throttle opening for F (forward), 4th and L/U (lockup) to limit the maximum travel speed.
★ The throttle opening is limited to 90%, when delivered.
★ Select a restricted throttle opening from 80%, 90% and 100% (no restriction).
★ The state in which F (forward), 4th and L/U (lockup) are selected is, in other words, the state in which F4 gear shift is completed and L/U is at the holding pressure.
★ When gear shift to a speed other than F4 is started or when L/U is cancelled, the upper limit value of this control becomes 100% (no restriction).
★ Setting at delivery is 90%.
1) Display the TUNING screen from the menu screen of Service mode.



2) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.



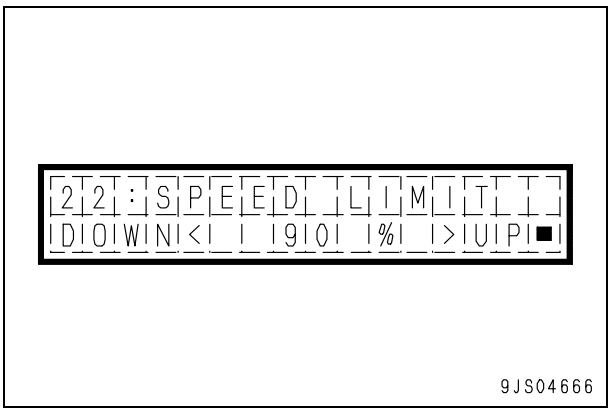
3) Using [<] or [>] switch, move the cursor to item of 22: SPEED LIMIT.



4) Press [◇] switch to settle the selection.

★ As the selection is settled, the maximum speed limit adjustment screen will be displayed.

5) Select “throttle position (80%, 90%, or 100%)” using [<] or [>] switch and then press [◇] switch to settle the setting change.



WA600-6 Wheel loader

Form No. SEN00555-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

30 Testing and adjusting

Testing and adjusting, Part 4

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Special functions of machine monitor (EMMS) 2
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Precautions for replacing VHMS controller 35
Pm-click inspection table 41

Testing and adjusting, Part 4

Special functions of machine monitor (EMMS)

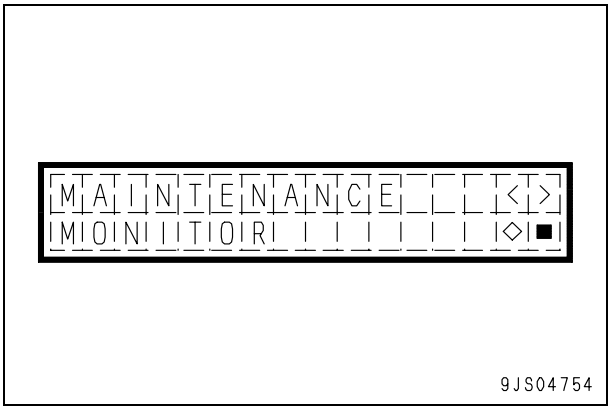
8. Maintenance monitoring function

The maintenance function offers the following capabilities in the maintenance of filters and oils.

- Change of maintenance interval time
- Selection between enabling or disabling timer by item
- Setting of a default value
- Selection between enabling or disabling timer for items

8-1. Changing maintenance interval time

1) Display the MAINTENANCE MONITOR screen from the menu screen of Service mode.

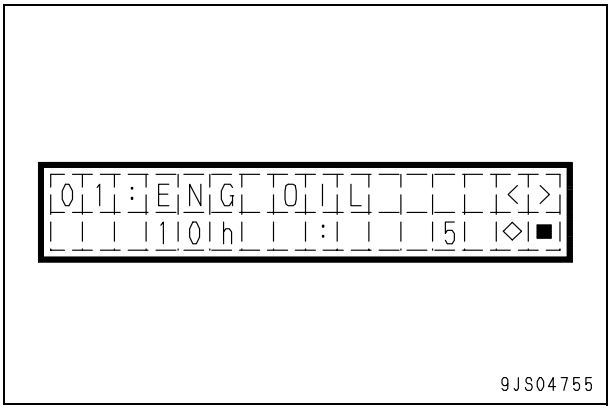


2) Press [◇] switch to display 01: ENG OIL screen.

★ The lower left side space indicates the time remained up to the replacement.

★ The lower right side space indicates the cumulative replacement frequencies.

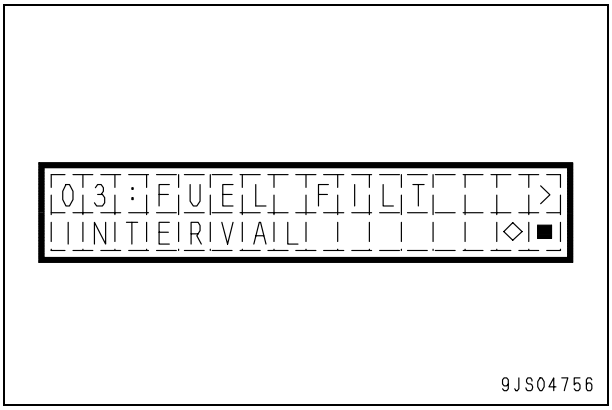
3) Using [<] or [>] switch, select the item for which the maintenance interval is to be changed from the following.



List of maintenance items

Item	ID No.	Indication of items on the character display	Replacement interval time (H)
Engine oil	01	ENG OIL	500
Engine oil filter	02	ENG OIL FILTER	500
Fuel pre-filter	41	FUEL P FILT	500
Transmission oil filter	13	TRANSM FILTER	500
Fuel filter	03	FUEL FILT	500
Transmission oil	12	TRANSM OIL	1000
Corrosion resistor	06	CORR-RESISTER	1000
Hydraulic tank breather element	05	HYD BREATHER	2000
Hydraulic oil filter	04	HYD FILT	2000
Hydraulic oil	10	HYD OIL	2000
Axle oil	15	AXLE OIL	2000

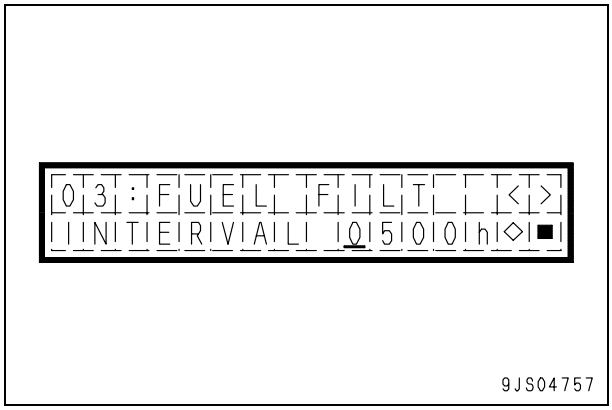
4) Settle the target items of interval change by use of [◇] switch.



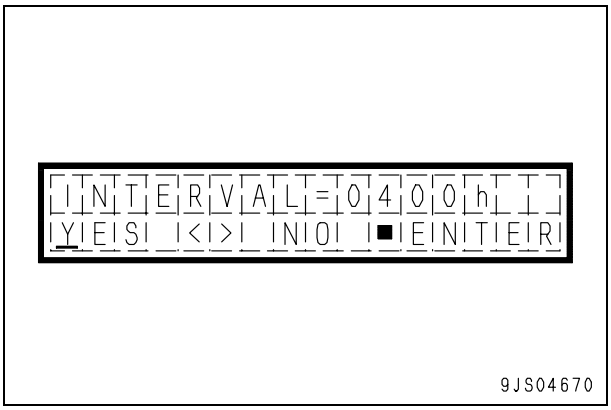
5) Maintenance interval time change procedure
   1] This cursor (C) is located at the highest-order digit. Pressing [<] or [>] switch changes the value of this digit in the range of 0 – 9.
   2] Press [◇] switch when the intended value appeared to specify it as the set value.
   ★ The cursor moves to the 2nd digit.
   3] Set the values up to the lowest-order digit in the same order and then press [◇] switch.
   - When the input interval time is within the setting range: The screen changes to the check screen.
   - When the entered interval time is out of the setting range: The entered interval time does not replace the current value and the input screen will be restored.

★ The shortest interval time value is 50 h.

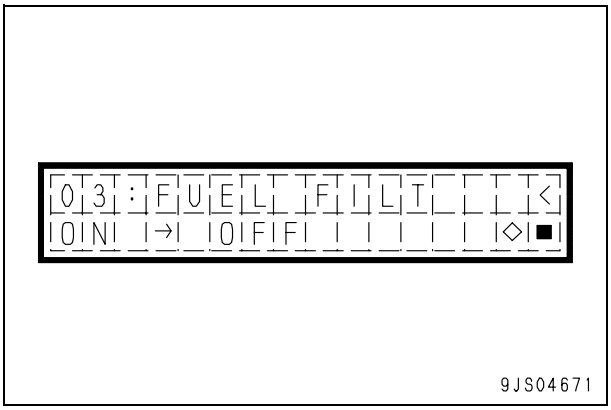
★ When you have entered a wrong value to a position except the highest-order digit, move to the highest-order digit using [■] switch and repeat the procedure from the first. In this case, the value that had been entered remains as it is until modified. When the cursor is at the highest-order digit, move to the higher layer using [■] switch.



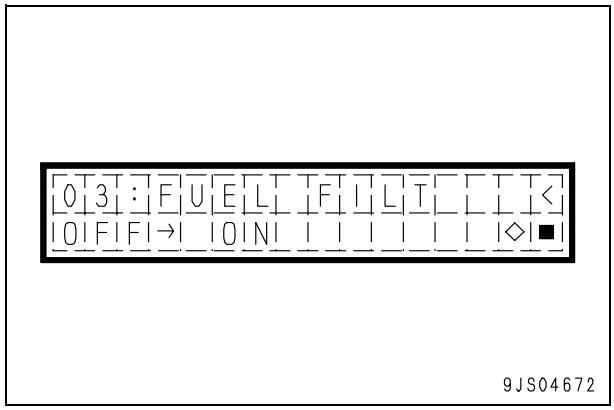
6) Select "YES" or "NO" using [<] or [>] switch.
★ The selected cursor will start flashing. If "YES" is selected and [■] switch is pressed, the information will be deleted. If "NO" is selected and [■] switch is pressed, deletion is cancelled and the maintenance interval change item screen is restored.
★ By default, the cursor is set to NO (cancel) to prevent resetting error.
★ When an interval time is changed, the timer remaining time is changed as shown below.
● Timer remaining time = Interval time being set – Elapsed time from the last replacement



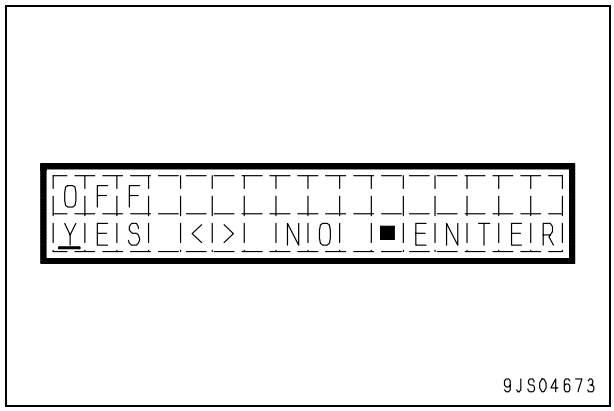
8-2. Selection between enabling or disabling timer by item
1) Pressing [<] or [>] switch from 8-1-3) Interval time change screen displays the "Selection between enabling or disabling timer by item" screen.
★ When "Timer by item" is enabled, the order of display is ON → OFF.



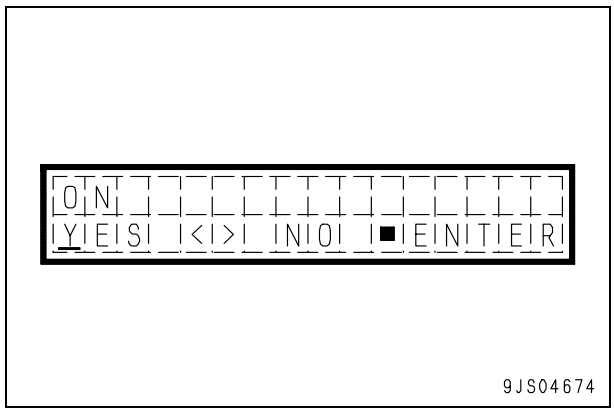
★ When "Timer by item" is disabled, the order of display becomes OFF → ON.
★ The default display is ON.



2) Press [◇] switch from this state.
★ If "Timer by item" is disabled, OFF will be displayed in the upper column.

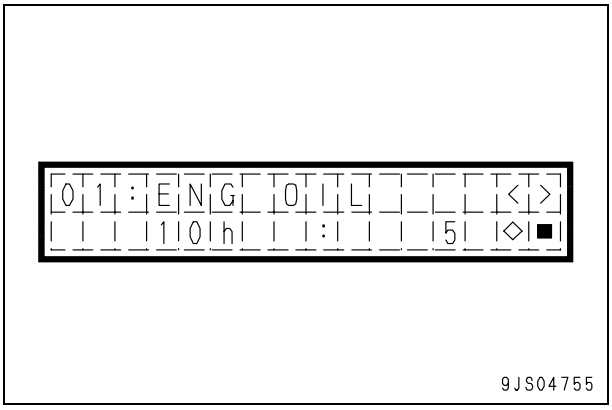


★ If "Timer by item" is enabled, ON will be displayed in the upper column.

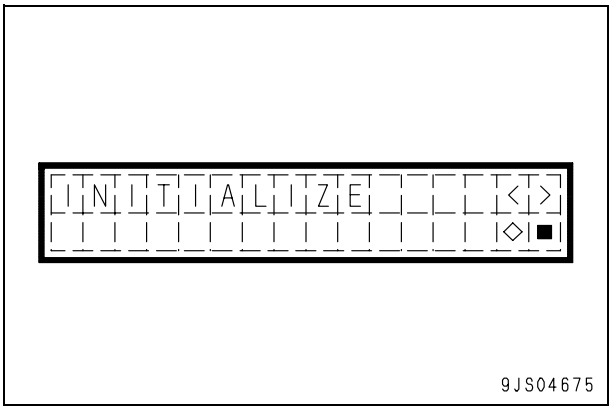


3) Select "YES" or "NO" using [<] or [>] switch.
★ The selected cursor will start flashing. If "YES" is selected and [■] switch is pressed, the information will be deleted. If "NO" is selected and [■] switch is pressed, deletion is cancelled and the maintenance interval change item screen is restored.
★ By default, the cursor is set to NO (cancel) to prevent resetting error.
★ An interval time is changed, the timer remaining time is changed as shown below.
● Timer remaining time = Interval time being set – Elapsed time from the last replacement

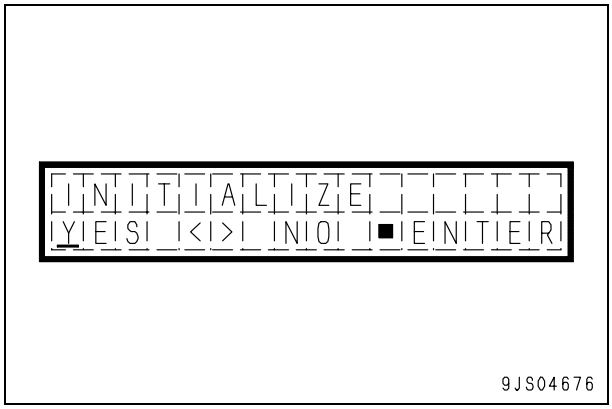
8-3. Changing set default value.
1) Press [◇] switch from the MAINTENANCE MONITOR screen of Service mode to display 01: ENG OIL screen.



2) Using [<] or [>] switch, select the INITIALIZE screen from the following table.

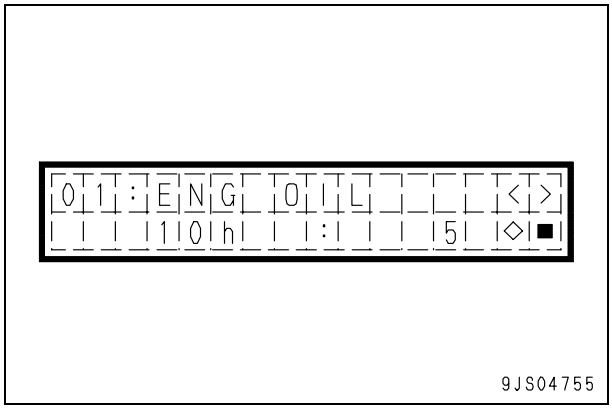


3) Press [◇] switch from this state.
4) Select "YES" or "NO" using [<] or [>] switch.
★ The selected cursor will start flashing. If "YES" is selected and [■] switch is pressed, the change will be enabled If "NO" is selected and [■] switch is pressed, the change will not be implemented and the maintenance monitoring screen will be restored.
★ By default, the cursor is set to NO (cancel) to prevent resetting error.

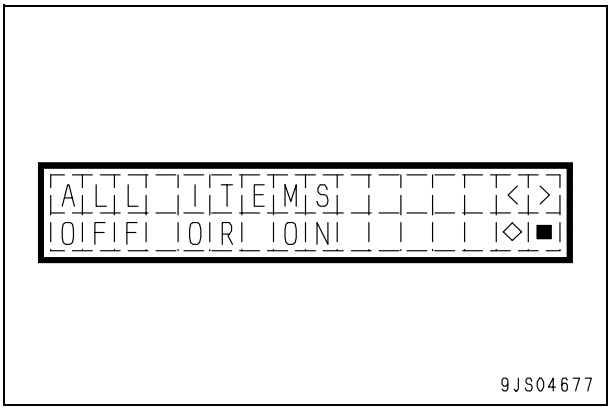


★ If the default value setting is executed, all the currently changed interval times are returned to the default values. It is executed on every item independent of whether or not the function is enabled for a specific item.
★ Timer remaining time shall be Default value – Elapsed time since the last replacement.
★ Executing the default value setting does not affect the reset frequency. Namely, it remains the same as before this operation was executed.
★ Set enable for enable or disable of individual items.

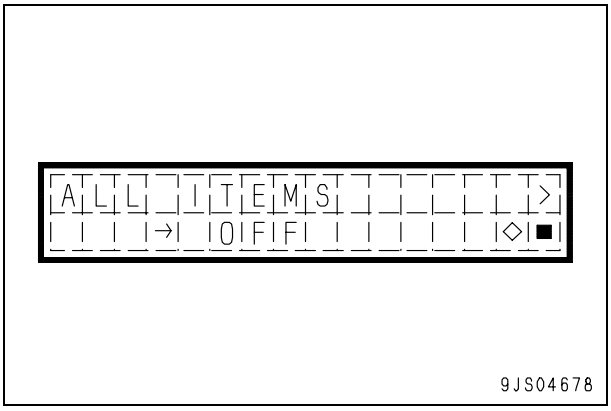
8-4. Selection between timer stop for all items and enable by item
1) Press [◇] switch from the MAINTENANCE MONITOR screen of Service mode to display 01: ENG OIL screen.



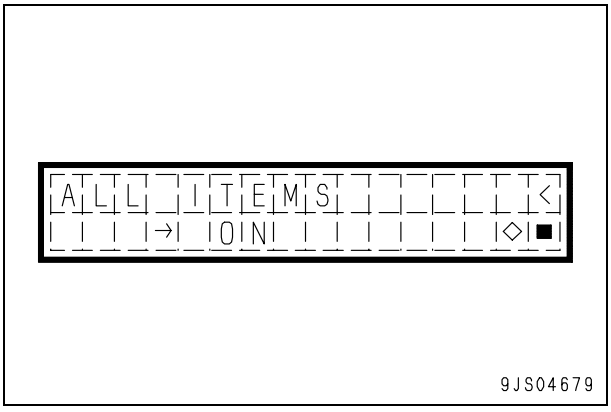
2) Using [<] or [>] switch, select the ALL ITEMS OFF OR ON screen from the following table.



3) Press [◇] switch to display the ALL ITEMS → OFF screen.

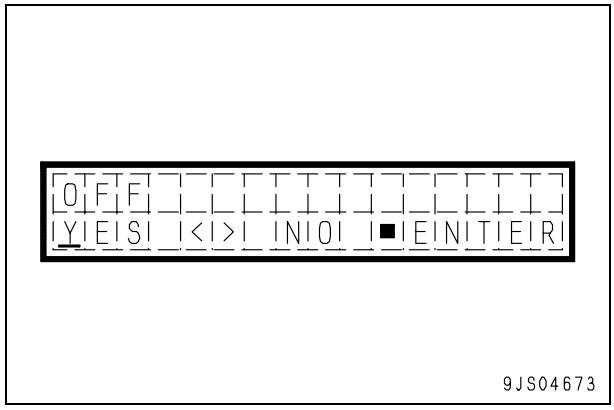


4) Press [<] or [>] switch when selecting the ALL ITEMS → ON.



5) Press [◇] switch from the ALL ITEMS → OFF screen or the ALL ITEMS → ON screen.

★ When [◇] switch is pressed from the ALL ITEMS → OFF screen, OFF will be is displayed in the upper space.

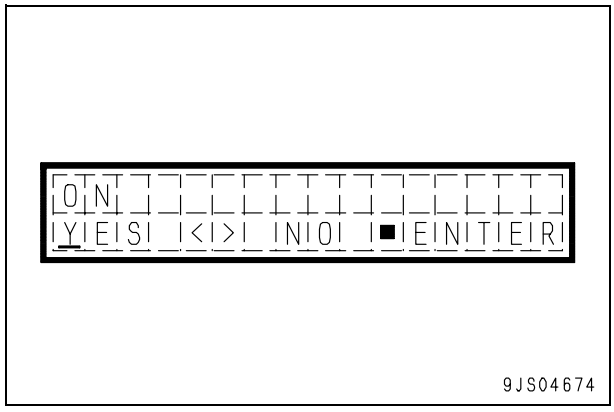


★ When [◇] switch is pressed from the ALL ITEMS → ON screen, ON will be is displayed in the upper space.

6) Select "YES" or "NO" using [<] or [>] switch.

★ The selected cursor will start flashing. If "YES" is selected and [■] switch is pressed, the information will be deleted. If "NO" is selected and [■] switch is pressed, deletion is cancelled and the maintenance interval change item screen is restored.

★ By default, the cursor is set to NO (cancel) to prevent resetting error.



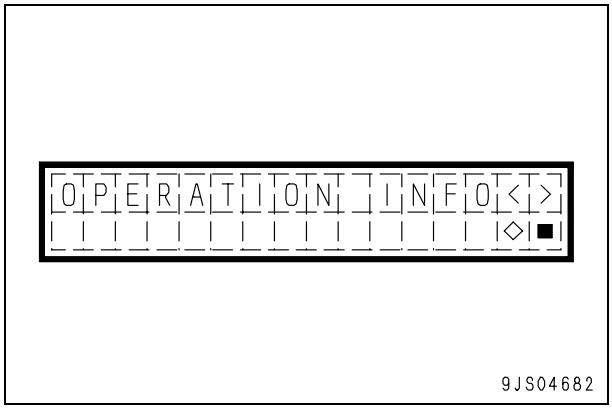
7) As the timer stop for all items is executed:
★ The timer function for all items is stopped and the MAINTENANCE MONITOR screen is restored.
★ Setting for individual items is also disabled.
★ If cancelled: The operation is cancelled and the MAINTENANCE MONITOR screen is restored.
8) When timer enable for all items is executed:
★ Interval time being set for all items is executed to the set value before disabled independent of whether or not it is enabled or disabled for a specific item.
★ The timer remaining time is reset. (The reset frequency remains the same as before the resetting.)
★ The MAINTENANCE MONITOR screen is restored.
★ Setting for individual items is also enabled.
★ If cancelled: The operation is cancelled and the MAINTENANCE MONITOR screen is restored.

9. Operating information display function

It is a fuel consumption-related function and displays the following information.

- Fuel consumption ratio and average fuel consumption
- Cumulative fuel consumption and travel distance
- Cumulative fuel consumption and elapsed time
- Loaded volume and loading frequency (This display is available only when the load meter is installed.)

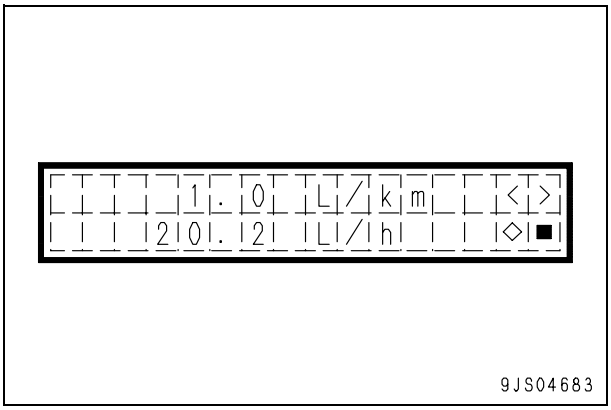
1) Selecting menu
Display the OPERATION INFO screen from the menu screen of Service mode.



2) Press [◇] switch to display the fuel consumption ratio and average fuel consumption screen.
3) Using [<] or [>] switch, select the item to be displayed from 1] – 4] on the fuel consumption ratio and average fuel consumption screen.
   1] Fuel consumption ratio and average fuel consumption screen
   ★ The upper column displays fuel consumption [L/km or L/mile] per 1 km (or 1 mile) from the last resetting.
   - Above value is computed from the fuel consumption ratio and travel distance (odometer distance).
   - The counting is stopped at 99999.9, the upper limit.

   ★ The lower column displays the average fuel consumption [L/h] from the last resetting.
   - The counting is stopped at 99999.9, the upper limit.

   ★ Calculation is done only for the duration in which the engine is run.



2] Cumulative fuel consumption and travel distance

★ The upper column displays the cumulative fuel consumption [L] from the last resetting.

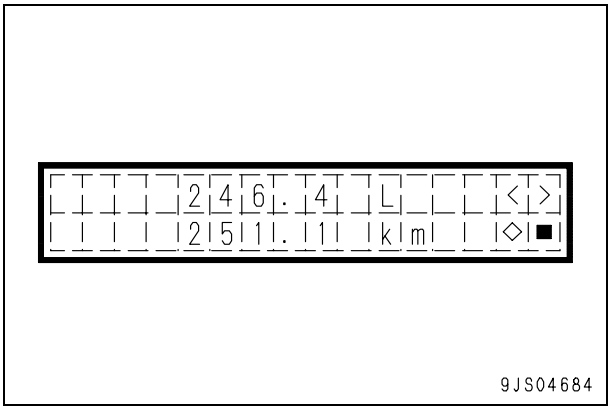
● The counting is stopped at 99999.9, the upper limit.

★ The lower column displays the travel distance [km or mile] from the last resetting.

● The unit km or mile shall be selected depending on that used on the odometer.

● The counting is stopped at 99999.9, the upper limit.

★ Calculation is done only for the duration in which the engine is run.



3] Cumulative fuel consumption and elapsed time

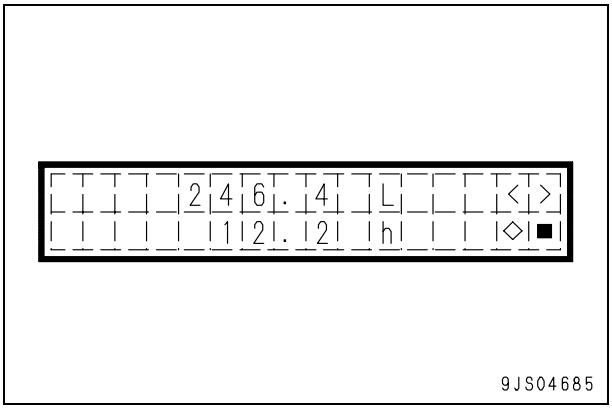
★ The upper column displays the cumulative fuel consumption [L] from the last resetting.

● The counting is stopped at 99999.9, the upper limit.

★ The lower column displays the elapsed time [h] from the last resetting.

● The counting is stopped at 99999.9, the upper limit.

★ Calculation is done only for the duration in which the engine is run.



4] Loaded volume and loading frequency screen

★ The upper column displays the loaded volume [ton] from the last resetting.

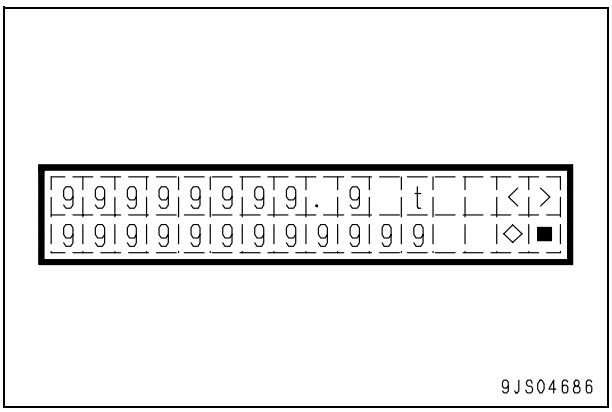
● Upper limit: Counting is stopped at 199999999.9 or 999999999.9.

● Short ton or metric ton depends on optional setting.

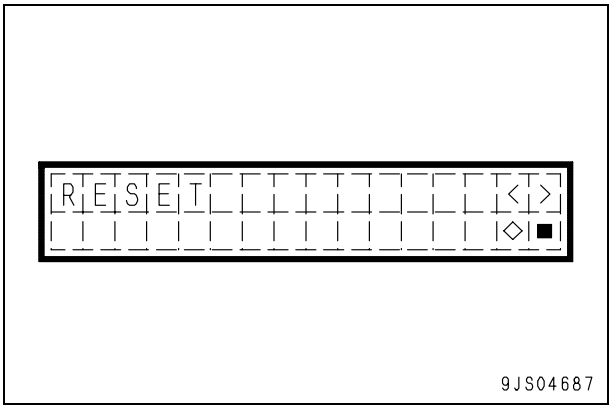
★ The lower column displays the loading frequency from the last resetting.

● Upper limit: Counting starts stopped at 65000 or 99999999999.

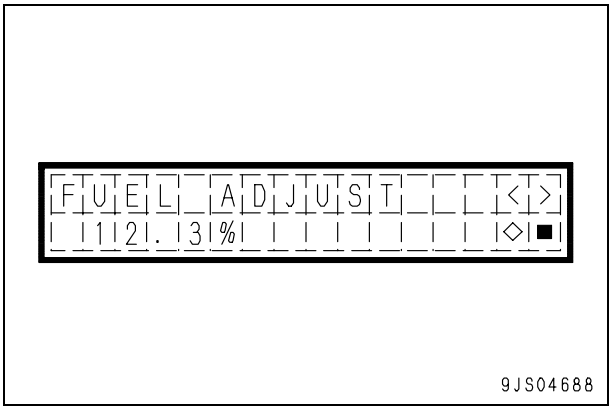
★ Calculation is done only for the duration in which the engine is run and the optional device is used.



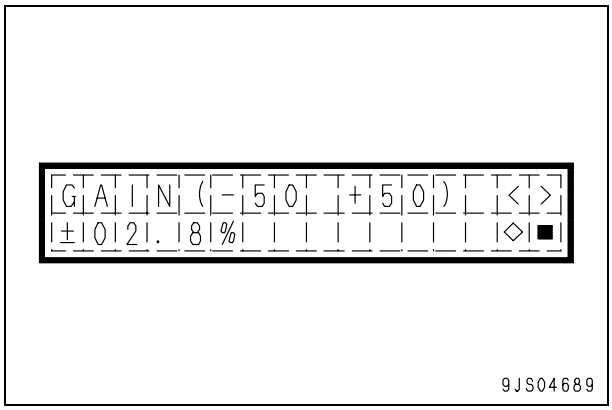
4) Deleting display data
★ Data on screens 5) – 8) allow deletion.
★ Select a desired item and then delete it using [◇] switch.
★ Use [■] switch when canceling deletion of data.



5) Setting gain correction
★ Gain correction denotes the function of correcting cumulative fuel consumption.
★ Gain correction is available only from the fuel consumption ratio and average fuel consumption screen.
1] After deleting data (RESET screen), press [<] or [>] switch to display the current set value.



2] Pressing [◇] switch displays the correction screen.
★ Default value: 0.0%
★ This setting allows correcting the cumulative fuel consumption in the range of –50.0 to +50.0.
3] Move the cursor to [+] or [–].
4] Pressing [<] or [>] switch alternately displays [+] and [–].
5] Press [◇] switch to settle [+] or [–].
★ The cursor moves to the highest-order digit of the set value.
6] Pressing [<] or [>] switch changes the value of this digit in the range of 0 – 9.
7] Press [◇] switch when the intended value appeared to specify it as the set value.
★ The cursor moves to the 2nd digit.
8] Set the values up to the lowest digit in the same order as above and then press [◇] switch to settle.
★ As the selection is settled, the preceding screen is restored.
★ If [■] switch is pressed before finishing entering, the cursor moves to the [+] and [–] position. In this case, the value remains unchanged. Pressing [■] switch again restores the preceding screen.
★ If the value is not in the –50 – +50 range, pressing [◇] switch at the lowest digit just moves the cursor the [+] and [–] position and the value remains as it is.



10. Manual snapshot function

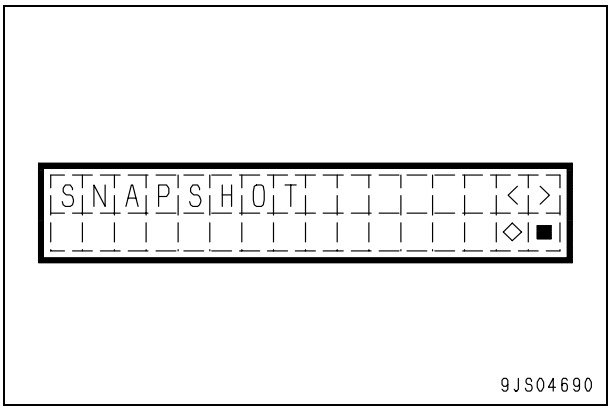
★ The manual snapshot function stores 7 minutes and 30 seconds worth data to be used for Pm clinic or testing/adjustment to VHMS controller.

★ When collecting data at a regular interval for Pm clinic, it is required to observe the machine operating procedure specified for the quick Pm. As for the data collection for the testing or adjustment purpose, however, no specified machine operating procedure is stipulated.

★ When using the data being stored with the manual snapshot function, a PC must be connected. For the connecting as well as operating procedure, refer to VHMS controller initial setting procedure. (Connection of a PC may be done before or after the snapshot.)

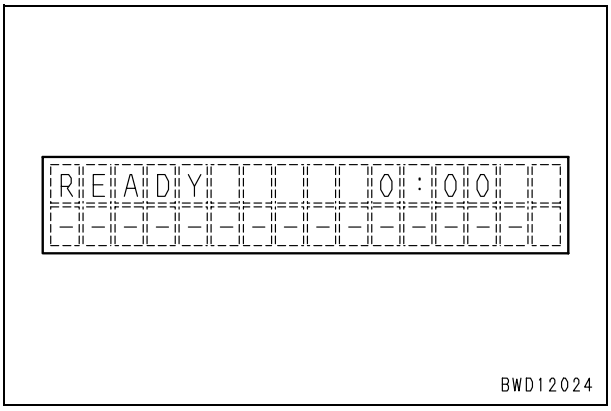
★ For detail of operation of the snapshot function, see the Quick Pm implementation procedure.

1) Display the SNAPSHOT screen from the menu screen of Service mode.



2) Pressing [◇] switch to turn on the ready (READY) screen.

★ The lower column displays 15 pieces of [–] sign.



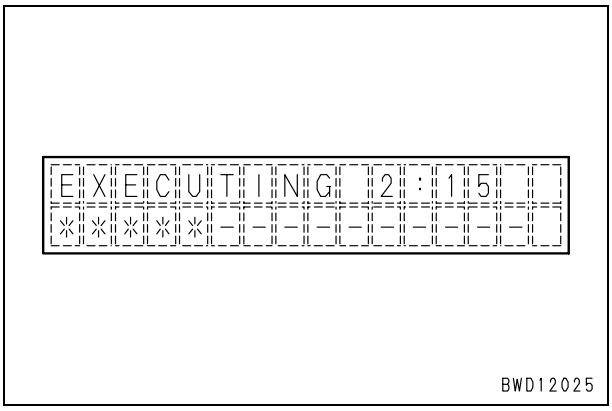
3) Press [◇] switch to start the snapshot.

★ The upper column displays the elapsed time.

★ [–] sign in the leftmost position of the lower column is replaced with [*] and it starts flashing.

★ For every 30 seconds, [–] is replaced with [*] starting with the leftmost one. When two or more [*] signs are displayed, the rightmost one flashes.

★ Pressing [■] switch while the snapshot is taking place stops the snapshot.

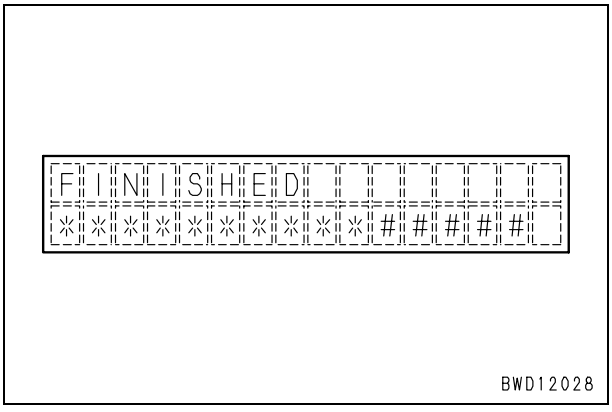


4) Refer to the Pm clinic implementation procedure for the machine operation.

★ After 10th [*] is displayed (5 minutes elapsed from the start), [#] will be displayed for 11th through 15th positions.

- *: Indicates the data sampling interval is once every 10 seconds.
- #: Data sampling interval is once every 1 second.

5) As 7 minutes and 30 seconds elapsed from start of the snapshot, following screen appears and then the initial screen is restored in 5 seconds later.
(End of snapshot)



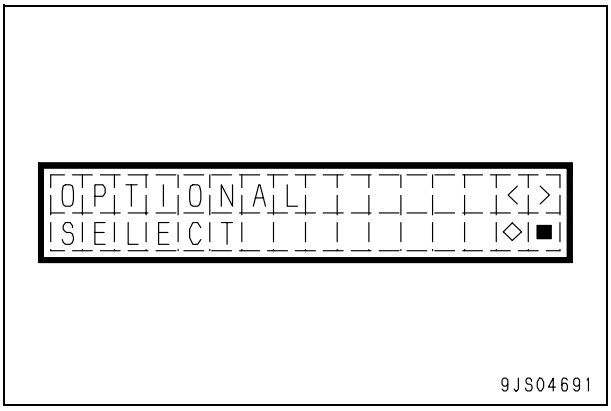
11. Optional device selecting function

★ When enabling optional setting, turn the starting switch off once after changing the current setting and then turn on the starting switch again after respective in-vehicle controller power supplies have been completely turned off (it takes approximately 15 seconds).

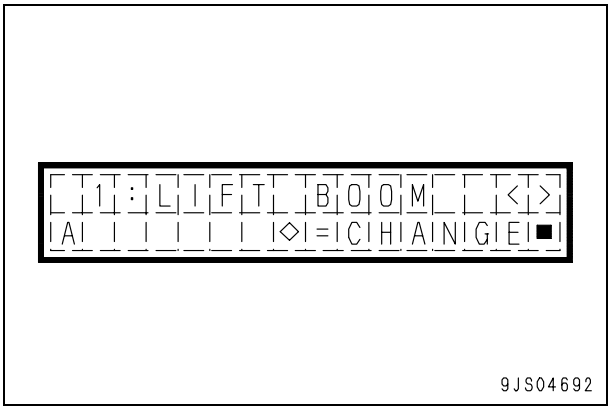
★ List of installed optional devices and their setting

Item	Display in English	Item No.	Default	Description of selection
Lift arm model	LIFT BOOM	1	STD	When Hi LIFT SHORT lift arm is installed, the setting applicable to each shall be implemented.
Auto grease	AUTO GREASE	2	None	When an option is provided, select ADD.
Low battery electrolyte sensor	BAT LIQUID	3	None	When an option is provided, select ADD.
Transmission clogging sensor	TRANSM CLOG	4	None	When an option is provided, select ADD.
Printer	PRINTER	5	None	When an option is provided, select ADD.
Tire size	TIRE SIZE	6	0	Normally, 0% shall be maintained without modifying current setting.
Selecting weight unit	SHORT TON	7	None	Factory-setting is done through special operation. Thus, setting change not available.
Travel speed unit	SPEED (UNIT)	8	MPH	Factory-setting is done through special operation. Thus, setting change not available.
Engine speed or travel speed display on character display and normal screen	RPM/ SPEED	10	Provided	Normally, ADD shall be maintained without modifying current setting.
Load meter	LOAD METER	11	None	When an option is provided, select ADD.
Emergency steering	EMERG S/T	13	Provided	When an option is not provided, select NO ADD.
Joystick steering or right FNR switch or both are absent	J/S-FNR SW	14	NON	This item does not function on WA600-6. No change allowed
Selecting ECO lamp display	ECO LAMP		Provided	Normally, ADD shall be maintained without modifying current setting.
ECSS	E.C.S.S.	20	None	When an option is provided, select ADD.
Automatic reversing fan	AUTO RE FAN	21	None	This item does not function on WA600-6. No change allowed
Torque converter lockup	LOCK UP	22	None	Select ADD.
No 4th	FORBID 4TH	23	None	Normally, ADD shall be maintained without modifying current setting.
Setting RPM	THROT LOCK	24	None	When an option is provided, select ADD.
Power mode priority	P-MODE PRI	25	None	When an option is provided, select ADD. (Setting available: Power mode is introduced as starting switch is turned on)
Very cold region specification	COLD SPEC	26	None	This item does not function. No change allowed
AJSS	AJSS STG	30	None	When an option is provided, select ADD. This item does not function on WA500-6. No change allowed
EPC 3-lever	EPC 3RD	31	None	When an option is provided, select ADD.
VHMS controller	VHMS	40	Provided	When an option is provided, select ADD. This item does not function on WA500-6. No change allowed

1) Display the OPTIONAL SELECT screen from the menu screen of Service mode.



2) Hold down [◇] switch for 5 seconds or longer.
3) The 1: LIFT BOOM screen will appear.

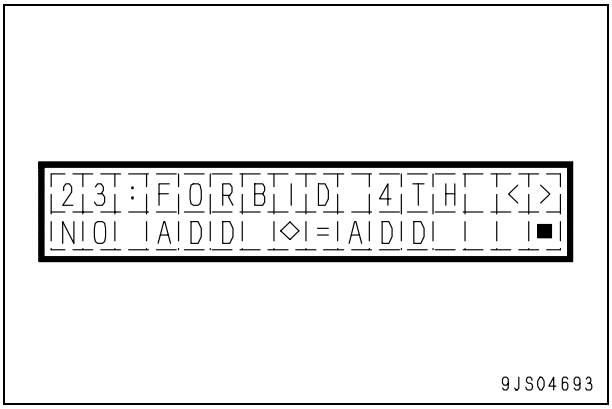


4) Using [<] or [>] switch, select a desired optional device from the list of installed options and their setting.
5) Modify contents of the option setting using [◇] switch.
6) Press [■] switch to return to the OPTIONAL SELECT screen.

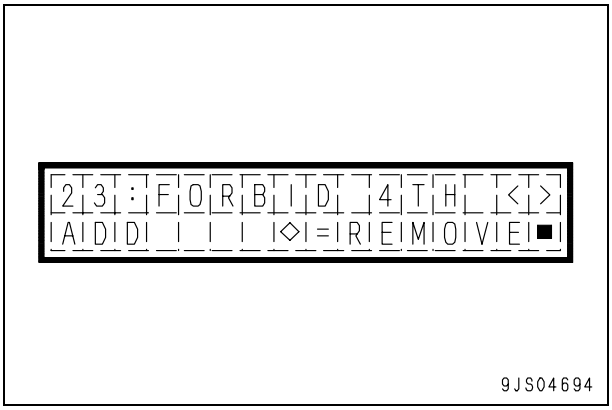
11-1. Changing lift arm model option selection
- ★ Pressing [◇] switch from the 1: LIFT BOOM screen interchanges A and B.
- ★ As A and B are interchanged, the sound (beep) indicating acceptance of the operation will be generated.
- ★ Select the lift arm length for A and B from the following.

Machine model	A	B
WA600-6	3850 mm	3990 mm
WA500-6	3250 mm	3636 mm

11-2. Option setting/not setting selection
- ★ Among the items included in the list of installed optional devices and their setting, the option setting/not setting selection applies to the following items.
- ★ If the options are not selected, the option non-selection screen is displayed.



- ★ If the options are selected, the option elected screen is displayed.



- ★ [◇] switch allows alternately displaying the option non-selection screen and the option-selected screen.

11-3. Setting tire deflection option

★ Select the tire deflection option from the list of installed optional devices and their setting.

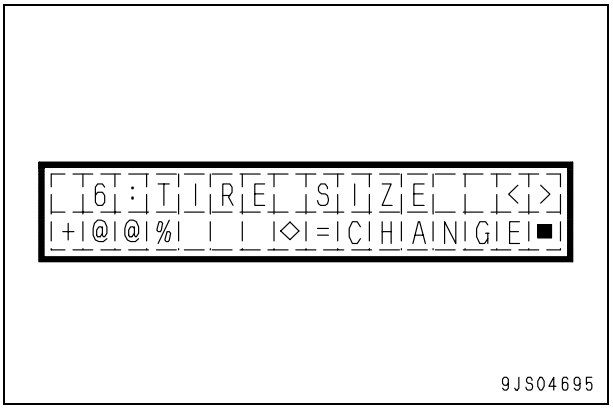
★ Pressing [◇] switch sequentially displays [@@]% in the following order.

★ The display progresses from +00 through –10. Pressing [◇] switch at this point returns the display to +00.

Order	No.1	No.2	No.3	No.4	No.5	No.6	No.7
@@	+00	+02	+04	+06	+08	+10	+12

Order	No.8	No.9	No.10	No.11	No.12	No.13	No.14
@@	–02	–4	–6	–8	–10	–12	+00

★ As the display is switched, the sound (beep) indicating acceptance of the operation will be generated.



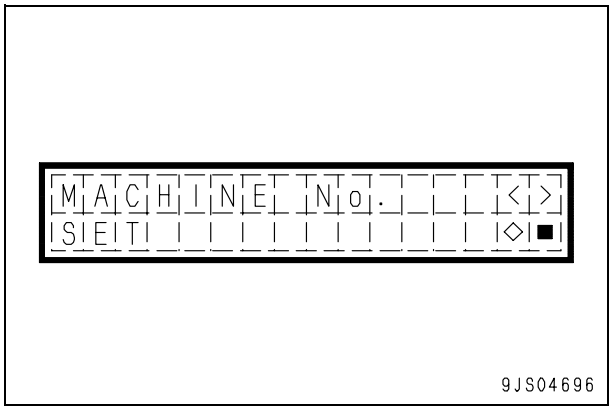
11-4. Storing option selection

1) When the option selection was changed, turn off the starting switch once to stop the controller operation completely.(After turning off the starting switch, wait for 5 seconds without doing any switch operation.)
2) The specified option selection is enabled as the starting switch is turned on.

★ Whenever an option selection is made, turn off the starting switch once and then turn it on again in approximately 15 seconds.

12. Machine serial number input function

1) Display the MACHINE No. SET screen from the menu screen of Service mode.



2) Press [◇] switch to display the MACHINE No. screen.
3) Enter the serial number according to the following procedure.

★ The cursor is positioned at the highest-order digit.

1] Pressing [<] or [>] switch increases or decreases the value at the cursor position. Select a desired value using these switches.

2] Press [◇] switch to settle the selection.

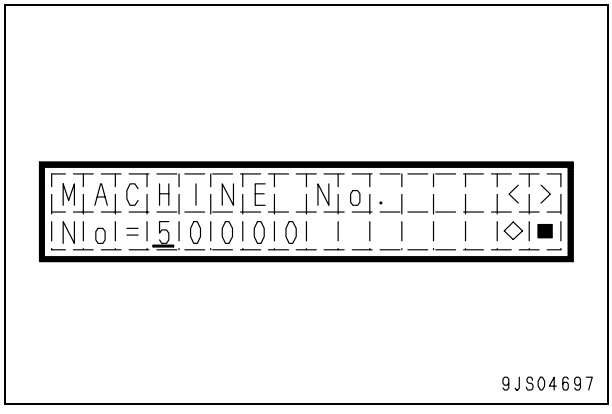
★ The cursor moves to the digit situated immediately on the right hand.

3] Set the values up to the lowest digit in the same order as above and then press [◇] switch to settle.

★ As the selection is settled, the immediately preceding screen is restored.

★ Pressing [■] switch while entry is taking place will move the cursor the highest-order digit. In this case, repeat entry from the highest-order digit.

★ If [■] switch is pressed while the cursor is at the highest-order digit, the immediately preceding screen will be restored.

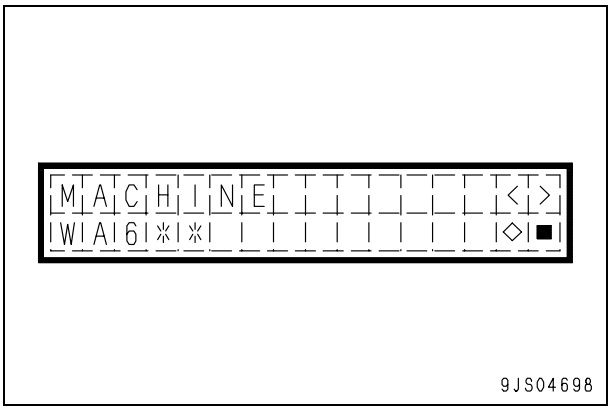


13. Model selection function

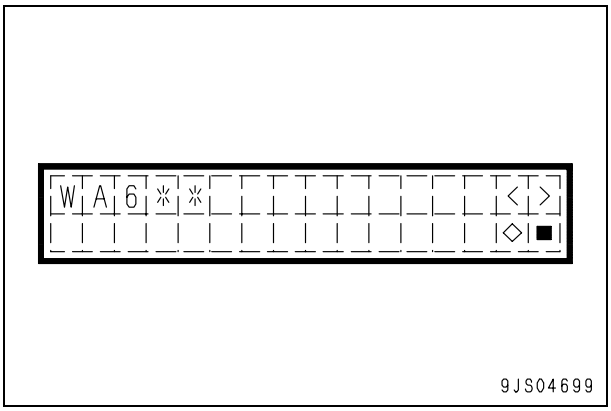
When the Service mode is turned on, check the models registered to the machine monitor. If the selected model was found in the machines installed to the machine monitor, there is no need of changing the model even though the model changing function is available.

13-1. Implementing the model change

1) Display the MACHINE screen from the menu screen of Service mode.
★ If WA600-6 is selected, WA6** will be displayed on the screen.
★ In the case of WA500-6, the display will be WA5**.



2) Hold down [◇] switch for 5 seconds to display the model selection screen.



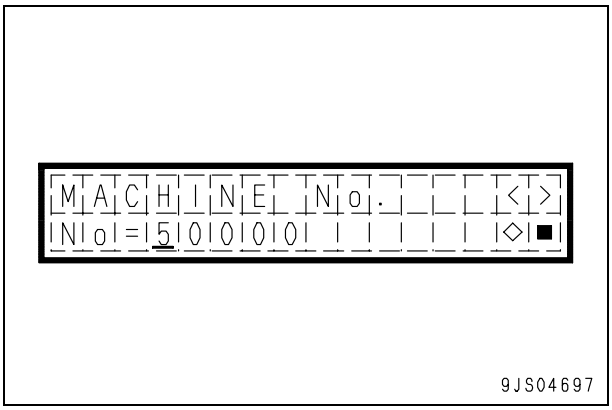
3) Using [<] or [>], replace WA5** with WA6**.
★ Press [■] switch when stopping the model selection.
★ As the operation is stopped, the sound (beep) indicating acceptance of the operation will be generated, restoring the MACHINE screen.
4) Settle the selected model by use of [◇] switch.
★ As the selection is settled, the sound (beep) indicating acceptance of the operation will be generated, restoring the MACHINE screen.
★ Make sure the model on the MACHINE screen is the target model.

13-2. Storing model change

1) When the model change was done, turn off the starting switch once to stop the controller operation completely. (After turning off the starting switch, wait for 5 seconds without doing any switch operation.)
2) The model being selected as the starting switch is turned on is validated.
★ Whenever a model change was done, turn off the starting switch once and then turn it on again in approximately 15 seconds.

14. Initialize function

This function is used only in the factory. It is, therefore, not used for a service purpose.



VHMS controller initial setting procedure

★ Equipment used for VHMS controller initial setting

Symbol		Part No.	Part name
ZB	1	799-608-3101	Service kit
		799-608-3210	• Diskette
		799-608-3220	• Wiring harness
	2	Commercially available	Note type PC (Windows 98/2000/Me/XP)

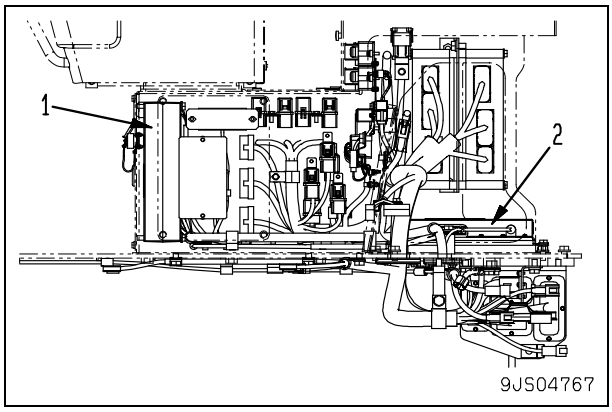
★ Initial setting of VHMS controller shall be done according to the following procedure. This operation is needed prior to a full-scale operation of a machine being delivered and assembled in the field, or prior to resumption of its operation after a long time of storage.
★ Machine data collected with VHMS controller are stored and managed on WebCARE database. In order to endure smooth data processing on WebCARE, consistency must be provided among the settings done on VHMS controller. Inconsistencies in the settings obstruct loading of data to WebCARE, hampering appropriate use of VHMS data. The initial setting, therefore, is a must.
★ For the installation procedure of the VHMS initial setting program to a PC, refer to the operation and maintenance manual being bundled with the service kit **ZB1**.
★ In the procedure, service menus of the monitor panel are used. Thus, it is advisable to reference the information contained in the "Special functions of monitor panel" to understand their procedure beforehand.
★ The initial setting procedure is described in the ORBCOMM installation specification and the ORBCOMM-less specification. When using the ORBCOMM installation specification, implement the procedures needed for VHMS alone, bypassing those prepared only for ORBCOMM installation specification.
★ Check each step of the setting work referencing the VHMS initial setting work check sheet.
★ Information such as models shown in the figures may not be identical with actual ones.

1. Confirmation of machine information, engine information, transmission controller information and controller information

★ This confirmation procedure is targeted at the entire machine.
Confirm and record the machine information, engine information, VHMS controller information and ORBCOMM terminal information.

No.	Information to be confirmed
1	Model name
2	Machine serial No.
3	Current service meter hour
4	Engine serial No.
5	Transmission serial No.
6	VHMS controller serial No.
7	ORBCOMM terminal serial No. [Only for machines equipped with ORBCOMM]

★ VHMS controller (1) and ORBCOMM terminal (2) are installed in the right side stand of the operator seat.



2. Connecting a PC

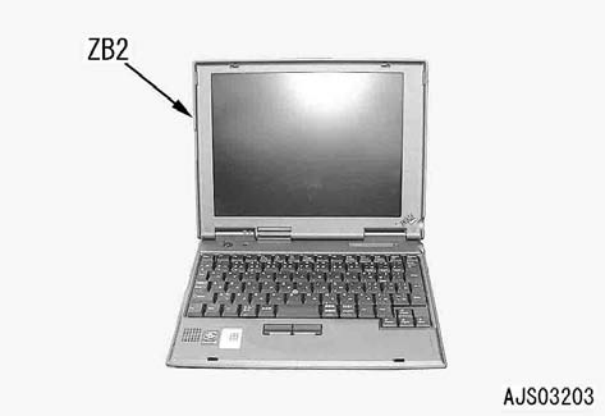
★ This work is done inside the cab.

1) Make sure the starting switch is at OFF position.

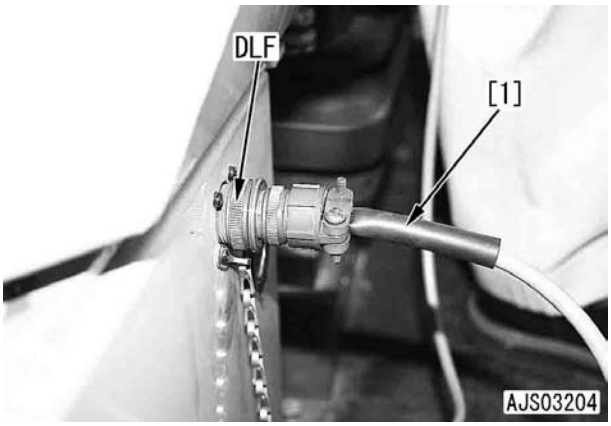
⚠ **Before connecting or disconnecting a PC, be sure to turn off the starting switch.**

2) Using harness [1] of service kit **ZB1**, connect the PC **ZB2** and download connector **DLF**.

★ Then connect the PC to RS232C terminal.



★ Download connector **DLF** is installed in the front side of the right stand of operator seat.



3. Confirming VHMS controller operation and confirming satellite capturing state

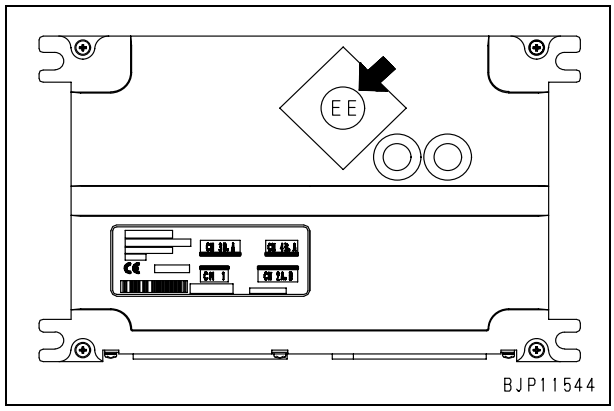
★ This work is done inside the cab.

★ Confirmation of capturing of the satellite is done for [ORBCOMM installation specification].

1) Turn the starting switch ON.

2) Check the controller for normal operation referencing 7-segment LED of VHMS controller.

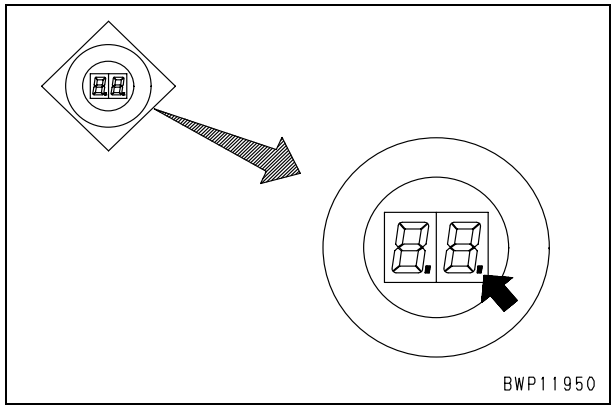
★ VHMS controller is fed with switch power supply. Thus, its operation is judged normal if its 7-segment LED starts flashing while rotating as the starting switch is turned on and then if the controller starts counting in the ascending order.



3) Among the 7-segment LED situated in the right side of VHMS controller, refer to the one that represents the decimal point to check whether or not ORBCOMM controller has captured the communication satellite. [ORBCOMM installation specification]

★ Check whether or not ORBCOMM controller is capturing the communication satellite from VHMS controller.

★ It is successfully capturing the satellite when the LED representing the decimal point in the right side 7-segment LED is flashing.



4. Starting the VHMS initial setting tool

★ This work is done inside the cab (from PC).

1) Turn on the PC power and start the OS.
2) Operating [VHMS initial setting tool] icon on the PC, start up the VHMS initial setting tool.

Important

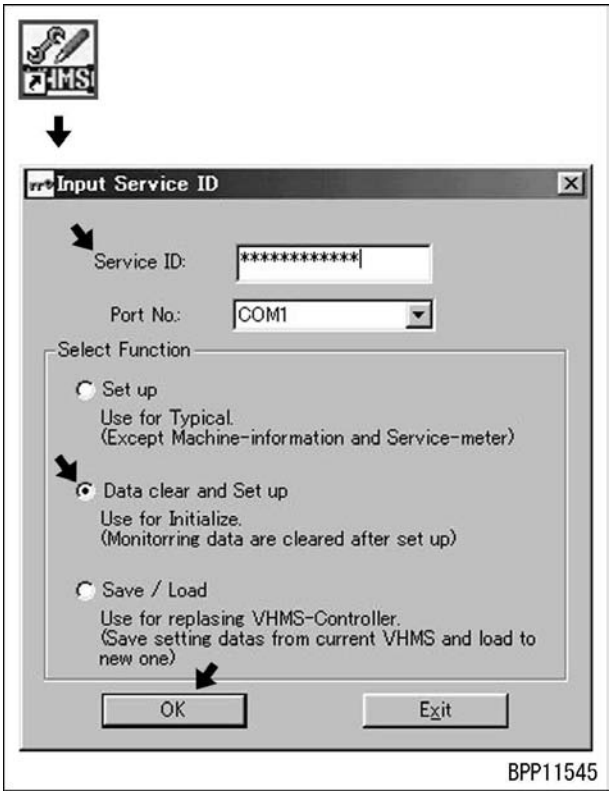
★ Appearance of the setup screen of the VHMS setting tool depends its tool.

★ When using Ver.3.5.2.1 or older version (CD-ROM), the setting procedure shall conform to that described in Section 5.

★ When using an update version (Ver.3.5.2.1 or after), the procedure in Section 6 shall be used.

★ It is recommended to download the latest VHMS version from WebCARE to update the currently used version. (Related material: PARTS & SERVICE OPERATION TIPS SEKN-5052)

3) Enter the 10-digit service ID to [Service ID].
   ★ Service ID: **7826119000**
4) Select [Data clear and Set up] from [Select Function] item.
5) Click [OK] button to proceed to the setup screen.



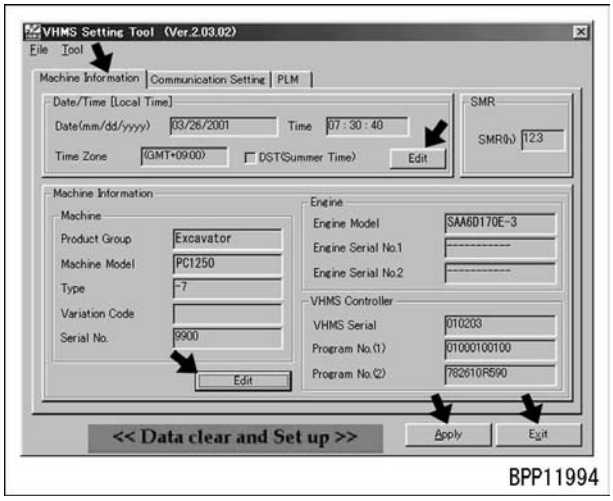
5. Initial setting of VHMS controller (Ver. 3. 5. 2. 1 or older version)

★ This work is done inside the cab (from PC).

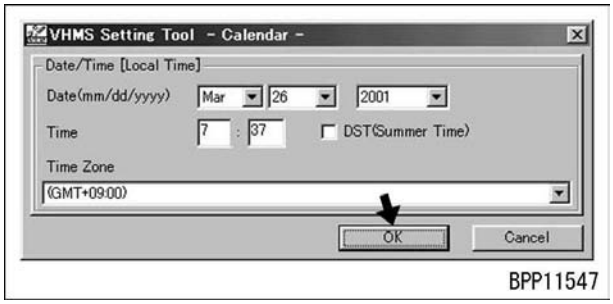
★ It is prohibited in the initial setting to modify the data of service meter [SMR].

[Machine Information]

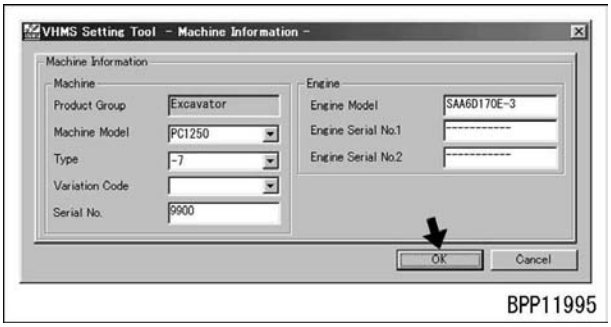
1) Open [Machine Information] tab.
   ★ [Data clear and Set up] menu displays [Machine Information] tab first.
2) Check every data for correctness.



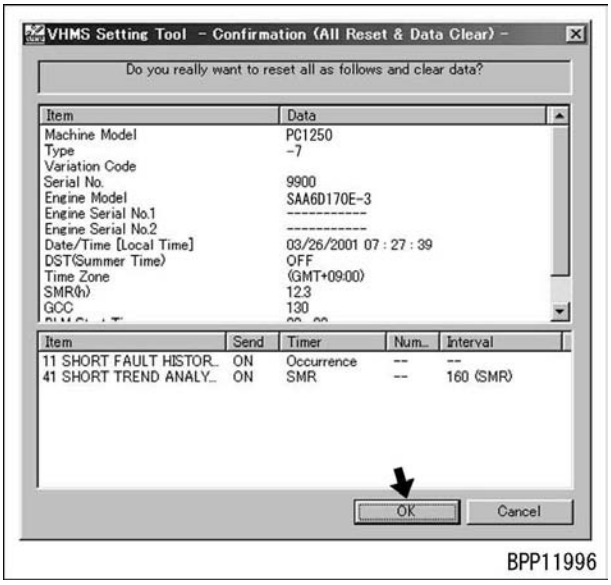
3) When [Date/Time] information is not appropriate, correct it in the following manner.
   1] Press [Edit] button in the lower right side of [Date/Time] box to display the correction screen.
   2] After correcting it to the correct information, press [OK] button.



4) When [Machine Information] information is not appropriate, correct it in the following manner.
   1] Press [Edit] button in the lower right side of [Machine Information] dialog box to display the correction screen.
   2] After correcting it to the correct information, press [OK] button.

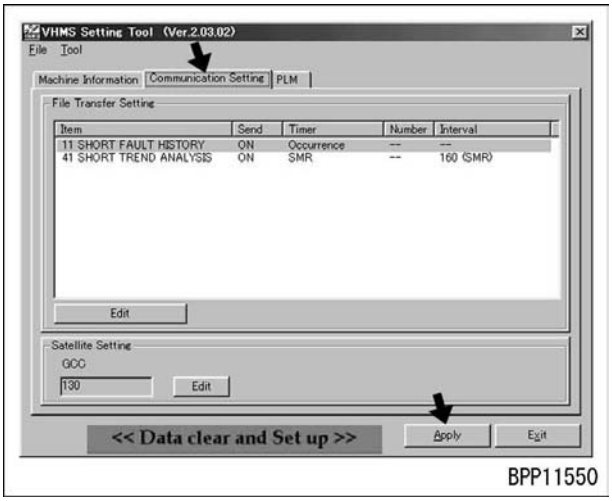


5) As every data in [Machine Information] has been checked and corrected, press [Apply] button to settle the setting.
   ★ As [Apply] button is pressed, a message confirming above setting will appear on the screen. Check the setting again and, if the setting is correct, press [OK] button.
   ★ ORBCOMM installation specification requires the settlement operation after [Communication Setting] is completed.

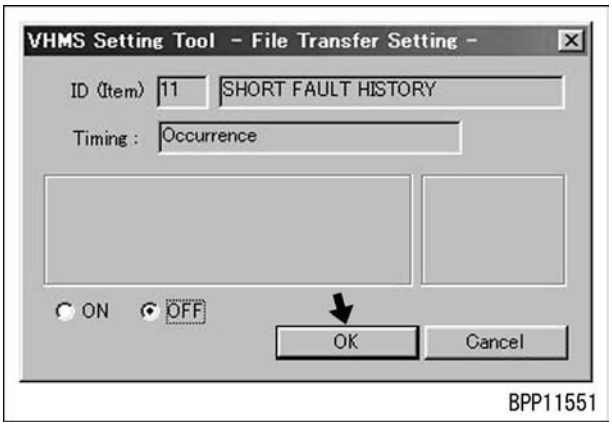


[Communication Setting] [ORBCOMM installation specification only]

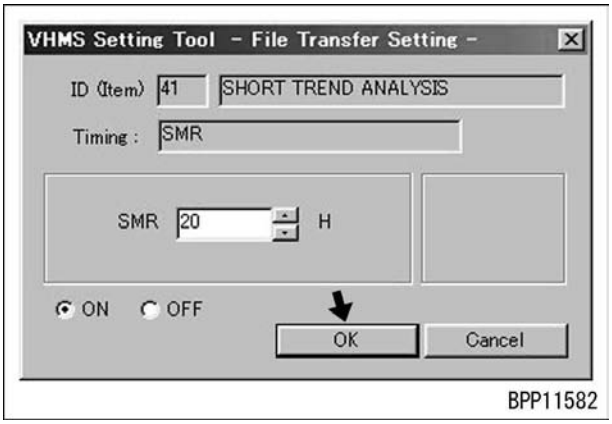
★ This setting shall be implemented after the request for station opening has been made and station of ORBCOMM has been opened.
   6) Open [Communication Setting] tab.
   7) Check every data for correctness.



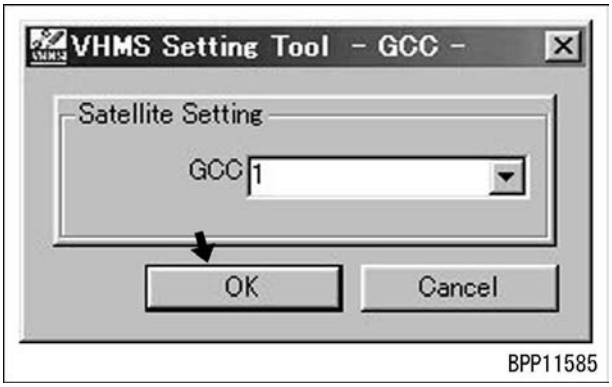
8) When modifying the setting of [SHORT FAULT HISTORY], employ the following procedure.
   1] Select [SHORT FAULT HISTORY] from the screen and then press [Edit] button in the lower left side of [File Transfer Setting] block to display the setup screen.
   2] Correct the setting and, as it is completed, press [OK] button.
      ★ In the initial setting, select [Occurrence] from [Timing] item and then set the function to ON.



9) When modifying the setting of [SHORT TREND ANALYSIS], employ the following procedure.
   1] Select [SHORT TREND ANALYSIS] from the screen and then press [Edit] button in the lower left side of [File Transfer Setting] block to display the setup screen.
   2] Correct the setting and, as it is completed, press [OK] button.
      ★ In the initial setting, enter [20h] to [SMR] and then set the function to ON.

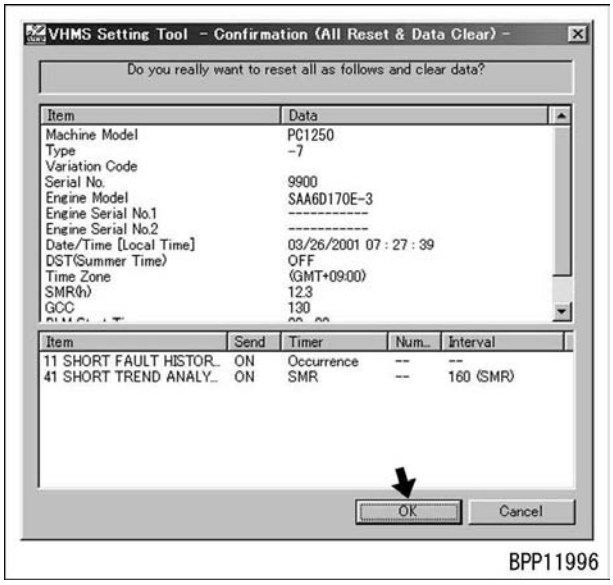


10) When modifying the setting of [Satellite Setting], employ the following procedure.
   1] Press [Edit] button in the [Satellite Setting] block to display the correction screen.
   2] Set the GCC code to the region applied and, as setting is completed, press [OK] button.

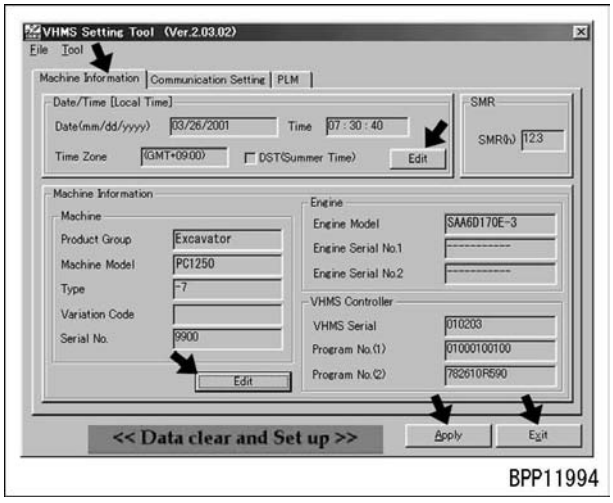


GCC codes and applicable regions			
Code	Applicable region	Code	Applicable region
1	America	122	Korea
120	Italy	123	Brazil
121	Malaysia	130	Japan

11) As every data in [Communication Setting] has been checked and corrected, press [Apply] button to settle the setting.
   ★ As [Apply] button is pressed, a message confirming above setting will appear on the screen. Check the setting again and, if the setting is correct, press [OK] button.



12) As every data in [Machine Information] and [Communication Setting] has been checked and corrected, press [Exit] button to end [VHMS initial setting tool].

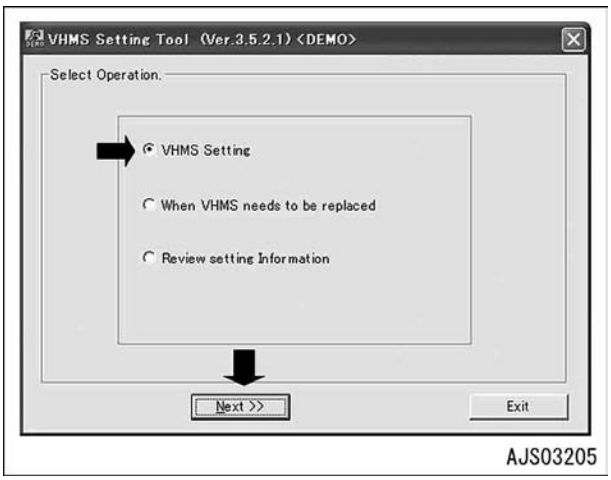


6. Initial setting of VHMS controller (Ver. 3. 5. 2. 1 or later version)

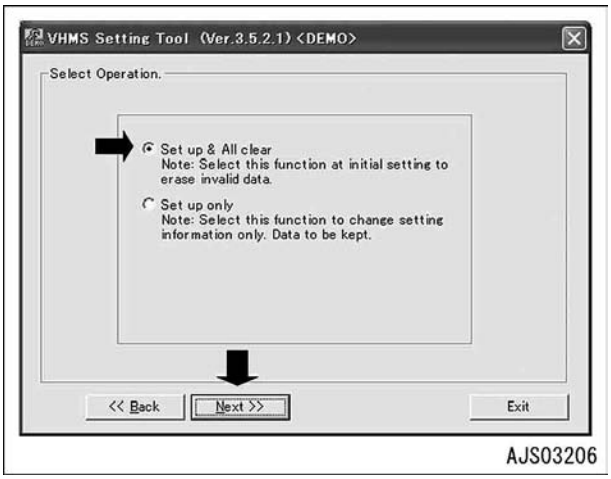
★ This work is done inside the cab (from PC).

★ It is prohibited in the initial setting to modify the data of service meter [SMR].

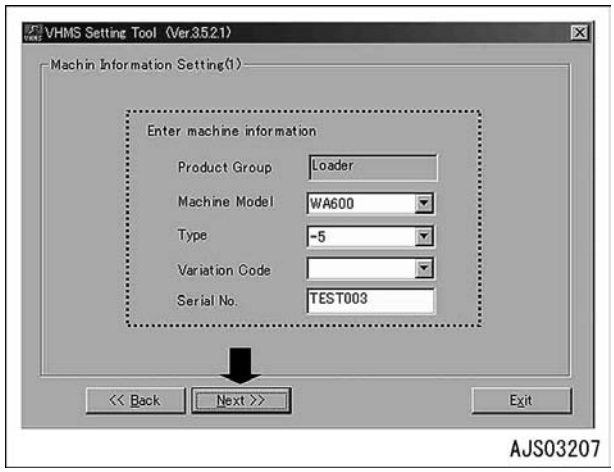
1) Select [VHMS Setting] and then press [Next] button.



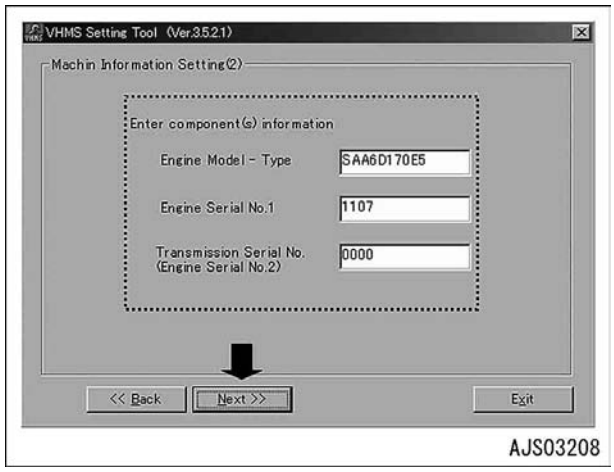
2) Select [Set up & All clear] and press [Next] button.



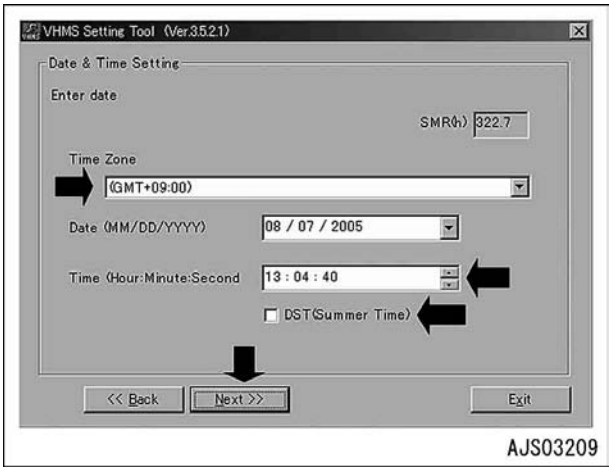
3) Confirm the machine information and, if they are correct, press [Next] button.



★ When VHMS has been installed later, it is required to enter the information such as [Serial No.].

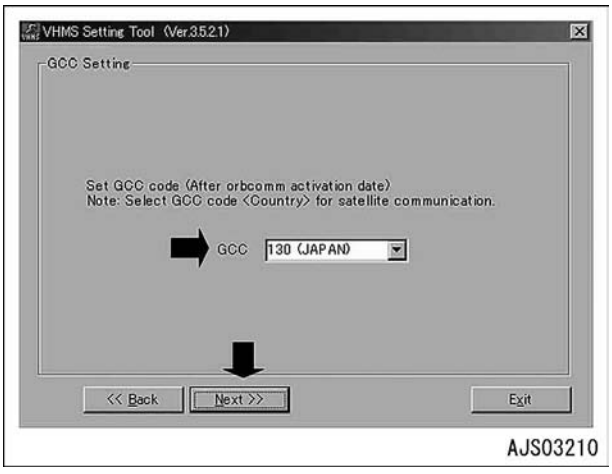


4) Select the time zone.
5) Enter the local time.
6) When DST (Daylight Saving Time) (or summer time) is currently used, press [Next] button.
   ★ Selecting DST advances the clock by an hour. Thus, correction of the time is needed again.

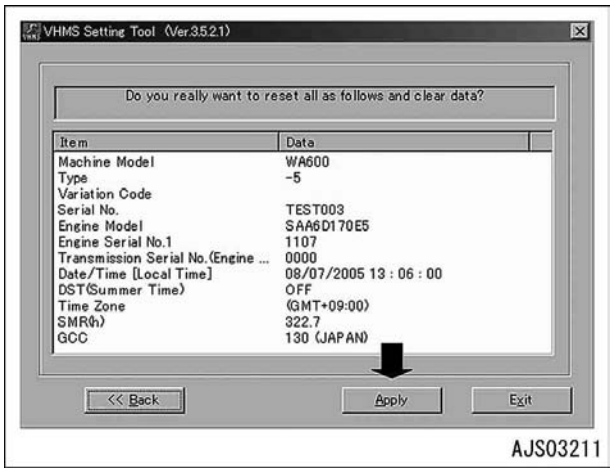


7) Set the GCC code to the target region of application and, as setting is completed, press [Next] button.

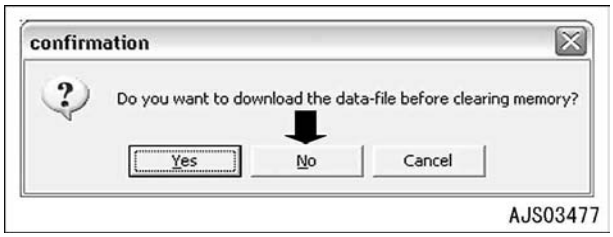
GCC codes and applicable regions			
Code	Applicable region	Code	Applicable region
1	America	122	Korea
120	Italy	123	Brazil
121	Malaysia	130	Japan



8) If there is no problem in the setting displayed last, press [Apply] button.



9) A screen message will confirm whether or not the data before the setting is to be saved. If the data is not necessary, select [NO].





10) As correction of the first setting is completed, press [OK] button to end the program.



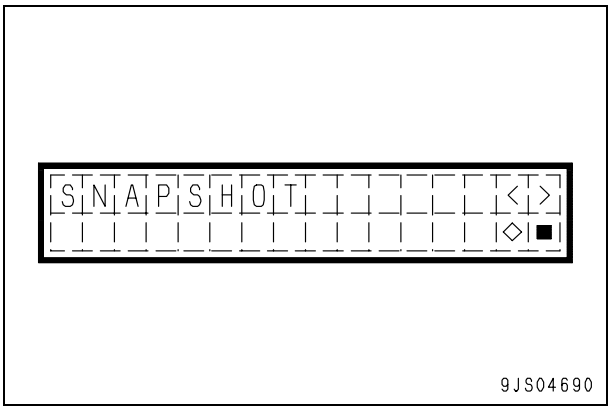
7. Executing quick Pm

★ Quick Pm denotes the Pm click done by use of the manual snapshot function of the machine monitor.

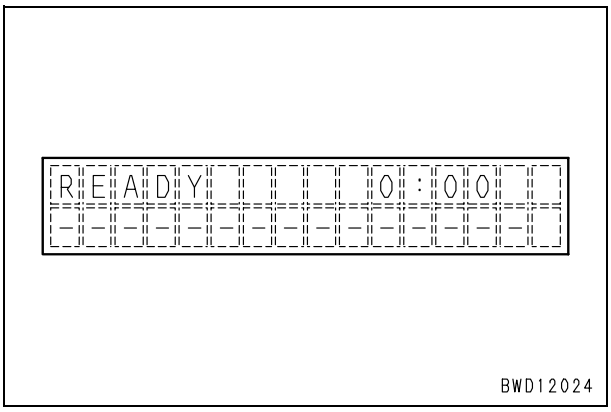
★ It stores 7 minutes and 30 seconds worth of data to VHMS controller.

⚠ **Park the machine in a flat place.**

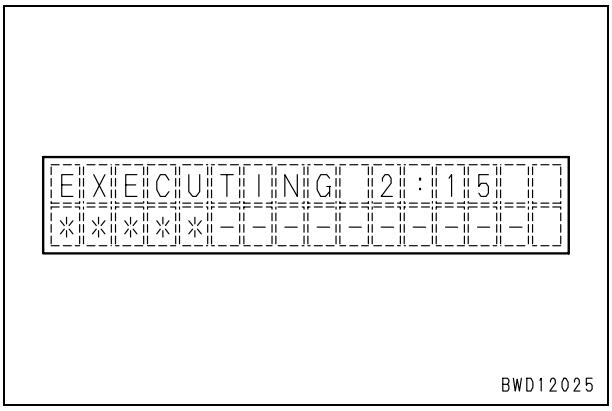
1) Start the engine.
2) Switch the machine monitor to Service menu.
   ★ For the procedure of opening Service menu, see "Special functions of machine monitor".
3) Display the manual snapshot function screen from the menu screen of Service mode.



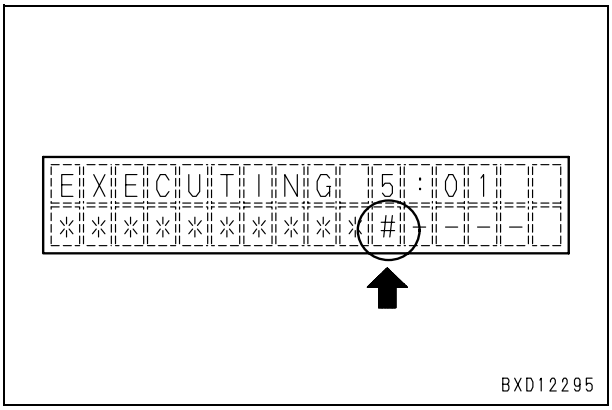
4) Press the buzzer cancel switch [◇].
5) [READY] will be displayed on the screen, turning on the standby mode.
   ★ The lower column displays 15 pieces of [–] sign.



6) Press the buzzer cancel switch [◇] to start the snapshot.
   ★ As the snapshot is started, the upper column starts displaying the elapsed time.
   ★ [–] in the leftmost position of the lower column is replaced with [*] for every 30 seconds. When 2 or more [*] signs are displayed, the rightmost one flashes.
   ★ When stopping the snapshot currently taking place, press the buzzer cancel switch [■].



7) After the snapshot is started, operate the machine according to the following table.
   ★ Make sure the engine coolant temperature and torque converter oil temperature are within the operating range.
   ★ After 10th [*] is displayed (5 minutes elapsed from the start), [#] will be displayed for 11th through 15th positions.
   - *: Indicates the data sampling interval is once every 10 seconds.
   - #: Indicates the data sampling interval is once every 1 second.

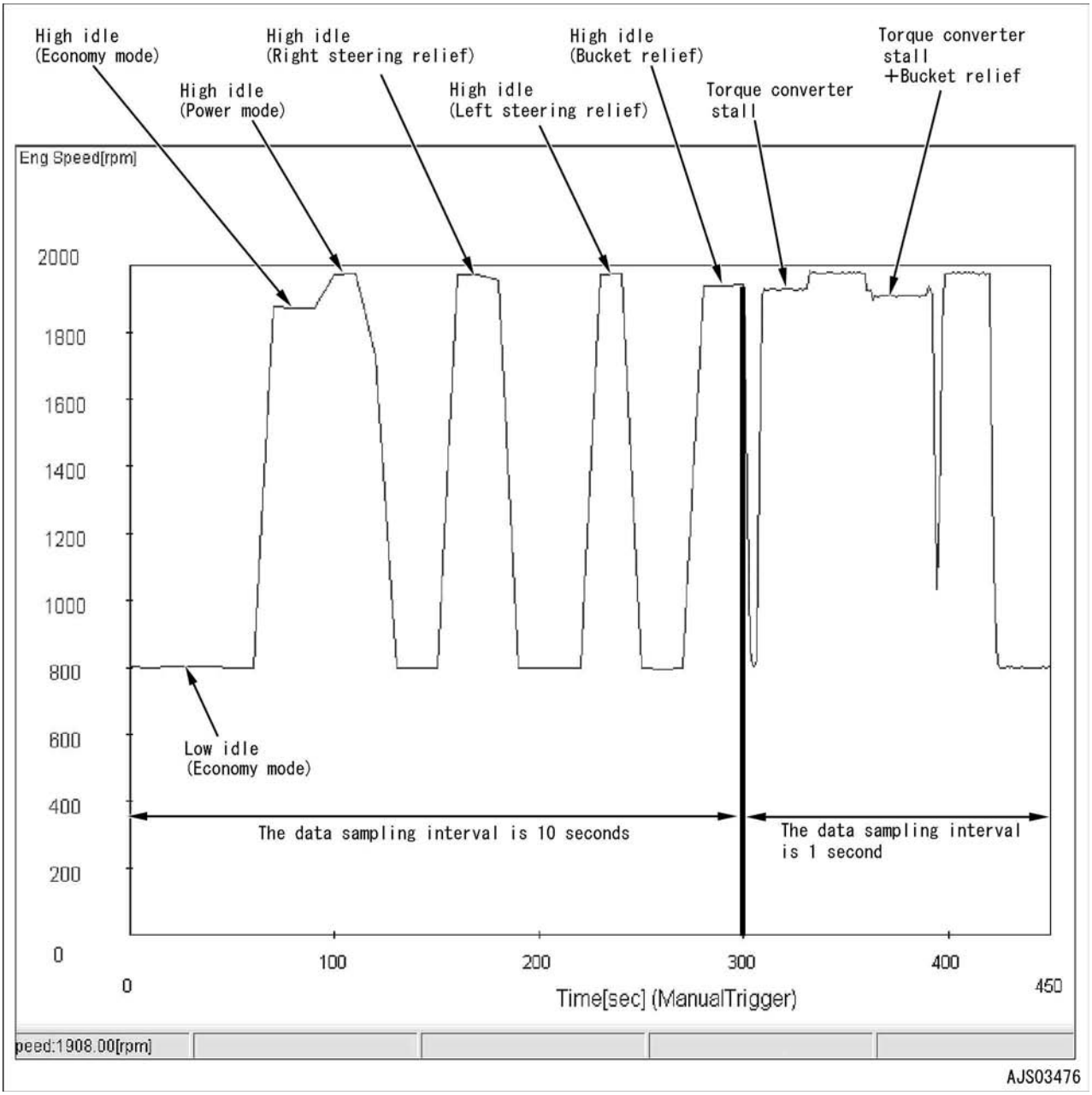


★ Machine operation for snapshot

No.	Start	End	Machine operation		
			Machine status	Power mode	Work equipment
1	0:00	1:00	Low idle	OFF	—
2	1:00	1:30	Hi idle	OFF	—
3	1:30	2:00	Hi idle	ON	—
4	2:00	2:30	Low idle	ON	Right steering
5	2:30	3:00	Hi idle	ON	Right steering
6	3:00	3:30	Low idle	ON	Left steering
7	3:30	4:00	Hi idle	ON	Left steering
8	4:00	4:30	Low idle	ON	Bucket relief
9	4:30	5:00	Hi idle	ON	Bucket relief
10	5:00	5:30	T/C stall (Note 1)	ON	—
11	5:30	6:00	Hi idle	ON	—
12	6:00	6:30	T/C stall (Note 1)	ON	Bucket relief
13	6:30	7:00	Hi idle	ON	Foot brake operation (Note 2)
14	7:00	7:30	Low idle	ON	Foot brake operation (Note 2)

(Note 1): 1) Set the auto-shift and manual selector switch to the manual.
2) Press the brake pedal fully, set the lever to F4 (forward at 4th) and set the engine to high idle.

(Note 2): Repeat pumping of the foot brake 20 times.



8) As 7 minutes and 30 seconds elapsed from start of the snapshot, following screen appears and then the initial screen is restored in 5 seconds. (End of snapshot)



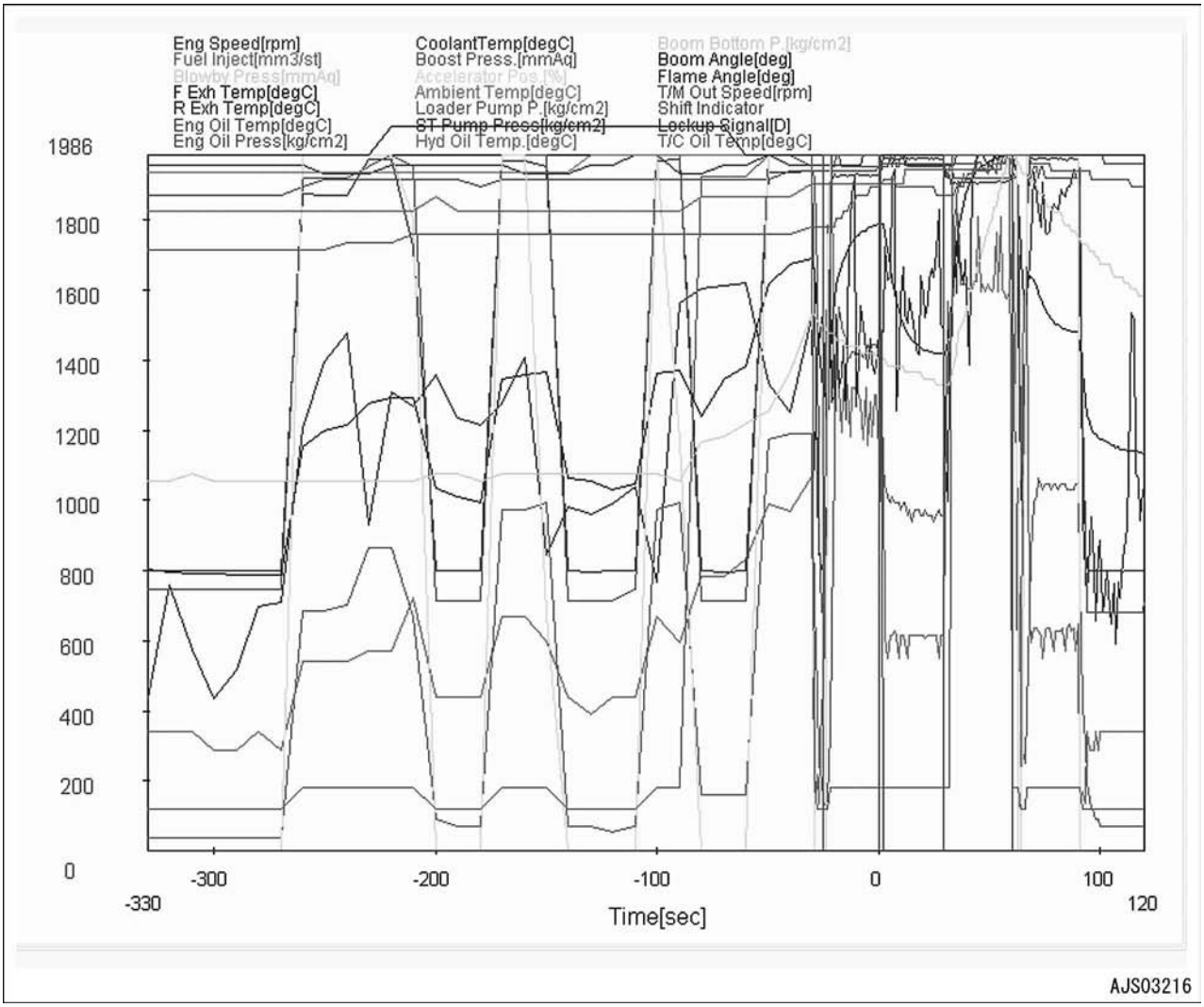
BWD12028

Important

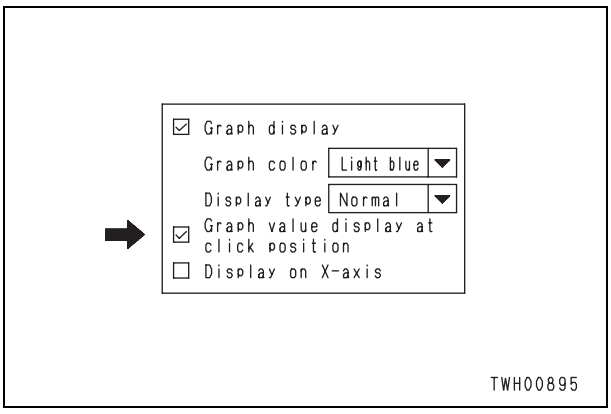
Data of quick Pm are recorded only once. Thus, if another quick PM is repeated, the current data will be overwritten with the last one. In order to avoid above trouble, be sure to download data of every completed quick Pm shall to PC. For the procedure, see 8. Download of setting data.

9) Read the quick PM data by use of the analysis tool.
   ★ For detailed usage of the analysis tool, see the operation and maintenance manual.

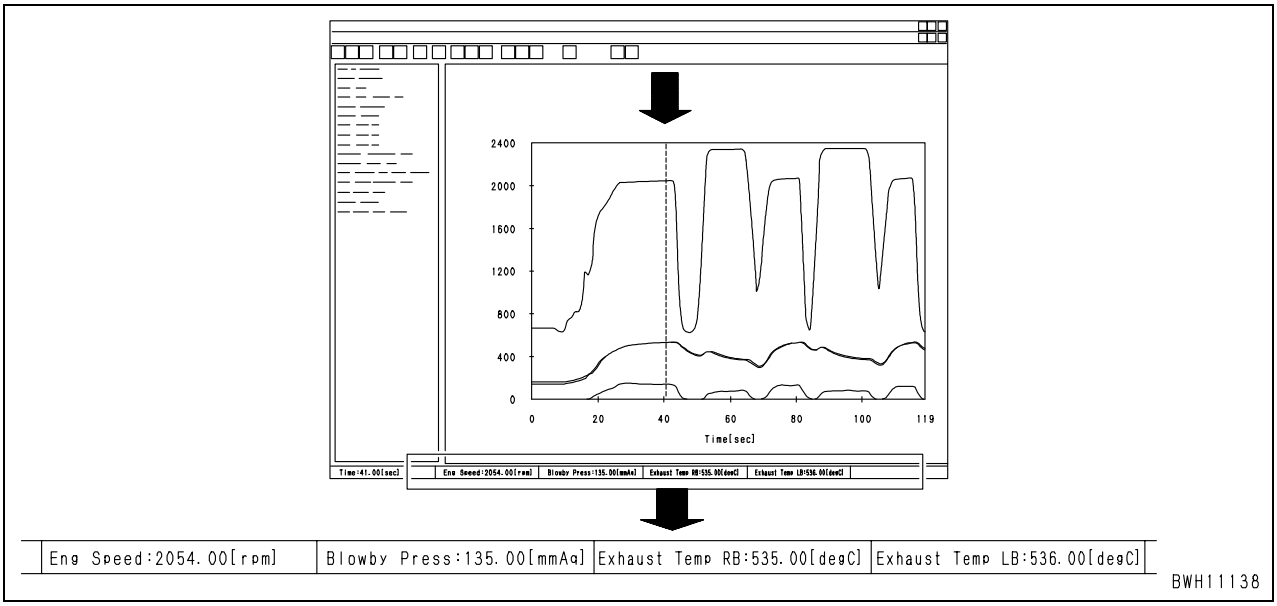
10) Open the quick Pm data to draw a graph.
   ★ Select time for X-axis and select the following for Y-axis.
   - Engine speed
   - Fuel Inject (fuel injection)
   - Blowby Press (Blow-by pressure)
   - F Exhaust Temp (Exhaust temperature 1, 2 and 3 cylinders)
   - R Exhaust Temp (Exhaust temperature 4, 5 and 6 cylinders)
   - Engine Oil Temp (Engine oil temperature)
   - Engine Oil Press (Engine oil pressure)
   - Coolant Temp (Engine coolant temperature)
   - Boost Press (Boost pressure)
   - Accelerator Pos (Accelerator angle)
   - Ambient Temp (Ambient temperature)
   - Loader Pump P (Work equipment oil pressure)
   - ST Pump Press (Steering oil pressure)
   - Hyd Oil Temp (Hydraulic oil temperature)
   - Boom Bottom P (Lift arm cylinder bottom pressure)
   - Boom Angle (Lift arm angle)
   - Frame Angle (Frame angle)
   - T/M Out Speed (Transmission output speed)
   - Shift Indicator (Shift position)
   - Lock Up Signal (Lockup signal)
   - T/C Oil Temp (Torque converter oil temperature)



11) Apply a check mark to the Display graph value at clicked position.



12) Clicking the graph shows, below the graph, the X-axis value of respective measurement items. (An example of a graph displayed – Not an actual one)

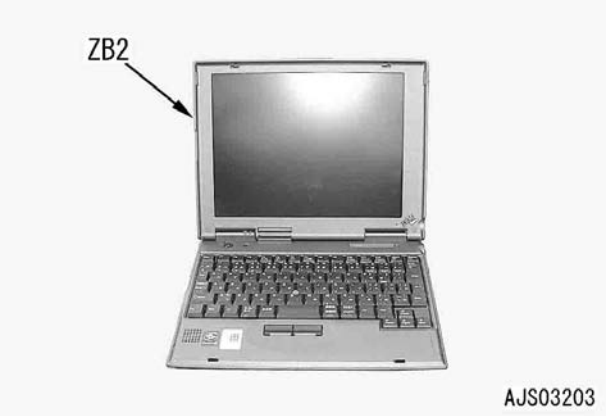


13) Record above values in the Pm clinic inspection sheet.
★ Following shows the relation between the data needed for Pm clinic and the measuring conditions.

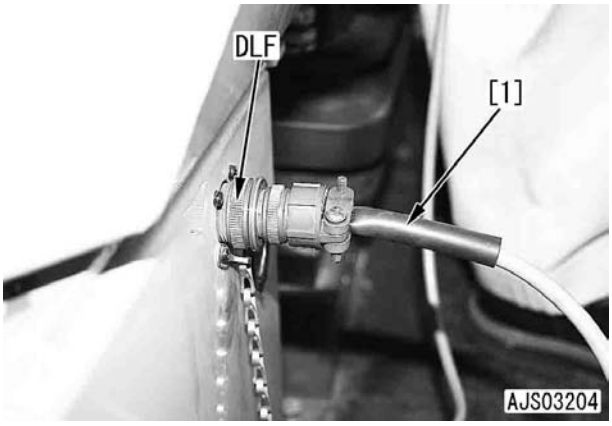
Measurement items / Machine operation	E/P mode	Engine speed	Blow-by pressure	Engine oil pressure	Exhaust gas temperature	Boost pressure	Transmission modulation pressure	Loader pump pressure	Steering pump pressure	Front brake pressure	Rear brake temperature
Low idle	E-mode	○		○			○				
Hi idle	E-mode	○					○				
Hi idle	P-mode	○					○				
Right steering + low idle	P-mode								○		
Right steering + high idle	P-mode								○		
Left steering + low idle	P-mode								○		
Left steering + high idle	P-mode								○		
Bucket relief + low idle	P-mode							○			
Bucket relief + high idle	P-mode	○						○			
Torque converter stall (Note 1)	P-mode	○	○		○	○					
Hi idle	P-mode										
Torque converter stall + bucket relief	P-mode	○	○		○	○					
Foot brake operation (Note 2) + high idle	P-mode									○	○
Foot brake operation (Note 2) + low idle	P-mode									○	○

8. Download of setting data

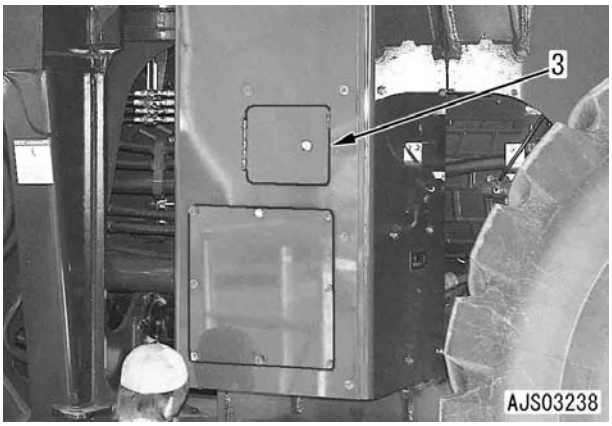
1) Using harness [1] of service kit **ZB1**, connect PC **ZB2** to download connector DLF in the cab or download connector VDL on the ground.

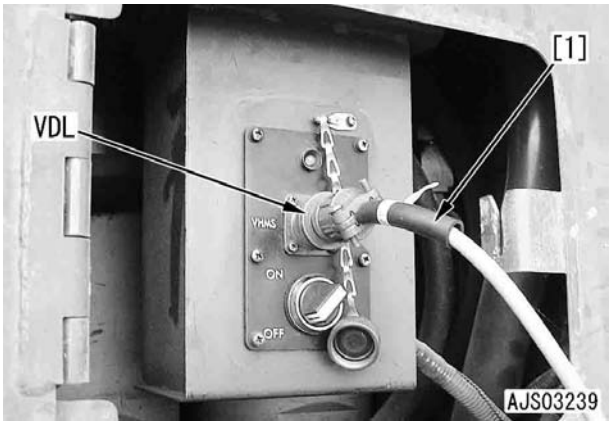


★ Download connector DLF in the cab is installed in the front side of the right stand of operator seat.

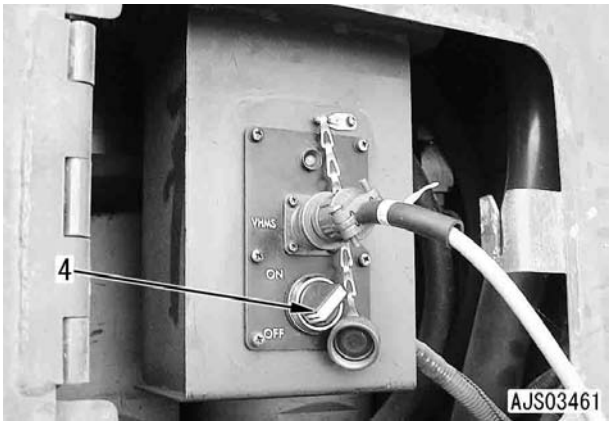


★ Download connector VDL on the ground is provided under cover (3) in the accumulator installation position, which is located on the left side of the machine body.





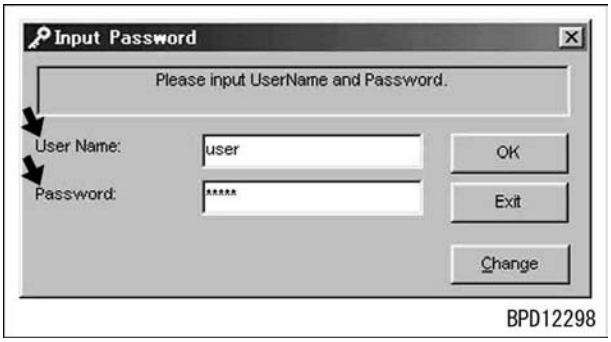
2) When using download connector DLF in the cab, set the starting switch to ON position.
3) When using download connector VDL on the ground, set switch (4) to ON position.
   ★ The green LED will come on.



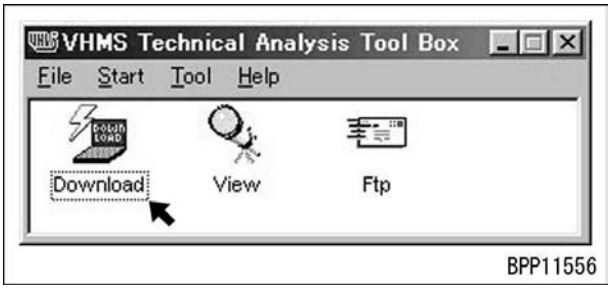
4) Operating [VHMS analysis tool] on PC, start up the VHMS analysis tool.



★ Enter [User Name] and [Password].
★ For the operating procedure, see the VHMS analysis tool operation and maintenance manual.

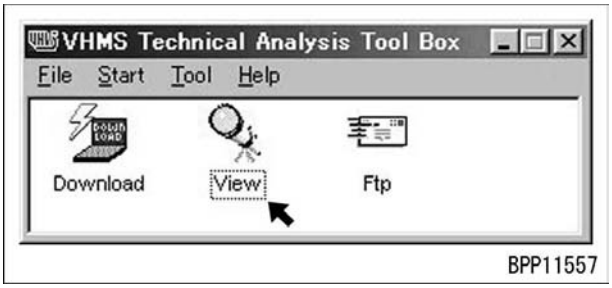


5) Using [Download] function, download the data currently recorded on VHMS to PC.
★ For the operating procedure, see the VHMS analysis tool operation and maintenance manual.
★ After making sure the download is complete, proceed to the next step.



9. Confirmation of download data

1) Check the setting data using [View] function.
★ For the operating procedure, see the VHMS analysis tool operation and maintenance manual.
★ Make sure that [MFA0] code, which was used in the quick snapshot, is indicated in [Fault History].
★ Make sure the snap shot data are recorded.



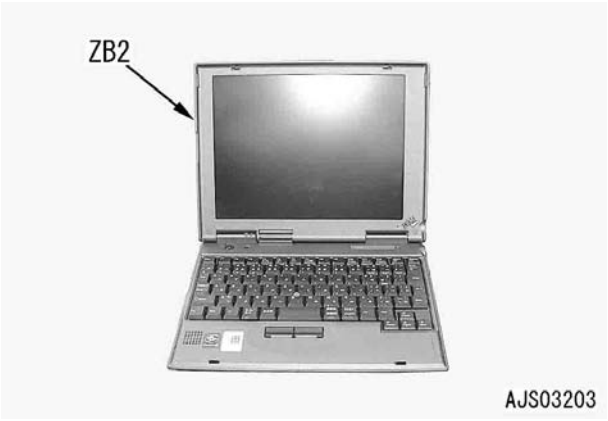
2) As check of the setting data is finished, end [VHMS analysis tool].

10. Disconnecting the PC

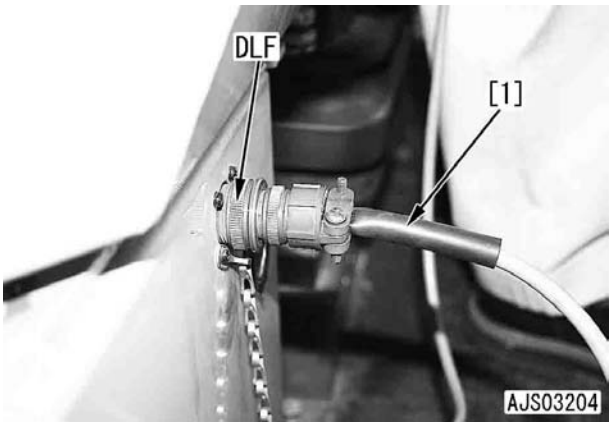
1) Make sure the starting switch is at OFF position.

⚠ **Before connecting or disconnecting a PC, be sure to turn off the starting switch.**

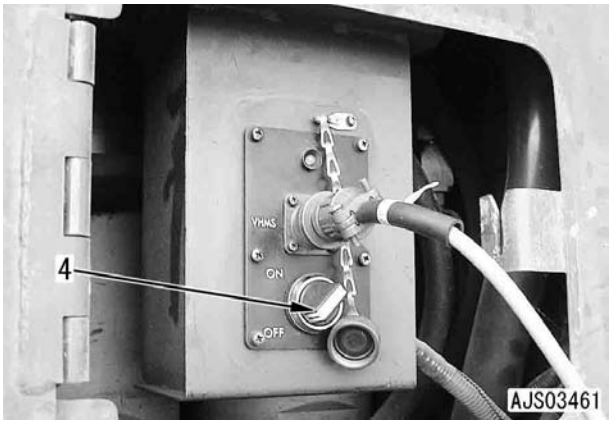
2) End the OS of PC **ZB2** and then turn off the PC power.

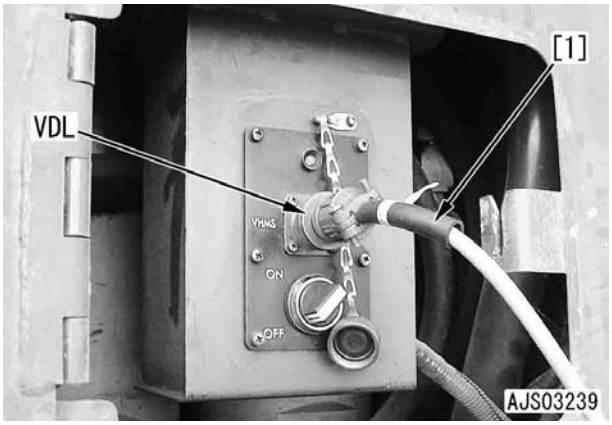


3) When the data was download into the cab, disconnect harness [1] of service kit **ZB1** from download connector **DLF**.



4) When the data was download to the ground, disconnect harness [1] of service kit **ZB1** from download connector VDL





11. Report to Komatsu

As steps 1 – 9 are completed, send VHMS/WebCARE setting report to VHMS/WebCARE Support Center in Komatsu Headquarters.

★ This report is a must since setting on the receiving end in the satellite communication must be done by Komatsu.

★ In this case, send VHMS data via Notes (LAN) or E-mail (WAN).

Komatsu VHMS/WebCARE Support Center

2-3-6, Akasaka Minato-Ku Tokyo, Japan

FAX: 81-3-5561-4766 (from outside of Japan)
FAX: 03-5561-4766 (Domestic user)

E-mail: webcare@komatsu.co.jp

[For storage]

VHMS Initial Setting Work Check Sheet

Date of setting:	
DB/branch office name	
Data entered by:	

Setup step		Check item	Result	
1	Confirmation of machine body and component nameplates	Model name		
		Serial No.		
		Engine serial No.		
		Transmission controller serial No.		
		VHMS controller serial No.		
2	Connection between PC and VHMS controller	Is the connection secure?	yes	no
3	VHMS controller check for normal operation	Is it operating normally? (Displays counting in ascending-order succeeding to rotation)	yes	no
4	Starting of VHMS initial setting tool	Is "Data Clear and Set up" selected for the setting tool mode?	yes	no
5	Initial setting of VHMS controller (Setting of machine body information) In this step, basic machine body information are set on VHMS controller	Is model name identical with machine body?	yes	no
		Is machine body serial No. correctly entered?	yes	no
		Is engine serial No. correctly entered?	yes	no
		Is today's date entered?	yes	no
		Is current time entered?	yes	no
		Is SMR correctly entered?	yes	no
6	Saving of settings	Is LED (7-segment) turned off?	yes	no
7	Confirmation of VHMS function	Is LED operation normal?	yes	no
8	Execution of quick Pm	Is service mode "SNAPSHOT" turned on and is the switch hit?	yes	no
9	Data storing operation on VHMS	Is LED (7-segment) turned off?	yes	no
10	Download	Is LED operation normal?	yes	no
11	Confirmation of download data	Are all files downloaded?	yes	no
		The time downloaded (Reference wrist watch)	Hour, minute:	
		[Confirmation of data]		
		Is [MFA0] error present in Fault History?	yes	no
		Are SMR and time in Fault History consistent with settings?	yes	no
		Is any data missing in Snap Shot0?	yes	no
12	Data storing operation on VHMS	Is LED (7-segment) turned off?	yes	no

[For storage]
ORBCOMM Station Opening Work Check Sheet

Date of setting:	
DB/branch office name	
Data entered by:	

Setup step		Check item	Result	
1	Confirmation of machine body and component nameplates	Model name		
		Serial No.		
		Engine serial No.		
		Transmission serial No.		
		VHMS controller serial No.		
		ORBCOMM terminal serial No.		
2	Connection between PC and VHMS controller	Is the connection secure?	yes	no
3	VHMS controller check for normal operation	Is it operating normally? (Displays counting in ascending-order succeeding to rotation)	yes	no
4	Starting of VHMS initial setting tool	Is "Set up" selected for the setting tool mode?	yes	no
5	Initial setting of VHMS controller 1. Setting of communication (Setting of machine body information and PLM are completed)	Entry of setting to S.Fault History		
		Presence/absence of communication	On	Off
		Number of cases (Default is 8 cases)		
		Entry of setting of S.Trend Analysis setting		
		Presence/absence of communication	On	Off
		Interval (Default is 20H)		
		Entry of setting of S.Payload data		
		Presence/absence of communication	On	Off
		Tabulation start time		
		Interval of tabulation (in days)	day	
	2. Setting for start of communication	Is GCC code set? (130 for Japan)	yes	no
6	Saving of settings	Is LED (7-segment) turned off after data was stored?	yes	no
7	ORBCOMM controller performance check	How is decimal point display in VHMS monitor (7-segment)? (OFF, ON, long/short flashing)	yes	no

To: VHMS / WebCARE Support Center
FAX : 81-3-5561-4766

SEKN5051-1
Attached Sheet

VHMS / WebCARE Basis Information Sheet

For Machine Registration into WebCARE	*Please describe clearly.*
<<DB information>>	
Distributor name / Branch	/
Person in charge	
e-mail address	
DB code(GCPS code)	
<<Customer information>>	
Customer name / Site name	/
<<Machine information>>	
Model - type	
Serial No.	
Engine Serial No. (Enter both of two engines if mounted.)	/
Transmission Serial No.	
Unit No.	
Date of Orbcomm activation	

For initial download data check	*Result*	
Reason for VHMS setting *Check the reason on the right. *For replacement,enter the serial No.of the replaced component below each column (**Note**).	○	**(Note 1)** **The new machine delivery or Retro - Fit**
	○	**(Note 1)** **Replace the VHMS controller.**
	○	**(Note 2 or 3)** **Replace the component.** **(engine or transmission)**
Setting date	(mm:dd:yyyy) (: :)	
Setting time (Checked by watch)	(HH :MM: SS) (: :)	
Person in charge of setting		
Service Meter Reading		
(**Note1**) New VHMS controller serial number.		
(**Note2**) New engine serial number. Enter both of two engines if mounted.	No.1 Engine ( )	
	No.2 Engine ( )	
(**Note3**) New transmission serial number.		
GCC code(If Orbcomm is equipped)		
Time difference (GMT)	**(Time Zone offset : 00)**	
Summer time (Daylight Savings Time)	**ON / OFF**	
Did you initialize VHMS as described in the shop manual ?	**YES**	

*****Important*****
***After entering the VHMS/WebCARE Basis Information Form,fax or email it to the following location with the initial download data.**
VHMS / WebCARE support center (Product Support Div. Komatsu LTD.)
TEL : 81-3-5561-2765 * FAX : 81-3-5561-4766 *** EMAIL : webcare@komatsu.co.jp**

Precautions for replacing VHMS controller

★ Care should be paid to the following equipment when replacing VHMS controller

Symbol		Part No.	Part name
ZB	1	799-608-3101	Service kit
		799-608-3210	• Diskette
		799-608-3220	• Wiring harness
	2	Commercially available	Note type PC (Windows 98/2000/Me/XP)

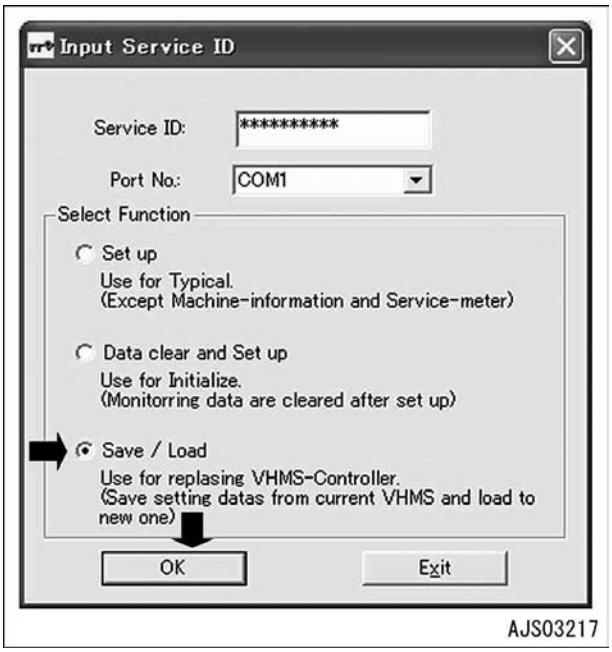
★ When it is required to replace a VHMS controller, setup of the replacing VHMS controller shall be conducted before and after the replacement according to the following procedure.
★ Machine data collected with VHMS controller are stored and managed on WebCARE database. In order to endure smooth data processing on WebCARE, consistency must be provided among the settings done on VHMS controller. Inconsistencies in the settings obstruct loading of data to WebCARE, hampering appropriate use of VHMS data. Setting work after replacement, therefore, is a must.
★ Check each step of the setting work referencing the "VHMS initial setting work check sheet".
★ Information such as models shown in the figures may not be identical with actual ones.

[Operations needed prior to replacement of VHMS controller]

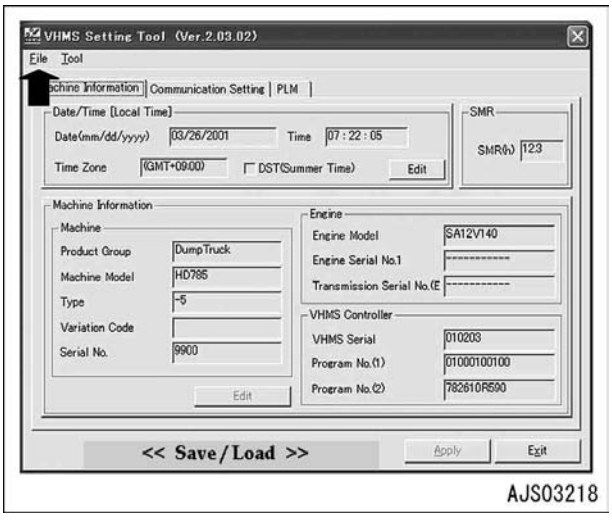
1. Download of the remaining data
- ★ This work is done inside the cab (from PC).
- ★ Using [Download] function, download the currently recorded and remained data on VHMS to PC.
- ★ For the operating procedure, refer to "8. Download of setting data" in "VHMS controller initial setting procedure".

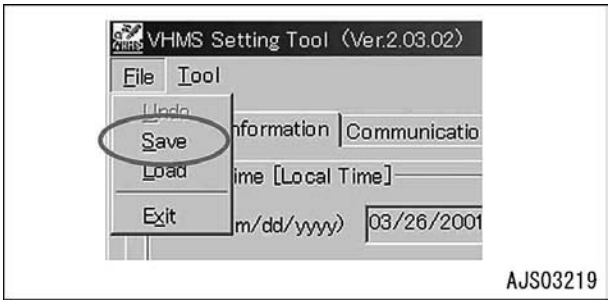
2. Confirmation, saving and loading of VHMS controller setting information (Ver. 3. 5. 2. 1 or older version)
- ★ This work is done inside the cab (from PC).
- ★ Setting information is saved from the VHMS controller to be replaced to the PC and the saved information is loaded to the new VHMS controller after the replacement.

2-1. Confirmation and saving of VHMS controller setting information prior to replacement
1) Connect the PC and start the VHMS initial setting tool.
   - ★ See the "VHMS controller initial setting procedure" for this operation.
2) Select [Save/Load] and press [OK] button.

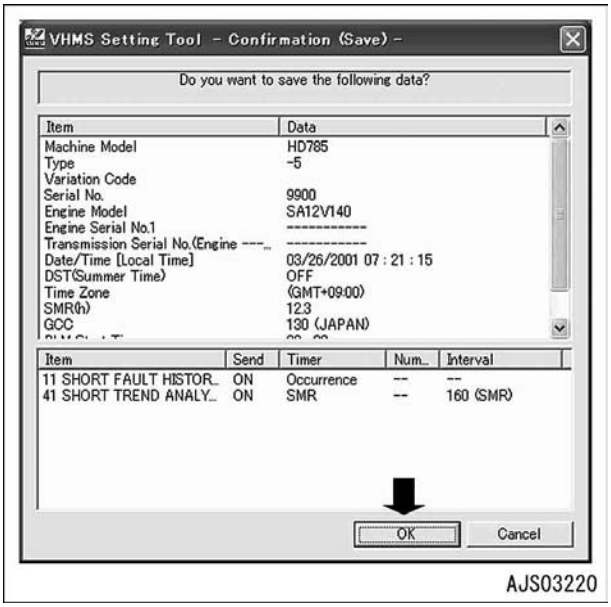


3) Confirm every information before the replacement.
4) Select [Save] from [File] of the menu.



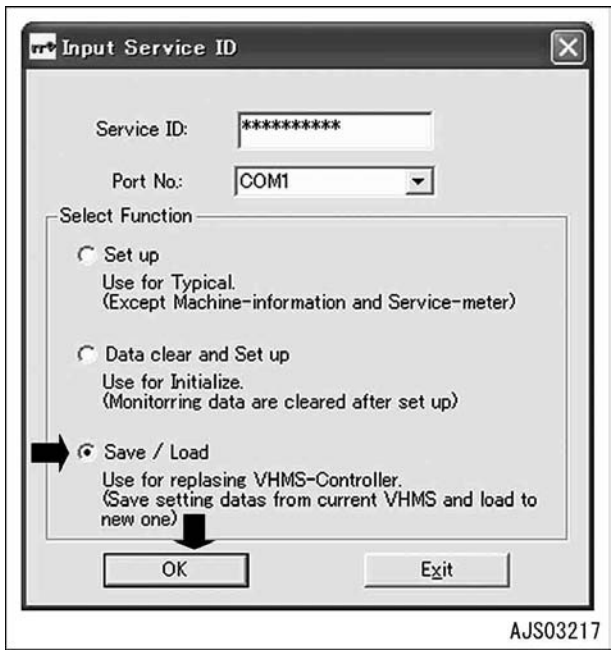


5) Reconfirm the information and then press [OK] button to save the information.

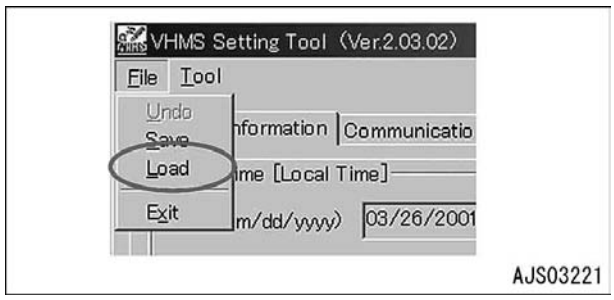


6) Select [Exit] from [File] of the menu to end the VHMS setting tool.
7) Disconnect the PC.
   ★ Refer to "10. Disconnecting the PC" in "VHMS controller initial setting procedure".
8) Turns the PC power off.
9) Proceed to replacement of VHMS controllers.

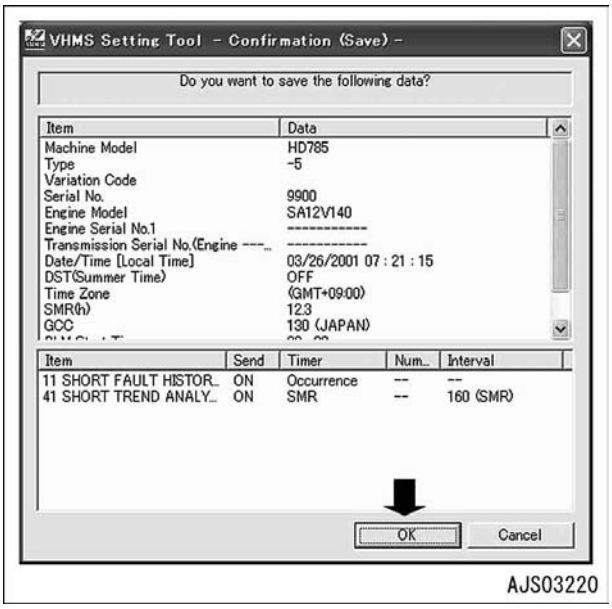
2-2. Loading the setting information to the replacing VHMS controller
1) Connect the PC again and start the VHMS initial setting tool.
   ★ See the "VHMS controller initial setting procedure" for this operation.
2) Select [Save/Load] and press [OK] button.



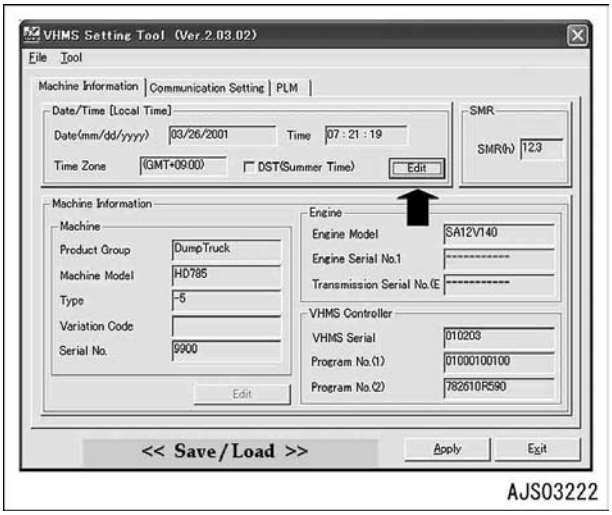
3) Select [Load] from [File] of the menu.



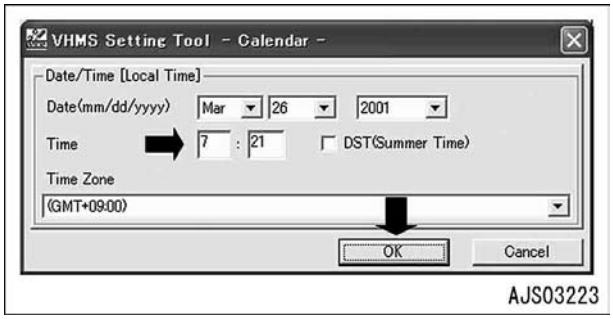
4) Currently saved information will be displayed. Press [OK] button.



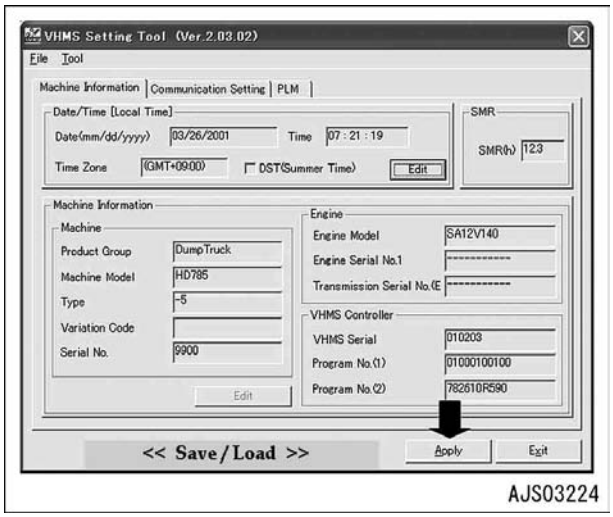
5) Display the saved information on another screen.
6) Press [Edit] button and adjust the time.

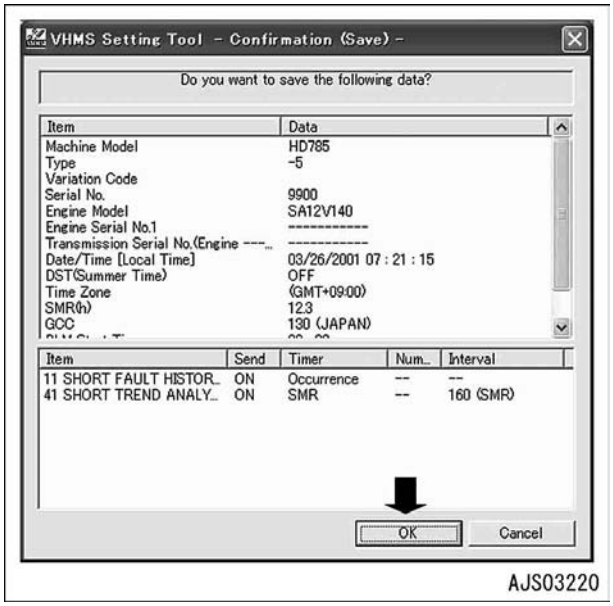


7) After adjusting time, press [OK] button.

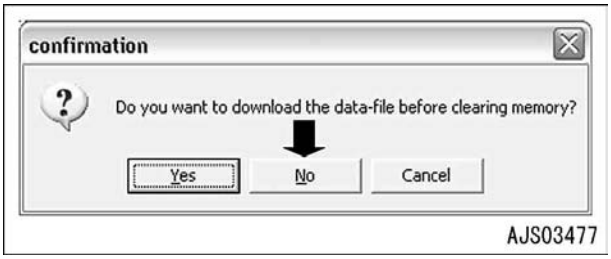


8) Press [Apply] button to display contents of the setting. Check the setting again and, if it is acceptable, press [OK] button.



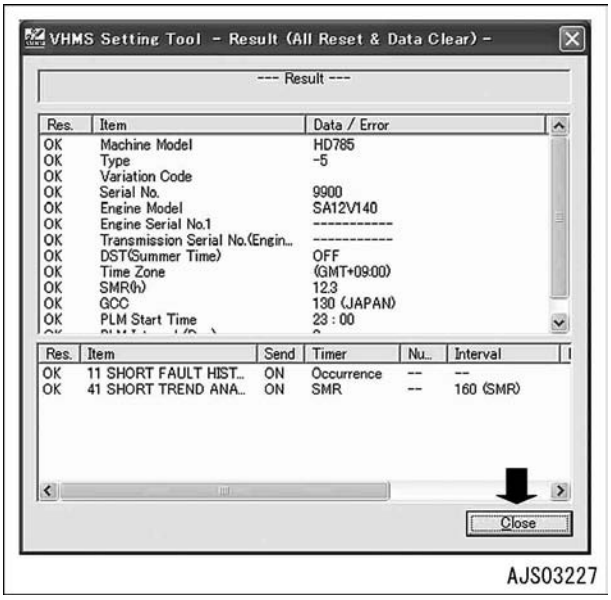


9) The confirmation screen will ask whether or not the data before the above setup is to be saved. Press [NO] button.
★ It is not necessary to save the data before the setting.





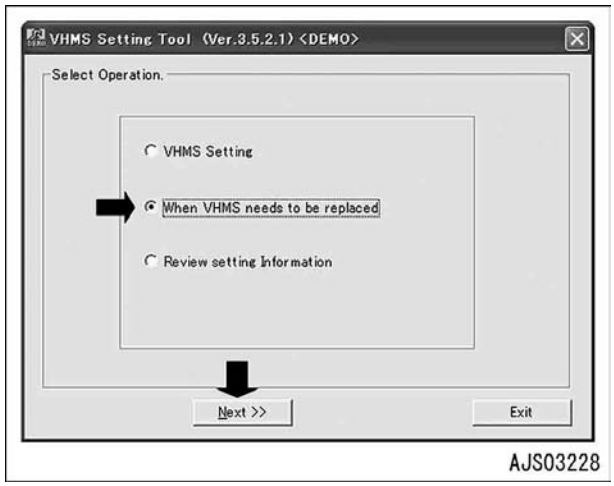
10) The setup result is displayed. Confirm the contents and press [Close] button.



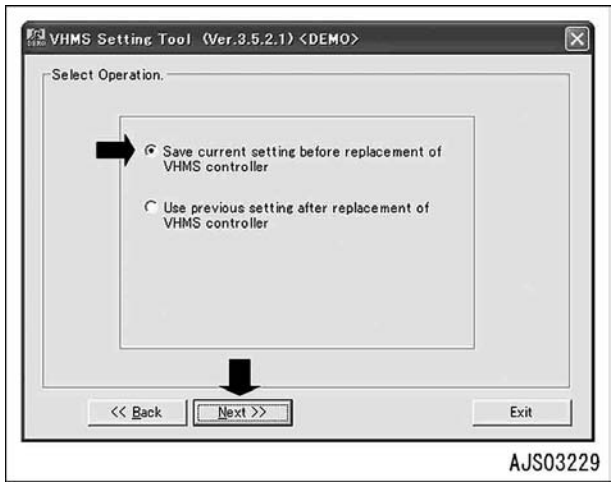
11) Select [Exit] from [File] of the menu to end the VHMS initial setting tool.

3. Confirmation, saving and loading of VHMS controller setting information (Ver. 3. 5. 2. 1 or later version)
★ This work is done inside the cab (from PC).
★ Setting information is saved from the VHMS controller to be replaced to the PC and the saved information is loaded to the new VHMS controller after the replacement.

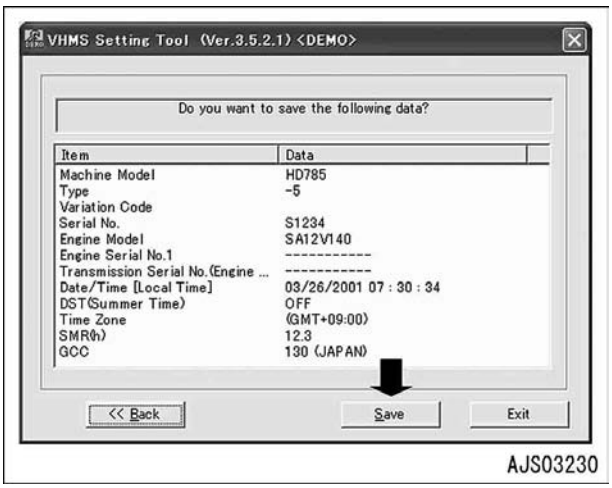
3-1. Confirmation of VHMS controller setting information prior to replacement
1) Connect the PC and start the VHMS initial setting tool.
★ See the "VHMS controller initial setting procedure" for this operation.
2) Select [When VHMS needs to be replaced] and then press [Next] button.



3) Select [Save current setting before replacement of VHMS controller] and press [Next] button.



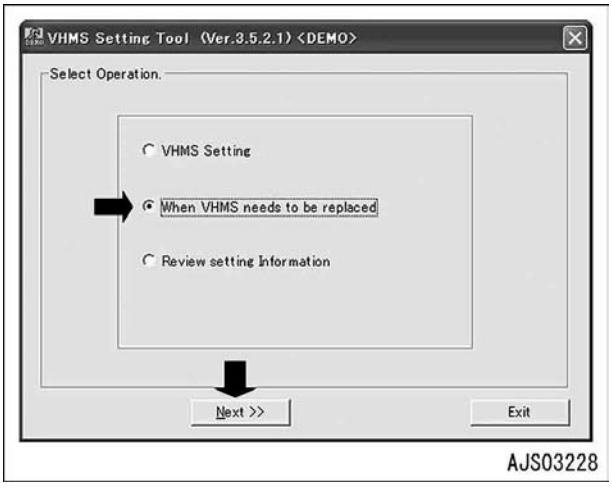
4) Confirm every information before the replacement and then press [Save] button.



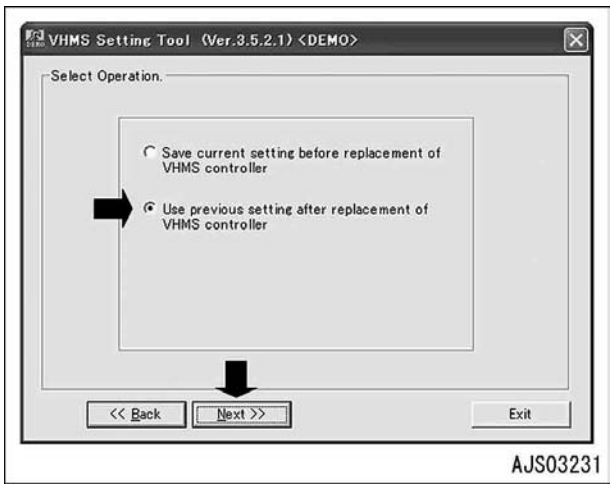
5) Select [Exit] from [File] of the menu to end the VHMS initial setting tool.
6) Disconnect the PC.
   ★ Refer to "10. Disconnecting the PC" in "VHMS controller initial setting procedure".
7) Turns the PC power off.
8) Proceed to replacement of VHMS controllers.

3-2. Loading the setting information to the replacing VHMS controller

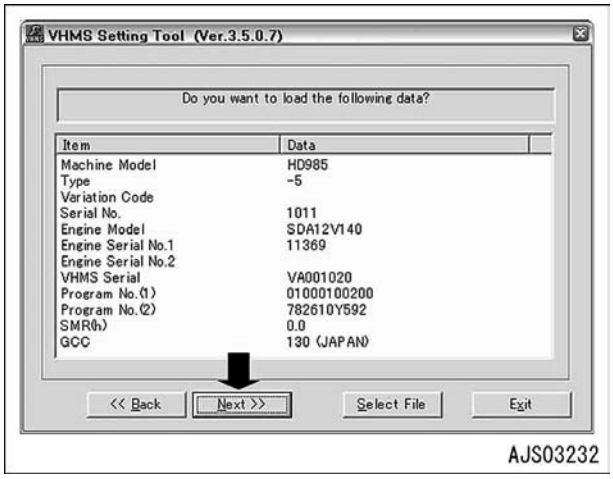
1) Connect the PC again and start the VHMS initial setting tool.
   ★ See the "VHMS controller initial setting procedure" for this operation.
2) Select [When VHMS needs to be replaced] and then press [Next] button.



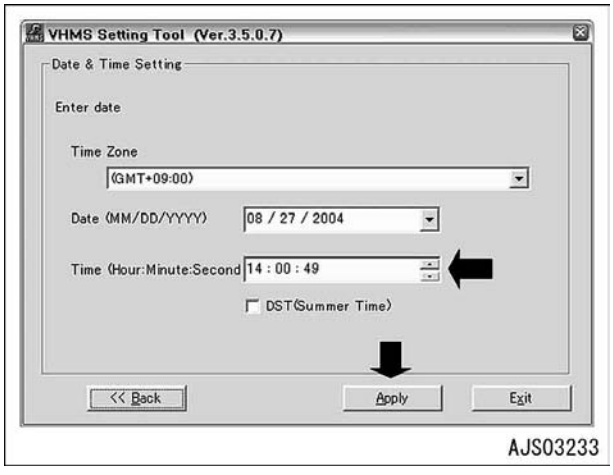
3) Select [Use previous setting after replacement of VHMS controller] and press [Next] button.



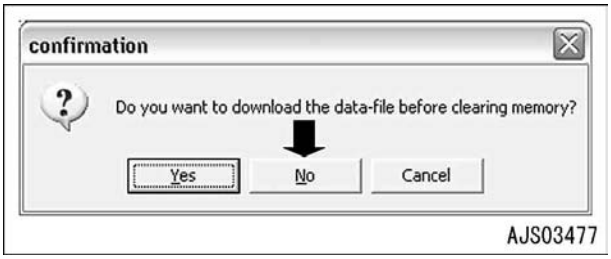
4) Currently saved information will be displayed. Press [Next] button.



5) Adjust the time and press [Apply] button.



6) The confirmation screen will ask whether or not the data before the above setup is to be saved. Press [NO] button.
   ★ It is not necessary to save the data before the setting.





7) The above completes modification of the setting. Press [OK] button to end the VHMS initial setting tool.



[Operations needed after replacement of VHMS controller]

★ Execute the quick Pm referring "7. Executing quick Pm" in "VHMS controller initial setting procedure".
★ Download the data referring "8. Download of setting data" in "VHMS controller initial setting procedure".
★ After the replacement, send VHMS/WebCARE setting report sheet to VHMS/WebCARE Support Center in Komatsu Headquarters.
★ Also send two sets of data, the downloaded before and after the VHMS replacement, via Notes (LAN) or E-mail (WAN).

Komatsu VHMS/WebCARE Support Center

2-3-6, Akasaka Minato-Ku Tokyo, Japan

FAX: 81-3-5561-4766 (from outside of Japan)
FAX: 03-5561-4766 (Domestic user)

E-mail: webcare@komatsu.co.jp

Pm-click inspection table

WA600-6 Serial No. 60001 and up

Machine serial No.	#
Engine serial No.	
	SAA6D170E-5 #

	hour inspection

Work instruction No.	Date of execution	Service meter	Inspector
	Year: Month: Day:	hours	

Interview with operator and walk-around check

Is there abnormality before starting inspection?	Outside temperature
	Max. °C
	Min. °C
	Altitude m

Maximum coolant temperature (overheated)? (During operation)	Maximum torque converter oil temperature (overheated)? (During operation)

★ If machine is cold, warm it up.
★ Working mode: P-mode

	Item	Condition		Unit	Standard value for new machine	Service limit value	Measurement result	Good	Bad
Engine	Engine speed	Engine at low idle		rpm	775 – 825	775 – 825			
		Engine at high idle			1,950 – 2,050	1,950 – 2,050			
		Engine at high idle and torque converter stalled			1,700 – 1,900	1,600 – 2,000			
		Engine at high idle and work equipment relieved			1,840 – 2,040	1,740 – 2,140			
		Torque converter stalled + Work equipment relieved			1,580 – 1,780	1,380 – 1,980			
	Blow-by pressure	Engine at high idle and torque converter stalled		kPa {mmH2O}	Max. 3.43 {Max. 350}	9.4 {960}			
	Lubricating oil pressure	SAE15W-40	Engine at high idle	MPa {kg/cm2}	Min. 0.34 {Min. 3.5}	0.21 {2.1}			
			Engine at low idle		Min. 0.1 {Min. 1.0}	0.08 {0.8}			
	Boost pressure	Engine at high idle and torque converter stalled		kPa {mmHg}	Min. 147 {Min. 1,100}	133 {1,000}			
	Exhaust temperature	Engine at high idle and toque converter stalled Outside temperature: 20°C		°C	Max. 650	700			

★ When shifting transmission gear to forward/reverse position, apply brake securely.

								Good	Bad
Transmission valve	Main relief pressure	Low idle	• Torque converter oil temperature: Within operating range • Working mode: P-mode	MPa {kg/cm2}	Min. 3.09 {Min. 31.5}	Min. 3.09 {Min. 31.5}			
		High idle			3.65 ± 0.2 {37.2 ± 2.0}	3.65 ± 0.2 {37.2 ± 2.0}			
	Torque converter inlet port oil pressure		• Torque converter oil temperature: Within operating range • Working mode: P-mode • Engine speed: High idle		0.94 ± 0.2 {9.6 ± 2.0}	0.94 ± 0.2 {9.6 ± 2.0}			
	Torque converter outlet port oil pressure				0.57 ± 0.1 {5.8 ± 1.0}	0.57 ± 0.1 {5.8 ± 1.0}			
	Modulation clutch oil pressure				2.48 ± 0.2 {25.3 ± 2.0}	2.48 ± 0.2 {25.3 ± 2.0}			
	Lubrication oil pressure				0.12 ± 0.06 {1.2 ± 0.6}	0.12 ± 0.06 {1.2 ± 0.6}			
	ECMV output (clutch) oil pressure	F clutch	• Torque converter oil temperature: Within operating range • Working mode: P-mode • Engine speed: High idle • Manual switch: ON		2.68 ± 0.2 {27.3 ± 2}	2.68 ± 0.2 {27.3 ± 2}			
		R clutch			3.12 ± 0.2 {31.8 ± 2.0}	3.12 ± 0.2 {31.8 ± 2.0}			
		1st clutch			3.07 ± 0.2 {31.3 ± 2.0}	3.07 ± 0.2 {31.3 ± 2.0}			
		2nd clutch			2.09 ± 0.2 {31.3 ± 2.0}	2.09 ± 0.2 {31.3 ± 2.0}			
		3rd clutch			3.07 ± 0.2 {31.3 ± 2.0}	3.07 ± 0.2 {31.3 ± 2.0}			
		4th clutch			3.07 ± 0.2 {31.3 ± 2.0}	3.07 ± 0.2 {31.3 ± 2.0}			
		Lockup clutch			1.84 ± 0.2 {18.8 ± 2.0}	1.84 ± 0.2 {18.8 ± 2.0}			

Pm-click inspection table

WA600-6 Serial No. 60001 and up

	Item	Condition		Unit	Standard value for new machine	Service limit value	Measurement result	Good	Bad
Steering	Secure frame with frame lock bar.								
	Steering relief pressure	Hydraulic oil temperature: 45 – 55°C Engine speed at high idle		MPa {kg/cm^2}	32.32 – 34.28 {330 – 350}	31.32 – 34.28 {320 – 350}			
	AJSS EPC pressure	Hydraulic oil temperature: 45 – 55°C Engine speed at high idle Operating AJSS fully			2.35 – 2.55 {24 – 26}	2.25 – 2.65 {23 – 27}			
Brake	Parking brake inlet pressure	Torque converter oil temperature: Within operating range Engine speed: Low idle		MPa {kg/cm^2}	Min. 2.45 {Min. 25.0}	Min. 2.45 {Min. 25.0}			
	Parking brake pilot pressure				Min. 3.09 {Min. 31.5}	Min. 3.09 {Min. 31.5}			
	Parking brake solenoid valve output pressure				Min. 2.45 {Min. 25.0}	Min. 2.45 {Min. 25.0}			
	Parking brake performance	Tire inflation pressure: Specified pressure Test on flat and dry paved slope of 1/5 (11° 20'). Set machine in operating state.		—	Stopped	Stopped			
	Disc thickness			mm	3.2 ± 0.08	Min. 2.97			
	Charge cut-in pressure	Hydraulic oil temperature: Within operating range Engine at low idle	Measure when brake oil pressure warning lamp goes off.	MPa {kg/cm^2}	5.88 – 6.37 {60 – 65}	5.39 – 6.86 {55 – 70}			
	Charge cut-out pressure		Measure when brake oil pressure starts lowering after rising.		9.8 – 10.78 {100 – 110}	9.31 – 11.27 {95 – 115}			
	Brake oil pressure	Hydraulic oil temperature: Within operating range Engine at low idle			4.9 – 5.59 {50 – 57}	4.7 – 5.78 {48 – 59}			
	Lowering of brake oil pressure	Engine: Stopped Measure lowering of oil pressure from 4.9 MPa {50 kg/cm^2} in 5 minutes.		kPa {kg/cm^2}	Max. 0.49 {Max. 5}	Max. 0.49 {Max. 5}			
	Wheel brake performance	Tire inflation pressure: Specified pressure Test on flat, level, straight, and dry paved road. Braking initial speed: 20km/h, Delay in pressing pedal: Max 0.1 sec Brake pedal pressing force: Specified force, 294 ± 29.4 Nm {30 ± 3 kg} Measure braking distance.		m	Max. 5	Max. 5			
	Wear of wheel brake disc	Measure with disc wear indicator.		mm	0	Max. 5.5			
Work equipment	Work equipment valve relief pressure	Hydraulic oil temperature: 45 – 55°C Engine at high idle	Bucket circuit relieved	MPa {kg/cm^2}	3.72 – 3.92 {38 – 40}	3.52 – 5.92 {36 – 40}			
	Work equipment valve LS differential pressure		Lift arm lever at half stroke		1.47 – 1.87 {15 – 19}	1.28 – 2.06 {13 – 21}			
	Lift arm speed		Rising time	sec	8.1 – 9.1	Max. 10.5			
			Lowering time		3.6 – 4.6	Max. 5.3			
	Bucket tilt back speed		Bucket full stroke time		2.7 – 3.3	Max. 4.0			
			Bucket at level time		1.7 – 2.3	Max. 2.9			
	Hydraulic drift of work equipment	Hydraulic oil temperature: Within operating range Engine: Stopped	Bucket cylinder	mm/ 15 min.	Max. 20	Max. 20			
			Lift cylinder		Max. 40	Max. 40			
Axle	Visual check of differential drain plug	Front axle		—	There must not be excessive metal powder.				
		Rear axle							

Memo

WA600-6 Wheel loader

Form No. SEN00556-01

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

General information on troubleshooting

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Points to remember when troubleshooting 2
Sequence of events in troubleshooting 3
Testing before troubleshooting 4
Classification and procedures of troubleshooting 5
Connection table for connector pin numbers 8
T-branch box and T-branch adapter table 31

General information on troubleshooting

Points to remember when troubleshooting

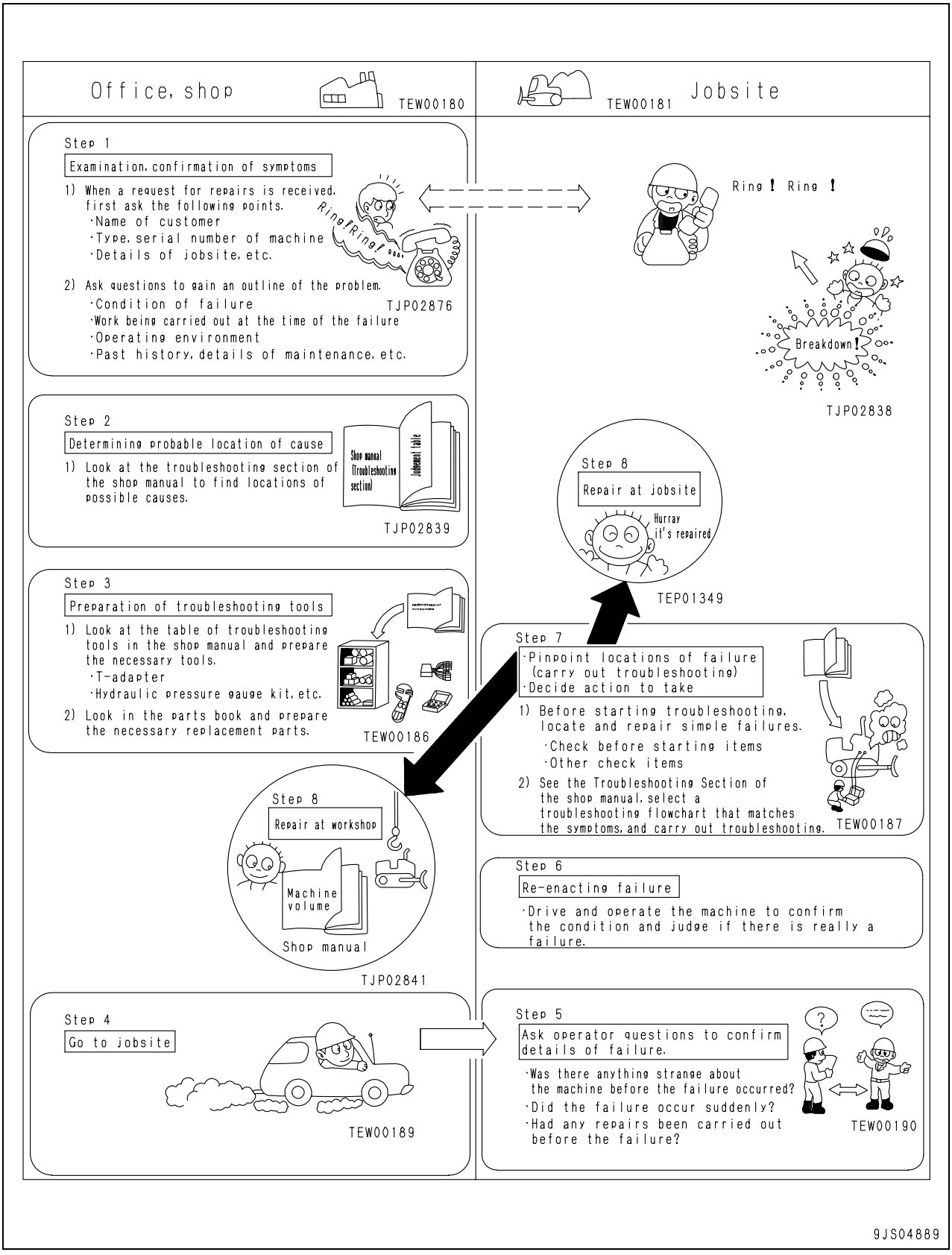
- ⚠ **Stop the machine in a level place, and check that the safety pin, blocks, and parking brake are securely fitted.**
- ⚠ **When carrying out the operation with 2 or more workers, keep strictly to the agreed signals, and do not allow any unauthorized person to come near.**
- ⚠ **If the radiator cap is removed when the engine is hot, hot coolant may spurt out and cause burns, so wait for the engine to cool down before starting troubleshooting.**
- ⚠ **Be extremely careful not to touch any hot parts or to get caught in any rotating parts.**
- ⚠ **When disconnecting wiring, always disconnect the negative (–) terminal of the battery first.**
- ⚠ **When removing the plug or cap from a location which is under pressure from oil, water, or air, always release the internal pressure first. When installing measuring equipment, be sure to connect it properly.**

The aim of troubleshooting is to pinpoint the basic cause of the failure, to carry out repairs swiftly, and to prevent reoccurrence of the failure. When carrying out troubleshooting, and important point is of course to understand the structure and function. However, a short cut to effective troubleshooting is to ask the operator various questions to form some idea of possible causes of the failure that would produce the reported symptoms.

1. When carrying out troubleshooting, do not hurry to disassemble the components.
   If components are disassembled immediately any failure occurs:
   - Parts that have no connection with the failure or other unnecessary parts will be disassembled.
   - It will become impossible to find the cause of the failure.

   It will also cause a waste of manhours, parts, or oil or grease, and at the same time, will also lose the confidence of the user or operator. For this reason, when carrying out troubleshooting, it is necessary to carry out thorough prior investigation and to carry out troubleshooting in accordance with the fixed procedure.
2. Points to ask user or operator
   1) Have any other problems occurred apart from the problem that has been reported?
   2) Was there anything strange about the machine before the failure occurred?
   3) Did the failure occur suddenly, or were there problems with the machine condition before this?
   4) Under what conditions did the failure occur?
   5) Had any repairs been carried out before the failure? When were these repairs carried out?
   6) Has the same kind of failure occurred before?
3. Check before troubleshooting
   1) Is there any sign of irregularities of the machine?
   2) Make checks before starting day's work.
   3) Make checks of other items.
   4) Check other maintenance items which can be visually checked and are considered necessary.
4. Confirming failure
   Confirm the extent of the failure yourself, and judge whether to handle it as a real failure or as a problem with the method of operation, etc.
   - ★ When operating the machine to reenact the troubleshooting symptoms, do not carry out any investigation or measurement that may make the problem worse.
5. Troubleshooting
   Use the results of the investigation and inspection in Items 2 – 4 to narrow down the causes of failure, then use the troubleshooting flowchart to locate the position of the failure exactly.
   - ★ The basic procedure for troubleshooting is as follows.
     1] Start from the simple points.
     2] Start from the most likely points.
     3] Investigate other related parts or information.
6. Measures to remove root cause of failure
   Even if the failure is repaired, if the root cause of the failure is not repaired, the same failure will occur again. To prevent this, always investigate why the problem occurred.

Sequence of events in troubleshooting



Testing before troubleshooting

	Item	Criteria	Remedy
Lubricating oil and coolant	1. Check of level and type of fuel	—	Add fuel
	2. Check for foreign matter in fuel	—	Clean or drain
	3. Check of level and type of oil in engine oil pan	Between H and L	Add oil
	4. Check of coolant level	Between FULL and LOW	Add coolant
	5. Check of air cleaner for clogging	No red	Clean or replace
	6. Check of level and type of hydraulic oil	Between H and L	Add oil
	7. Check of level and type of transmission oil	In upper range of site gauge	Add oil
	8. Check of engine oil filter for clogging	—	Replace
	9. Check of hydraulic oil filter for clogging	—	Replace
	10. Check of transmission oil filter for clogging	—	Replace
Electrical parts	11. Check of battery terminal cables for looseness and corrosion	—	Retighten or replace
	12. Check of alternator terminal cables for looseness and corrosion	—	Retighten or replace
	13. Check of starting motor terminal cables for looseness and corrosion	—	Retighten or replace
	14. Check of operation of instruments	—	Repair or replace
Hydraulic and mechanical equipment	15. Check for abnormal noise and smell	—	Repair
	16. Check for oil leakage	—	Repair
	17. Bleeding air	—	Bleed air
	18. Check of effect of brake	—	Repair or adjust
Electrical equipment	19. Check of battery voltage (with engine stopped)	20 – 30 V	Charge or replace
	20. Check of battery electrolyte level	Between U.L and L.L	Add or replace
	21. Check wires for discoloration, burn, and removal of cover	—	Replace
	22. Check for removed wire clamp and drooping wire	—	Repair
	23. Check wiring for wetting with water (Check connectors and terminals for wetting with water, in particular)	—	Disconnect and dry connectors
	24. Check of slow-blow fuses and fuses for disconnection and corrosion	—	Replace
	25. Check of alternator voltage (with engine at medium speed or higher)	After several-minute operation: 27.5 – 29.5 V	Repair or replace
	26. Check of operating sound of battery relay (Starting switch OFF ⇔ ON)	—	Replace

Classification and procedures of troubleshooting

Classification of troubleshooting

Mode	Contents
Display of code	Troubleshooting by failure code (Display of code)
E-mode	Troubleshooting for electric system
H-mode	Troubleshooting for hydraulic and mechanical system
S-mode	Troubleshooting for engine unit

Procedure for troubleshooting

If a phenomenon looking like a trouble occurs in the machine, select a proper troubleshooting No. according to the following procedure, and then go to the corresponding troubleshooting section.

1. **Procedure for troubleshooting to be taken when action code is displayed on machine monitor:**
   If an action code is displayed on the machine monitor, display the failure code in the failure code display mode (for the electrical system and the mechanical system) of the machine monitor (EMMS).
   Carry out troubleshooting in [Display of failure code] according to the displayed failure code.
   - ★ Each failure code "flashes" when the trouble corresponding to it is detected. Even if a failure code "lights up" when the starting switch is turned ON, the trouble corresponding to that failure code may not have been repaired (Some troubles can be detected by simply turning the starting switch ON).
   - ★ If a failure code is recorded, be sure to perform the operation for reproducing it to see if the trouble corresponding to it has been repaired (For the method of reproducing the failure code, see the troubleshooting in [Display of code]).

2. **Procedure for troubleshooting to be taken when failure code is recorded:**
   If an action code is not displayed on the machine monitor, check for a failure code in the failure code display mode (for the electrical system and the mechanical system) of the machine monitor (EMMS).
   If a failure code is recorded, carry out troubleshooting in [Display of code] according to that failure code.
   - ★ Each failure code "flashes" when the trouble corresponding to it is detected. Even if a failure code "lights up" when the starting switch is turned ON, the trouble corresponding to that failure code may not have been repaired (Some troubles can be detected by simply turning the starting switch ON).
   - ★ If a failure code is recorded, be sure to perform the operation for reproducing it to see if the trouble corresponding to it has been repaired (For the method of reproducing the failure code, see the troubleshooting in [Display of code]).

3. **Procedure of troubleshooting to be taken when action code is not displayed and failure code is not recorded:**
   If a failure code is not recorded in the machine monitor (EMMS), a trouble that the machine cannot find out by itself may have occurred in the electrical system or hydraulic and mechanical system.
   In this case, check the phenomenon looking like a trouble again and select the same phenomenon from the table of "Phenomena looking like troubles and troubleshooting Nos.", and then carry out troubleshooting related to that phenomenon in the "E-mode", "H-mode", or "S-mode".

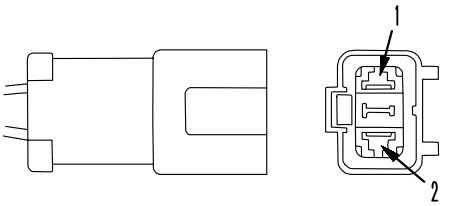
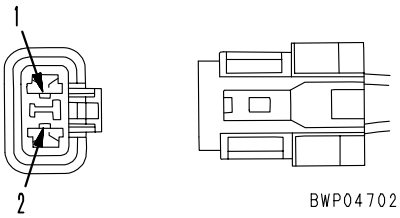
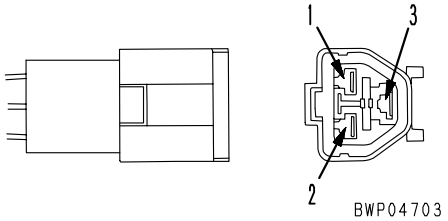
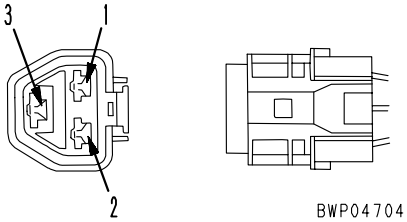
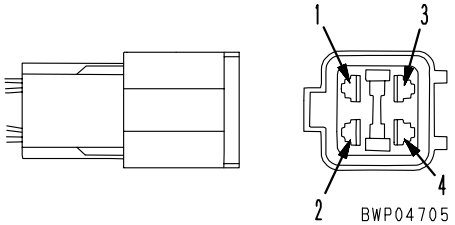
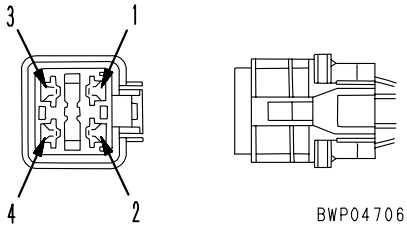
Phenomena looking like troubles and troubleshooting Nos.

No.	Phenomena looking like trouble		Troubleshooting			
			Code display	E-mode	H-mode	S-mode
Phenomena related to action codes and failure codes						
1	Action codes are displayed on machine monitor		Check failure code			
2	If failure code display function is checked, failure codes are displayed		●			
Phenomena related to engine						
3	Engine does not start easily.			E-1		S-1
4	Engine does not start.	Engine does not crank		E-1		S-2 a)
5		Engine cranks but exhaust smoke does not comes out				S-2 b)
6		Exhaust smoke comes out but engine does not start (Fuel is injected)				S-2 c)
7	Engine does not pick up smoothly.					S-3
8	Engine stops during operation				H-2	S-4
9	Engine rotation is abnormal (Engine hunts)					S-5
10	Output is insufficient (Power is low)					S-6
11	Exhaust gas color is bad (Incomplete combustion)					S-7
12	Oil consumption is excessive (or exhaust smoke is blue)					S-8
13	Engine oil becomes contaminated quickly					S-9
14	Fuel is consumed much					S-10
15	Coolant contains oil (blows back or reduces)					S-11
16	Engine oil pressure drops					S-12
17	Oil level rises (Water or fuel is mixed in oil)					S-13
18	Coolant temperature too high (Overheating)					S-14
19	Abnormal sound comes out					S-15
20	Vibration is excessive					S-16
Phenomena related to power train						
21	Machine does not start				H-1	
22	Torque converter lockup is not switched (engine stalls)				H-2	
23	Torque converter lockup is not turned on				H-3	
24	Travel speed is low, rush force is low, grade-ability is low, and gear speed does not change				H-4	
25	Large shocks are made when machine starts and gear is shifted				H-5	
26	Large time lag is made when machine starts and gear is shifted				H-6	
27	Torque converter oil temperature is high				H-7	
Phenomena related to steering						
28	Machine cannot be steered [machine with steering wheel]				H-8	
29	Machine cannot be steered [machine with AJSS]				H-9	
30	Steering response is low [machine with steering wheel]				H-10	
31	Steering response is low [machine with AJSS]				H-11	
32	Steering is heavy [machine with steering wheel]				H-12	
33	Steering wheel shakes or makes large shocks [machine with steering wheel]				H-13	
34	Steering wheel shakes or makes large shocks [machine with AJSS]				H-14	

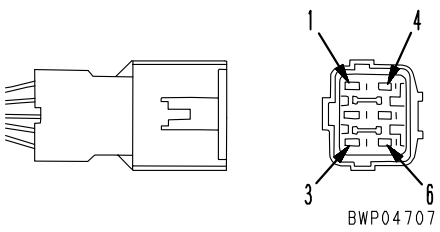
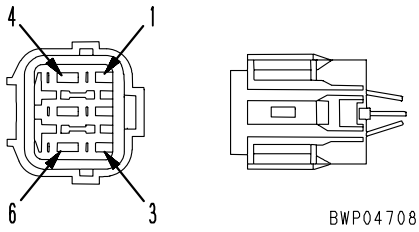
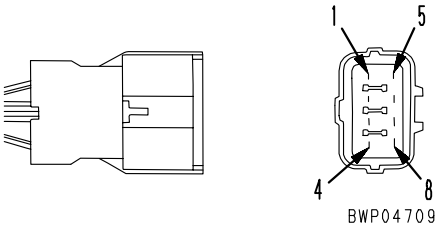
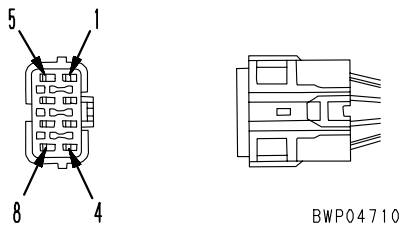
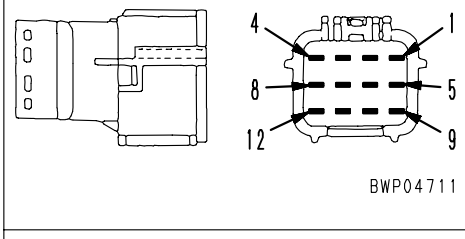
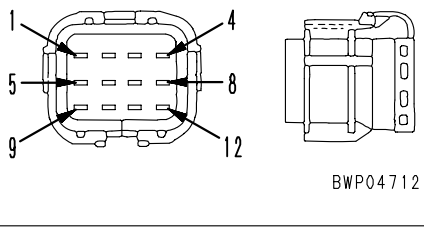
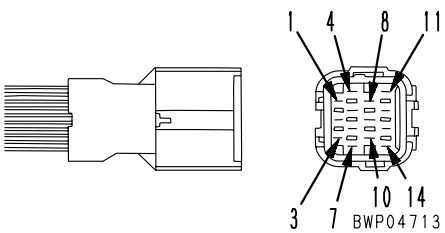
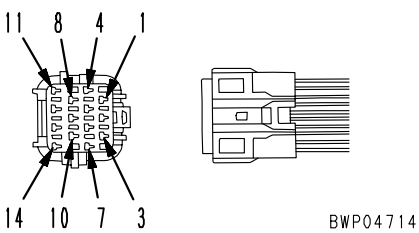
Phenomena related to brake					
35	Wheel brake does not work or braking force is low			H-15	
36	Wheel brake is not reset or it drags			H-16	
37	Parking brake does not work or braking force is low			H-17	
38	Parking brake cannot be reset or it drags (including emergency release system)			H-18	
Phenomena related to work equipment					
39	Lift arm does not rise			H-19	
40	Lift arm speed is low or rising force of lift arm is insufficient			H-20	
41	When lift arm rises, its speed lowers at specific height			H-21	
42	Bucket cannot be held with lift arm cylinder (Bucket floats)			H-22	
43	Hydraulic drift of lift arm is large			H-23	
44	Lift arm shakes during operation			H-24	
45	Bucket does not tilt back			H-25	
46	Bucket speed is low or tilting back force is insufficient			H-26	
47	Bucket spool lowers during tilt-back operation			H-27	
48	Bucket cannot be held with bucket cylinder			H-28	
49	Hydraulic drift of bucket is large			H-29	
50	Bucket shakes while machine is traveling with load (Work equipment valve is in HOLD)			H-30	
51	Engine speed lowers remarkably or engine stalls during work equipment control			H-31	
52	Large shock is made when work equipment starts and stops			H-32	
53	When work equipment circuit is relieved singly, other work equipment moves			H-33	
54	ECSS does not operate, and pitching or bouncing occurs			H-34	
Others					
55	Wiper does not operate		E-2		
56	Windshield washer does not operate		E-3		
57	Headlamp, clearance lamp, tail lamp, and license plate lamp do not light up or go off		E-4		
58	Working lamp does not light up or go off		E-5		
59	Step lamp does not light up or go off		E-6		
60	Turn signal lamp and hazard lamp do not light up or go off		E-7		
61	Brake lamp does not light or it keeps lighting up		E-8		
62	Backup lamp does not light or it keeps lighting up		E-9		
63	Backup buzzer does not sound or it keeps sounding		E-10		
64	Horn does not sound or it keeps sounding		E-11		
65	Warning buzzer does not sound or it keeps sounding		E-12		
66	Air conditioner does not operate or stop		E-13		

Connection table for connector pin numbers

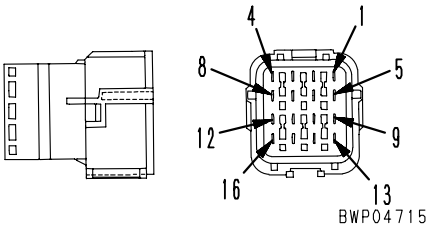
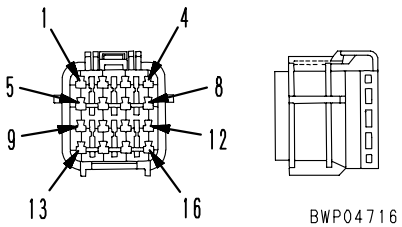
★ The terms male and female refer to the pins, while the terms male housing and female housing refer to the mating portion of the housing.

No. of pins	X type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
1	Part No. : 08055-00181	Part No. : 08055-00191	799-601-7010
2	 BWP04701	 BWP04702	799-601-7020
	Part No. : 08055-00282	Part No. : 08055-00292	
3	 BWP04703	 BWP04704	799-601-7030
	Part No. : 08055-00381	Part No. : 08055-00391	
4	 BWP04705	 BWP04706	799-601-7040
	Part No. : 08055-00481	Part No. : 08055-00491	
—	Terminal part No. : 79A-222-3370 ·Electric wire size: 0.85 ·Grommet: Black ·Q'ty: 20	Terminal part No. : 79A-222-3390 ·Electric wire size: 0.85 ·Grommet: Black ·Q'ty: 20	—
—	Terminal part No. : 79A-222-3380 ·Electric wire size: 2.0 ·Grommet: Red ·Q'ty: 20	Terminal part No. : 79A-222-3410 ·Electric wire size: 2.0 ·Grommet: Red ·Q'ty: 20	—

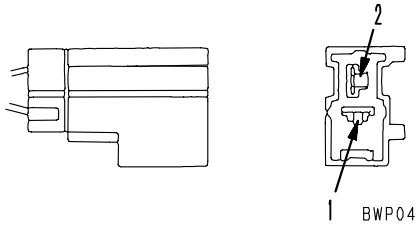
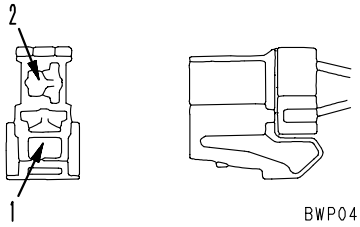
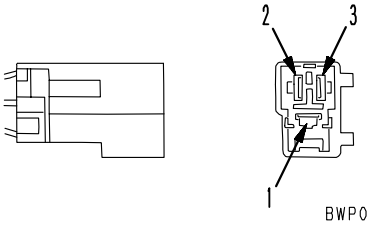
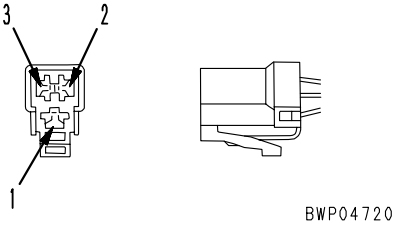
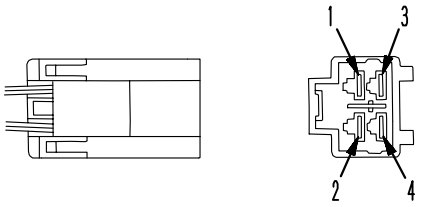
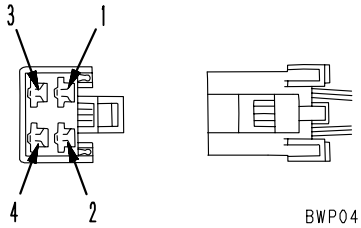
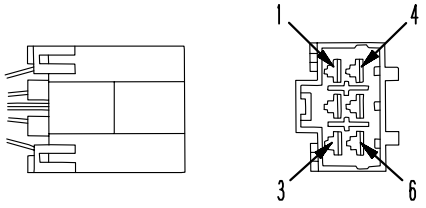
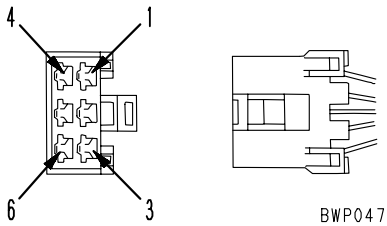
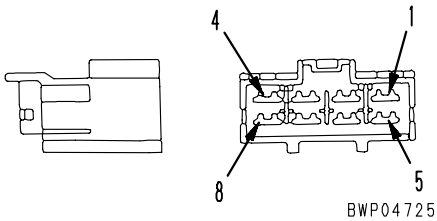
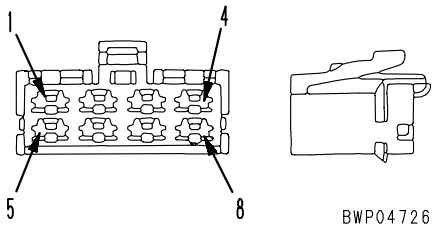
9JS04890

No. of pins	SWP type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
6			799-601-7050
	Part No. : 08055-10681	Part No. : 08055-10691	
8			799-601-7060
	Part No. : 08055-10881	Part No. : 08055-10891	
12			799-601-7310
	Part No. : 08055-11281	Part No. : 08055-11291	
14			799-601-7070
	Part No. : 08055-11481	Part No. : 08055-11491	

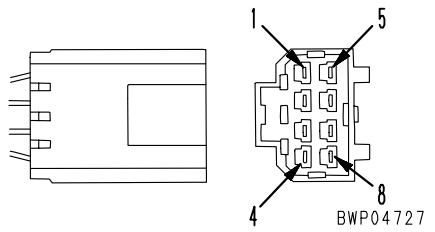
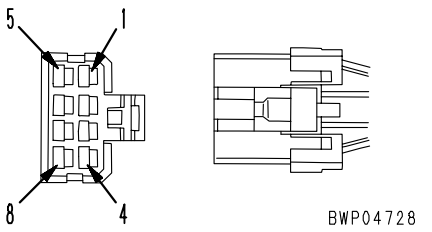
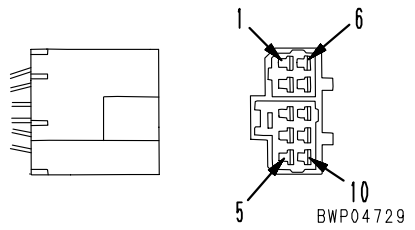
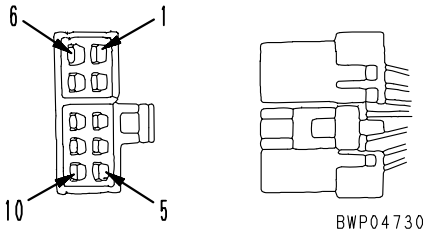
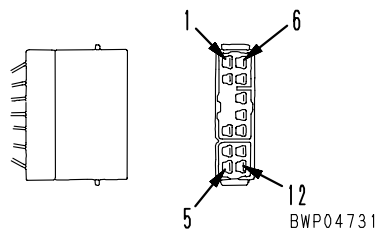
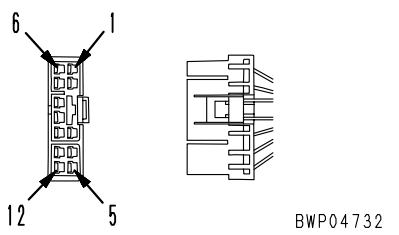
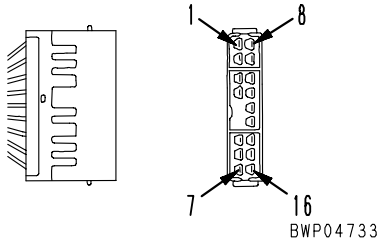
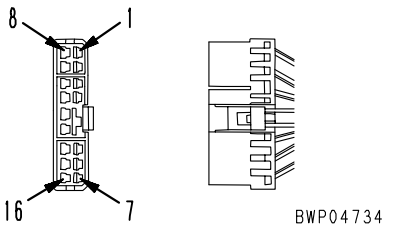
9JS04891

No. of pins	SWP type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
16	 BWP04715	 BWP04716	799-601-7320
	Part No. : 08055-11681	Part No. : 08055-11691	
—	Terminal part No. : ·Electric wire size: 0.85 ·Grommet: Black ·Q'ty: 20	Terminal part No. : ·Electric wire size: 0.85 ·Grommet: Black ·Q'ty: 20	—
—	Terminal part No. : ·Electric wire size: 1.25 ·Grommet: Red ·Q'ty: 20	Terminal part No. : ·Electric wire size: 1.25 ·Grommet: Red ·Q'ty: 20	—

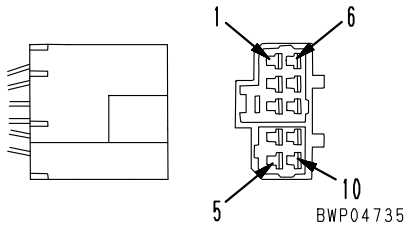
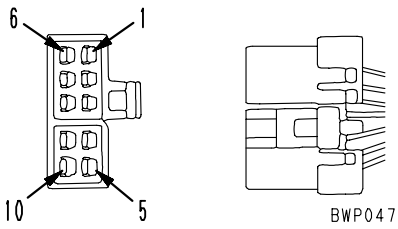
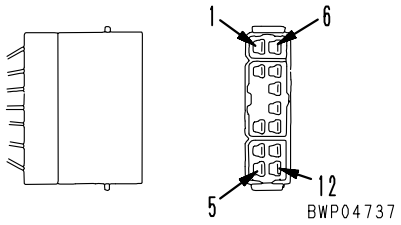
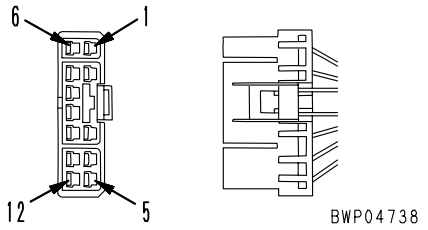
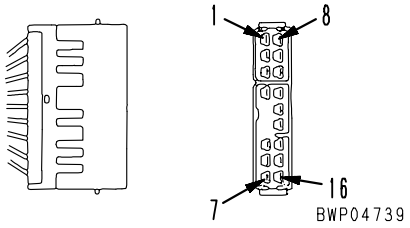
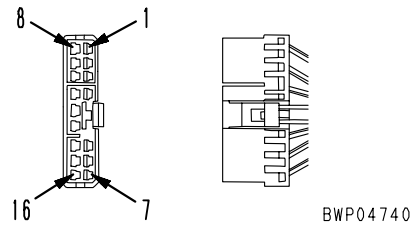
9JS04892

No. of pins	M type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
1	Part No. : 08056-00171	Part No. : 08056-00181	799-601-7080
2	 BWP04717	 BWP04718	799-601-7090
	Part No. : 08056-00271	Part No. : 08056-00281	
3	 BWP04719	 BWP04720	799-601-7110
	Part No. : 08056-00371	Part No. : 08056-00381	
4	 BWP04721	 BWP04722	799-601-7120
	Part No. : 08056-00471	Part No. : 08056-00481	
6	 BWP04723	 BWP04724	799-601-7130
	Part No. : 08056-00671	Part No. : 08056-00681	
8	 BWP04725	 BWP04726	799-601-7340
	Part No. : 08056-00871	Part No. : 08056-00881	

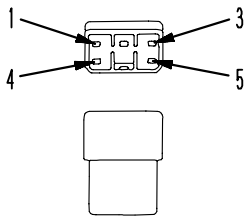
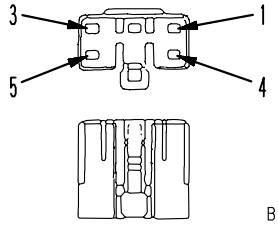
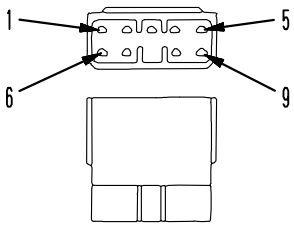
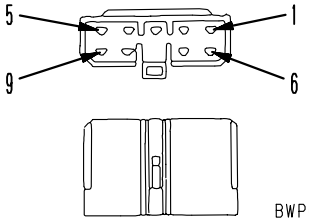
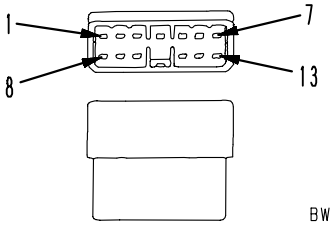
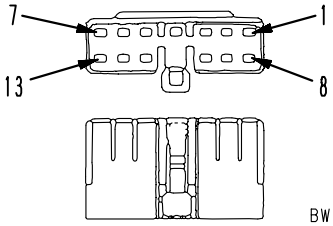
9JS04893

No. of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8			799-601-7140
	Part No. : 08056-10871	Part No. : 08056-10881	
10 (White)			799-601-7150
	Part No. : 08056-11071	Part No. : 08056-11081	
12 (White)			799-601-7350
	Part No. : 08056-11271	Part No. : 08056-11281	
16 (White)			799-601-7330
	Part No. : 08056-11671	Part No. : 08056-11681	

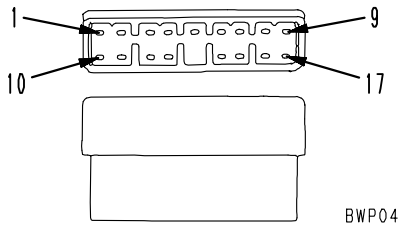
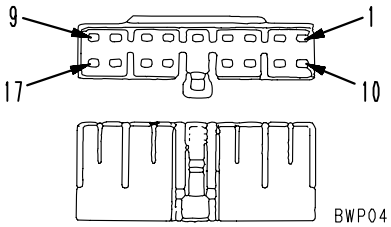
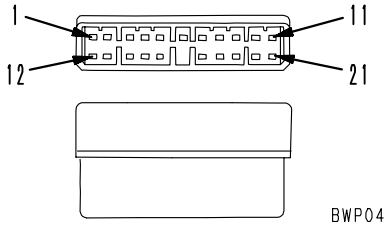
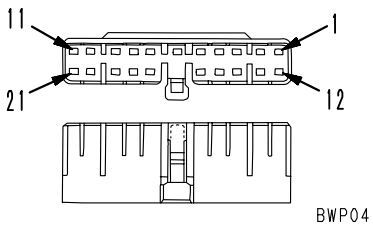
9JS04894

No. of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10 (Blue)			—
	—	—	
12 (Blue)			799-601-7160
	Part No. : 08056-11272	Part No. : 08056-11282	
16 (Blue)			799-601-7170
	Part No. : 08056-11672	Part No. : 08056-11682	

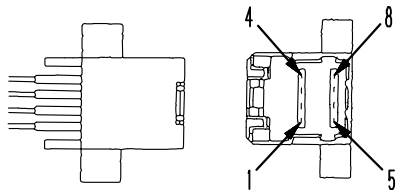
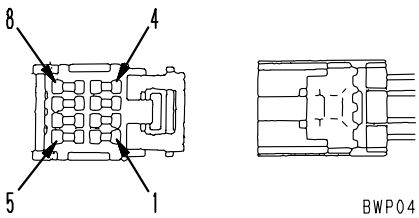
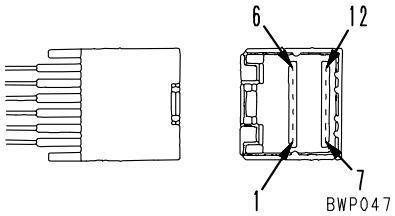
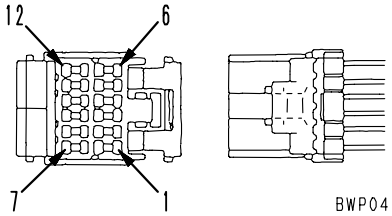
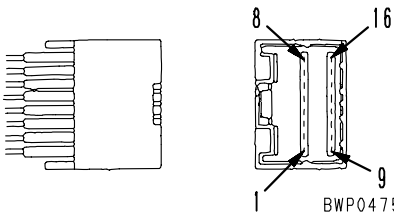
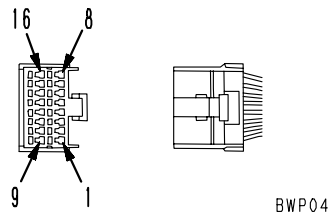
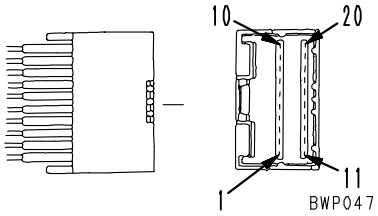
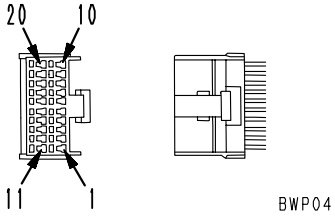
9JS04895

No. of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
7	Body part No. : 79A-222-2640 (Q'ty:5)	Body part No. : 79A-222-2630 (Q'ty:5)	—
11	Body part No. : 79A-222-2680 (Q'ty:5)	Body part No. : 79A-222-2670 (Q'ty:5)	—
5	 BWP04741	 BWP04742	799-601-2710
	Body part No. : 79A-222-2620 (Q'ty:5)	Body part No. : 79A-222-2610 (Q'ty:5)	
9	 BWP04743	 BWP04744	799-601-2950
	Body part No. : 79A-222-2660 (Q'ty:5)	Body part No. : 79A-222-2650 (Q'ty:5)	
13	 BWP04745	 BWP04746	799-601-2720
	Body part No. : 79A-222-2710 (Q'ty:2)	Body part No. : 79A-222-2690 (Q'ty:2)	

9JS04896

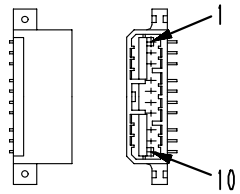
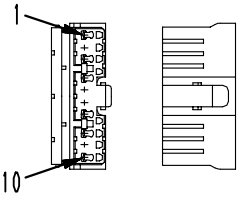
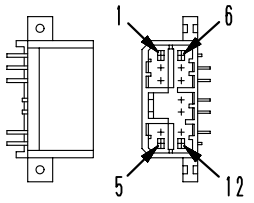
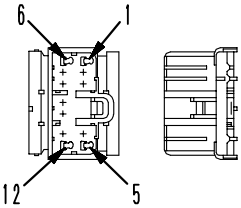
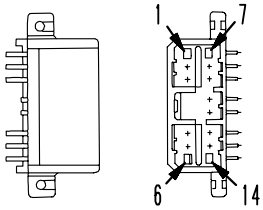
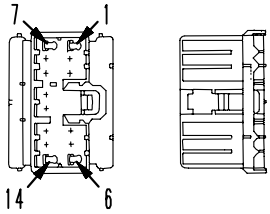
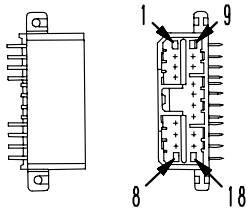
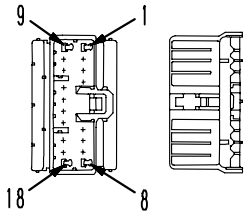
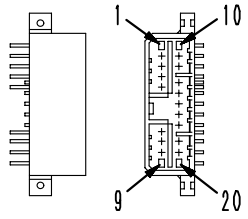
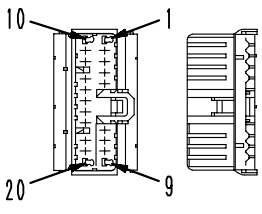
No. of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
17	 BWP04747	 BWP04748	799-601-2730
	Body part No. : 79A-222-2730 (Q'ty:2)	Body part No. : 79A-222-2720 (Q'ty:2)	
21	 BWP04749	 BWP04750	799-601-2740
	Body part No. : 79A-222-2750 (Q'ty:2)	Body part No. : 79A-222-2740 (Q'ty:2)	
	Terminal part No. : 79A-222-2770 (Q'ty:50)	Terminal part No. : 79A-222-2760 (Q'ty:50)	

9JS04897

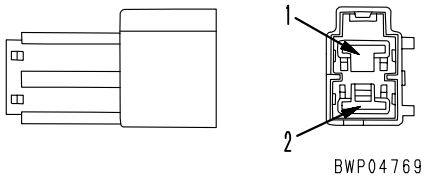
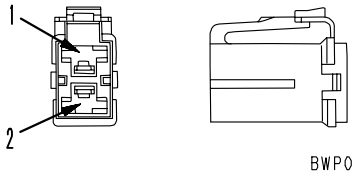
No. of pins	AMP040 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8	 BWP04751	 BWP04752	799-601-7180
	—	Housing part No. : 79A-222-3430 (Q'ty:5)	
12	 BWP04753	 BWP04754	799-601-7190
	—	Housing part No. : 79A-222-3440 (Q'ty:5)	
16	 BWP04755	 BWP04756	799-601-7210
	—	Housing part No. : 79A-222-3450 (Q'ty:5)	
20	 BWP04757	 BWP04758	799-601-7220
	—	Housing part No. : 79A-222-3460 (Q'ty:5)	

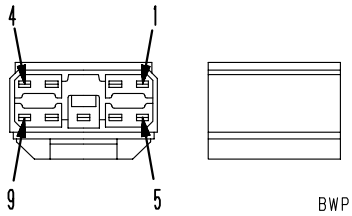
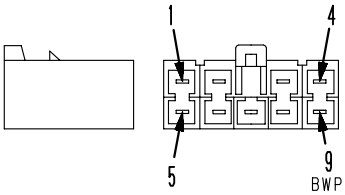
★ Terminal part No. :79A-222-3470 (No relation with number of pins)

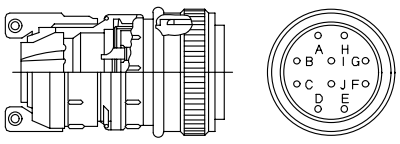
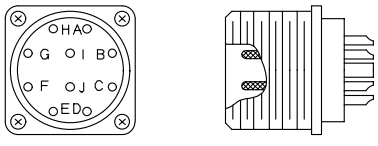
9JS04898

No. of pins	AMP070 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10	 BWP04759	 BWP04760	799-601-7510
	—	Part No. : 7821-92-7330	
12	 BWP04761	 BWP04762	799-601-7520
	—	Part No. : 7821-92-7340	
14	 BWP04763	 BWP04764	799-601-7530
	—	Part No. : 7821-92-7350	
18	 BWP04765	 BWP04766	799-601-7540
	—	Part No. : 7821-92-7360	
20	 BWP04767	 BWP04768	799-601-7550
	—	Part No. : 7821-92-7370	

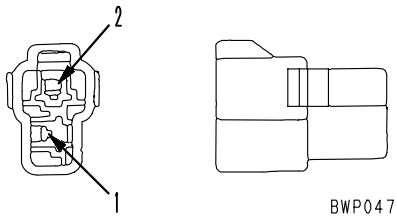
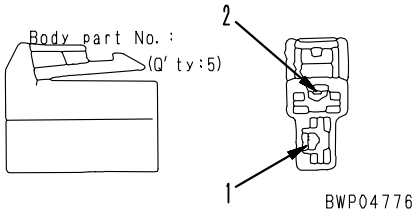
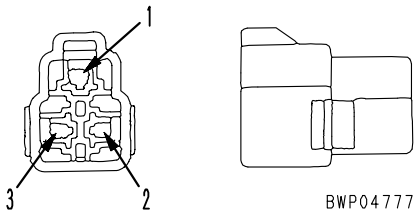
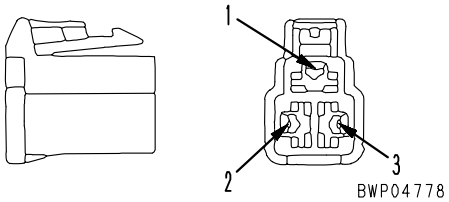
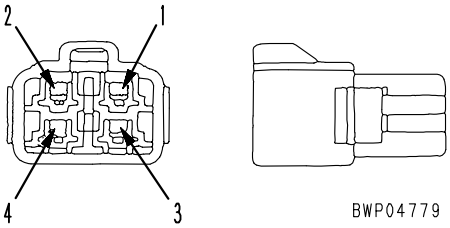
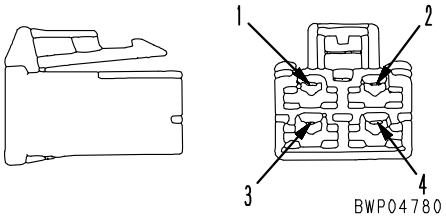
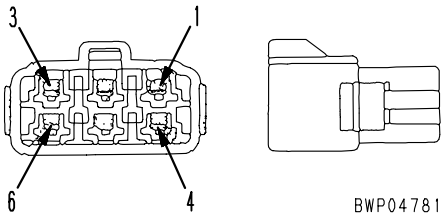
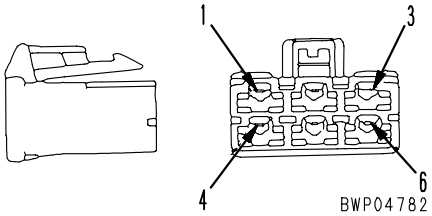
9JS04899

No. of pins	L type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
2	 BWP04769	 BWP04770	—
	—	—	

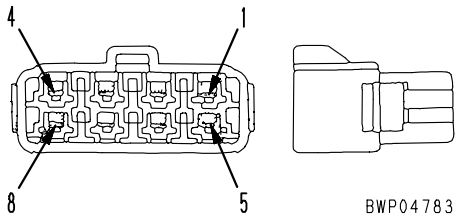
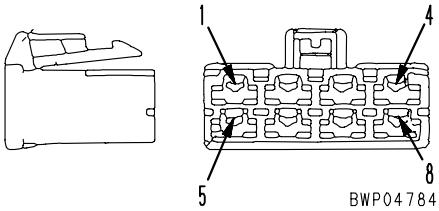
No. of pins	Connector for PA		
	Male (female housing)	Female (male housing)	T-adapter Part No.
9	 BWP04771	 BWP04772	—
	—	—	

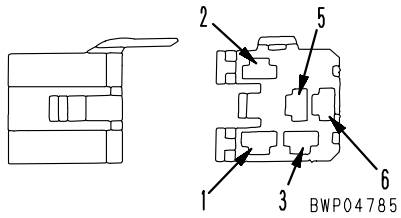
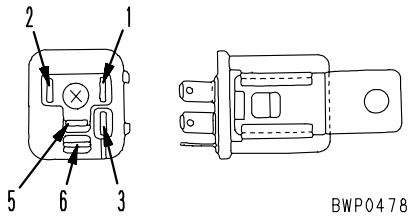
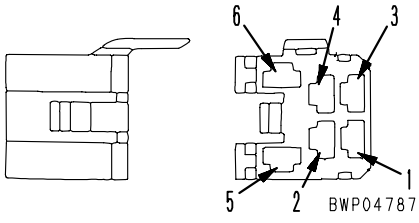
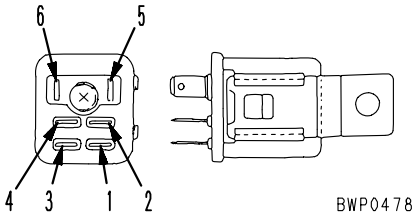
No. of pins	Bendix MS connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10	 BWP04773	 BWP04774	799-601-3460
	—	—	

9JS04900

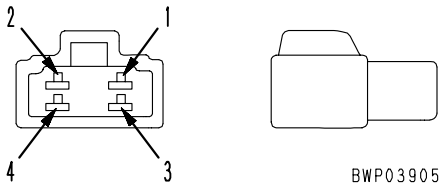
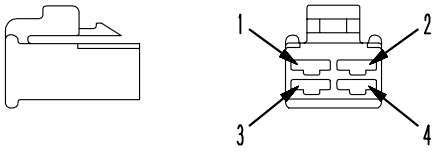
No. of pins	KES 1 (Automobile) connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
2			—
	Part No. : 08027-10210 (Natural color) 08027-10220 (Black)	Part No. : 08027-10260 (Natural color) 08027-10270 (Black)	
3			—
	Part No. : 08027-10310	Part No. : 08027-10360	
4			—
	Part No. : 08027-10410 (Natural color) 08027-10420 (Black)	Part No. : 08027-10460 (Natural color) 08027-10470 (Black)	
6			—
	Part No. : 08027-10610 (Natural color) 08027-10620 (Black)	Part No. : 08027-10660 (Natural color) 08027-10670 (Black)	

9JS04901

No. of pins	KES1 (Automobile) connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8			—
	Part No. :08027-10810 (Natural color) 08027-10820 (Black)	Part No. :08027-10860 (Natural color) 08027-10870 (Black)	

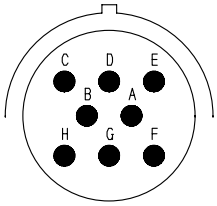
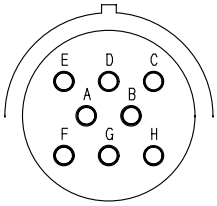
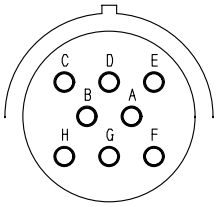
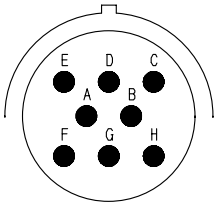
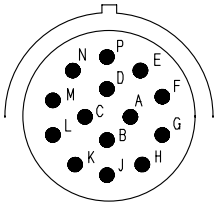
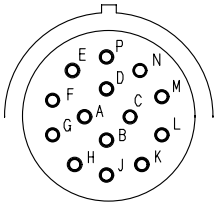
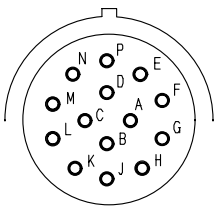
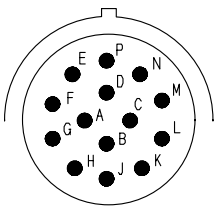
No. of pins	Connector for relay (Socket type)		
	Male (female housing)	Female (male housing)	T-adapter Part No.
5			799-601-7360
	—	—	
6			799-601-7370
	—	—	

9JS04902

No. of pins	F type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
4	 BWP03905	 BWP03906	—
	—	—	

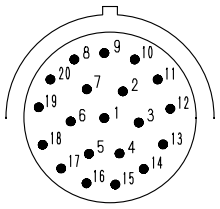
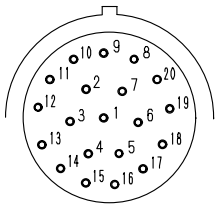
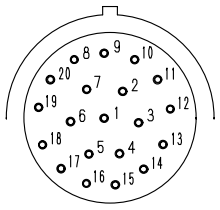
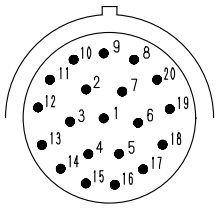
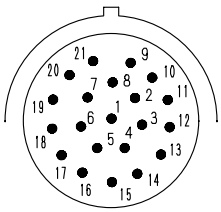
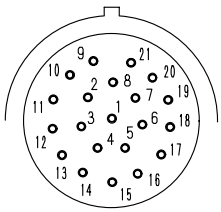
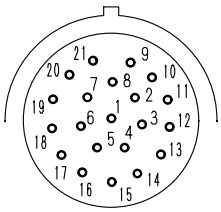
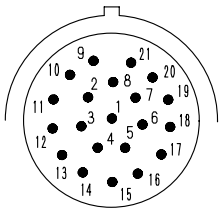
9JS04903

[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
18-8 (1)	Pin (male terminal)	Pin (female termial)	799-601-9210
	 BWP05001	 BWP05002	
	Part No. :08191-11201, 08191-11202, 08191-11205, 08191-11206	Part No. :08191-14101, 08191-14102, 08191-14105, 08191-14106	
	Pin (female terminal)	Pin (male termial)	799-601-9210
	 BWP05003	 BWP05004	
	Part No. :08191-12201, 08191-12202, 08191-12205, 08191-12206	Part No. :08191-13101, 08191-13102, 08191-13105, 08191-13106	
18-14 (2)	Pin (male terminal)	Pin (female termial)	799-601-9220
	 BWP05005	 BWP05006	
	Part No. :08191-21201, 08191-12202, 08191-21205, 08191-12206	Part No. :08191-24101, 08191-24102, 08191-24105, 08191-24106	
	Pin (female terminal)	Pin (male termial)	799-601-9220
	 BWP05007	 BWP05008	
	Part No. :08191-22201, 08191-22202, 08191-22205, 08191-22206	Part No. :08191-23101, 08191-23102, 08191-23105, 08191-23106	

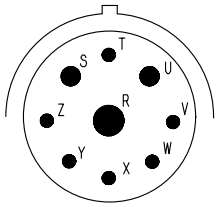
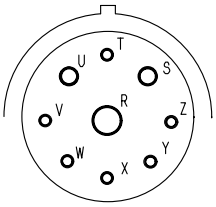
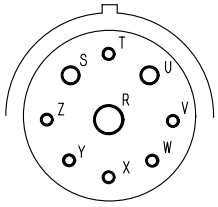
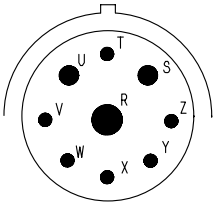
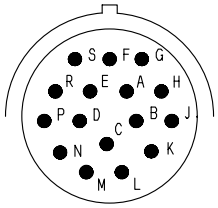
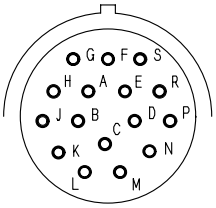
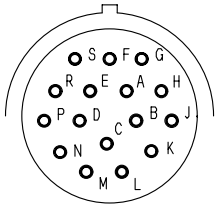
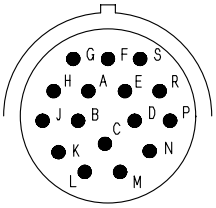
9JS04904

[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
18-20 (3)	Pin (male terminal)	Pin (female termial)	799-601-9230
	 BWP05009	 BWP05010	
	Part No. :08191-31201, 08191-31202	Part No. :08191-34101, 08191-34102	
	Pin (female terminal)	Pin (male termial)	799-601-9230
	 BWP05011	 BWP05012	
	Part No. :08191-32201, 08191-32202	Part No. :08191-33101, 08191-33102	
18-21 (4)	Pin (male terminal)	Pin (female termial)	799-601-9240
	 BWP05013	 BWP05014	
	Part No. :08191-41201, 08191-42202	Part No. :08191-44101, 08191-44102	
	Pin (female terminal)	Pin (male termial)	799-601-9240
	 BWP05015	 BWP05016	
	Part No. :08191-42201, 08191-42202	Part No. :08191-43101, 08191-43102	

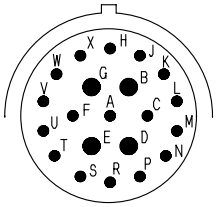
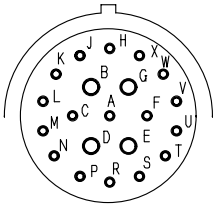
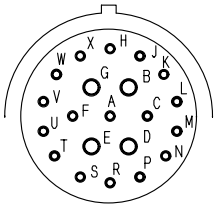
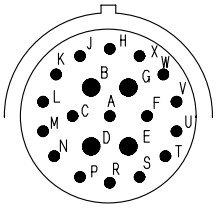
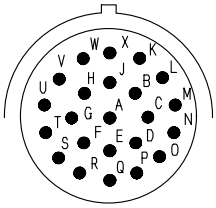
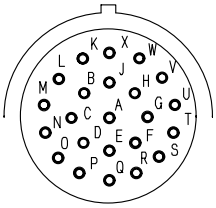
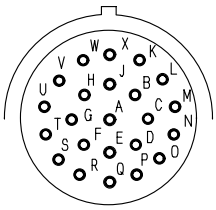
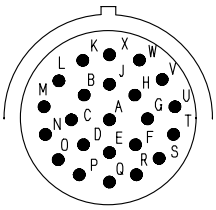
9JS04905

[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
24-9 (5)	Pin (male terminal)	Pin (female termial)	799-601-9250
	 BWP05017	 BWP05018	
	Part No. :08191-51201, 08191-51202	Part No. :08191-54101, 08191-54102	
	Pin (female terminal)	Pin (male termial)	799-601-9250
	 BWP05019	 BWP05020	
	Part No. :08191-52201, 08191-52202	Part No. :08191-53101, 08191-53102	
24-16 (6)	Pin (male terminal)	Pin (female termial)	799-601-9260
	 BWP05021	 BWP05022	
	Part No. :08191-61201, 08191-62202, 08191-61205, 08191-62206	Part No. :08191-64101, 08191-64102, 08191-64105, 08191-64106	
	Pin (female terminal)	Pin (male termial)	799-601-9260
	 BWP05023	 BWP05024	
	Part No. :08191-62201, 08191-62202, 08191-62205, 08191-62206	Part No. :08191-63101, 08191-63102, 08191-63105, 08191-63106	

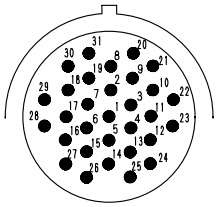
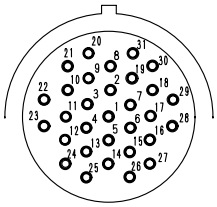
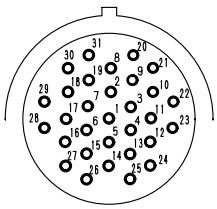
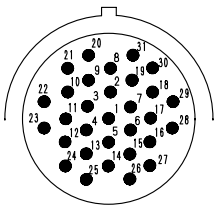
9JS04906

[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
24-21 (7)	Pin (male terminal)	Pin (female termial)	799-601-9270
	 BWP05025	 BWP05026	
	Part No. :08191-71201, 08191-71202, 08191-71205, 08191-71206	Part No. :08191-74101, 08191-74102, 08191-74105, 08191-74106	
	Pin (female terminal)	Pin (male termial)	799-601-9270
	 BWP05027	 BWP05028	
	Part No. :08191-72201, 08191-72202, 08191-72205, 08191-72206	Part No. :08191-73101, 08191-73102, 08191-73105, 08191-73106	
24-23 (8)	Pin (male terminal)	Pin (female termial)	799-601-9280
	 BWP05029	 BWP05030	
	Part No. :08191-81201, 08191-81202, 08191-81203, 08191-81204, 08191-81205, 08191-80206	Part No. :08191-84101, 08191-84102, 08191-84103, 08191-84104, 08191-84105, 08191-84106	
	Pin (female terminal)	Pin (male termial)	799-601-9280
	 BWP05031	 BWP05032	
	Part No. :08191-82201, 08191-82202, 08191-82203, 08191-82204, 08191-82205, 08191-82206	Part No. :08191-83101, 08191-83102, 08191-83103, 08191-83104, 08191-83105, 08191-83106	

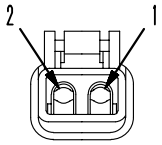
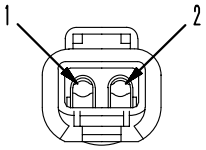
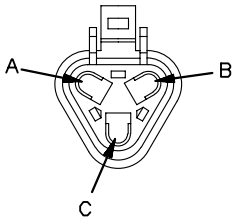
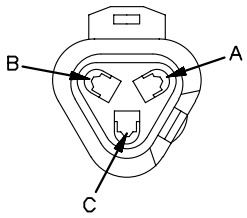
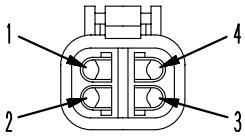
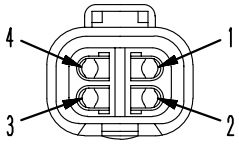
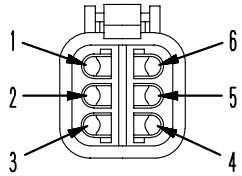
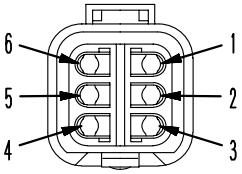
9JS04907

[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
24-31 (9)	Pin (male terminal)	Pin (female termial)	799-601-9290
	 BWP05033	 BWP05034	
	Part No. :08191-91203, 08191-91204, 08191-91205, 08191-91206	Part No. :08191-94103, 08191-94104, 08191-94105, 08191-94106	
	Pin (female terminal)	Pin (male termial)	799-601-9290
	 BWP05035	 BWP05036	
	Part No. :08191-92203, 08191-92204, 08191-92205, 08191-92206	Part No. :08191-93103, 08191-93104, 08191-93105, 08191-93106	

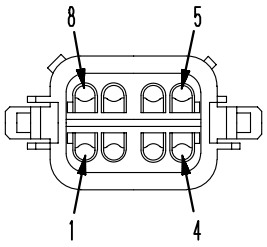
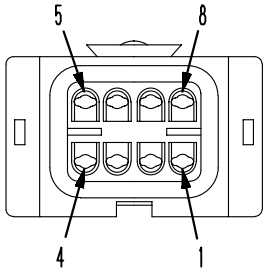
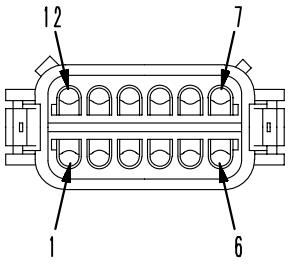
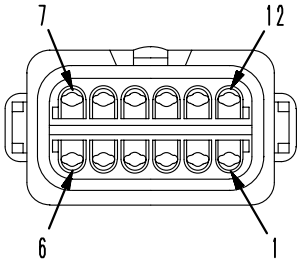
9JS04908

[The pin No. is also marked on the connector (electric wire insertion end)]

No. of pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05037	 BWP05038	799-601-9020
	Part No. :08192-12200 (normal type) 08192-22200 (fine wire type)	Part No. :08192-12100 (normal type) 08192-22100 (fine wire type)	
3	 BWP05039	 BWP05040	799-601-9030
	Part No. :08192-13200 (normal type) 08192-23200 (fine wire type)	Part No. :08192-13100 (normal type) 08192-23100 (fine wire type)	
4	 BWP05041	 BWP05042	799-601-9040
	Part No. :08192-14200 (normal type) 08192-24200 (fine wire type)	Part No. :08192-14100 (normal type) 08192-24100 (fine wire type)	
6	 BWP05043	 BWP05044	799-601-9050
	Part No. :08192-16200 (normal type) 08192-26200 (fine wire type)	Part No. :08192-16100 (normal type) 08192-26100 (fine wire type)	

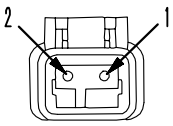
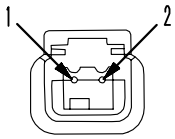
9JS04909

[The pin No. is also marked on the connector (electric wire insertion end)]

No. of pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
8	 BWP05045	 BWP05046	8GR:799-601-9060 8B: 799-601-9070 8G: 799-601-9080 8BR:799-601-9090
	Part No. :08192-1820□ (normal type) 08192-2820□ (fine wire type)	Part No. :08192-1810□ (normal type) 08192-2810□ (fine wire type)	
12	 BWP05047	 BWP05048	12GR:799-601-9110 12B: 799-601-9120 12G: 799-601-9130 12BR:799-601-9140
	Part No. :08192-1920□ (normal type) 08192-2920□ (fine wire type)	Part No. :08192-1910□ (normal type) 08192-2910□ (fine wire type)	

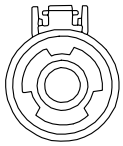
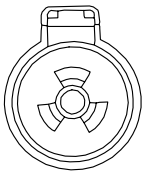
9JS04910

[The pin No. is also marked on the connector (electric wire insertion end)]

No. of pins	DTM Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05049	 BWP05050	799-601-9010
	Part No. :08192-02200	Part No. :08192-02100	

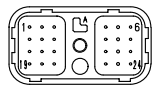
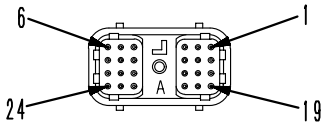
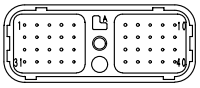
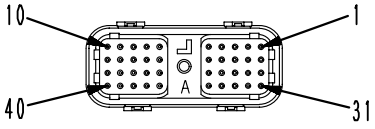
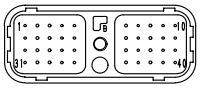
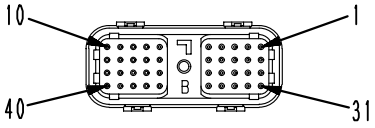
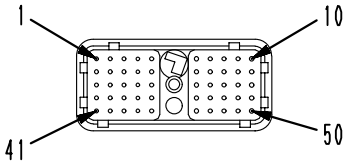
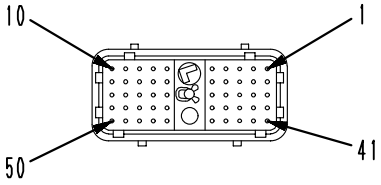
9JS04911

[The pin No. is also marked on the connector (electric wire insertion end)]

No. of pins	DTHD Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05051	 BWP05052	—
	Part No. :08192-31200 (Contact size #12) 08192-41200 (Contact size #8) 08192-51200 (Contact size #4)	Part No. :08192-31100 (Contact size #12) 08192-41100 (Contact size #8) 08192-51100 (Contact size #4)	

9JS04912

[The pin No. is also marked on the connector (electric wire insertion end)]

No. of pins	DRC26 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
24	 BJD12722	 BJD12723	799-601-9360
	–	Part No. :7821-93-3110	
40 (A)	 BJD12724	 BJD12725	799-601-9350
	–	Part No. :7821-93-3120	
40 (B)	 BJD12726	 BJD12727	799-601-9350
	–	Part No. :7821-93-3130	
50	 9JS02951	 9JS02952	799-601-4210
	–	–	

9JS04913

T-branch box and T-branch adapter table

★ The vertical column shows part number of T-branch box or T-branch, and horizontal column shows part number of T-branch.

Part No.	Connector type or part name	No. of pins	ID symbol	T-branch adapter kit																Others
				799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	
799-601-2600	T-branch box (For ECONO)	21		●		●	●						●	●		●					
799-601-3100	T-branch box (For MS)	37						●													
799-601-3200	T-branch box (For MS)	37						●													
799-601-3300	T-branch box (For ECONO)	24								●											
799-601-3360	• Plate for MS (24 pins)									●											
799-601-3370	• Plate for MS (17 pins)									●											
799-601-3380	• Plate for MS (14 pins)									●											
799-601-3410	Adapter for BENDIX (MS)	24	MS-24P							●	●										
799-601-3420	Adapter for BENDIX (MS)	24	MS-24P							●	●										
799-601-3430	Adapter for BENDIX (MS)	17	MS-17P							●	●										
799-601-3440	Adapter for BENDIX (MS)	17	MS-17P							●	●										
799-601-3450	Adapter for BENDIX (MS)	5	MS-5P						●	●											
799-601-3460	Adapter for BENDIX (MS)	10	MS-10P							●	●										
799-601-3510	Adapter for BENDIX (MS)	5	MS-5S						●	●											
799-601-3520	Adapter for BENDIX (MS)	17	MS-17P						●	●											
799-601-3530	Adapter for BENDIX (MS)	19	MS-19P							●	●										
799-601-2910	Adapter for BENDIX (MS)	14	MS-14P						●	●											
799-601-3470	Case									●											
799-601-2710	Adapter for MIC	5	MIC-5P	●	●		●							●							
799-601-2720	Adapter for MIC	13	MIC-13P	●	●		●							●							
799-601-2730	Adapter for MIC	17	MIC-17P	●	●	●	●						●	●		●					
799-601-2740	Adapter for MIC	21	MIC-21P	●	●	●	●						●	●		●					
799-601-2950	Adapter for MIC	9	MIC-9P									●	●	●		●					
799-601-2750	Adapter for ECONO	2	ECONO 2P	●	●																
799-601-2760	Adapter for ECONO	3	ECONO 3P	●	●																
799-601-2770	Adapter for ECONO	4	ECONO 4P	●	●																
799-601-2780	Adapter for ECONO	8	ECONO 8P	●	●																
799-601-2790	Adapter for ECONO	12	ECONO 12P	●	●																
799-601-2810	Adapter for DLI	8	DLI-8P	●	●																
799-601-2820	Adapter for DLI	12	DLI-12P	●	●																
799-601-2830	Adapter for DLI	16	DLI-16P	●	●																
799-601-2840	Additional cable (ECONO type)	12	ECONO 12P	●	●									●							
799-601-2850	Case			●																	
799-601-4210	Adapter for DRC	50	DRC50																		●
799-601-7010	Adapter for X (T-branch)	1												●		●					
799-601-7020	Adapter for X	2	X2P									●	●	●		●					
799-601-7030	Adapter for X	3	X3P									●	●	●		●					
799-601-7040	Adapter for X	4	X4P									●	●	●		●					

Part No.	Connector type or part name	No. of pins	ID symbol	T-branch adapter kit																Others
				799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	
799-601-7050	Adapter for SWP	6	SW6P									●	●	●							
799-601-7060	Adapter for SWP	8	SW8P									●	●	●							
799-601-7310	Adapter for SWP	12	SW12P																		●
799-601-7070	Adapter for SWP	14	SW14P											●		●					
799-601-7320	Adapter for SWP	16	SW16P																		●
799-601-7080	Adapter for M (T-branch)	1												●		●					
799-601-7090	Adapter for M	2	M2P									●	●	●		●					
799-601-7110	Adapter for M	3	M3P									●	●	●		●					
799-601-7120	Adapter for M	4	M4P									●	●	●		●					
799-601-7130	Adapter for M	6	M6P									●	●	●		●					
799-601-7340	Adapter for M	8	M8P																		●
799-601-7140	Adapter for S	8	S8P									●	●	●		●					
799-601-7150	Adapter for S (white)	10	S10P									●	●	●		●					
799-601-7160	Adapter for S (blue)	12	S12P									●	●	●							
799-601-7170	Adapter for S (blue)	16	S16P									●	●	●		●					
799-601-7330	Adapter for S (white)	16	S16PW													●					
799-601-7350	Adapter for S (white)	12	S12PW																		●
799-601-7180	Adapter for AMP040	8	A8P											●							
799-601-7190	Adapter for AMP040	12	A12P											●		●					
799-601-7210	Adapter for AMP040	16	A16P									●	●	●		●					
799-601-7220	Adapter for AMP040	20	A20P									●	●	●		●					
799-601-7230	Short connector for X	2										●	●	●		●					
799-601-7240	Case											●	●								
799-601-7270	Case													●							
799-601-7510	Adapter for 070	10	07-10												●						
799-601-7520	Adapter for 070	12	07-12												●						
799-601-7530	Adapter for 070	14	07-14												●						
799-601-7540	Adapter for 070	18	07-18												●						
799-601-7550	Adapter for 070	20	07-20												●						
799-601-7360	Adapter for relay	5	REL-5P																		●
799-601-7370	Adapter for relay	6	REL-6P																		●
799-601-7380	Adapter for JFC	2																			●
799-601-9010	Adapter for DTM	2	DTM2														●		●		
799-601-9020	Adapter for DT	2	DT2														●		●		
799-601-9030	Adapter for DT	3	DT3														●		●		
799-601-9040	Adapter for DT	4	DT4														●		●		
799-601-9050	Adapter for DT	6	DT6														●		●		
799-601-9060	Adapter for DT (gray)	8	DT8GR														●		●		
799-601-9070	Adapter for DT (black)	8	DT8B														●		●		
799-601-9080	Adapter for DT (green)	8	DT8G														●		●		
799-601-9090	Adapter for DT (brown)	8	DT8BR														●		●		
799-601-9110	Adapter for DT (gray)	12	DT12GR														●		●		
799-601-9120	Adapter for DT (black)	12	DT12B														●		●		

Part No.	Connector type or part name	No. of pins	ID symbol	T-branch adapter kit															Others
				799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	
799-601-9130	Adapter for DT (green)	12	DT12G														●		●		
799-601-9140	Adapter for DT	12	DT12BR														●		●		
799-601-9210	Adapter for HD30-18	8	D18-8														●	●			
799-601-9220	Adapter for HD30-18	14	D18-14														●	●			
799-601-9230	Adapter for HD30-18	20	D18-20														●	●			
799-601-9240	Adapter for HD30-18	21	D18-21														●	●			
799-601-9250	Adapter for HD30-24	9	D24-9														●	●			
799-601-9260	Adapter for HD30-24	16	D24-16														●	●			
799-601-9270	Adapter for HD30-24	21	D24-21														●	●			
799-601-9280	Adapter for HD30-24	23	D24-23														●	●			
799-601-9290	Adapter for HD30-24	31	D24-31														●	●			
799-601-9310	Plate for HD30 (24 pins)																●	●		●	
799-601-9320	T-branch box (For DT HD)	12															●	●		●	
799-601-9330	Case																●				
799-601-9340	Case																	●			
799-601-9350	Adapter for DRC	40	DRC-40																	●	
799-601-9360	Adapter for DRC	24	DRC-24																	●	
799-601-9410	Adapter for engine (CRI-T2)	2	G																		●
799-601-9420	Adapter for engine (CRI-T2) Adapter for engine (CRI-T3)	3	A3																		●
799-601-9430	Adapter for engine (CRI-T2) Adapter for engine (CRI-T3)	2	P																		●
799-601-9440	Adapter for engine (CRI-T2)	3	1, 2, 3																		●
795-799-5520	Adapter for engine (HPI-T2)	2	S																		●
795-799-5530	Adapter for engine (HPI-T2) Adapter for engine (CRI-T3)	2	C																		●
795-799-5540	Adapter for engine (HPI-T2) Adapter for engine (CRI-T3)	2	A																		●
795-799-5460	Cable for engine (HPI-T2)	3																			●
795-799-5470	Cable for engine (HPI-T2)	3																			●
795-799-5480	Cable for engine (HPI-T2)	3																			●
799-601-4160	Adapter for engine (CRI-T3)	2	OIL																		●
799-601-4340	Adapter for engine (CRI-T3)	2	1, 2, 3																		●
799-601-4130	Adapter for engine (CRI-T3)	3	FCIN																		●
799-601-4140	Adapter for engine (CRI-T3)	3	FCIG																		●
799-601-4150	Adapter for engine (CRI-T3)	3	FCIB																		●
799-601-4180	Adapter for engine (CRI-T3)	3	FCIP3																		●
799-601-4190	Adapter for engine (CRI-T3)	3	1, 2, 3																		●
799-601-4240	Adapter for engine (CRI-T3)	3	1, 2, 3																		●
799-601-4250	Adapter for engine (CRI-T3)	3	1, 2, 3																		●
799-601-4330	Adapter for engine (CRI-T3)	3	1, 2, 3																		●
799-601-4230	Adapter for engine (CRI-T3)	4	1, 2, 3, 4																		●
799-601-4260	Adapter for controller (ENG)	4	DTP4																		●
799-601-4210	Adapter for controller (ENG)	50	DRC50																		●

Part No.	Connector type or part name	No. of pins	ID symbol	T-branch adapter kit																	Others
				799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	
799-601-4220	Adapter for controller (ENG)	60	DRC60																		●
799-601-4280	Box for controller (PUMP)	121																			●
799-601-9720	Adapter for controller (HST)	16	HST16A																		●
799-601-9710	Adapter for controller (HST)	16	HST16B																		●
799-601-9370	Adapter for controller (HST)	26	HST26A																		●

WA600-6 Wheel loader

Form No. SEN00557-00

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

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Failure code [15SBL1] (ECMV R clutch: When command current is OFF, fill signal is ON) 28
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Failure code [15SELH] (ECMV (1): When command current is ON, fill signal is OFF) 34
Failure code [15SFL1] (ECMV (2): When command current is OFF, fill signal is ON) 36
Failure code [15SFLH] (ECMV (2): When command current is ON, fill signal is OFF) 38

Failure code [15SGL1] (ECMV (3): When command current is OFF, fill signal is ON)..... 40
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Troubleshooting by failure code (Display of code), Part 1

Failure codes list

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
1500L0	TORQFLOW transmission	Double meshing	TM	E03	Electrical system
15B0NX	Transmission filter	Clogging	MON	E01	Mechanical system
15SAL1	ECMV F clutch	When command current is OFF, fill signal is ON	TM	E03	Electrical system
15SALH	ECMV F clutch	When command current is ON, fill signal is OFF	TM	E01	Electrical system
15SBL1	ECMV R clutch	When command current is OFF, fill signal is ON	TM	E03	Electrical system
15SBLH	ECMV R clutch	When command current is ON, fill signal is OFF	TM	E01	Electrical system
15SEL1	ECMV 1st clutch	When command current is OFF, fill signal is ON	TM	E03	Electrical system
15SELH	ECMV 1st clutch	When command current is ON, fill signal is OFF	TM	E01	Electrical system
15SFL1	ECMV 2nd clutch	When command current is OFF, fill signal is ON	TM	E03	Electrical system
15SFLH	ECMV 2nd clutch	When command current is ON, fill signal is OFF	TM	E01	Electrical system
15SGL1	ECMV 3rd clutch	When command current is OFF, fill signal is ON	TM	E03	Electrical system
15SGLH	ECMV 3rd clutch	When command current is ON, fill signal is OFF	TM	E01	Electrical system
15SHL1	ECMV 4th clutch	When command current is OFF, fill signal is ON	TM	E03	Electrical system
15SHLH	ECMV 4th clutch	When command current is ON, fill signal is OFF	TM	E01	Electrical system
15W0NT	Transmission modulation clutch	Overheat	TM	E02	Mechanical system
2F00MA	Parking brake	Malfunction	MON	E03	Electrical system
2G42ZG	Front accumulator	Low oil pressure	MON	E03	Mechanical system
2G43ZG	Rear accumulator	Low oil pressure	MON	E03	Mechanical system
44K0L4	Bucket positioner	ON/OFF signals disagree	WRK	E01	Electrical system
A000N1	Engine	Overrun	VHMS	—	VHMS system (n201)
AA1ANX	Air cleaner	Clogging	MON	E01	Mechanical system
AB00L6	Alternator	Signal disagrees with operating state of engine	MON	E03	Electrical system
AB00MA	Alternator	Malfunction	MON	E03	Mechanical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
B@BAZG	Engine oil	Low oil pressure	ENG	E03	Mechanical system
B@BAZK	Engine oil	Low level	MON	E01	Mechanical system
B@BCNS	Coolant	Overheating	ENG	E02	Mechanical system
B@BCZK	Coolant	Low level	MON	E01	Mechanical system
B@C7NS	Brake oil	Overheating	MON	E02	Mechanical system
B@CENS	Torque converter oil	Overheating	MON	E02	Mechanical system
B@GAZK	Battery electrolyte	Low level	MON	E01	Mechanical system
B@HANS	Hydraulic oil	Overheating	MON	E02	Mechanical system
CA111	Abnormality in engine controller	—	ENG	E03	Electrical system
CA115	Engine Ne or Bkup speed sensor error	—	ENG	E03	Electrical system
CA122	Charge pressure sensor high error	—	ENG	E03	Electrical system
CA123	Charge pressure sensor low error	—	ENG	E03	Electrical system
CA131	Throttle sensor high error	—	ENG	E03	Electrical system
CA132	Throttle sensor low error	—	ENG	E03	Electrical system
CA135	Oil pressure sensor high error	—	ENG	E01	Electrical system
CA141	Oil pressure sensor low error	—	ENG	E01	Electrical system
CA144	Coolant temperature sensor high error	—	ENG	E01	Electrical system
CA145	Coolant temperature sensor low error	—	ENG	E01	Electrical system
CA153	Charge temperature sensor high error	—	ENG	E01	Electrical system
CA154	Charge temperature sensor low error	—	ENG	E01	Electrical system
CA187	Sensor power supply 2 low error	—	ENG	E03	Electrical system
CA212	Engine oil pressure sensor high error (VHMS)	—	ENG	E01	Electrical system
CA213	Engine oil pressure sensor low error (VHMS)	—	ENG	E01	Electrical system
CA221	Ambient pressure sensor high error	—	ENG	E01	Electrical system
CA222	Ambient pressure sensor low error	—	ENG	E01	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
CA227	Sensor power supply 2 voltage high error	—	ENG	E03	Electrical system
CA234	Engine overspeed	—	ENG	E02	Electrical system
CA238	Ne speed sensor supply power voltage error	—	ENG	E03	Electrical system
CA263	Fuel temperature sensor high error	—	ENG	E01	Electrical system
CA265	Fuel temperature sensor low error	—	ENG	E01	Electrical system
CA271	PCV1 short circuit	—	ENG	E03	Electrical system
CA272	PCV1 disconnection	—	ENG	E03	Electrical system
CA273	PCV2 short circuit	—	ENG	E03	Electrical system
CA274	PCV2 disconnection	—	ENG	E03	Electrical system
CA322	Injector #1 (L/B #1) open/short error	—	ENG	E03	Electrical system
CA323	Injector #5 (L/B #5) open/short error	—	ENG	E03	Electrical system
CA324	Injector #3 (L/B #3) open/short error	—	ENG	E03	Electrical system
CA325	Injector #6 (L/B #6) open/short error	—	ENG	E03	Electrical system
CA331	Injector #2 (L/B #2) open/short error	—	ENG	E03	Electrical system
CA332	Injector #4 (L/B #4) open/short error	—	ENG	E03	Electrical system
CA342	Calibration code incompatibility	—	ENG	E03	Electrical system
CA351	Injectors drive circuit error	—	ENG	E03	Electrical system
CA352	Sensor power supply 1 voltage low error	—	ENG	E03	Electrical system
CA386	Sensor power supply 1 voltage high error	—	ENG	E03	Electrical system
CA431	Idle validation switch error	—	ENG	E01	Electrical system
CA432	Idle validation action error	—	ENG	E03	Electrical system
CA435	Engine oil pressure switch error	—	ENG	E03	Electrical system
CA441	Battery voltage low error	—	ENG	E03	Electrical system
CA442	Battery voltage high error	—	ENG	E03	Electrical system
CA449	Common rail pressure high error 2	—	ENG	E03	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
CA451	Common rail pressure sensor high error	—	ENG	E03	Electrical system
CA452	Common rail pressure sensor low error	—	ENG	E03	Electrical system
CA553	Common rail pressure high error 1	—	ENG	E03	Electrical system
CA559	Supply pump pressure very low error	—	ENG	E03	Electrical system
CA689	Engine Ne speed sensor error	—	ENG	E03	Electrical system
CA731	Engine Bkup speed sensor phase error	—	ENG	E03	Electrical system
CA757	All continuous data lost error	—	ENG	E03	Electrical system
CA778	Engine Bkup speed sensor error	—	ENG	E03	Electrical system
CA1228	EGR valve servo error 1	—	ENG	E03	Electrical system
CA1625	EGR valve servo error 2	—	ENG	E03	Electrical system
CA1626	Bypass valve solenoid current high error	—	ENG	E03	Electrical system
CA1627	Bypass valve solenoid current low error	—	ENG	E03	Electrical system
CA1628	Bypass valve servo error 1	—	ENG	E03	Electrical system
CA1629	Bypass valve servo error 2	—	ENG	E03	Electrical system
CA1631	Bypass valve lift sensor high error	—	ENG	E03	Electrical system
CA1632	Bypass valve lift sensor low error	—	ENG	E03	Electrical system
CA1633	KOMNET datalink timeout error	—	ENG	E03	Electrical system
CA2185	Throttle sensor supply voltage high error	—	ENG	E03	Electrical system
CA2186	Throttle sensor supply voltage low error	—	ENG	E03	Electrical system
CA2249	Supply pump pressure very low error 2	—	ENG	E03	Electrical system
CA2271	EGR valve position sensor high error	—	ENG	E03	Electrical system
CA2272	EGR valve position sensor low error	—	ENG	E03	Electrical system
CA2351	EGR valve solenoid operation short circuit	—	ENG	E03	Electrical system
CA2352	EGR valve solenoid operation disconnection	—	ENG	E03	Electrical system
CA2555	Intake heater relay voltage low error	—	ENG	E01	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
CA2556	Intake heater relay voltage high error	—	ENG	E01	Electrical system
D191KA	AJSS neutral safety relay	Disconnection	WRK	E01	Electrical system
D191KB	AJSS neutral safety relay	Short-circuit	WRK	E01	Electrical system
D192KA	ECSS solenoid	Disconnection	TM	E01	Electrical system
D192KB	ECSS solenoid	Short circuit	TM	E01	Electrical system
D192KY	ECSS solenoid	Power supply line short	TM	E01	Electrical system
D198KA	Transmission oil pressure bypass solenoid	Disconnection	TM	E01	Electrical system
D198KB	Transmission oil pressure bypass solenoid	Short circuit	TM	E01	Electrical system
D198KY	Transmission oil pressure bypass solenoid	Short circuit with power supply line	TM	E01	Electrical system
D5ZHKA	Terminal C signal	Disconnection	TM	E01	Electrical system
D5ZHKB	Terminal C signal	Short circuit	TM	E01	Electrical system
D5ZHKZ	Terminal C signal	Disconnection or short circuit	WRK	E01	Electrical system
D5ZHL6	Terminal C signal	Signal does not match engine running or stopped state	MON	E01	Electrical system
DA80L4	Auto grease controller	ON/OFF signals disagree	MON	—	Electrical system
DAF3KK	Machine monitor	Low source voltage (input)	MON	E03	Electrical system
DAF5KP	Machine monitor	Low output voltage	MON	E01	Electrical system
DAFRKR	Machine monitor CAN communication	Defective communication (Abnormality in target component system)	TM	E03	Electrical system
DAQ0KK	Transmission controller	Low source voltage	TM	E03	Electrical system
DAQ0KT	Transmission controller	Abnormality in controller	TM	E01	Electrical system
DAQ2KK	Transmission controller load power supply line	Low source voltage (input)	TM	E03	Electrical system
DAQ9KQ	Transmission controller model selection wiring harness	Disagreement of model selection signals	MON	E03	—
DAQRKR	Transmission controller CAN communication	Defective communication (Abnormality in target component system)	MON	E03	Electrical system
DAQRMA	Transmission controller CAN communication	Malfunction	MON	E03	—
DB2RKR	Common rail ENG controller CAN communication	Defective communication (Abnormality in target component system)	TM	E03	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
DB90KK	Work equipment controller	Low source voltage (input)	WRK	E03	Electrical system
DB90KT	Work equipment controller	Abnormality in controller	WRK	E01	Electrical system
DB92KK	Work equipment controller load power supply line	Low source voltage (input)	WRK	E03	Electrical system
DB95KX	Work equipment controller power supply output	Out of input signal range	WRK	E03	Electrical system
DB99KQ	Work equipment controller model selection wiring harness	Disagreement of model selection signals	MON	E03	—
DB9RKR	Work equipment controller CAN communication	Defective communication (Abnormality in target component system)	TM	E03	Electrical system
DB9RMA	Work equipment controller CAN communication	Malfunction	MON	E03	—
DB9RMC	Work equipment controller CAN communication	Defective operation	WRK	E03	Electrical system
DBB0KK	VHMS controller	Low source voltage (input)	VHMS	—	VHMS system (n901)
DBB0KQ	VHMS controller	Disagreement of model selection signals	VHMS	—	VHMS system (nF11)
DBB3KK	VHMS controller battery power supply	Low source voltage (input)	VHMS	—	VHMS system (n905)
DBB5KP	VHMS controller 5 V power supply output	Low output voltage	VHMS	—	VHMS system (n904)
DBB6KP	VHMS controller 24 V power supply output	Low output voltage	VHMS	—	VHMS system (n902)
DBB7KP	VHMS controller 12 V power supply output	Low output voltage	VHMS	—	VHMS system (n903)
DBBQKR	VHMS controller KOMNET	Defective communication (Abnormality in target component system)	VHMS	—	VHMS system (n802)
DD15LD	■ switch (Panel switch 1)	Switch is kept pressed for long time	MON	E01	Electrical system
DD16LD	◇ switch (Panel switch 2)	Switch is kept pressed for long time	MON	E01	Electrical system
DD17LD	< switch (Panel switch 3)	Switch is kept pressed for long time	MON	E01	Electrical system
DD18LD	> switch (Panel switch 4)	Switch is kept pressed for long time	MON	E01	Electrical system
DD1ALD	Remote positioner raise/lower set switch (RAISE)	Switch is kept pressed for long time	WRK	E01	Electrical system
DD1BLD	Remote positioner raise/lower set switch (LOWER)	Switch is kept pressed for long time	WRK	E01	Electrical system
DD1CLD	Load meter subtotal switch	Switch is kept pressed for long time	MON	E01	Electrical system
DD1FLD	Load meter mode selector switch (A/B)	Switch is kept pressed for long time	MON	E01	Electrical system
DD1GLD	Load meter mode selector switch (+/–)	Switch is kept pressed for long time	MON	E01	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
DD1HLD	Load meter display selector switch	Switch is kept pressed for long time	MON	E01	Electrical system
DDA7L4	RPM set ON/OFF switch	ON/OFF signals disagree	TM	E01	Electrical system
DDA8KB	RPM set idle-up/down switch (idle-up)	Short circuit	TM	E01	Electrical system
DDA9KB	RPM set idle-up/down switch (idle-down)	Short circuit	TM	E01	Electrical system
DDB6L4	Turn parking brake switch (Neutralizer)	ON/OFF signals disagree	TM	E03	Electrical system
DDD1LD	Remote positioner bucket angle set switch	Switch is kept pressed for long time	WRK	E01	Electrical system
DDDBKA	Traction adjustment dial	Disconnection	TM	E01	Electrical system
DDDBKB	Traction adjustment dial	Short circuit	TM	E01	Electrical system
DDE5MA	Emergency steering drive switch	Malfunction	MON	E01	Electrical system
DDK4KA	AJSS FNR switch	Disconnection	TM	E03	Electrical system
DDK4KB	AJSS FNR switch	Short circuit	TM	E03	Electrical system
DDK5L4	AJSS shift-up/down switch	ON/OFF signals disagree	TM	E01	Electrical system
DDK6KA	FNR lever switch	Disconnection	TM	E03	Electrical system
DDK6KB	FNR lever switch	Short circuit	TM	E03	Electrical system
DDP5KA	Lock detection pressure switch of steering lock lever	Disconnection	TM	E01	Electrical system
DDT0L4	Shift mode selector switch	ON/OFF signals disagree	TM	E01	Electrical system
DDW9LD	Kick-down switch	Switch is kept pressed for long time	TM	E01	Electrical system
DDWLLD	Hold switch	Switch is kept pressed for long time	TM	E01	Electrical system
DDY0LD	Load meter cancel switch	Switch is kept pressed for long time	MON	E01	Electrical system
DF10KA	Transmission shift lever	Disconnection	TM	E01	Electrical system
DF10KB	Transmission shift lever	Short circuit	TM	E01	Electrical system
DGE5KX	Atmospheric temperature sensor	Out of input signal range	VHMS	—	VHMS system (n401)
DGF1KA	Transmission oil temperature sensor	Disconnection	TM	E01	Electrical system
DGF1KB	Transmission oil temperature sensor	Short circuit	TM	E01	Electrical system
DGH2KX	Hydraulic oil temperature sensor	Out of input signal range	MON	E01	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
DGR2KA	Rear brake oil temperature sensor	Disconnection	MON	E01	Electrical system
DGR2KX	Rear brake oil temperature sensor	Out of input signal range	MON	E01	Electrical system
DGT1KA	Torque converter oil temperature sensor	Disconnection	MON	E01	Electrical system
DGT1KB	Torque converter oil temperature sensor	Short circuit	MON	E01	Electrical system
DGT1KX	Torque converter oil temperature sensor	Out of input signal range	MON	E01	Electrical system
DGT4KA	Exhaust gas temperature sensor (F)	Disconnection	VHMS	—	VHMS system (n312)
DGT4KB	Exhaust gas temperature sensor (F)	Short circuit	VHMS	—	VHMS system (n311)
DGT5KA	Exhaust gas temperature sensor (R)	Disconnection	VHMS	—	VHMS system (n322)
DGT5KB	Exhaust gas temperature sensor (R)	Short circuit	VHMS	—	VHMS system (n321)
DH21KA	Oil pressure sensor of work equipment pump	Disconnection	WRK	E01	Electrical system
DH21KB	Oil pressure sensor of work equipment pump	Short circuit	WRK	E01	Electrical system
DHE5KB	Blow-by pressure sensor	Short circuit	VHMS	—	VHMS system (n332)
DHE5KY	Blow-by pressure sensor	Short circuit with power supply line	VHMS	—	VHMS system (n331)
DHPCKX	Lift arm cylinder bottom pressure sensor	Out of input signal range	MON	E01	Electrical system
DHPDKX	Lift arm cylinder head pressure sensor	Out of input signal range	MON	E01	Electrical system
DHT2L6	Transmission filter clogging sensor	Signal disagrees with operating state of engine	MON	E01	Electrical system
DHT8KX	Steering oil pressure sensor	Out of input signal range	VHMS	—	VHMS system (n533)
DHTBKA	Modulation clutch pressure sensor	Disconnection	TM	E03	Electrical system
DHTBKB	Modulation clutch pressure sensor	Short circuit	TM	E03	Electrical system
DHU2KX	Front brake oil pressure sensor (F)	Out of input signal range	VHMS	—	VHMS system (n711)
DHU3KX	Rear brake oil pressure sensor (R)	Out of input signal range	VHMS	—	VHMS system (n712)
DK30KA	AJSS lever angle sensor	Disconnection	WRK	E01	Electrical system
DK30KY	AJSS lever angle sensor	Short circuit with power supply line	WRK	E01	Electrical system
DK59KA	Lift arm lever EPC potentiometer (Main)	Disconnection	WRK	E03	Electrical system
DK59KY	Lift arm lever EPC potentiometer (Main & Sub)	Short circuit with power supply line	WRK	E03	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
DK59L8	Lift arm lever EPC potentiometer (Main)	Analog signals disagree	WRK	E03	Electrical system
DK5AKA	Lift arm lever EPC potentiometer (Sub)	Disconnection	WRK	E03	Electrical system
DK5AKY	Lift arm lever EPC potentiometer (Sub)	Short circuit with power supply line	WRK	E03	Electrical system
DK5BKA	Bucket lever EPC potentiometer (Main)	Disconnection	WRK	E03	Electrical system
DK5BKY	Bucket lever EPC potentiometer (Main)	Short circuit with power supply line	WRK	E03	Electrical system
DK5BL8	Bucket lever EPC potentiometer (Main & Sub)	Analog signals disagree	WRK	E03	Electrical system
DK5CKA	Bucket lever EPC potentiometer (Sub)	Disconnection	WRK	E03	Electrical system
DK5CKY	Bucket lever EPC potentiometer (Sub)	Short circuit with power supply line	WRK	E03	Electrical system
DK5DKA	3rd valve (attachment) lever EPC potentiometer (Main)	Disconnection	WRK	E03	Electrical system
DK5DKY	3rd valve (attachment) lever EPC potentiometer (Main)	Short circuit with power supply line	WRK	E03	Electrical system
DK5DL8	3rd valve (attachment) lever EPC potentiometer (Main & Sub)	Analog signals disagree	WRK	E03	Electrical system
DK5EKA	3rd valve (attachment) lever EPC potentiometer (Sub)	Disconnection	WRK	E03	Electrical system
DK5EKY	3rd valve (attachment) lever EPC potentiometer (Sub)	Short circuit with power supply line	WRK	E03	Electrical system
DKA0KA	Lift arm angle sensor	Disconnection	WRK	E01	Electrical system
DKA0KX	Lift arm angle sensor	Out of input signal range	MON	E01	Electrical system
DKA0KY	Lift arm angle sensor	Short circuit with power supply line	WRK	E01	Electrical system
DKA0L0	Lift arm angle sensor	Improper positioning	WRK	E01	Electrical system
DKD0KA	Frame angle sensor	Disconnection	WRK	E01	Electrical system
DKD0KY	Frame angle sensor	Short circuit with power supply line	WRK	E01	Electrical system
DKD0KZ	AJSS lever and frame angle sensor	Disconnection or short circuit	WRK	E01	Electrical system
DLFAKA	Modulation clutch output shaft speed sensor	Disconnection	TM	E03	Electrical system
DLFALC	Modulation clutch output shaft speed sensor	Speed signals disagree	TM	E03	Electrical system
DLT3KA	Transmission output shaft speed sensor (2)	Disconnection	TM	E03	Electrical system
DLT3LC	Transmission output shaft speed sensor (2)	Speed signals disagree	TM	E03	Electrical system
DLT4KB	Transmission output shaft speed sensor (1)	Short circuit	TM	E03	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
DLT4KX	Transmission output shaft speed sensor (1)	Out of input signal range	TM	E03	Electrical system
DUM1KB	Remote positioner raise indicator lamp	Short circuit	WRK	—	—
DUM2KB	Remote positioner lower indicator lamp	Short circuit	WRK	—	—
DV00KB	Alarm buzzer	Short circuit	MON	E01	Electrical system
DW4PKA	Lift arm raise EPC solenoid	Disconnection	WRK	E03	Electrical system
DW4PKB	Lift arm raise EPC solenoid	Short circuit	WRK	E03	Electrical system
DW4PKY	Lift arm raise EPC solenoid	Short circuit with power supply line	WRK	E03	Electrical system
DW4QKA	Lift arm lower EPC solenoid	Disconnection	WRK	E03	Electrical system
DW4QKB	Lift arm lower EPC solenoid	Short circuit	WRK	E03	Electrical system
DW4QKY	Lift arm lower EPC solenoid	Short circuit with power supply line	WRK	E03	Electrical system
DW4RKA	Bucket tilt EPC solenoid	Disconnection	WRK	E03	Electrical system
DW4RKB	Bucket tilt EPC solenoid	Short circuit	WRK	E03	Electrical system
DW4RKY	Bucket tilt EPC solenoid	Short circuit with power supply line	WRK	E03	Electrical system
DW4SKA	Bucket dump EPC solenoid	Disconnection	WRK	E03	Electrical system
DW4SKB	Bucket dump EPC solenoid	Short circuit	WRK	E03	Electrical system
DW4SKY	Bucket dump EPC solenoid	Short circuit with power supply line	WRK	E03	Electrical system
DW7BKA	Fan reverse solenoid	Disconnection	TM	E01	Electrical system
DW7BKB	Fan reverse solenoid	Short circuit	TM	E01	Electrical system
DW7BKY	Fan reverse solenoid	Short circuit with power supply line	TM	E01	Electrical system
DW7DKA	Hydraulic drive fan neutral solenoid	Disconnection	TM	E01	Electrical system
DW7DKB	Hydraulic drive fan neutral solenoid	Short circuit	TM	E01	Electrical system
DW7DKY	Hydraulic drive fan neutral solenoid	Short circuit with power supply line	TM	E01	Electrical system
DWM1KA	Work equipment neutral lock EPC solenoid	Disconnection	WRK	E01	Electrical system
DWM1KB	Work equipment neutral lock EPC solenoid	Short circuit	WRK	E01	Electrical system
DWM1KY	Work equipment neutral lock EPC solenoid	Short circuit with power supply line	WRK	E01	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
DWN6KA	Lift arm raise magnet detent solenoid	Disconnection	WRK	E01	Electrical system
DWN6KB	Lift arm raise magnet detent solenoid	Short circuit	WRK	E01	Electrical system
DWN6KY	Lift arm raise magnet detent solenoid	Short circuit with power supply line	WRK	E01	Electrical system
DWN7KA	Lift arm float magnet detent solenoid	Disconnection	WRK	E01	Electrical system
DWN7KB	Lift arm float magnet detent solenoid	Short circuit	WRK	E01	Electrical system
DWN7KY	Lift arm float magnet detent solenoid	Short circuit with power supply line	WRK	E01	Electrical system
DWN8KA	Bucket tilt magnet detent solenoid	Disconnection	WRK	E01	Electrical system
DWN8KB	Bucket tilt magnet detent solenoid	Short circuit	WRK	E01	Electrical system
DWN8KY	Bucket tilt magnet detent solenoid	Short circuit with power supply line	WRK	E01	Electrical system
DWNFKA	Modulation clutch cut-off release solenoid	Disconnection	TM	E01	Electrical system
DWNFKB	Modulation clutch cut-off release solenoid	Short circuit	TM	E01	Electrical system
DWNFKY	Modulation clutch cut-off release solenoid	Short circuit with power supply line	TM	E03	Electrical system
DX16KA	Fan pump EPC solenoid	Disconnection	TM	E01	Electrical system
DX16KB	Fan pump EPC solenoid	Short circuit	TM	E01	Electrical system
DX16KY	Fan pump EPC solenoid	Short circuit with power supply line	TM	E01	Electrical system
DXA1KA	Pump PC-EPC solenoid	Disconnection	WRK	E01	Electrical system
DXA1KB	Pump PC-EPC solenoid	Short circuit	WRK	E01	Electrical system
DXF0KA	AJSS EPC solenoid	Disconnection	WRK	E01	Electrical system
DXF0KB	AJSS EPC solenoid	Short circuit	WRK	E01	Electrical system
DXH1KA	Lockup ECMV solenoid	Disconnection	TM	E01	Electrical system
DXH1KB	Lockup ECMV solenoid	Short circuit	TM	E01	Electrical system
DXH1KY	Lockup ECMV solenoid	Short circuit with power supply line	TM	E03	Electrical system
DXH4KA	1st clutch ECMV solenoid	Disconnection	TM	E03	Electrical system
DXH4KB	1st clutch ECMV solenoid	Short circuit	TM	E03	Electrical system
DXH4KY	1st clutch ECMV solenoid	Short circuit with power supply line	TM	E03	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
DXH5KA	2nd clutch ECMV solenoid	Disconnection	TM	E03	Electrical system
DXH5KB	2nd clutch ECMV solenoid	Short circuit	TM	E03	Electrical system
DXH5KY	2nd clutch ECMV solenoid	Short circuit with power supply line	TM	E03	Electrical system
DXH6KA	3rd clutch ECMV solenoid	Disconnection	TM	E03	Electrical system
DXH6KB	3rd clutch ECMV solenoid	Short circuit	TM	E03	Electrical system
DXH6KY	3rd clutch ECMV solenoid	Short circuit with power supply line	TM	E03	Electrical system
DXH7KA	R clutch ECMV solenoid	Disconnection	TM	E03	Electrical system
DXH7KB	R clutch ECMV solenoid	Short circuit	TM	E03	Electrical system
DXH7KY	R clutch ECMV solenoid	Short circuit with power supply line	TM	E03	Electrical system
DXH8KA	F clutch ECMV solenoid	Disconnection	TM	E03	Electrical system
DXH8KB	F clutch ECMV solenoid	Short circuit	TM	E03	Electrical system
DXH8KY	F clutch ECMV solenoid	Short circuit with power supply line	TM	E03	Electrical system
DXHHKA	4th clutch ECMV solenoid	Disconnection	TM	E03	Electrical system
DXHHKB	4th clutch ECMV solenoid	Short circuit	TM	E03	Electrical system
DXHHKY	4th clutch ECMV solenoid	Short circuit with power supply line	TM	E03	Electrical system
DXHJKA	3rd valve extract EPC solenoid	Disconnection	WRK	E03	Electrical system
DXHJKB	3rd valve extract EPC solenoid	Short circuit	WRK	E03	Electrical system
DXHJKY	3rd valve extract EPC solenoid	Short circuit with power supply line	WRK	E03	Electrical system
DXHKKA	3rd valve retract EPC solenoid	Disconnection	WRK	E03	Electrical system
DXHKKB	3rd valve retract EPC solenoid	Short circuit	WRK	E03	Electrical system
DXHKKY	3rd valve retract EPC solenoid	Short circuit with power supply line	WRK	E03	Electrical system
DXHPKA	Modulation clutch solenoid	Disconnection	TM	E03	Electrical system
DXHPKB	Modulation clutch solenoid	Short circuit	TM	E03	Electrical system
DXHPKY	Modulation clutch solenoid	Short circuit with power supply line	TM	E03	Electrical system
DXHPMA	Modulation clutch solenoid	Malfunction	TM	E01	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
F@BBZL	Blow-by pressure	High error	VHMS	—	VHMS system (n338)
F@BYNR	Exhaust gas temperature (F)	Abnormal heat	VHMS	—	VHMS system (n362)
F@BYNS	Exhaust gas temperature (F)	Overheating	VHMS	—	VHMS system (n361)
F@BZNR	Exhaust gas temperature (R)	Abnormal heat	VHMS	—	VHMS system (n372)
F@BZNS	Exhaust gas temperature (R)	Overheating	VHMS	—	VHMS system (n371)

★ Those failure codes to which the corresponding number is not indicated in the action code space are not displayed on the ordinary screen if a failure is found. They are just recorded in the abnormality record (electrical system and mechanical system) of the service menu.

★ The category of record is used for indicating to which of the electrical and mechanical system of the service menu's abnormality record a given failure is classified. VHMS failure codes, which are available only in VHMS specifications, are stored only in VHMS controller; therefore, they are not recorded in the abnormality record.
(The VHMS abnormality record can be downloaded by connecting your PC to the VHMS controller.) The 4-digit VHMS failure code enclosed in ( ) indicates an error code that is displayed with two digits on each 7-segment LED of the VHMS controller.

Before carrying out troubleshooting for electrical system

Connection table of fuse box and circuit breaker

★ This connection table indicates the devices to which the power of the fuse box and circuit breaker is supplied. (A switch power supply is a device which supplies power while the starting switch is in the ON position and a constant power supply is a device which supplies power while the starting switch is in the OFF and ON positions).

★ When carrying out troubleshooting related to the electrical system, you should check the fuse box and circuit breaker to see if the power is supplied normally.

Fuse box A

Type of power supply	Fuse No.	Capacity of fuse	Destination of power
Constant power supply Circuit breaker CBF1 (30A)	1	10 A	Starting switch terminal B circuit
	2	10 A	Hazard lamp circuit
	3	10 A	Stair lamp circuit
	4	10 A	Transmission controller (B) circuit
	5	10 A	Work equipment controller (B) circuit
	6	10 A	Machine monitor (B), VHMS controller (B) circuit
Switch power supply starting switch ACC	7	5 A	Engine controller circuit
Switch power supply circuit breaker CBF2 (105A)	8	10 A	Horn circuit
	9	20 A	Air conditioner circuit
	10	10 A	Auto grease circuit
	11	20 A	Rear glass heater circuit
	12	10 A	Radio circuit
	13	20 A	Air suspension seat, DC-DC converter circuit
	14	10 A	VHMS controller (A) circuit
	15	10 A	Spare

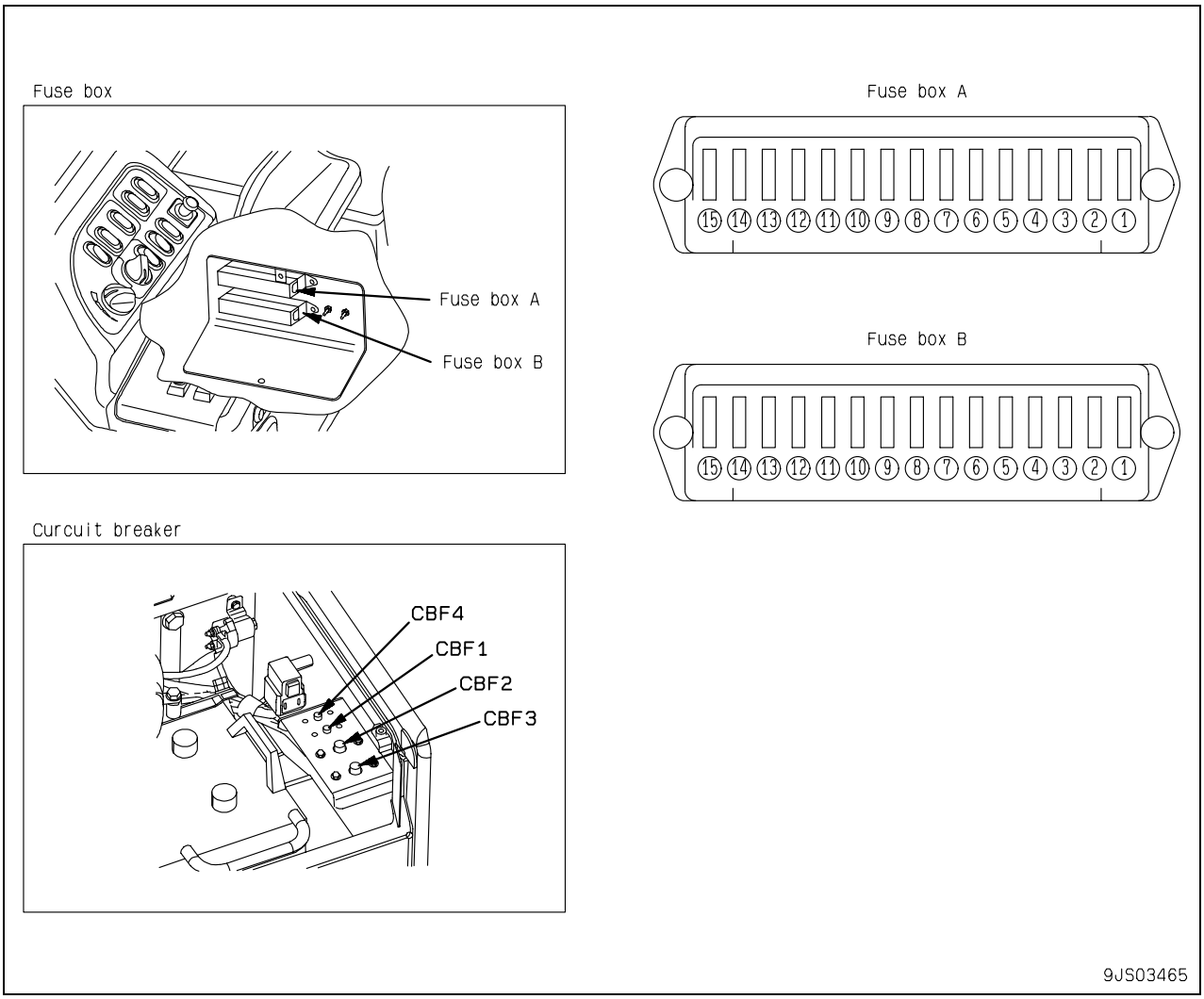
Fuse box B

Type of power supply	Fuse No.	Capacity of fuse	Destination of power
Switch power supply circuit breaker CBF3 (105A)	1	10 A	Turn signal lamp circuit
	2	10 A	Back-up lamp and blinking lamp circuit
	3	20 A	Front working lamp circuit
	4	20 A	Rear working lamp circuit
	5	10 A	Transmission controller (A) circuit
	6	10 A	Parking brake circuit
	7	10 A	Work equipment controller (A) circuit
	8	10 A	Machine monitor (A) circuit
	9	20 A	Wiper and washer circuit
	10	10 A	Spare
	11	20 A	Main lamp circuit
Relay circuit power supply of small lamp	12	10 A	Right clearance lamp circuit
	13	10 A	Left clearance lamp circuit
Relay circuit power supply of small lamp	14	10 A	Right headlamp circuit
	15	10 A	Left headlamp circuit

Circuit breaker

Type of power supply	Circuit breaker No.	Breaker capacity	Destination of power
Constant power supply	CBF1	30 A	Starting switch circuit, work equipment controller circuit, machine monitor circuit, VHMS controller circuit
Switch power supply	CBF2	105 A	Fuse box (A): Circuits 8 – 15
Switch power supply	CBF3	105 A	Fuse box (B): Circuits 1 – 11
Constant power supply	CBF4	20 A	Engine controller circuit

Locations and numbers of fuse boxes and circuit breakers



Information contained in troubleshooting table

Action code	Failure code	Trouble	Problem that appears on machine
Monitor display	**Monitor display**		
Contents of trouble	**State where the monitor panel or controller detects the trouble**		
Action of controller	**Action taken by machine monitor or controller to protect system or devices when engine controller detects trouble**		
Problem that appears on machine	**Problem that appears on machine as result of action taken by machine monitor or controller (shown above)**		
Related information	**Information related to detected trouble or troubleshooting**		

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	**Possible causes of trouble is assumed to be detected** (The order number indicates a serial number, not a priority sequence.)	**<Described contents>** **• Standard value in normal state to judge assumed cause (good or not)** **• Remarks required to judge whether the cause is good** **<Phenomenon of defective wiring harness>** **• Disconnection in wiring** **The connector connection is defective or the wiring harness is disconnected.** **• Grounding fault** **A harness not connected to ground (earth) circuit comes into contact with the ground (earth) circuit.** **• Hot short circuit** **A harness not connected to the power (24 V) circuit comes into contact with the power (24 V) circuit.** **• Short circuit** **A harnesses of an independent circuit abnormally comes into contact with one of another circuit.** **<Notes on troubleshooting>** **(1) Method of indicating connector number and handling T-branch** **For troubleshooting, insert or connect T-branch adapter as shown below unless especially specified.** **• When "male" or "female" is not indicated for a connector number, disconnect the connector, and insert the T-branch adapter in both the male and female.** **• When "male" and "female" is indicated for a connector number, disconnect the connector, and insert the T-branch adapter in only either the male or female.** **(2) Pin number description sequence and tester lead handling** **For troubleshooting, connect the plus (+) and minus (–) leads as shown below unless especially specified.** **• Connect the plus (+) lead to a pin or harness indicated in the front.** **• Connect the minus (–) lead to a pin or harness indicated in the rear.**
	2		
	3		
	2		

Related circuit diagram

This is the excerpted circuit diagram related to trouble

- **Connector No.: Indicates (Model – No. of pins) (Color)**
- **"Connector No. and pin No." from each branching/ merging point: Shows the ends of branch or source of merging within the parts of the same wiring harness.**
- **Arrow (⟷): Roughly shows the location on the machine.**

Failure code [1500L0] (TORQFLOW transmission : Double meshing)

Action code	Failure code	Trouble	TORQFLOW transmission: Double meshing (Transmission controller system)
E03	**1500L0**		
Contents of trouble	• A combination for double meshing is input as a fill signal.		
Action of controller	• Turns the centralized warning lamp and warning buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission may be broken.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

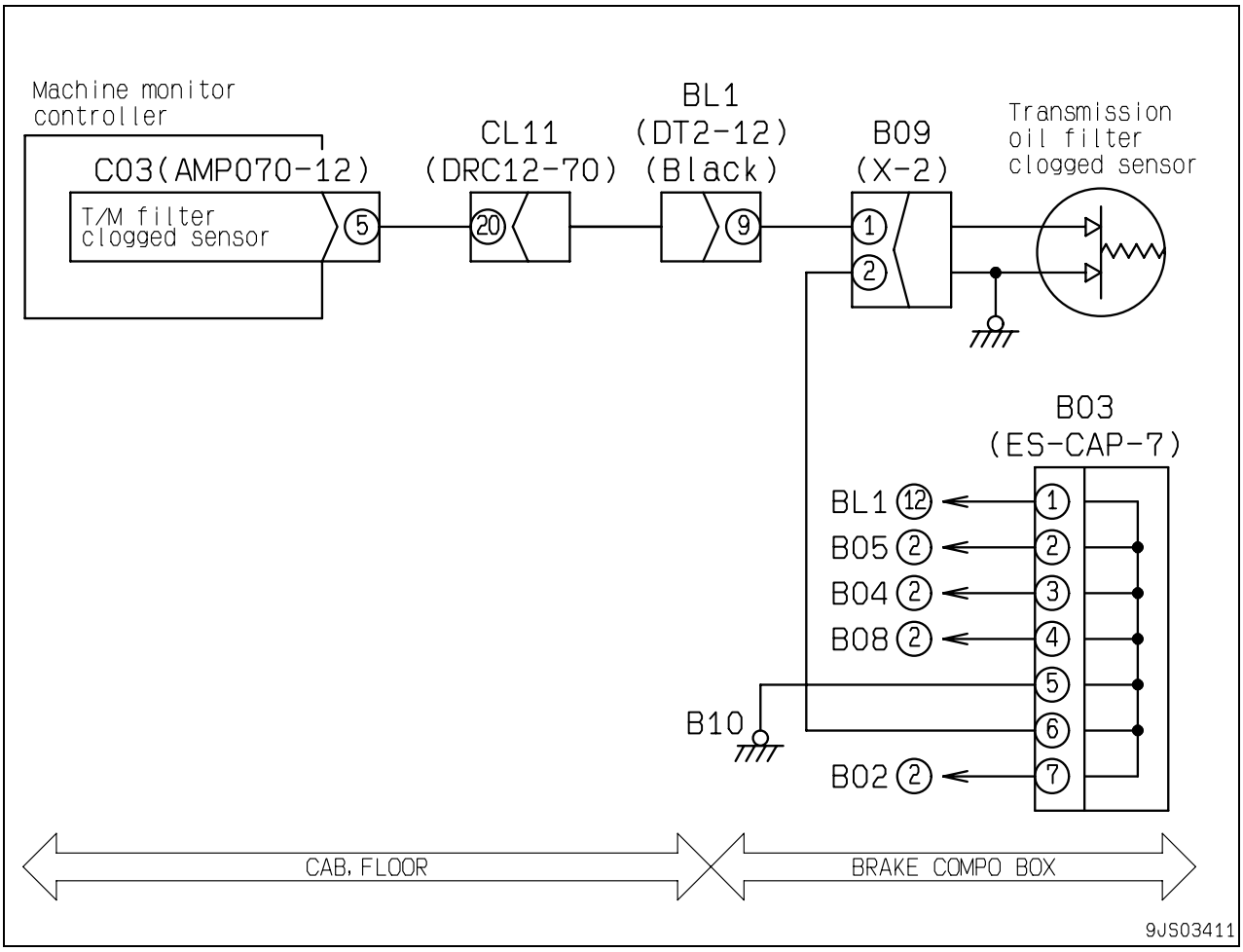
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	See failure codes [15SAL1], [15SBL1], [15SEL1], [15SFL1], [15SGL1] and [15SHL1].	

Failure code [15B0NX] (Transmission filter: Clogged)

Action code	Failure code	Trouble	Transmission filter: Clogged (Machine monitor system)
E01	**15B0NX**		
Contents of trouble	• Transmission filter clogging sensor circuit is OPEN. (When torque converter oil temperature is above 50°C)		
Action of controller	• Turns the transmission filter clogging caution lamp ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The transmission filter clogging caution lamp lights on. • The transmission may be broken.		
Related information	• The input state (ON/OFF) from the transmission filter clogging sensor can be checked with the monitoring function (Code: 40903, D-IN-24). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Transmission filter clogging	The transmission filter may be clogged. Check it directly.			
	2	Defective transmission clogging sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			B09 (male)	Transmission oil filter	Resistance	
			Between (1) and (2)	Normal	Max. 1 Ω	
				Clogging	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C03 (female) (5) – B09 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between B09 (male) (2) – chassis ground		Resistance	Max. 1 Ω
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between C03 (female) (5) – B09 (female) (1)		Voltage	Max. 1 V
	5	Defective machine monitor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			C03 (female)	Transmission oil filter	Resistance	
			Between (5) and chassis ground	Normal	Max. 1 Ω	
				Clogging	Min. 1 MΩ	

Circuit diagram related to transmission clogging sensor

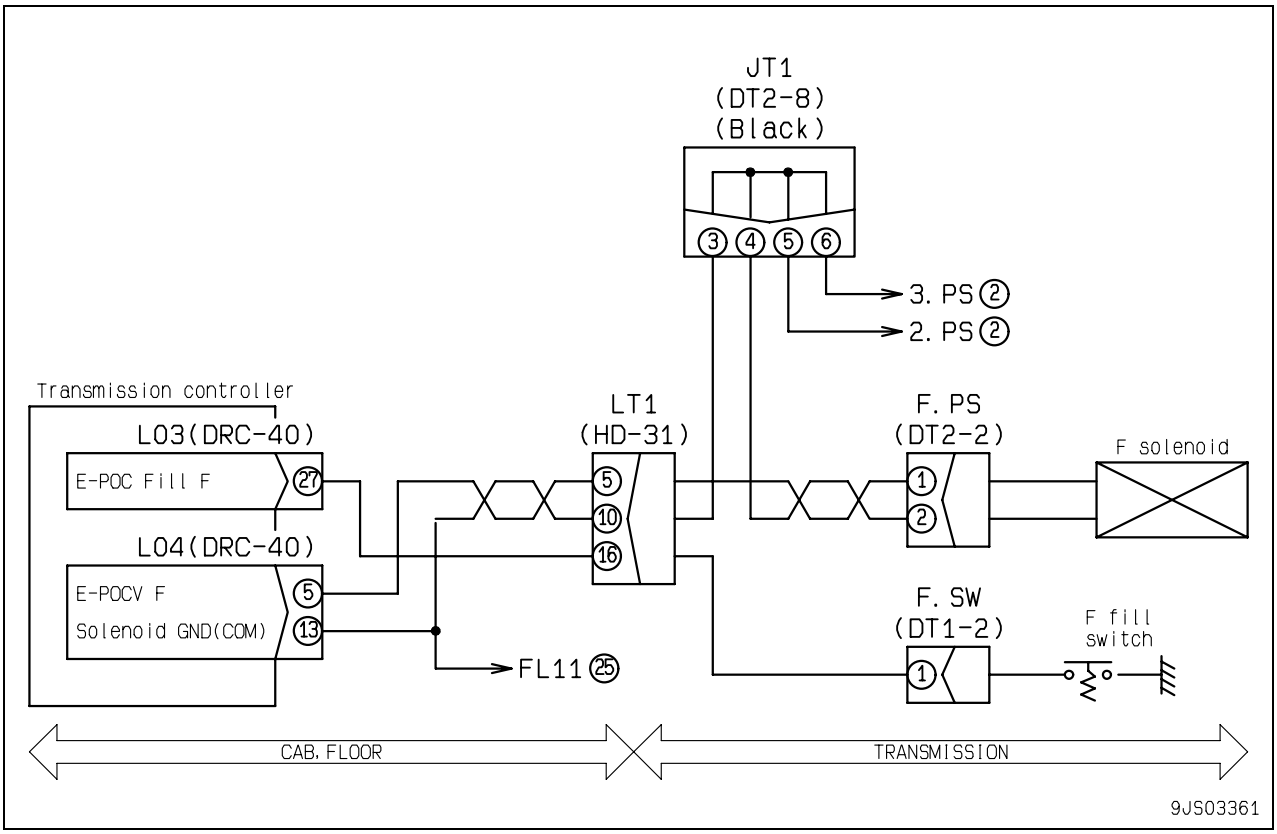


Failure code [15SAL1] (ECMV F clutch: When command current is OFF, fill signal is ON)

Action code	Failure code	Trouble	ECMV F clutch: When command current is OFF, fill signal is ON (Transmission controller system)
E03	**15SAL1**		
Contents of trouble	• When F ECMV solenoid output is turned OFF, F ECMV fill switch signal ON is input, and clutch is not released.		
Action of controller	• Judges that the F ECMV fill switch signal is turned ON. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• F travel is enabled, but R travel is disabled.		
Related information	• The output state (current) to the F clutch ECMV solenoid can be checked with the monitoring function (Code: 31608, ECMV F DIR). • The input state (ON/OFF) from the F fill switch can be checked with the monitoring function (Code: 40908, D-IN-25). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective F ECMV fill switch (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.		
			F.SW (male)	Directional lever or directional switch	Resistance
			Between (1) and chassis ground	F (Forward)	Max. 1 Ω
				Other than above	Min. 1 MΩ
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L03 (female) (27) – F.SW (female) (1)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.		
			L03	Directional lever or directional switch	Voltage
			Between (27) and chassis ground	F (Forward)	Max. 1 V
				Other than above	8 – 10 V

Circuit diagram related to transmission F clutch

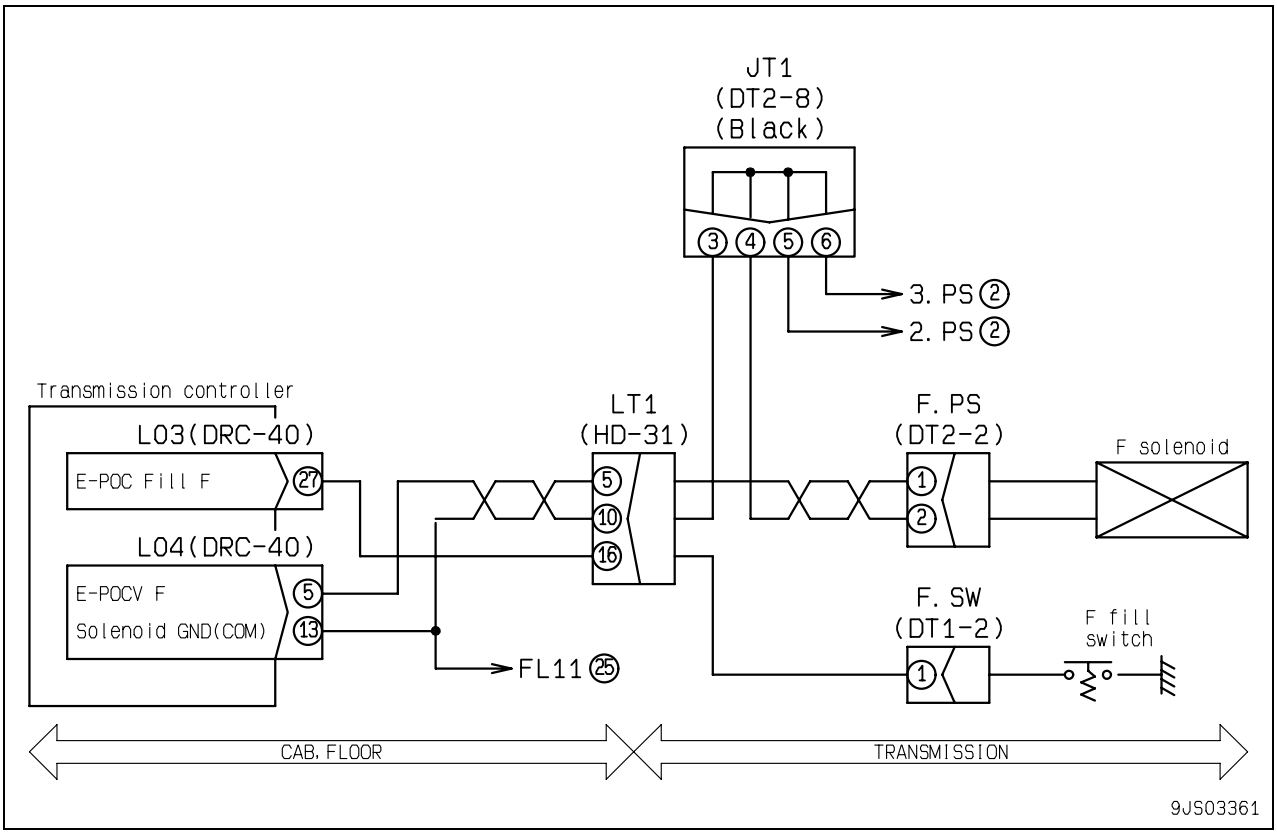


Failure code [15SALH] (ECMV F clutch: When command current is ON, fill signal is OFF)

Action code	Failure code	Trouble	ECMV F clutch: When command current is ON, fill signal is OFF (Transmission controller system)
E01	**15SALH**		
Contents of trouble	• When F ECMV solenoid output is turned ON, F ECMV fill switch signal ON is not input.		
Action of controller	• Judges that the F ECMV fill switch signal is turned OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• When the travel direction is changed, a shock or a time lag may be made.		
Related information	• The output state (current) to the F clutch ECMV solenoid can be checked with the monitoring function (Code: 31608, ECMV F DIR). • The input state (ON/OFF) from the F fill switch can be checked with the monitoring function (Code: 40908, D-IN-25). • Method of reproducing failure code: Start engine, and set directional lever or switch to F. • This error code may be displayed just after the transmission oil is replaced.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective F ECMV fill switch (Internal disconnection)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			F.SW (male)	Directional lever or directional switch	Resistance	
			Between (1) and chassis ground	F (Forward)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (27) – F.SW (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			L03	Directional lever or directional switch	Voltage	
			Between (27) and chassis ground	F (Forward)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission F clutch

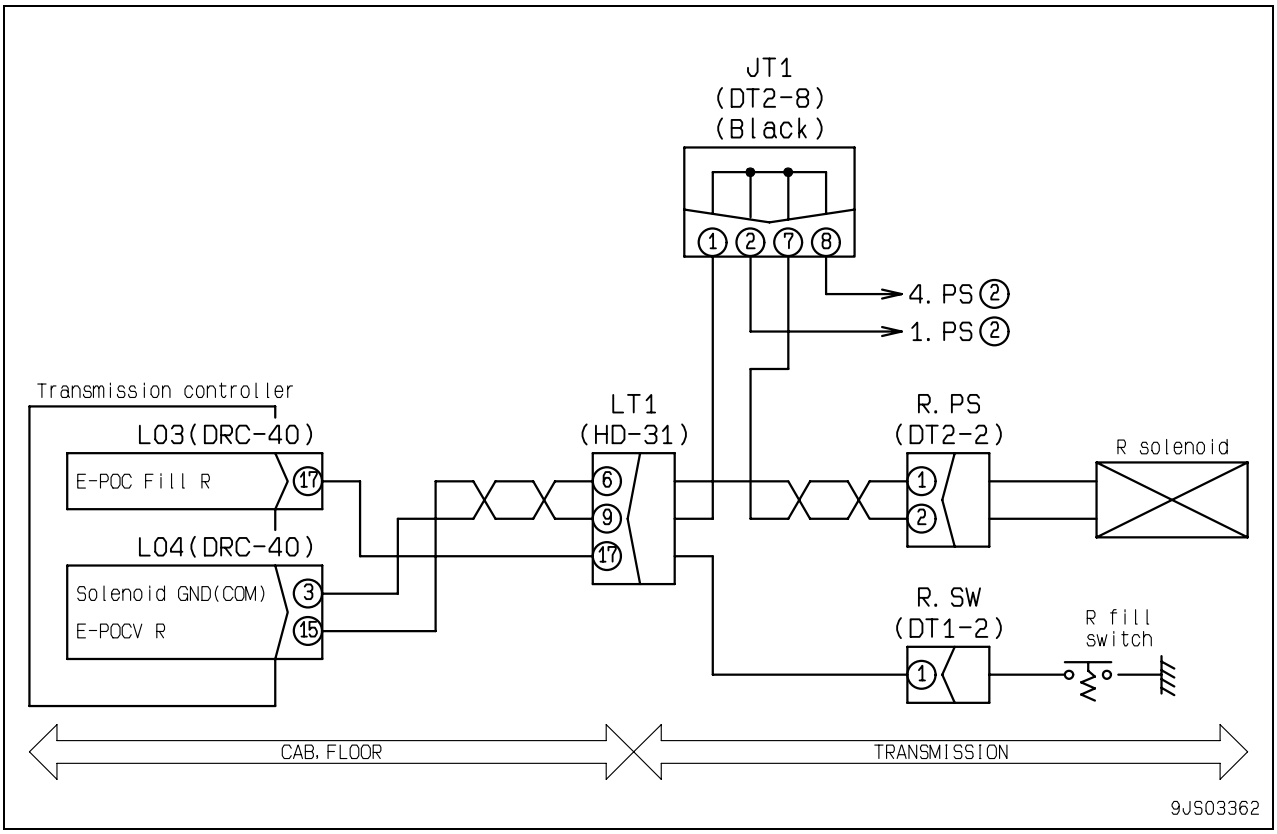


Failure code [15SBL1] (ECMV R clutch: When command current is OFF, fill signal is ON)

Action code	Failure code	Trouble	ECMV R clutch: When command current is OFF, fill signal is ON (Transmission controller system)
E03	**15SBL1**		
Contents of trouble	• When R ECMV solenoid output is turned OFF, R ECMV fill switch signal ON is input, and clutch is not released.		
Action of controller	• Judges that the R ECMV fill switch signal is turned ON. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The machine can travel in the R position, but cannot travel in the F position.		
Related information	• The output state (current) to the R clutch ECMV solenoid can be checked with the monitoring function (Code: 31606, ECMV R DIR). • The input state (ON/OFF) from the R fill switch can be checked with the monitoring function (Code: 40908, D-IN-26). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective R ECMV fill switch (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.		
			R.SW (male)	Directional lever or directional switch	Resistance
			Between (1) and chassis ground	R (Reverse)	Max. 1 Ω
				Other than above	Min. 1 MΩ
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L03 (female) (17) – R.SW (female) (1)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.		
			L03	Directional lever or directional switch	Voltage
			Between (17) and chassis ground	R (Reverse)	Max. 1 V
				Other than above	8 – 10 V

Circuit diagram related to transmission R clutch

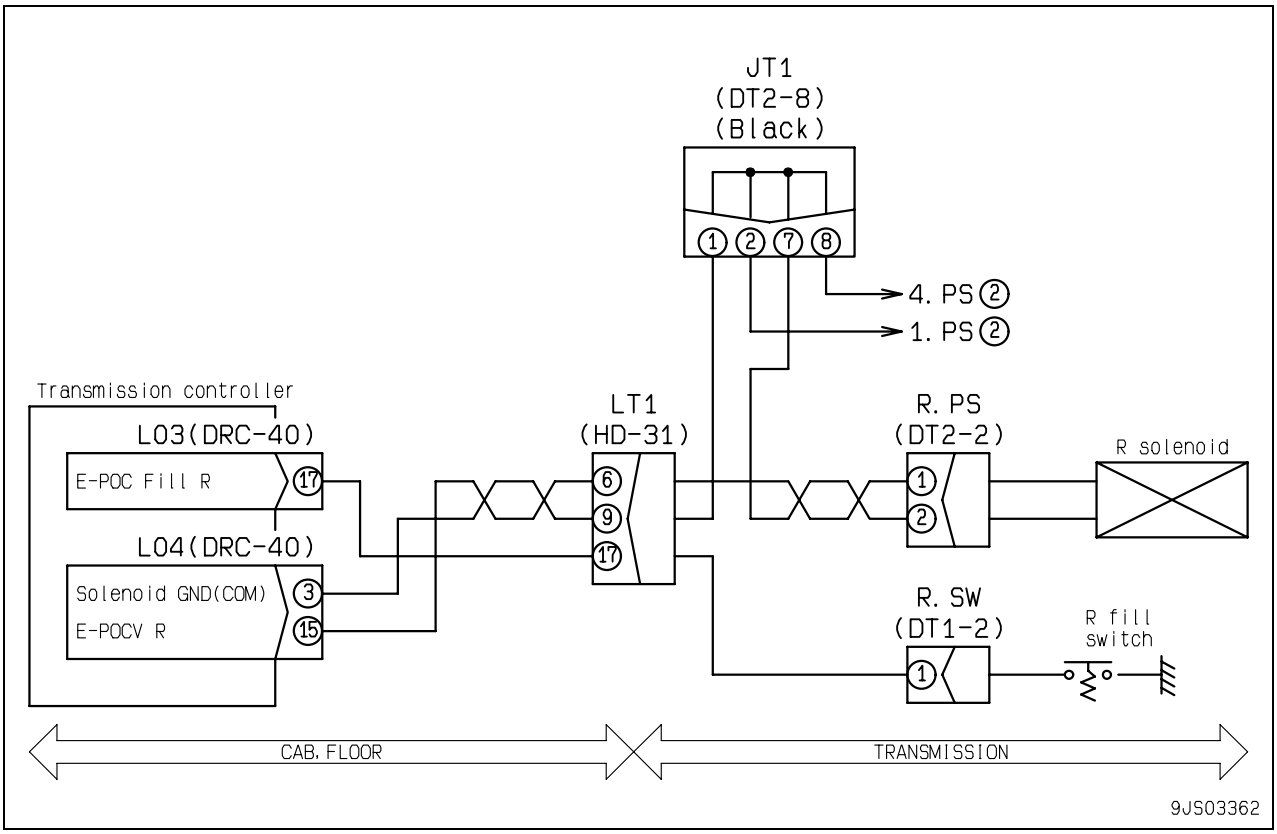


Failure code [15SBLH] (ECMV R clutch: When command current is ON, fill signal is OFF)

Action code	Failure code	Trouble	ECMV R clutch: When command current is OFF, fill signal is ON (Transmission controller system)
E01	**15SBLH**		
Contents of trouble	• When R ECMV solenoid output is turned ON, R ECMV fill switch signal ON is not input.		
Action of controller	• Judges that the R ECMV fill switch signal is turned OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• When the travel direction is changed, a shock or a time lag may be made.		
Related information	• The output state (current) to the R clutch ECMV solenoid can be checked with the monitoring function (Code: 31606, ECMV R DIR). • The input state (ON/OFF) from the R fill switch can be checked with the monitoring function (Code: 40908, D-IN-26). • Method of reproducing failure code: Start engine, and set directional lever or switch to R. • This error code may be displayed just after the transmission oil is replaced.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective R ECMV fill switch (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			R.SW (male)	Directional lever or directional switch	Resistance	
			Between (1) and chassis ground	R (Reverse)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (17) – R.SW (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			L03	Directional lever or directional switch	Voltage	
			Between (17) and chassis ground	R (Reverse)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission R clutch

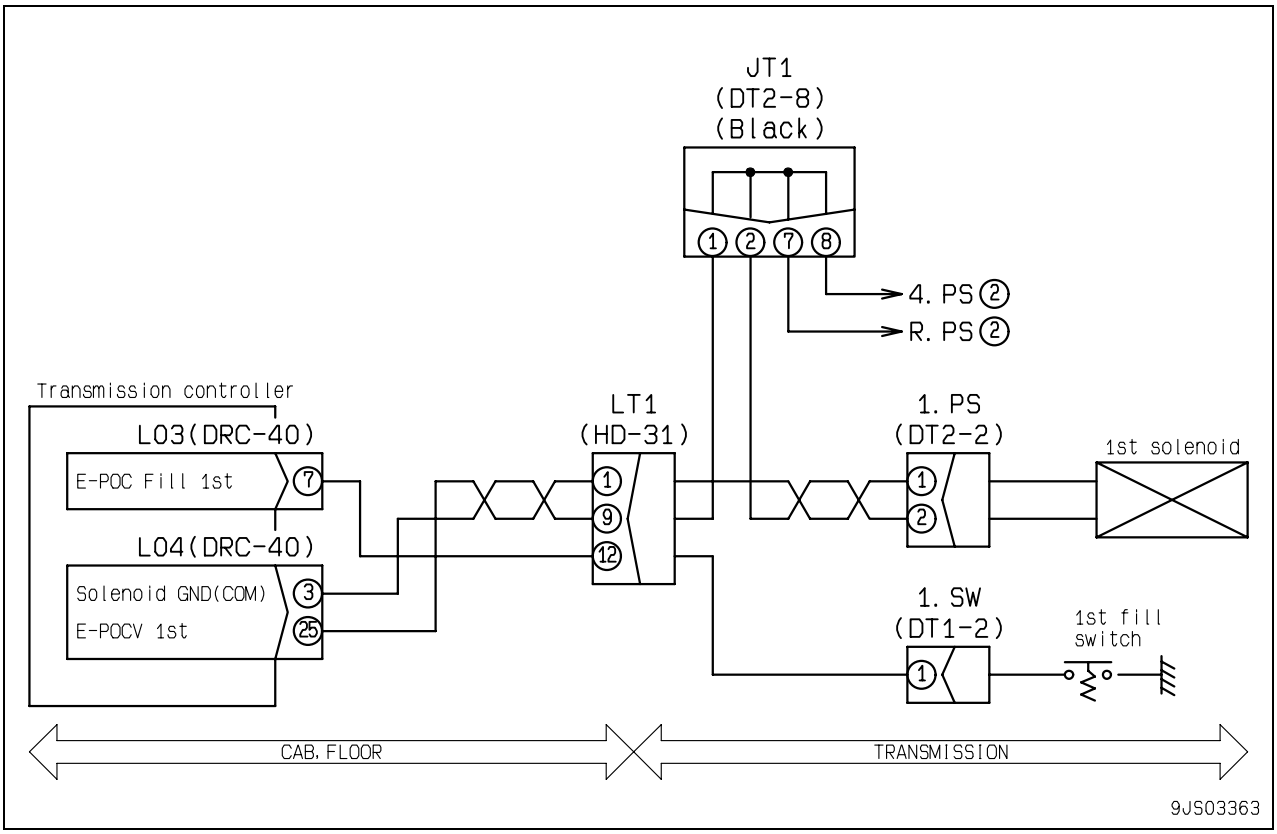


Failure code [15SEL1] (ECMV (1): When command current is OFF, fill signal is ON)

Action code	Failure code	Trouble	ECMV (1): When command current is OFF, fill signal is ON (Transmission controller system)
E03	**15SEL1**		
Contents of trouble	• When 1st ECMV solenoid output is turned OFF, 1st ECMV fill switch signal ON is input, and clutch is not released.		
Action of controller	• Judges that the 1st ECMV fill switch signal is turned ON. • Holds 2nd, 3rd, and 4th proportional solenoid outputs OFF. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The machine can travel at 1st, but not at 2nd, 3rd, and 4th.		
Related information	• The output state (current) to the 1st clutch ECMV solenoid can be checked with the monitoring function (Code: 31602, ECMV 1 DIR). • The input state (ON/OFF) from the 1st fill switch can be checked with the monitoring function (Code: 40908, D-IN-27). • Method of reproducing failure code: Start engine.		

<table>
<tr><td rowspan="8">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective 1st ECMV fill switch (Internal short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.
• Turn parking brake switch OFF.
• Keep pressing brake pedal to prevent machine from traveling.</td></tr>
<tr><td>1.SW (male)</td><td>Shift lever</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) and chassis ground</td><td>1st (1st speed)</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Other than above</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Grounding fault in wiring harness
(Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between L03 (female) (7) – 1.SW (female) (1)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective transmission controller</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.
• Turn parking brake switch OFF.
• Keep pressing brake pedal to prevent machine from traveling.
• Set the auto shift and manual shift selector switch in the MANUAL position.
• Set the directional lever or directional selector switch to the F (forward) or R (reverse) position.</td></tr>
<tr><td>L03</td><td>Shift lever</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (7) and chassis ground</td><td>1st (1st speed)</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>Other than above</td><td colspan="2">8 – 10 V</td></tr>
</table>

Circuit diagram related to transmission 1st clutch

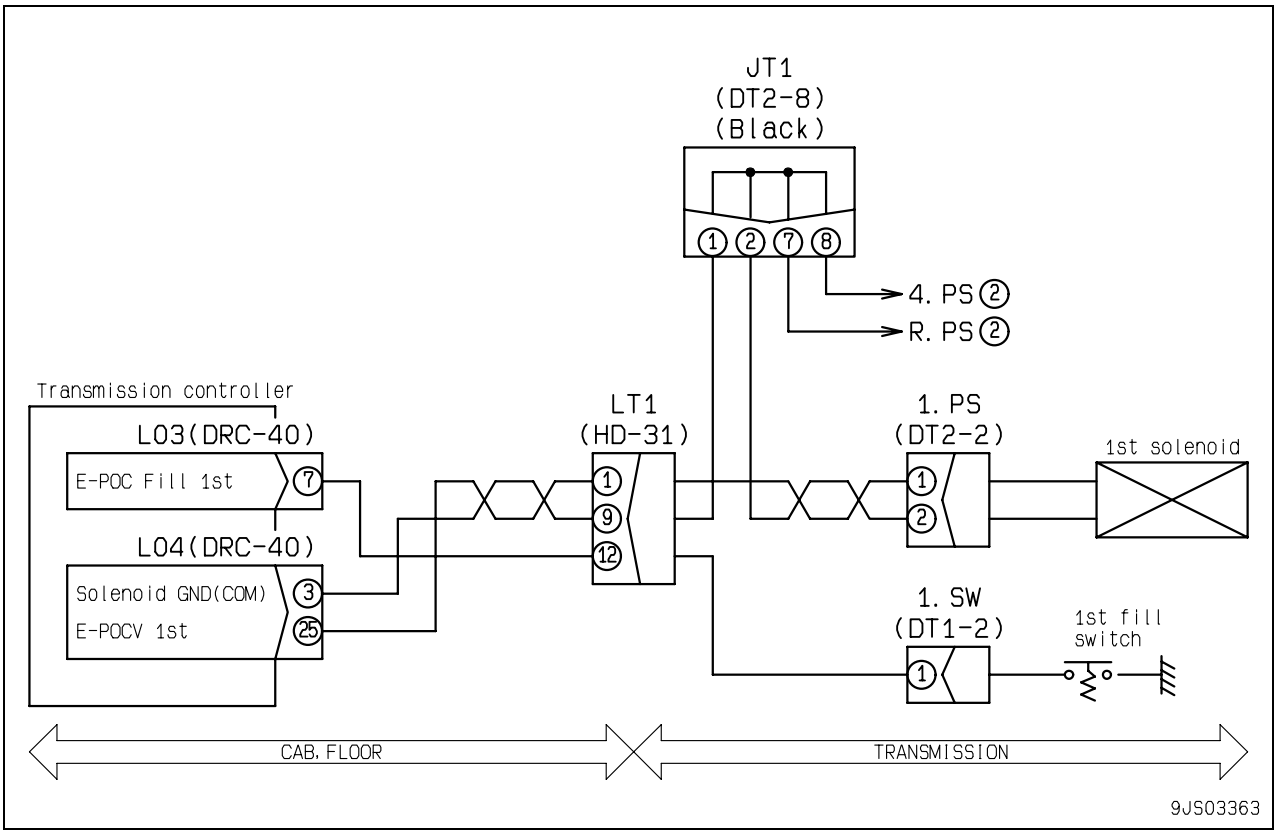


Failure code [15SELH] (ECMV (1): When command current is ON, fill signal is OFF)

Action code	Failure code	Trouble	ECMV (1): When command current is ON, fill signal is OFF (Transmission controller system)
E01	**15SELH**		
Contents of trouble	• When 1st ECMV solenoid output is turned ON, 1st ECMV fill switch signal ON is not input.		
Action of controller	• Judges that the 1st ECMV fill switch signal is turned OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The machine does not travel at 1st. • When the 1st gear speed is changed, a shock or a time lag may be made.		
Related information	• The output state (current) to the 1st clutch ECMV solenoid can be checked with the monitoring function (Code: 31602, ECMV 1 DIR). • The input state (ON/OFF) from the 1st fill switch can be checked with the monitoring function (Code: 40908, D-IN-27). • Method of reproducing failure code: Start engine, and set the manual/auto shift selector switch in the MANUAL position, then set the directional lever or directional selector switch to the F (forward) or R (reverse), and 1st shift lever position. • This error code may be displayed just after the transmission oil is replaced.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 1st ECMV fill switch (Internal disconnection)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			1.SW (male)	Shift lever	Resistance	
			Between (1) and chassis ground	1st (1st speed)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (7) – 1.SW (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling. • Set the auto shift and manual shift selector switch in the MANUAL position. • Set the directional lever or directional selector switch to the F (forward) or R (reverse) position.			
			L03	Shift lever	Voltage	
			Between (7) and chassis ground	1st (1st speed)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission 1st clutch

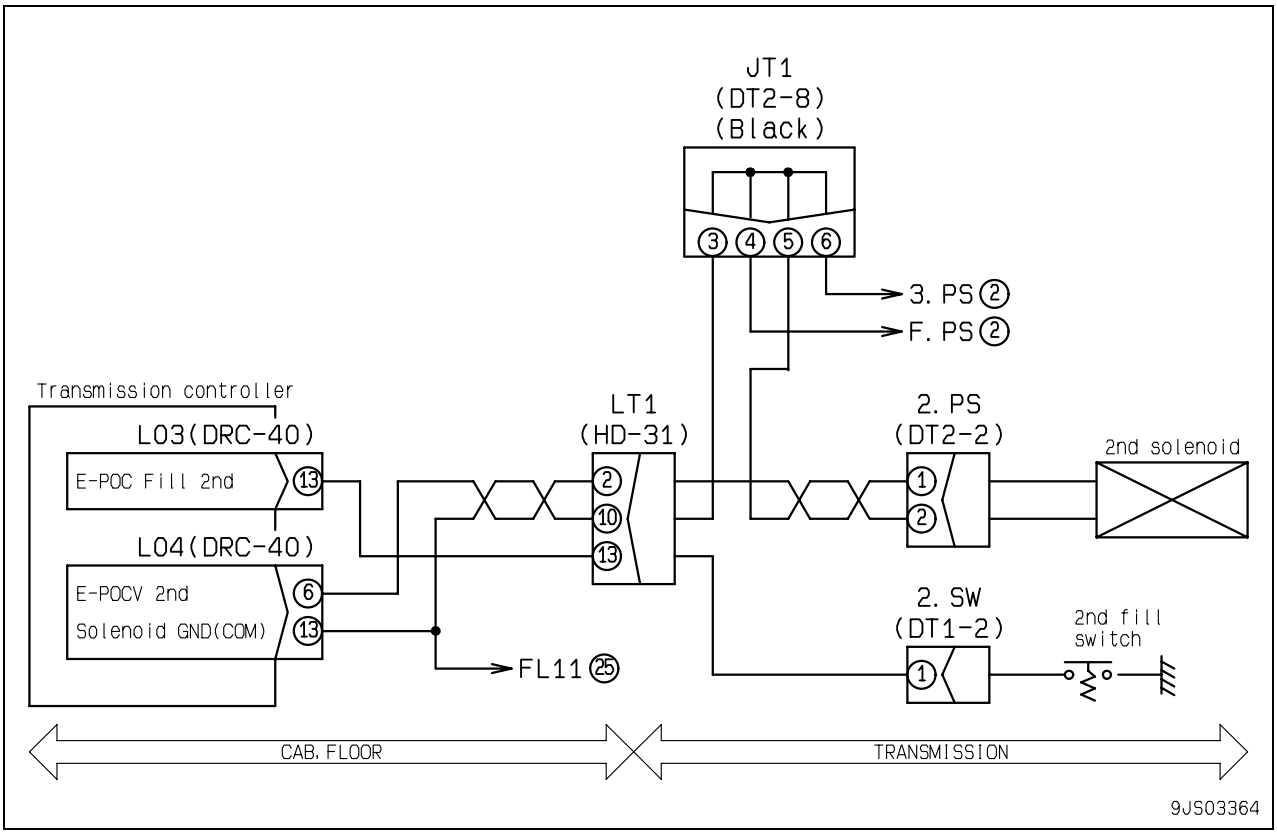


Failure code [15SFL1] (ECMV (2): When command current is OFF, fill signal is ON)

Action code	Failure code	Trouble	ECMV (2): When command current is OFF, fill signal is ON (Transmission controller system)
E03	**15SFL1**		
Contents of trouble	• When 2nd ECMV solenoid output is turned OFF, 2nd ECMV fill switch signal ON is input, and clutch is not released.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • Judges that the 2nd ECMV fill switch signal is turned ON. • Holds 1st, 3rd, and 4th proportional solenoid outputs OFF. • Even if cause of failure disappears, system does not reset itself until directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The machine can travel at 2nd, but not at 1st, 3rd, and 4th.		
Related information	• The output state (current) to the 2nd clutch ECMV solenoid can be checked with the monitoring function (Code: 31603, ECMV 2 DIR). • The input state (ON/OFF) from the 2nd fill switch can be checked with the monitoring function (Code: 40908, D-IN-28). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 2nd ECMV fill switch (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.		
			2.SW (male)	Shift lever	Resistance
			Between (1) and chassis ground	2nd (2nd speed)	Max. 1 Ω
				Other than above	Min. 1 MΩ
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L03 (female) (13) – 2.SW (female) (1)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling. • Set the auto shift and manual shift selector switch in the MANUAL position. • Set the directional lever or directional selector switch to the F (forward) or R (reverse) position.		
			L03	Shift lever	Voltage
			Between (13) and chassis ground	2nd (2nd speed)	Max. 1 V
				Other than above	8 – 10 V

Circuit diagram related to transmission 2nd clutch

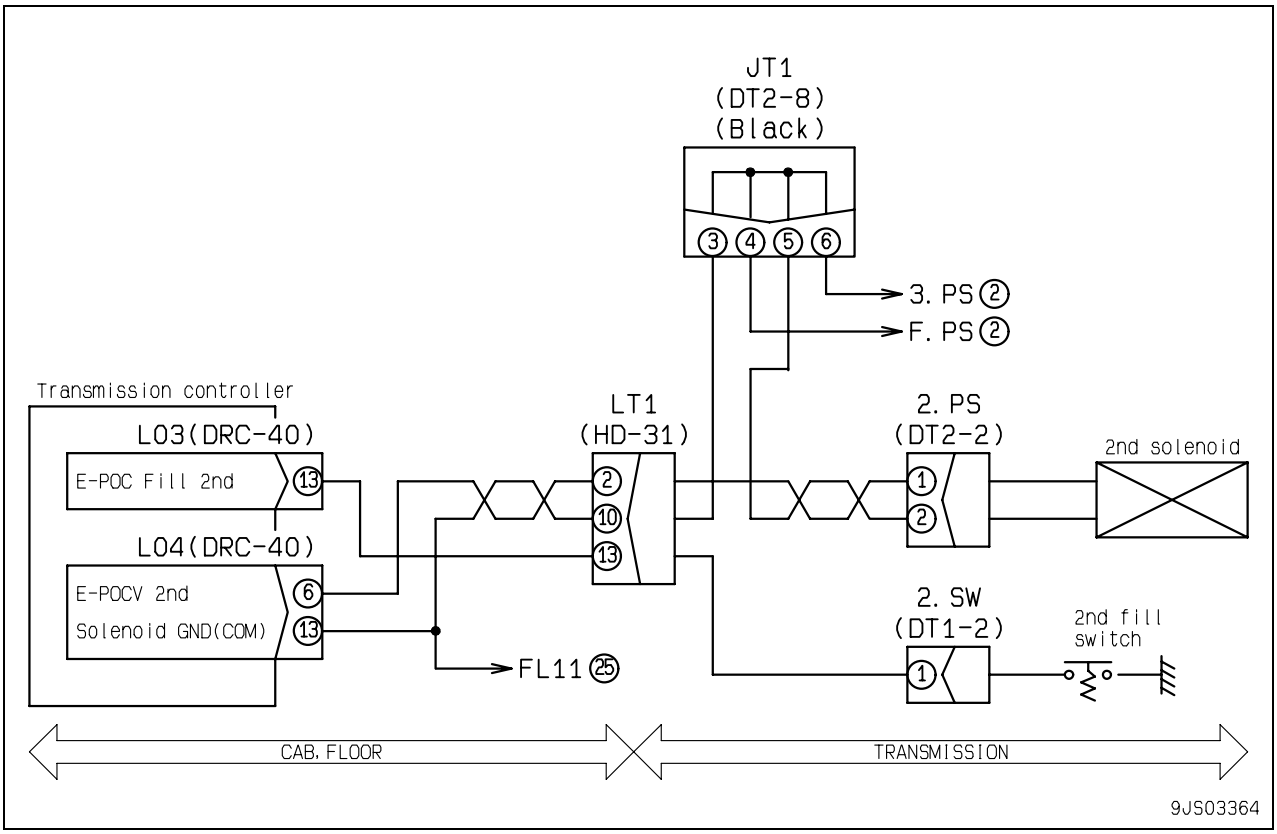


Failure code [15SFLH] (ECMV (2): When command current is ON, fill signal is OFF)

Action code	Failure code	Trouble	ECMV (2): When command current is ON, fill signal is OFF (Transmission controller system)
E01	**15SFLH**		
Contents of trouble	• When 2nd ECMV solenoid output is turned ON, 2nd ECMV fill switch signal ON is not input.		
Action of controller	• Judges that the 2nd ECMV fill switch signal is turned OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The machine does not travel at 2nd. • When the 2nd gear speed is changed, a shock or a time lag may be made.		
Related information	• The output state (current) to the 2nd clutch ECMV solenoid can be checked with the monitoring function (Code: 31603, ECMV 2 DIR). • The input state (ON/OFF) from the 2nd fill switch can be checked with the monitoring function (Code: 40908, D-IN-28). • Method of reproducing failure code: Start engine, and set the manual/auto shift selector switch in the MANUAL position, then set the directional lever or directional selector switch to the F (forward) or R (reverse), and 2nd shift lever position. • This error code may be displayed just after the transmission oil is replaced.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 2nd ECMV fill switch (Internal disconnection)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			2.SW (male)	Shift lever	Resistance	
			Between (1) and chassis ground	2nd (2nd speed)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (13) – 2.SW (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling. • Set the auto shift and manual shift selector switch in the MANUAL position. • Set the directional lever or directional selector switch to the F (forward) or R (reverse) position.			
			L03	Shift lever	Voltage	
			Between (13) and chassis ground	2nd (2nd speed)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission 2nd clutch

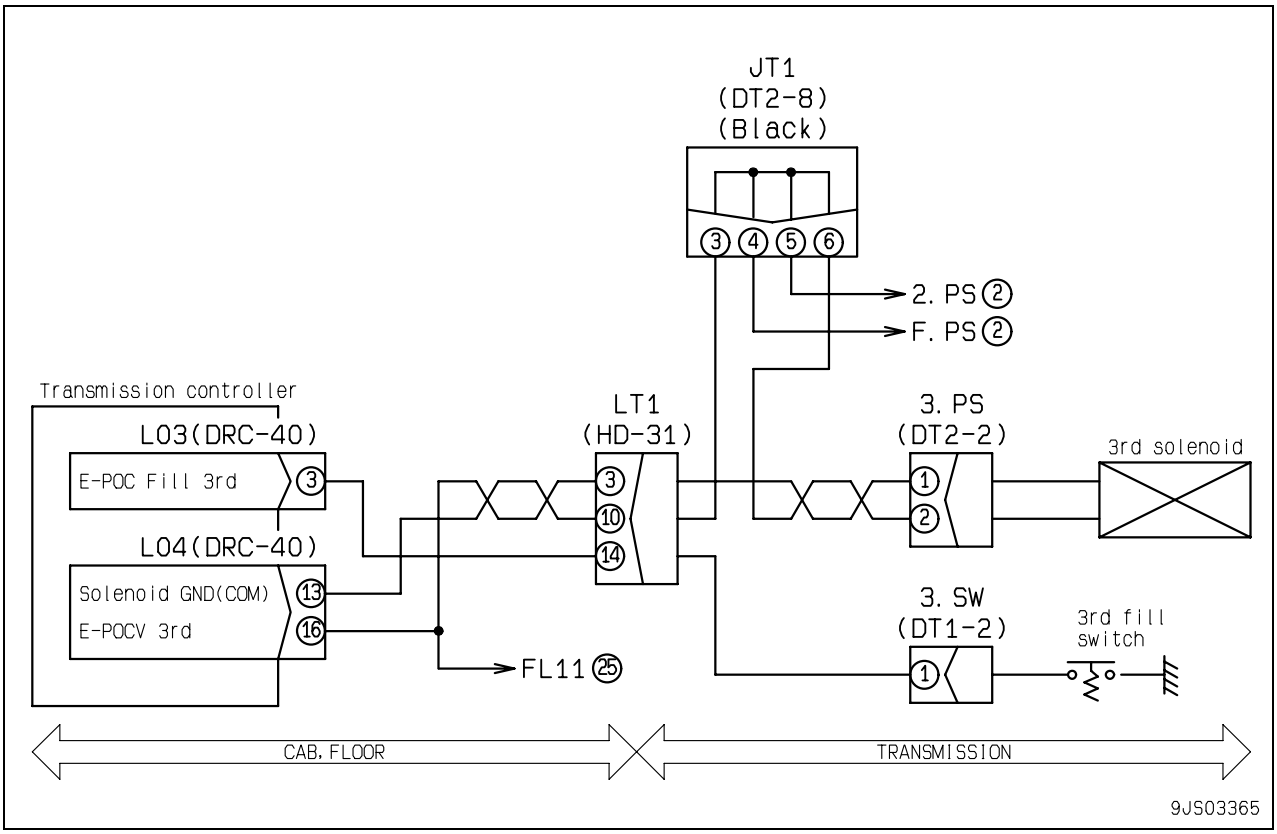


Failure code [15SGL1] (ECMV (3): When command current is OFF, fill signal is ON)

Action code	Failure code	Trouble	ECMV (3): When command current is OFF, fill signal is ON (Transmission controller system)
E03	**15SGL1**		
Contents of trouble	• When 3rd ECMV solenoid output is turned OFF, 3rd ECMV fill switch signal ON is input, and clutch is not released.		
Action of controller	• Judges that the 3rd ECMV fill switch signal is turned ON. • Holds 1st, 2nd, and 4th proportional solenoid outputs OFF. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The machine can travel at 3rd, but not at 1st, 2nd, and 4th.		
Related information	• The output state (current) to the 3rd clutch ECMV solenoid can be checked with the monitoring function (Code: 31604, ECMV 3 DIR). • The input state (ON/OFF) from the 3rd fill switch can be checked with the monitoring function (Code: 40908, D-IN-29). • Method of reproducing failure code: Start engine.		

<table>
<tr><td rowspan="8">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective 3rd ECMV fill switch (Internal short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.
• Turn parking brake switch OFF.
• Keep pressing brake pedal to prevent machine from traveling.</td></tr>
<tr><td>3.SW (male)</td><td>Shift lever</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) and chassis ground</td><td>3rd (3rd speed)</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Other than above</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Grounding fault in wiring harness
(Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between L03 (female) (3) – 1.SW (female) (1)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective transmission controller</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.
• Turn parking brake switch OFF.
• Keep pressing brake pedal to prevent machine from traveling.
• Set the auto shift and manual shift selector switch in the MANUAL position.
• Set the directional lever or directional selector switch to the F (forward) or R (reverse) position.</td></tr>
<tr><td>L03</td><td>Shift lever</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (3) and chassis ground</td><td>3rd (3rd speed)</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>Other than above</td><td colspan="2">8 – 10 V</td></tr>
</table>

Circuit diagram related to transmission 3rd clutch

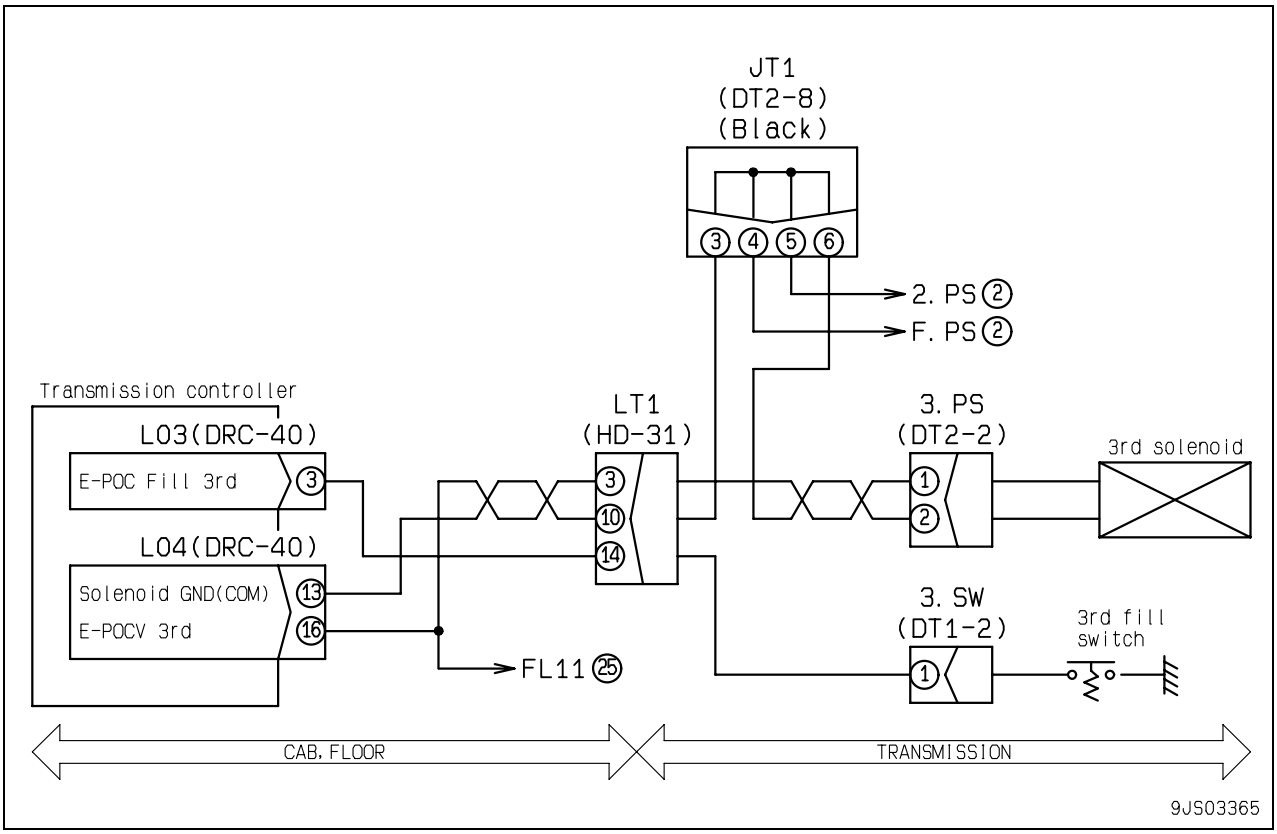


Failure code [15SGLH] (ECMV (3): When command current is ON, fill signal is OFF)

Action code	Failure code	Trouble	ECMV (3): When command current is ON, fill signal is OFF (Transmission controller system)
E01	**15SGLH**		
Contents of trouble	• When 3rd ECMV solenoid output is turned ON, 3rd ECMV fill switch signal ON is not input.		
Action of controller	• Judges that the 3rd ECMV fill switch signal is turned OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The machine does not travel at 3rd. • When the 3rd gear speed is changed, a shock or a time lag may be made.		
Related information	• The output state (current) to the 3rd clutch ECMV solenoid can be checked with the monitoring function (Code: 31604, ECMV 3 DIR). • The input state (ON/OFF) from the 3rd fill switch can be checked with the monitoring function (Code: 40908, D-IN-29). • Method of reproducing failure code: Turn starting switch ON, and set the manual/auto shift selector switch in the MANUAL position, then set the directional lever or directional selector switch to the F (forward) or R (reverse), and 3rd shift lever position. • This error code may be displayed just after the transmission oil is replaced.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 3rd ECMV fill switch (Internal disconnection)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			3.SW (male)	Shift lever	Resistance	
			Between (1) and chassis ground	3rd (3rd speed)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (3) – 3.SW (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling. • Set the auto shift and manual shift selector switch in the MANUAL position. • Set the directional lever or directional selector switch to the F (forward) or R (reverse) position.			
			L03	Shift lever	Voltage	
			Between (3) and chassis ground	3rd (3rd speed)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission 3rd clutch

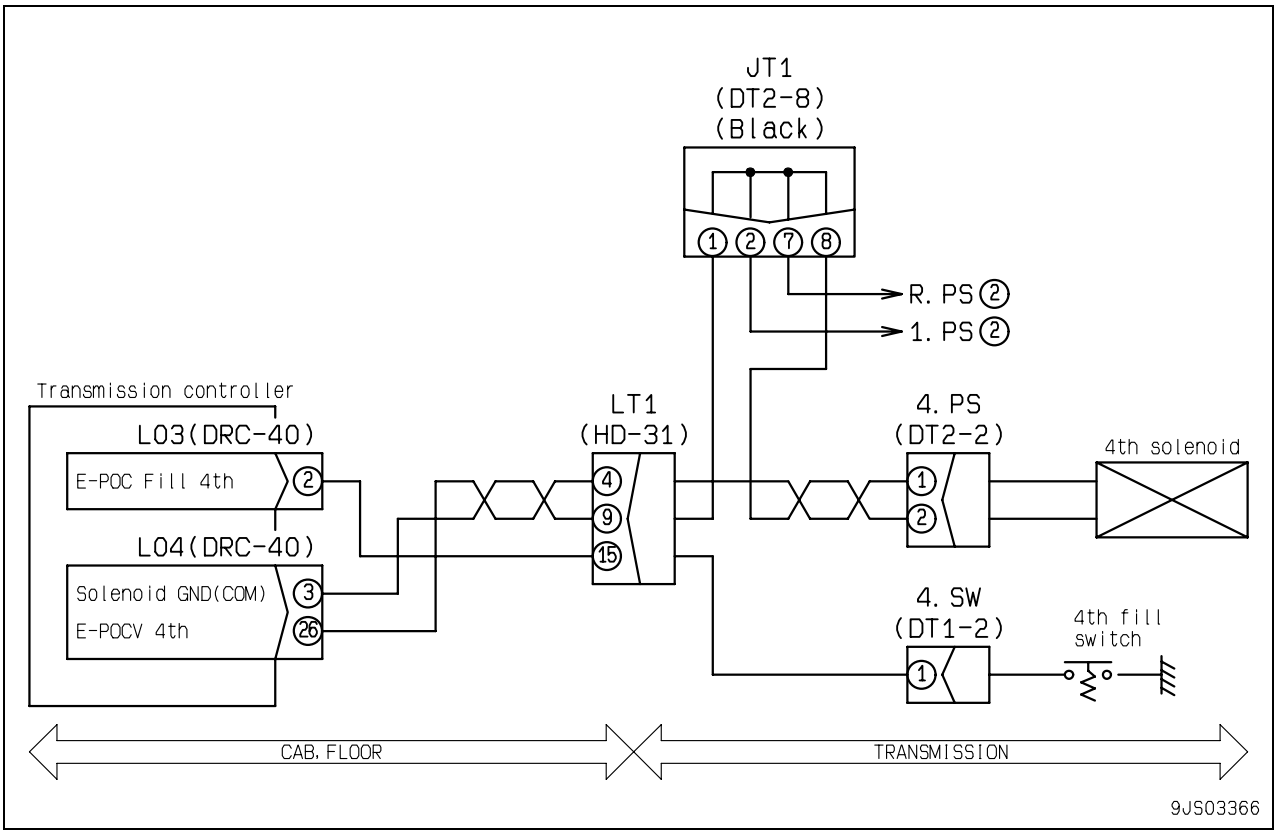


Failure code [15SHL1] (ECMV (4): When command current is OFF, fill signal is ON)

Action code	Failure code	Trouble	ECMV (4): When command current is OFF, fill signal is ON (Transmission controller system)
E03	**15SHL1**		
Contents of trouble	• When 4th ECMV solenoid output is turned OFF, 4th ECMV fill switch signal ON is input, and clutch is not released.		
Action of controller	• Judges that the 4th ECMV fill switch signal is turned ON. • Holds 1st, 2nd, and 3rd proportional solenoid outputs OFF. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The machine can travel at 4th, but not at 1st, 2nd, and 3rd.		
Related information	• The output state (current) to the 4th clutch ECMV solenoid can be checked with the monitoring function (Code: 31605, ECMV 4 DIR). • The input state (ON/OFF) from the 4th fill switch can be checked with the monitoring function (Code: 40908, D-IN-30). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 4th ECMV fill switch (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.		
			4.SW (male)	Shift lever	Resistance
			Between (1) and chassis ground	4th (4th speed)	Max. 1 Ω
				Other than above	Min. 1 MΩ
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L03 (female) (2) – 4.SW (female) (1)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling. • Set the auto shift and manual shift selector switch in the MANUAL position. • Set the directional lever or directional selector switch to the F (forward) or R (reverse) position.		
			L03	Shift lever	Voltage
			Between (2) and chassis ground	4th (4th speed)	Max. 1 V
				Other than above	8 – 10 V

Circuit diagram related to transmission 4th clutch

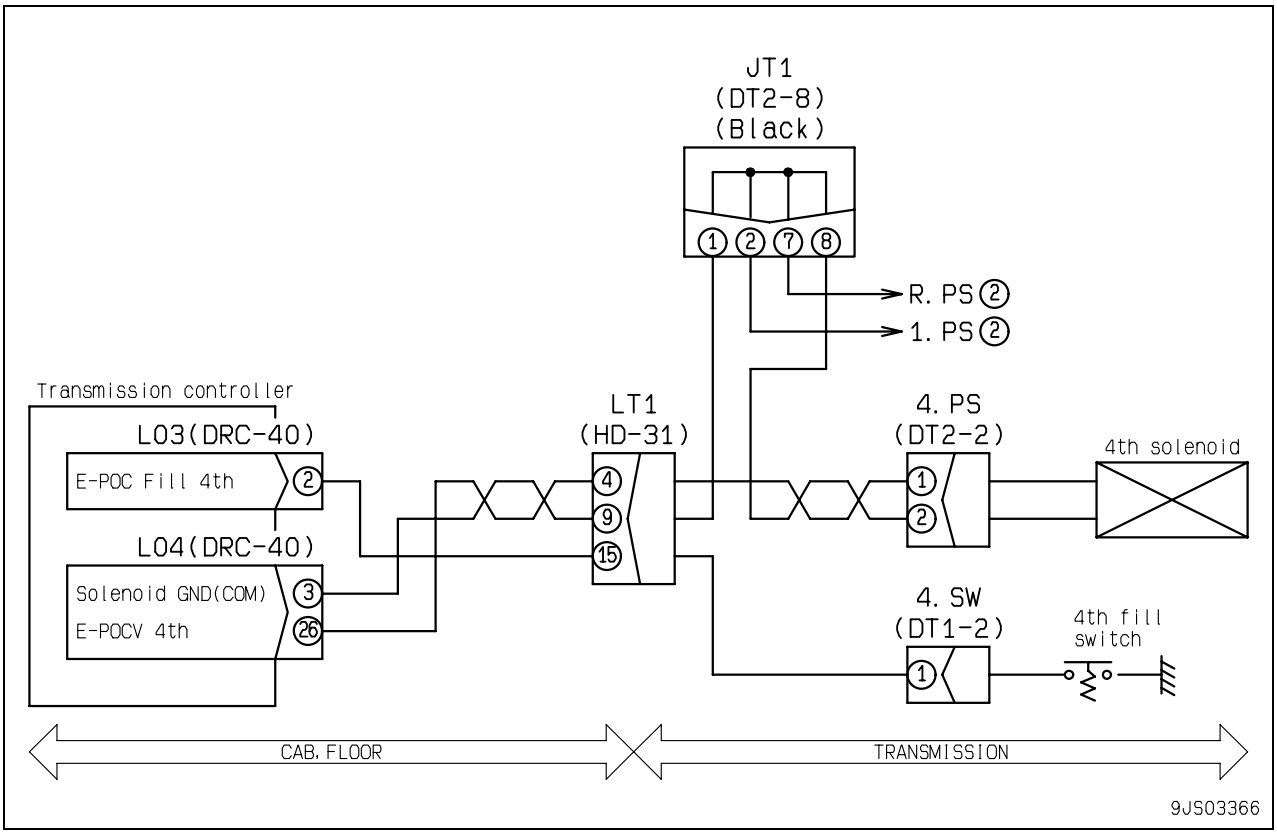


Failure code [15SHLH] (ECMV (4): When command current is ON, fill signal is OFF)

Action code	Failure code	Trouble	ECMV (4): When command current is ON, fill signal is OFF (Transmission controller system)
E01	**15SHLH**		
Contents of trouble	• When 4th ECMV solenoid output is turned ON, 4th ECMV fill switch signal ON is not input.		
Action of controller	• Judges that the 4th ECMV fill switch signal is turned OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The machine may not travel at 4th. • When the 4th gear speed is changed, a shock or a time lag may be made.		
Related information	• The output state (current) to the 4th clutch ECMV solenoid can be checked with the monitoring function (Code: 31605, ECMV 4). • The input state (ON/OFF) from the 4th fill switch can be checked with the monitoring function (Code: 40908, D-IN-30). • Method of reproducing failure code: Turn starting switch ON, and set the manual/auto shift selector switch in the MANUAL position, then set the directional lever or directional selector switch to the F (forward) or R (reverse), and 4th shift lever position. • This error code may be displayed just after the transmission oil is replaced.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 4th ECMV fill switch (Internal disconnection)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			4.SW (male)	Shift lever	Resistance	
			Between (1) and chassis ground	4th (4th speed)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (2) – 4.SW (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling. • Set the auto shift and manual shift selector switch in the MANUAL position. • Set the directional lever or directional selector switch to the F (forward) or R (reverse) position.			
			L03	Shift lever	Voltage	
			Between (2) and chassis ground	4th (4th speed)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission 4th clutch



Failure code [15W0NT] (Transmission modulation clutch: Overheating)

Action code	Failure code	Trouble	Transmission modulation clutch: Overheating (Transmission controller system)
E02	**15W0NT**		
Contents of trouble	• The calorific value of the modulation clutch is higher than the set value. (Overheating)		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	—		
Related information	• The state (calorific value) of the modulation clutch can be checked with the monitoring function (Code: 92500, MOD/C Q). • The state (heat rate) of the modulation clutch can be checked with the monitoring function (Code: 92501, MOD/C q). • Method of reproducing failure code: Engine started + Travel		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Transmission controller	Transmission controller may be defective (Since trouble is in system, troubleshooting cannot be carried out.)
	2	Overload	Cause may be wrong operation such as continuous use of modulation clutch. Explain correct operating method to operator.

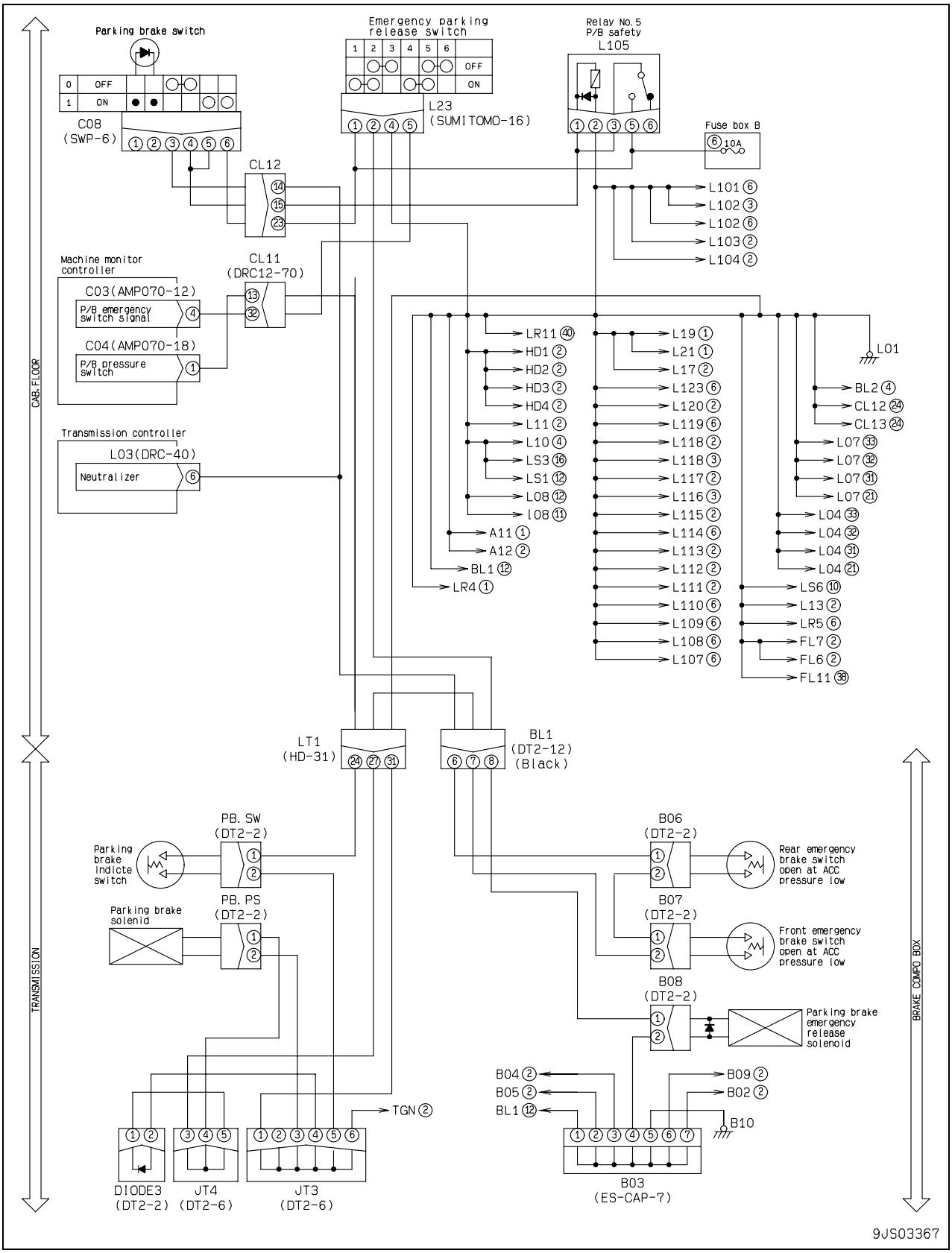
Failure code [2F00MA] (Parking brake: Malfunction)

Action code	Failure code	Trouble	Parking brake: Malfunction (Machine monitor system)
E03	**2F00MA**		
Contents of trouble	• While the F or R clutch is operated, the parking brake operation sensor circuit is OPEN. (The neutralizer does not work.)		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The parking brake drags (is kept operated).		
Related information	• The input state (ON/OFF) from the parking indicator switch can be checked with the monitoring function (Code: 40903, D-IN-26). • Method of reproducing failure code: Turn the starting switch ON. • This error may be displayed because of engine stall operation or the emergency brake is applied during travel.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective parking brake indicator switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			PB.SW (male)	Parking brake	Resistance
			Between (1) and (2)	Released	Max. 1 Ω
				Operates	Min. 1 MΩ
	2	Defective parking brake switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			C08 (male)	Parking brake switch	Resistance
			Between (3) and (4)	ON	Min. 1 MΩ
				OFF	Max. 1 Ω
			Between (5) and (6)	ON	Max. 1 Ω
				OFF	Min. 1 MΩ
			Between (3) and (6)	Normal	Min. 1 MΩ
	3	Defective parking brake solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			PB.PS (male)	Resistance	
			Between (1) and (2)	10 – 40 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	4	Defective emergency brake pressure switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			B06 (male), B07 (male)	Parking brake	Resistance
			Between (1) and (2)	Normal brake pressure Min. 4.9 MPa {50 kg/cm^2}	Max. 1 Ω
				Low brake pressure Min. 3.14 MPa {32 kg/cm^2}	Min. 1 MΩ

<table>
<tr><td rowspan="10">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="7">5</td><td rowspan="7">Disconnection in wiring harness (Disconnection or defective contact)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between C04 (female) (1) – PB.SW (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between C08 (female) (3) – B06 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between B06 (female) (2) – B07 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between B07 (female) (2) – PB.PS (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between C08 (female) (3) – L03 (female) (6)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between PB.SW (female) (2) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Defective machine monitor</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.</td></tr>
<tr><td>C04</td><td>Parking brake oil pressure</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (1) and chassis ground</td><td>Released</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>Operates</td><td colspan="2">20 – 30 V</td></tr>
</table>

Circuit diagram related to parking brake

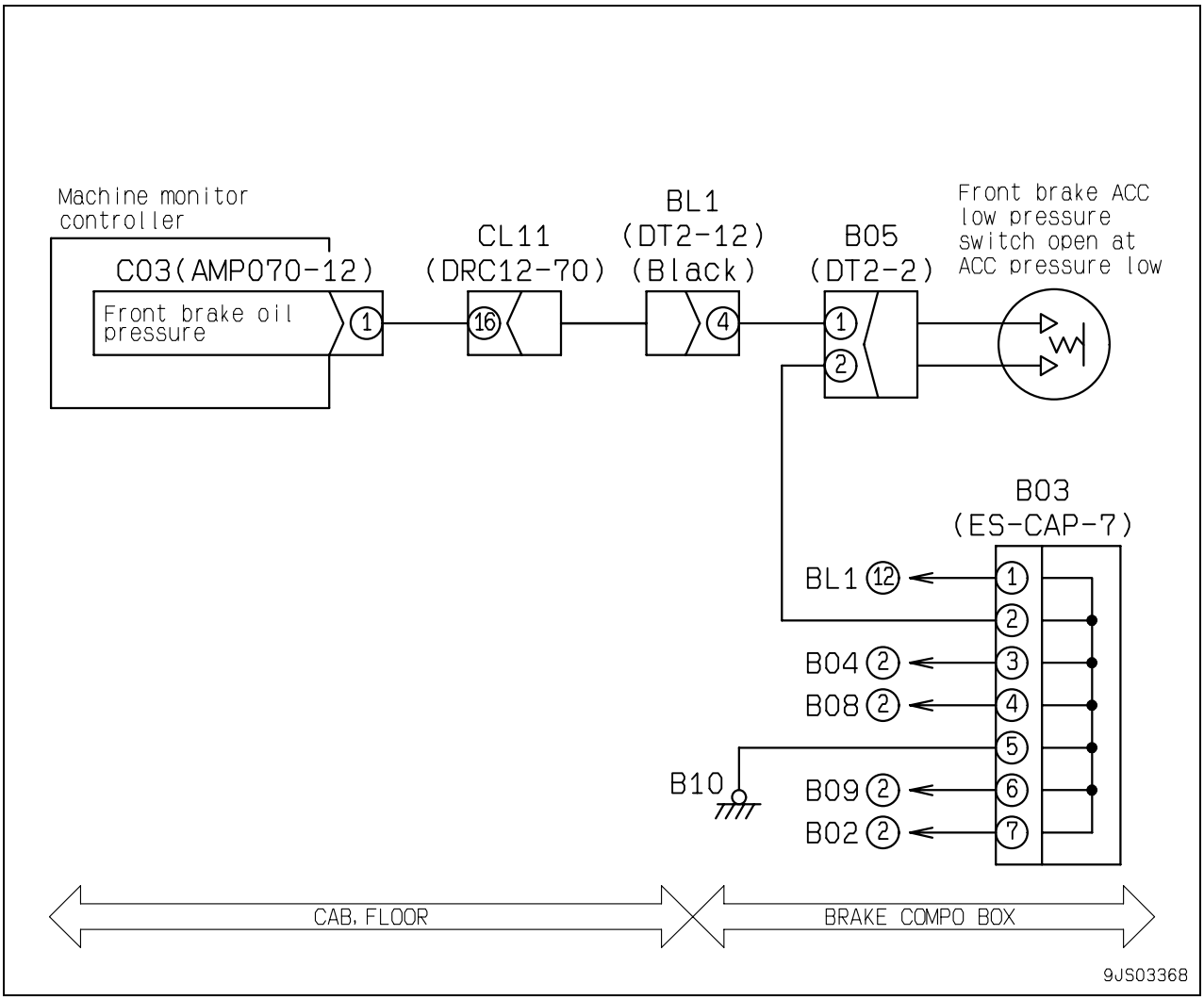


Failure code [2G42ZG] (Front accumulator: Low oil pressure)

Action code	Failure code	Trouble	Front brake accumulator: Low oil pressure (Machine monitor system)
E03	**2G42ZG**		
Contents of trouble	• 45 seconds after the engine is started, the front brake accumulator pressure sensor circuit is OPEN.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The front brake accumulator oil pressure lowers. • The brake may not work. • The parking brake may keep working.		
Related information	• The input state (ON/OFF) from the front brake oil pressure sensor can be checked with the monitoring function (Code: 40902, D-IN-16). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	The front brake accumulator oil pressure lowers.	Check the front brake accumulator oil pressure. (See Testing and adjusting.)			
	2	Defective front brake oil pressure sensor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			B05 (male)	Front brake accumulator oil pressure	Resistance	
			Between (1) and (2)	Normal brake pressure Min. 5.88 MPa {60 kg/cm^2}	Max. 1 Ω	
				Low brake pressure Max. 3.92 MPa {40 kg/cm^2}	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C03 (female) (1) – B05 (female) (1)		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C03 (female)	Front brake accumulator oil pressure	Resistance	
			Between (1) and chassis ground	Normal brake pressure Min. 5.88 MPa {60 kg/cm^2}	Max. 1 Ω	
				Low brake pressure Max. 3.92 MPa {40 kg/cm^2}	Min. 1 MΩ	

Circuit diagram related to front brake accumulator



WA600-6 Wheel loader

Form No. SEN00558-01

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 2

Troubleshooting by failure code (Display of code), Part 2 4
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Failure code [44K0L4] (Bucket positioner: ON/OFF signals disagree) 6
Failure code [A000N1] (or VHMS_LED display: “n2” → “01”) (Engine: Overrun) 8
Failure code [AA1ANX] (Air cleaner: Clogging) 10
Failure code [AB00L6] (Alternator: Signal disagrees with operating state of engine) 12
Failure code [AB00MA] (Alternator: Malfunction) 14
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Failure code [B@BCNS] (Engine overheating) 20
Failure code [B@BCZK] (Coolant: Low level) 22
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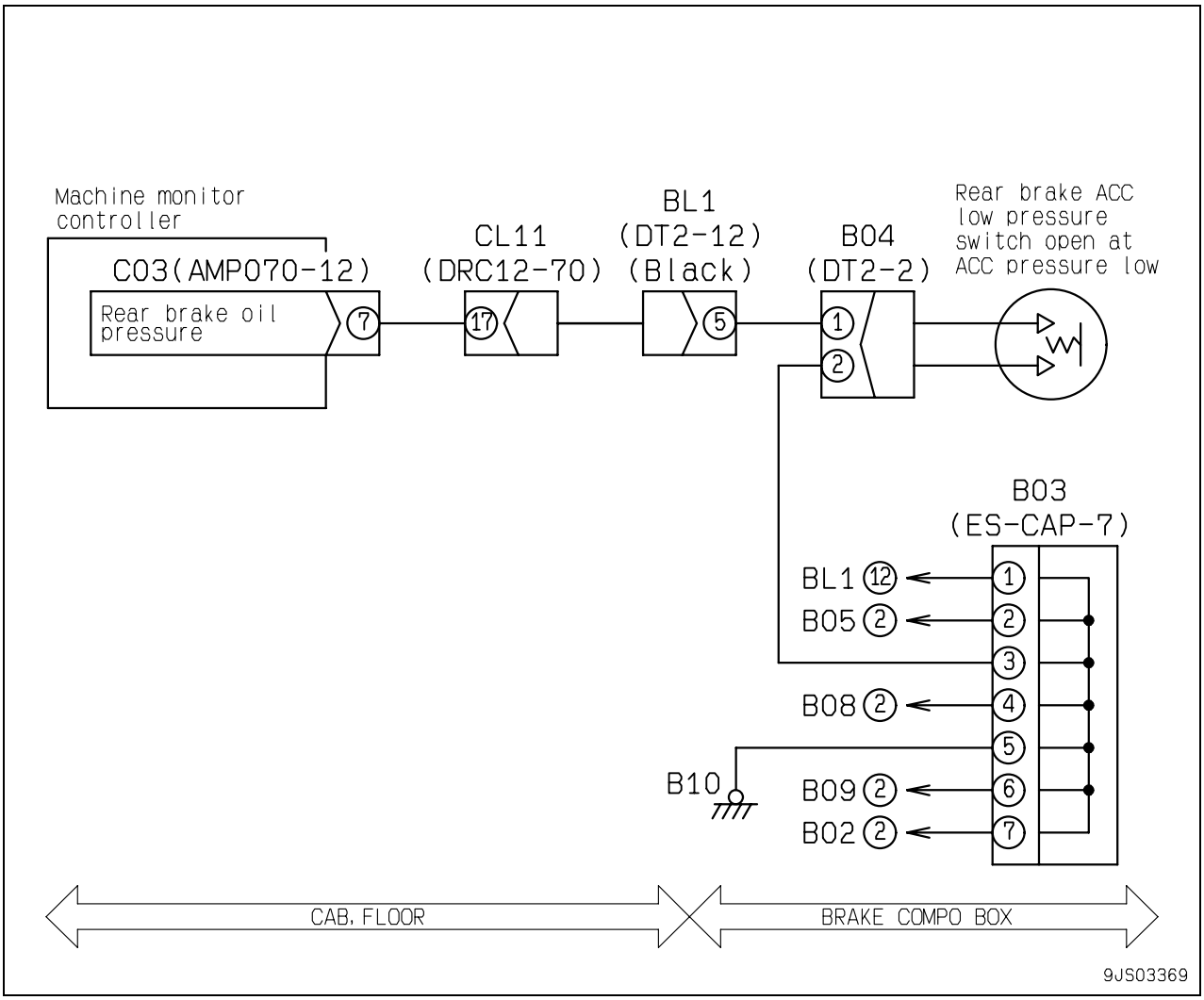
Troubleshooting by failure code (Display of code), Part 2

Failure code [2G43ZG] (Rear accumulator: Low oil pressure)

Action code	Failure code	Trouble	Rear accumulator: Low oil pressure (Machine monitor system)
E03	**2G43ZG**		
Contents of trouble	• 45 seconds after the engine is started, the rear brake accumulator pressure sensor circuit is OPEN.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Low rear brake accumulator oil pressure • The brake may not work. • The parking brake may keep working.		
Related information	• The input state (ON/OFF) from the rear brake oil pressure sensor can be checked with the monitoring function (Code: 40902, D-IN-17). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Low rear brake accumulator oil pressure	Check the rear brake accumulator oil pressure. (See Testing and adjusting.)			
	2	Defective rear brake oil pressure sensor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			B04 (male)	Rear brake accumulator oil pressure	Resistance	
			Between (1) and (2)	Normal brake pressure Min. 5.88 MPa {Min. 60 kg/cm^2}	Max. 1 Ω	
				Low brake pressure Max. 3.92 MPa {Max. 40 kg/cm^2}	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C03 (female) (7) – B04 (female) (1)		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C03 (female)	Rear brake accumulator oil pressure	Resistance	
			Wiring harness between (7) – chassis ground	Normal brake pressure Min. 5.88 MPa {Min. 60 kg/cm^2}	Max. 1 Ω	
				Low brake pressure Max. 3.92 MPa {Max. 40 kg/cm^2}	Min. 1 MΩ	

Circuit diagram related to rear brake accumulator

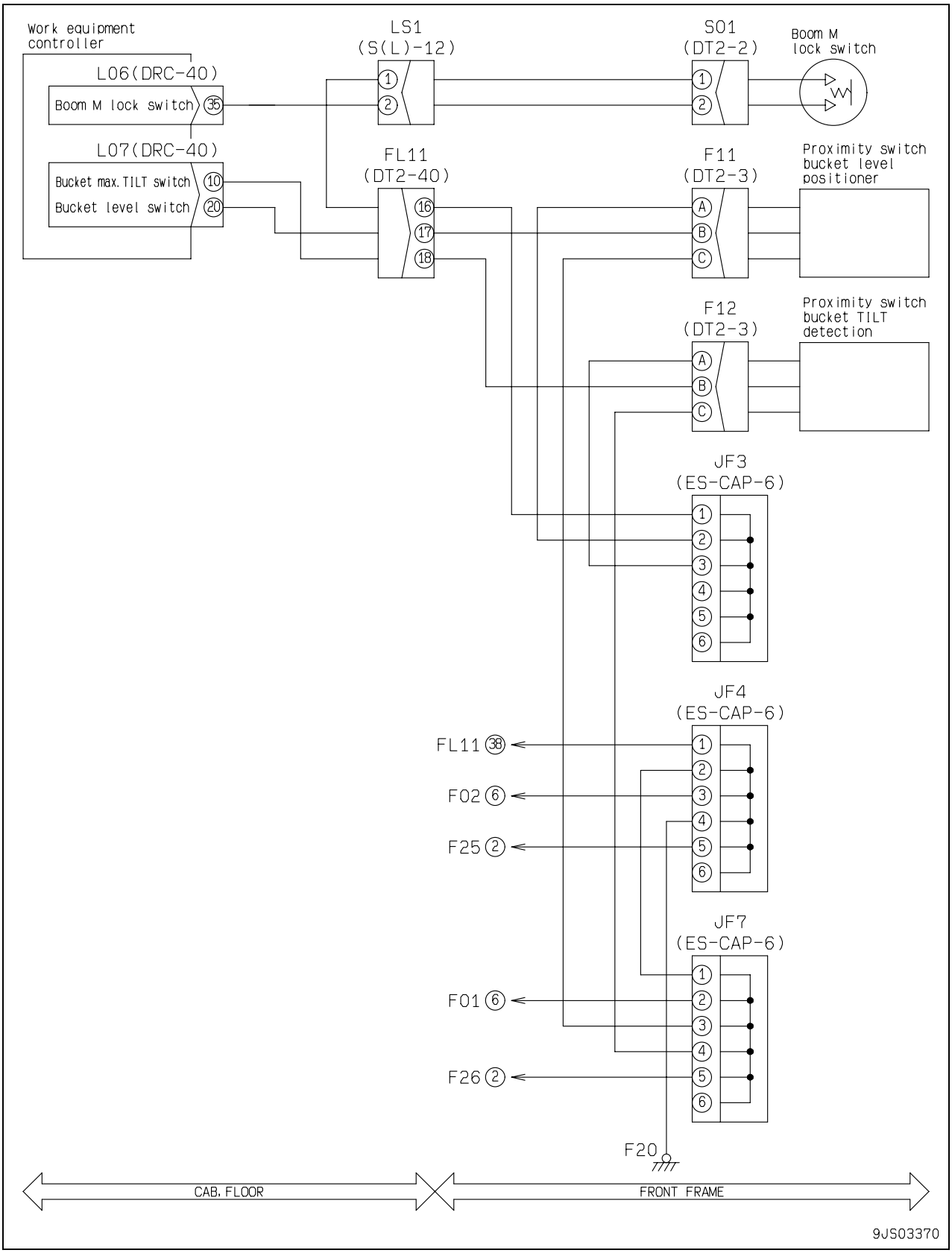


Failure code [44K0L4] (Bucket positioner: ON/OFF signals disagree)

Action code	Failure code	Trouble	Bucket positioner: ON/OFF signals disagree (Work equipment controller system)
E01	**44K0L4**		
Contents of trouble	• The signals input from the bucket proximity switch are combined impossibly. • After bucket level-over signal ON and full stroke signal OFF were continued for 3 seconds, full stroke signal ON was detected for one second. • After bucket level-over signal ON and full stroke signal OFF were continued for 3 seconds, bucket level-over signal OFF was detected for one second. • If cause of failure disappears, system resets itself.		
Action of controller	• Judged to be below bucket level.		
Problem that appears on machine	• Bucket leveler does not function		
Related information	• The input state (ON/OFF) from the bucket cylinder full stroke proximity switch can be checked with the monitoring function (Code: 40911, D-IN-8). (STD) • The input state (ON/OFF) from the bucket cylinder level proximity switch can be checked with the monitoring function (Code: 40911, D-IN-9). • Method of reproducing failure code: Tilt and dump bucket slowly many times.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective bucket cylinder level proximity switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			F11	Position of bucket	Voltage	
			Between (A) and (C)	Normal	20 – 30 V	
			Between (B) and (C)	Below horizontal	Max. 1 V	
				Above horizontal	8 – 10 V	
	2	Defective bucket cylinder full stroke proximity switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			F12	Position of bucket	Voltage	
			Between (A) and (C)	Normal	20 – 30 V	
			Between (B) and (C)	Tilt full stroke	8 – 10 V	
				Other than tilt full stroke	Max. 1 V	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F12 (female) (B) – L07 (female) (10)		Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F11 (female) (B) – L07 (female) (20)		Resistance	Min. 1 MΩ
	5	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	Position of bucket	Voltage	
			Between (10) and chassis ground	Below horizontal	Max. 1 V	
				Above horizontal	8 – 10 V	
			Between (20) and chassis ground	Tilt full stroke	8 – 10 V	
				Other than tilt full stroke	Max. 1 V	

Circuit diagram related to bucket proximity switch



Failure code [A000N1] (or VHMS_LED display: “n2” → “01”) (Engine: Overrun)

Action code	Failure code	Trouble	Engine: Overrun (VHMS controller system)
—	**A000N1**		
Contents of trouble	• Engine speed exceeded 2,624 rpm.		
Action of controller	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	—		
Related information	• The monitor panel does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n2” → “01”. • VHMS controller inputs engine speed signal with CAN communication from engine controller. • If failure code [**CA212**] (engine speed sensor high error (VHMS)) is displayed, carry out trouble-shooting for it first. • Method of reproducing failure code: Start engine and travel.		

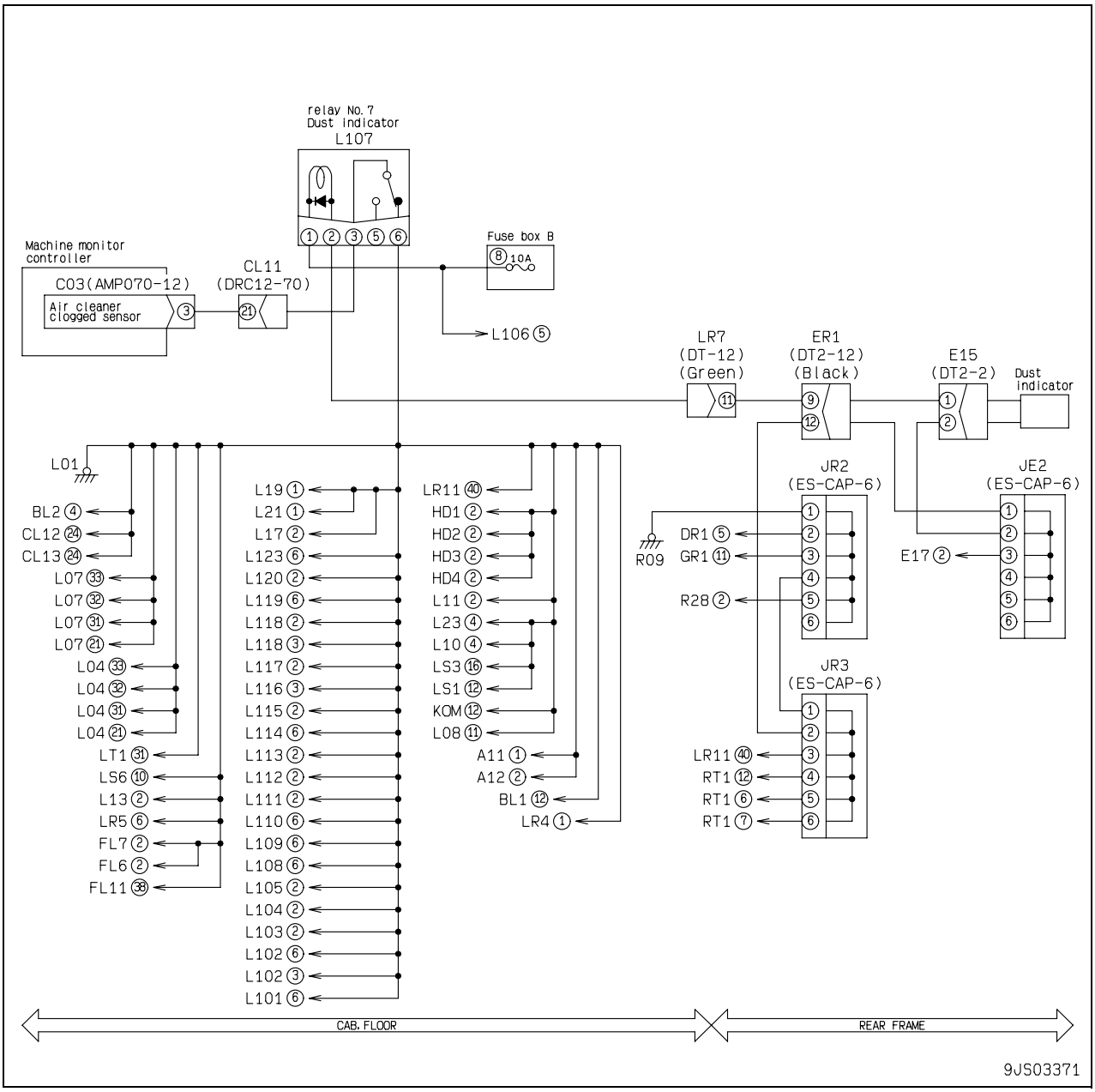
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective operating travel	Engine speed increased due to shift-down during travel. • Instruct the operator on how to travel the machine properly.
	2	Defective VHMS controller	If the above is normal, VHMS controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [AA1ANX] (Air cleaner: Clogging)

Action code	Failure code	Trouble	Air cleaner: Clogging (Machine monitor system)
E01	**AA1ANX**		
Contents of trouble	• The air cleaner clogging sensor circuit is OPEN.		
Action of controller	• Turns the air cleaner clogging caution lamp ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The engine does not start or pick up easily, its output is insufficient, and its exhaust gas color is black.		
Related information	• The input state (ON/OFF) from the air cleaner clogging sensor can be checked with the monitoring function (Code: 40902, D-IN-20). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Clogged air cleaner	The air cleaner may be clogged. Check it directly.			
	2	Defective dust indicator (Internal disconnection)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			E15 (female)	Failure code “**AA1ANX**”	Dust indicator	
			Short (1) with (2)	Turned ON	Normal (Air cleaner is normal)	
				Turned OFF	Defective (Air cleaner is clogged)	
	3	Defective dust indicator relay (L107) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L107 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			When dust indicator relay (L107) is replaced with a relay of the same type (5-pin type), if the condition becomes normal, the exchange relay is defective.			
	4	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L107 (female) (2) – E15 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between E15 (female) (2) – chassis ground		Resistance	Max. 1 Ω
	5	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L107 (female) (2) – E15 (female) (1)		Resistance	Min. 1 MΩ
	6	Defective machine monitor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			C03	Dust indicator	Voltage	
			Between (3) and chassis ground	Normal (Air cleaner is normal)	20 – 30 V	
				Defective (Air cleaner is clogged)	Max. 1 V	

Circuit diagram related to dust indicator

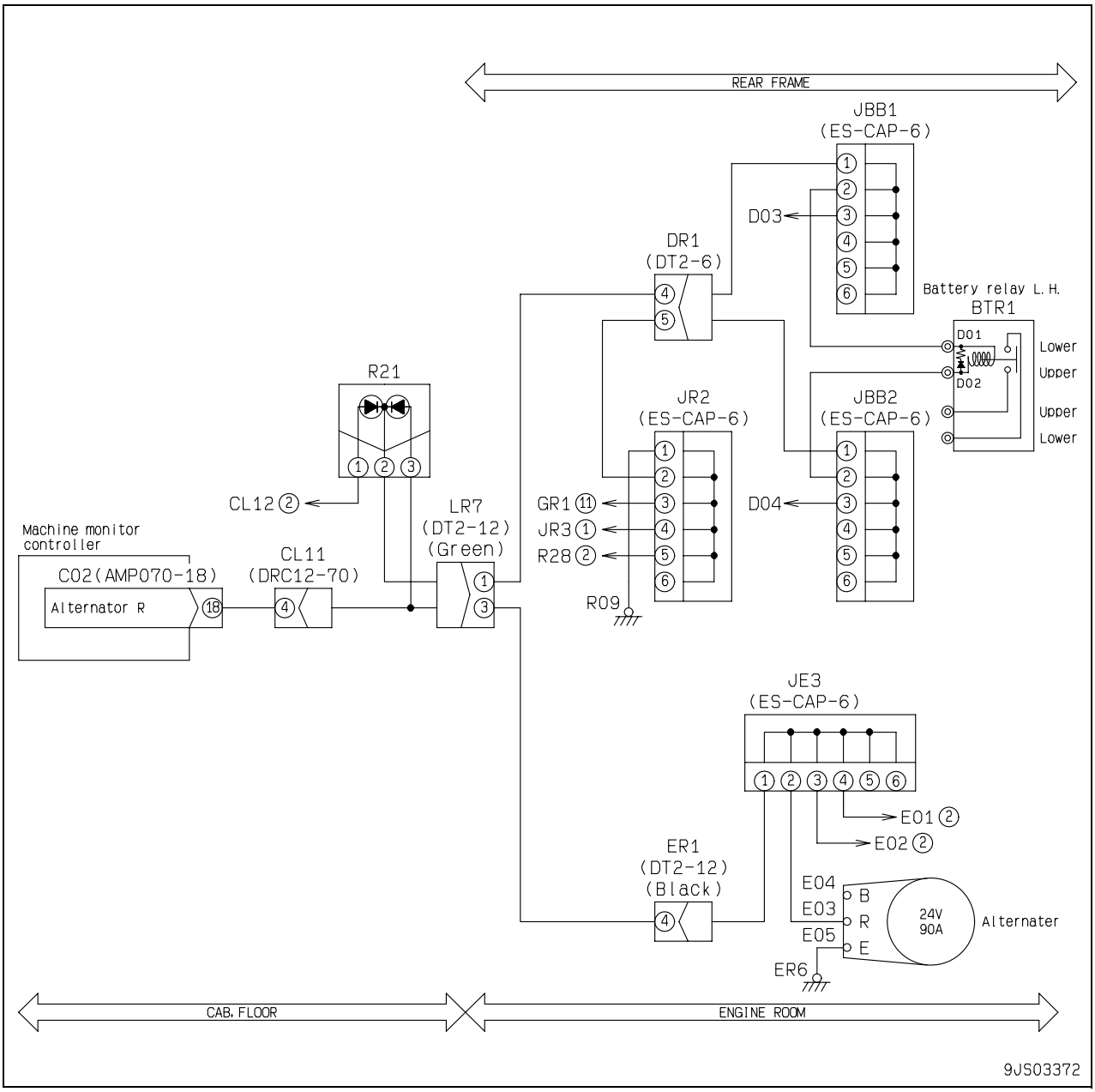


Failure code [AB00L6] (Alternator: Signal disagrees with operating state of engine)

Action code	Failure code	Trouble	Alternator: Signal disagrees with operation and stop of engine (Machine monitor system)
E03	**AB00L6**		
Contents of trouble	• When engine is stopped, alternator terminal R input voltage is above 12 V.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The engine does not start. • After the starting switch is simply turned ON, the service meter advances.		
Related information	• The input state (voltage) from the alternator can be checked with the monitoring function (Code: 04302, ALTERNATOR R). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective alternator (Internal defect)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			Alternator	Engine	Voltage	
			Between terminal R (E03) and chassis ground	Start (Throttle: Above 1/2)	27.5 – 29.5 V	
				Stopped	Max. 1 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between alternator terminal R (E03) – C02 (female) (18), – R21 (female) (3), – circuit branch		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			C02	Engine	Voltage	
			Between (18) and chassis ground	Start (Throttle: Above 1/2)	27.5 – 29.5 V	
				Stopped	Max. 1 V	

Circuit diagram related to alternator

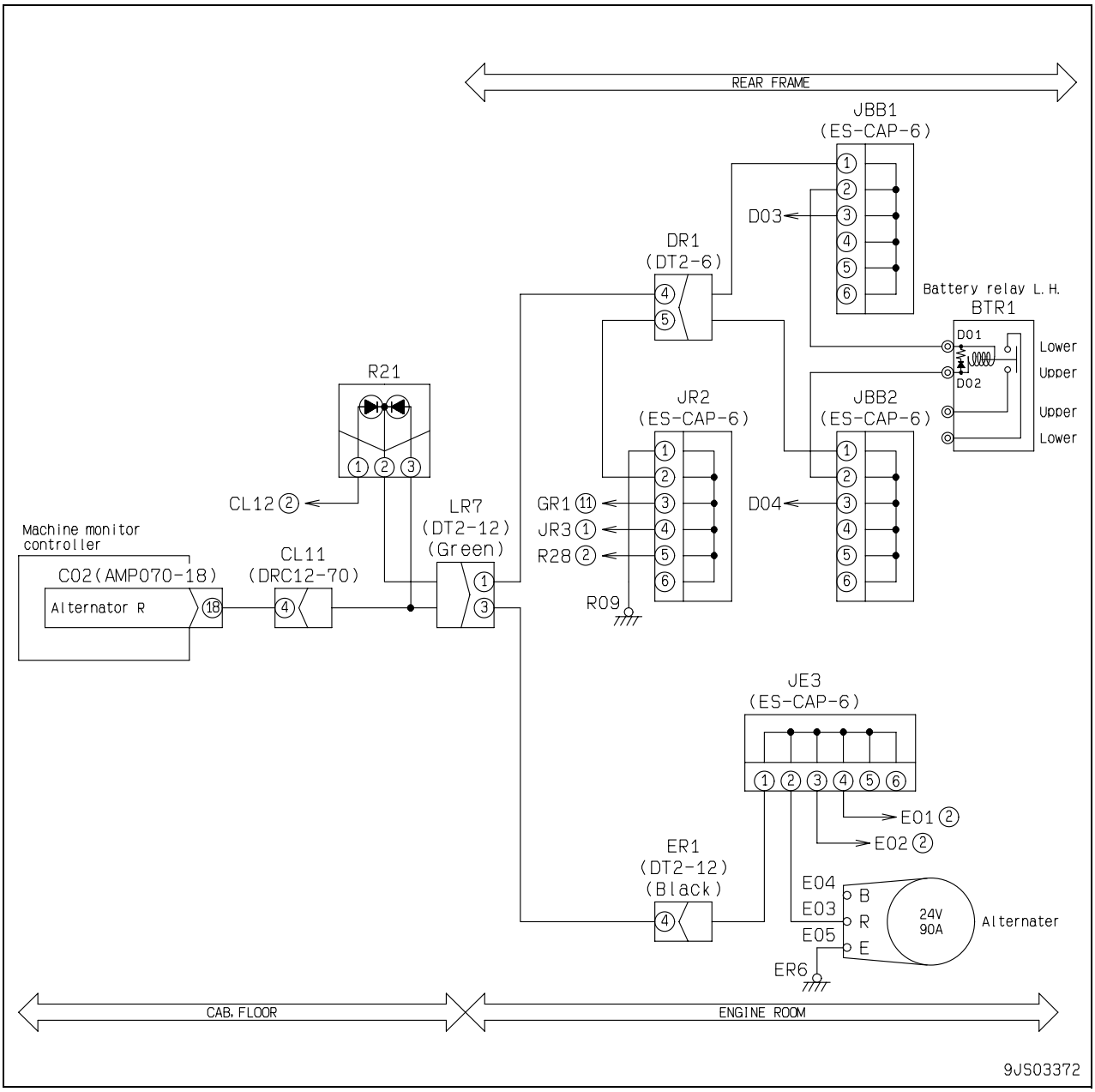


Failure code [AB00MA] (Alternator: Malfunction)

Action code	Failure code	Trouble	Alternator: Malfunction (Machine monitor system)
E03	**AB00MA**		
Contents of trouble	• While the engine is running, the alternator terminal R input voltage is below 5 V.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Deteriorated battery • The engine does not start. • The service meter does not advance.		
Related information	• The input state (voltage) from the alternator can be checked with the monitoring function (Code: 04302, ALTERNATOR R). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Deteriorated battery	The battery may be deteriorated. Check it directly.			
	2	Defective alternator (Internal defect)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			Alternator	Engine	Voltage	
			Between terminal R (E03) and chassis ground	Start (Throttle: Above 1/2)	27.5 – 29.5 V	
				Stopped	Max. 1 V	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between alternator terminal R (E03) – C02 (female) (18)		Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between alternator terminal R (E03) – C02 (female) (18), – R21 (female) (3), – circuit branch		Resistance	Min. 1 MΩ
	5	Defective machine monitor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			C02	Engine	Voltage	
			Between (18) and chassis ground	Start (Throttle: Above 1/2)	27.5 – 29.5 V	
				Stopped	Max. 1 V	

Circuit diagram related to alternator

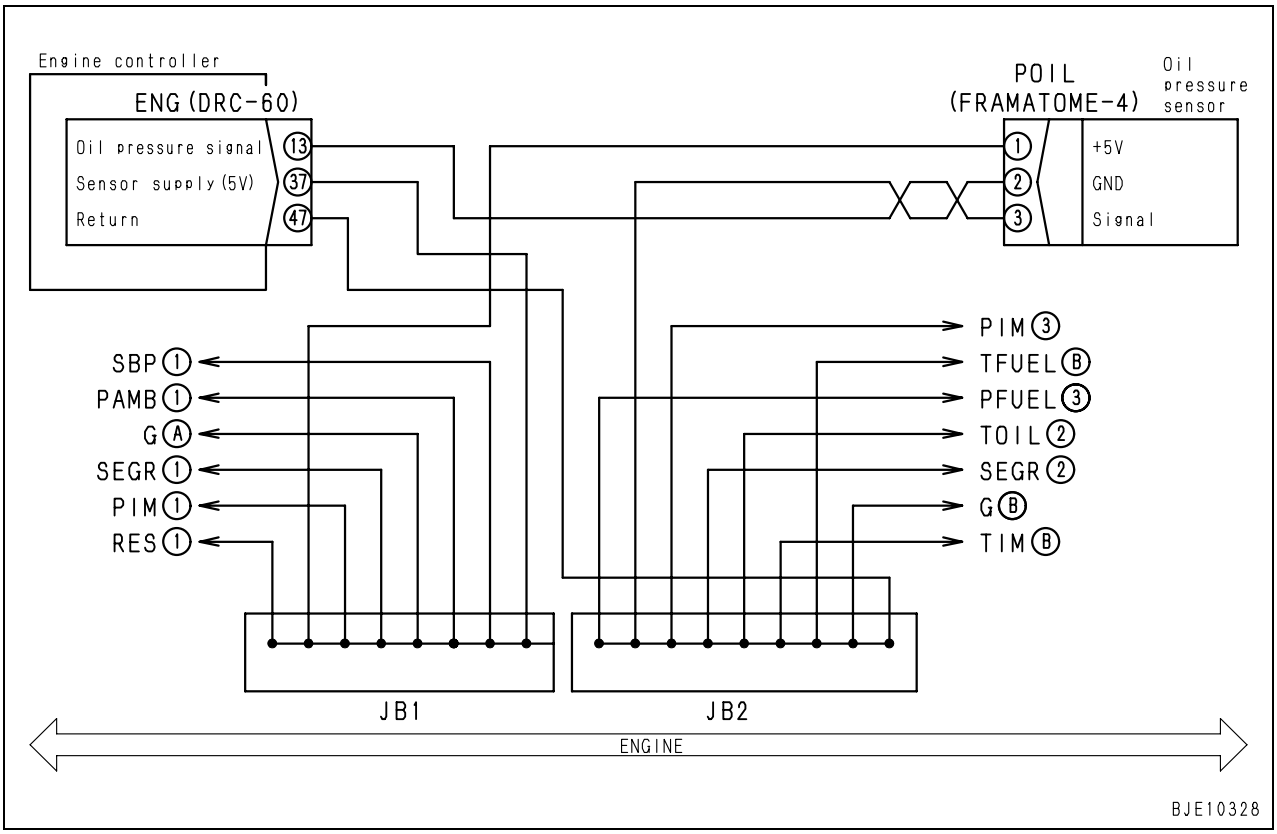


Failure code [B@BAZG] (Rotation derating by low engine oil pressure)

Action code	Failure code	Trouble	Rotation derating by low engine oil pressure (Engine controller system)
E03	**B@BAZG**		
Contents of trouble	• When engine speed was below 500 rpm for 15 seconds or more, engine oil pressure became lower than operating range.		
Action of controller	• Limit output for travel (Limit injection rate and engine speed) • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• The input state (oil pressure) from the engine oil pressure sensor can be checked with the monitoring function (Code: 37200). • The input state (voltage) from the engine oil pressure sensor can be checked with the monitoring function (Code: 37201). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power supply system	If failure code [**CA187**] or [**CA227**] is also indicated, carry out troubleshooting for it first.			
	2	Defective oil pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.			
			POIL		Voltage	
			Between (1) and (2)	Power supply	4.75 – 5.25V	
			Sensor voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (37) – POIL (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – POIL (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (13) – POIL (female) (3)		Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (37) – POIL (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – POIL (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (13) – POIL (female) (3)		Resistance	Min. 1 MΩ
	5	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.			
			ENG		Voltage	
			Between (37) and (47)	Power supply	4.75 – 5.25V	
			Between (13) and (47)	Signal	0.3 – 4.7 V	

Circuit diagram related to engine oil pressure sensor

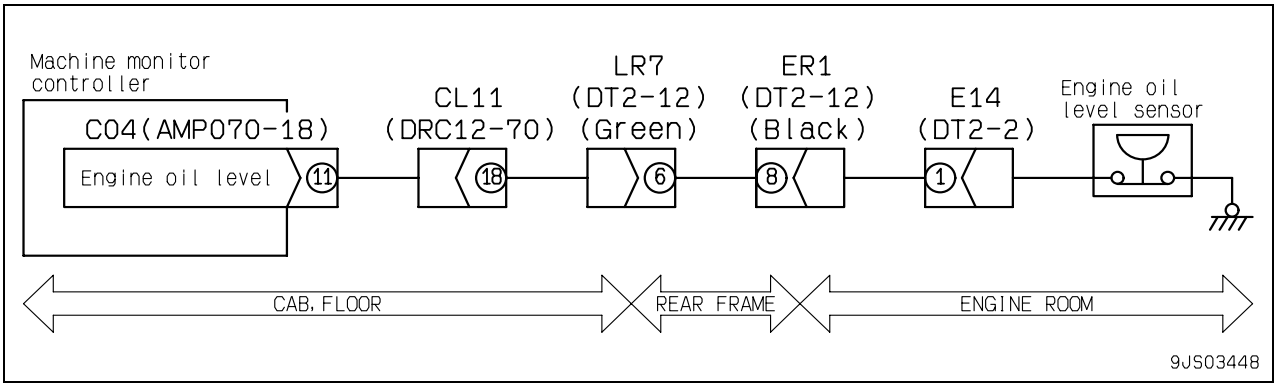


Failure code [B@BAZK] (Engine oil: Low level)

Action code	Failure code	Trouble	Engine oil: Low level (Machine monitor system)
E01	**B@BAZK**		
Contents of trouble	• The engine oil level sensor circuit is OPEN.		
Action of controller	• Turns the engine oil level caution lamp ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The engine oil level is low (The engine may be broken).		
Related information	• The input state (ON/OFF) from the engine oil level sensor can be checked with the monitoring function (Code: 40903, D-IN-29). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Low engine oil level	The engine oil level may be low. Check it directly.			
	2	Defective engine oil level sensor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			E14 (male)	Engine oil level	Resistance	
			Between (1) and chassis ground	Normal	Max. 1 Ω	
				Insufficient (Low)	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C04 (female) (11) – E14 (female) (1)		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C04 (female)	Engine oil level	Resistance	
			Wiring harness between (11) – chassis ground	Normal	Max. 1 Ω	
				Insufficient (Low)	Min. 1 MΩ	

Circuit diagram related to engine oil level sensor

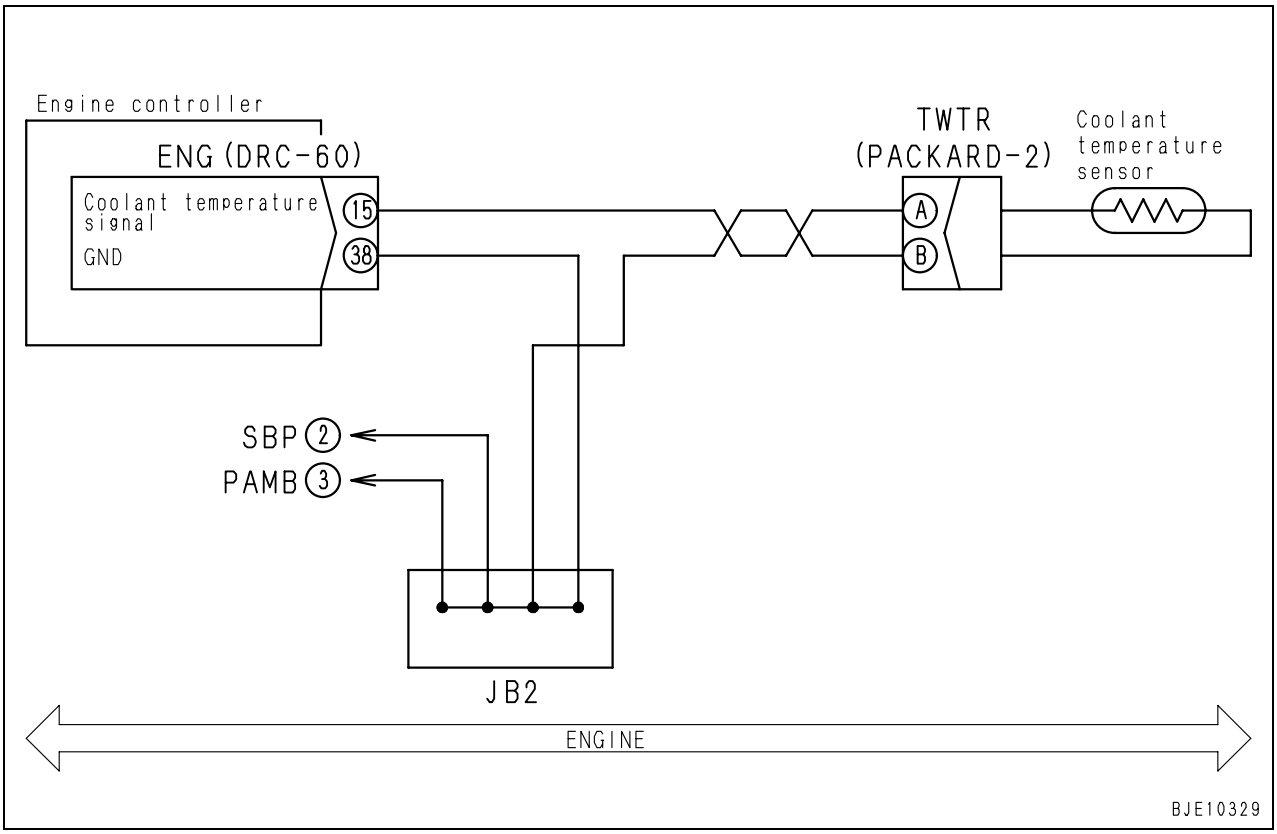


Failure code [B@BCNS] (Engine overheating)

Action code	Failure code	Trouble	Engine overheating (Engine controller system)
E02	**B@BCNS**		
Contents of trouble	• When engine speed was below 500 rpm for 3 seconds or more, coolant temperature exceeded operating range.		
Action of controller	• Limits output and continues operation. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• The input state (voltage) from the coolant temperature sensor can be checked with the monitoring function (Code: 04104). • The input state (voltage) from the coolant temperature sensor can be checked with the monitoring function (Code: 04105). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective coolant temperature sensor (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			TWTR (male)	Coolant temperature	Resistance	
			Between (A) and (B)	10 – 100°C	0.6 – 20 kΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (15) – TWTR (female) (A)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (38) – TWTR (female) (B)		Resistance	Max. 1 Ω
	3	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Coolant temperature	Resistance	
			Between (15) and (38)	10 – 100°C	0.6 – 20 kΩ	

Circuit diagram related to coolant temperature sensor

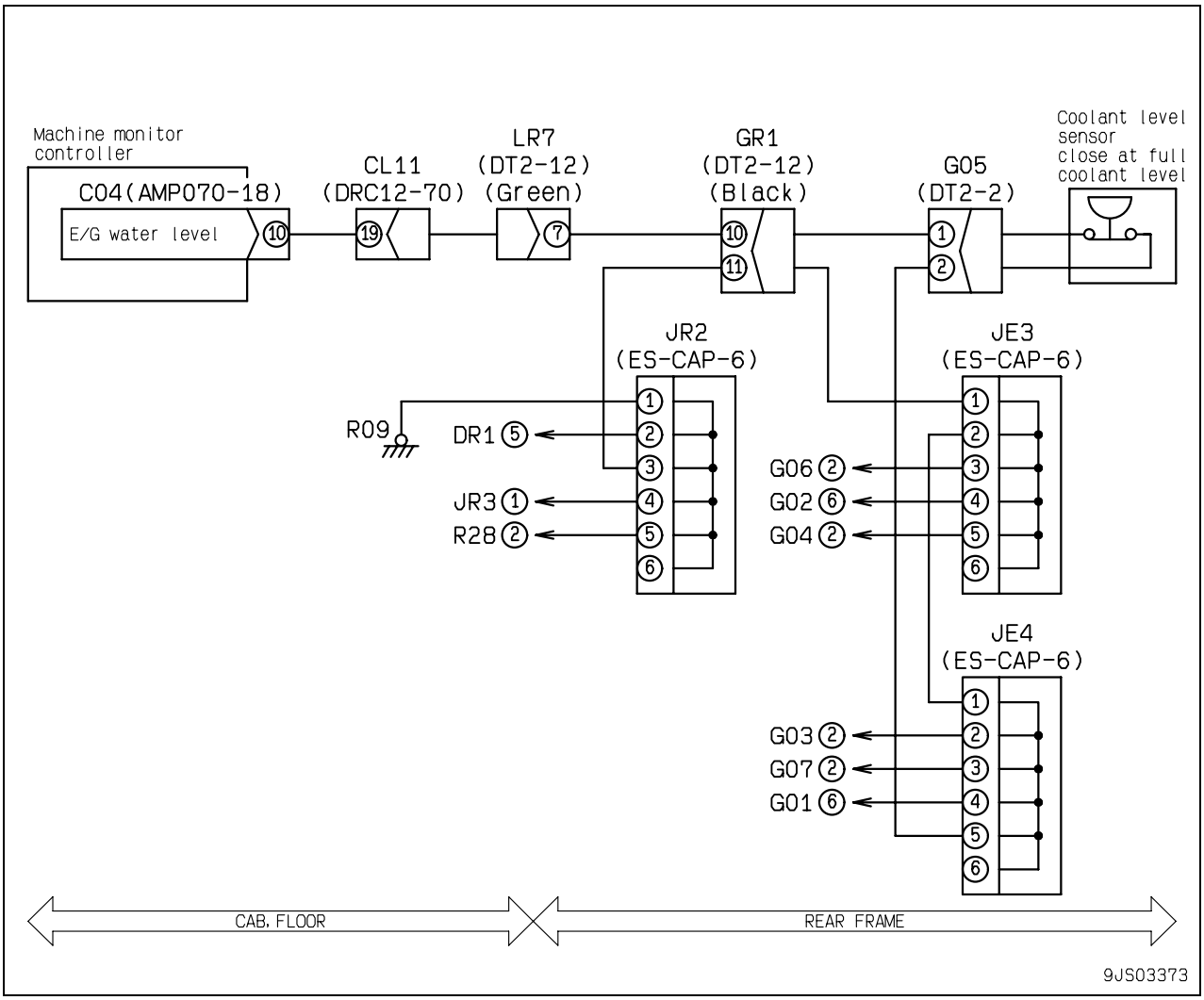


Failure code [B@BCZK] (Coolant: Low level)

Action code	Failure code	Trouble	Coolant: Low level (Machine monitor system)
E01	**B@BCZK**		
Contents of trouble	• The coolant level sensor circuit is OPEN.		
Action of controller	• Turns the coolant level caution lamp ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The coolant level is low. The engine overheats (The engine may be broken).		
Related information	• The input state (ON/OFF) from the coolant level sensor can be checked with the monitoring function (Code: 40903, D-IN-27). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Low coolant level	The coolant level may be low. Check it directly.			
	2	Defective coolant level sensor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			G05 (male)	Sub-tank	Resistance	
			Between (1) and (2)	Below low level (Abnormal)	Min. 1 MΩ	
				Above low level (Normal)	Max. 1 Ω	
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C04 (female) (10) – G05 (female) (1)		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C04 (female)	Sub-tank	Resistance	
			Wiring harness between (10) – chassis ground	Below low level (Abnormal)	Min. 1 MΩ	
				Above low level (Normal)	Max. 1 Ω	

Circuit diagram related to coolant level sensor

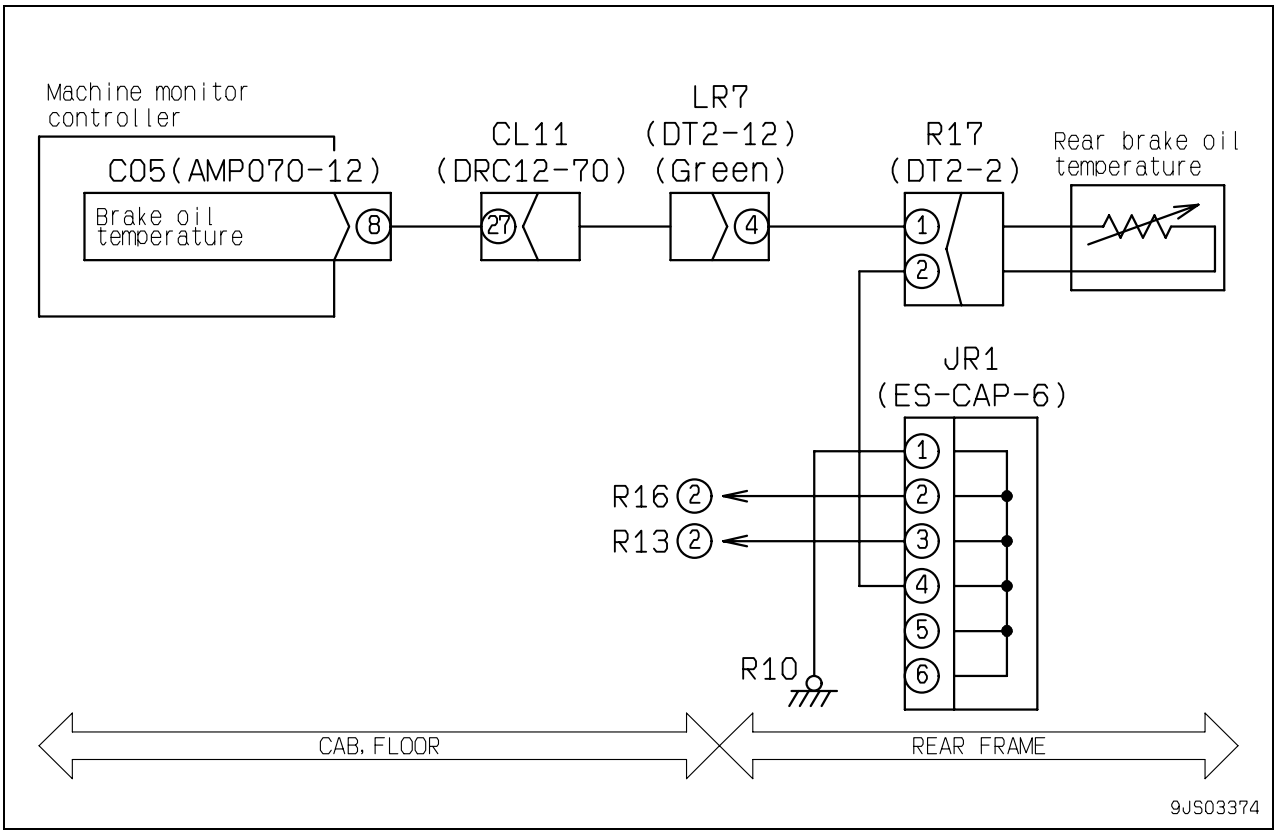


Failure code [B@C7NS] (Brake oil: Overheating)

Action code	Failure code	Trouble	Brake oil: Overheating (Machine monitor system)
E02	**B@C7NS**		
Contents of trouble	• Brake oil temperature was above 130°C for 5 seconds. • When travel speed was above 35 km/h, brake oil temperature, 125°C and above, was detected continuously for 5 seconds.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Brake oil temperature caution lamp lights up • The brake may be damaged.		
Related information	• The input state (oil temperature) from the rear brake oil temperature sensor can be checked with the monitoring function (Code: 30202, R BRAKE OIL). • The input state (voltage) from the rear brake oil temperature sensor can be checked with the monitoring function (Code: 30205, R BRAKE OIL). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective brake operation	Brake may overheat because brake was operated improperly during travel. • Instruct the operator on how to travel the machine properly.		
	2	Defective rear brake oil temperature sensor (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R17 (male)	Rear brake oil temperature	Resistance
			Between (1) and (2)	25°C (Normal temperature)	35 – 50 kΩ
				100°C	3.1 – 4.5 kΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			C05 (female)	Rear brake oil temperature	Resistance
			Wiring harness between (8) – chassis ground	25°C (Normal temperature)	35 – 50 kΩ
				100°C	3.1 – 4.5 kΩ

Circuit diagram related to rear brake oil temperature sensor

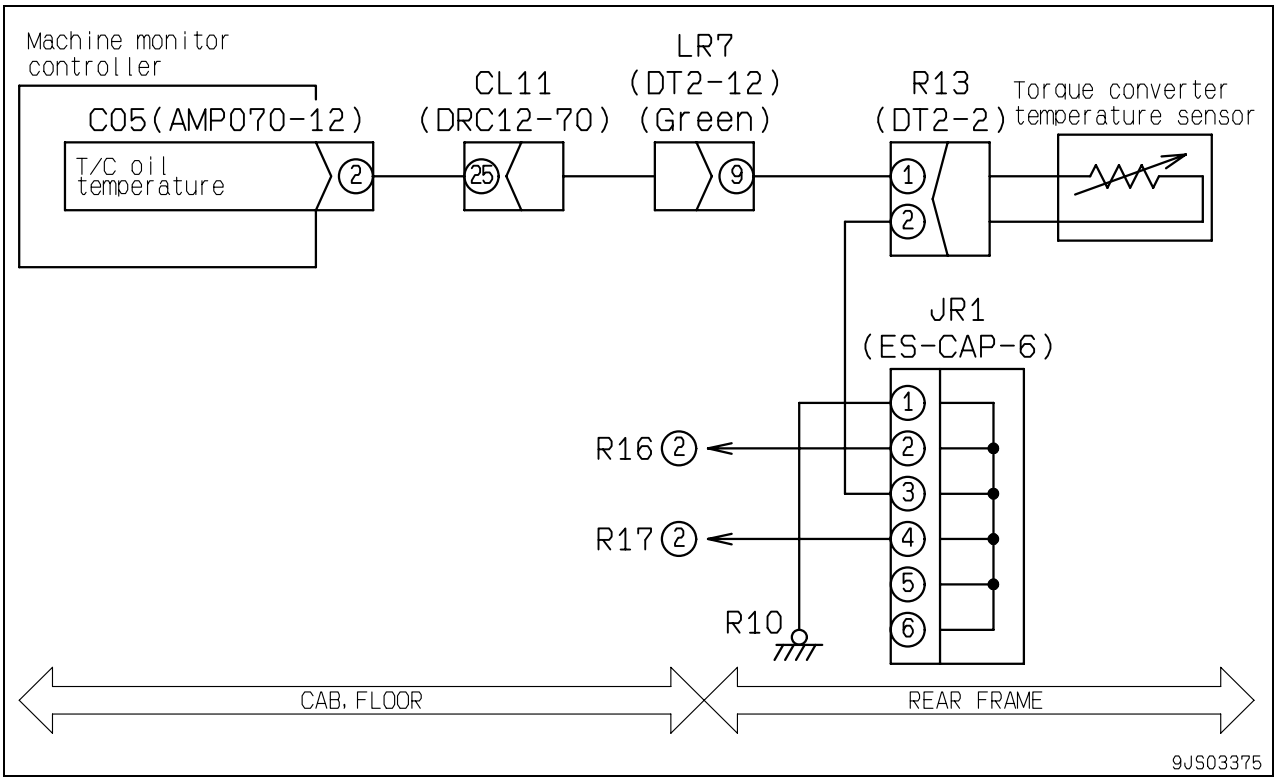


Failure code [B@CENS] (Torque converter oil: Overheating)

Action code	Failure code	Trouble	Torque converter oil: Overheating (Machine monitor system)
E02	**B@CENS**		
Contents of trouble	• The torque converter oil temperature is above 130°C.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself. (125°C and blow was detected continuously for 5 seconds.)		
Problem that appears on machine	• The torque converter oil temperature caution lamp is turned ON (If the machine is used as it is, the torque converter may be broken).		
Related information	• The input state (oil temperature) from the torque converter oil temperature sensor can be checked with the monitoring function (Code: 40100, TC OIL TEMP). • The input state (voltage) from the torque converter oil temperature sensor can be checked with the monitoring function (Code: 40101, TC OIL TEMP). • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Overheating of torque converter oil	Torque converter oil may overheat due to torque converter stall, etc. (See Troubleshooting of hydraulic and mechanical system (H-mode).)			
	2	Defective torque converter oil temperature sensor (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R13 (male)	Torque converter oil temperature	Resistance	
			Between (1) and (2)	25°C (Normal temperature)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C05 (female) (2) – R13 (female) (1)		Resistance	Min. 1 MΩ
	4	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C05 (female)	Torque converter oil temperature	Resistance	
			Between (2) and chassis ground	25°C (Normal temperature)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	

Circuit diagram related to torque converter oil temperature sensor

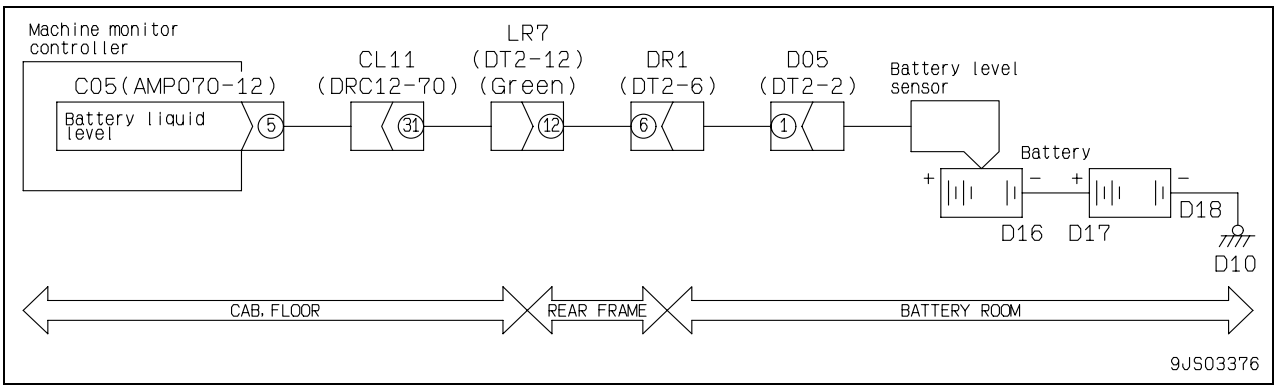


Failure code [B@GAZK] (Battery electrolyte: Low level)

Action code	Failure code	Trouble	Battery electrolyte: Low level (Machine monitor system)
E01	**B@GAZK**		
Contents of trouble	• The electrolyte level sensor (if equipped) circuit is CLOSE.		
Action of controller	• Turns the electrolyte level caution lamp ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Turns the electrolyte level caution lamp ON. • The electrolyte level is low • Engine may not start easily.		
Related information	• The input state (voltage) from the electrolyte level sensor can be checked with the monitoring function (Code: 40300, BATTERY A). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	The electrolyte level is low	The electrolyte level may be low. Check it directly.			
	2	Defective electrolyte level sensor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			D05 (male)	Battery electrolyte level	Resistance	
			Between (1) and chassis ground	Normal	Max. 1 Ω	
				Insufficient level (Low level)	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C05 (female) (5) – D05 (female) (1)		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C05 (female)	Battery electrolyte level	Resistance	
			Wiring harness between (5) – chassis ground	Normal	Max. 1 Ω	
				Insufficient level (low level)	Min. 1 MΩ	

Circuit diagram related to battery electrolyte level sensor

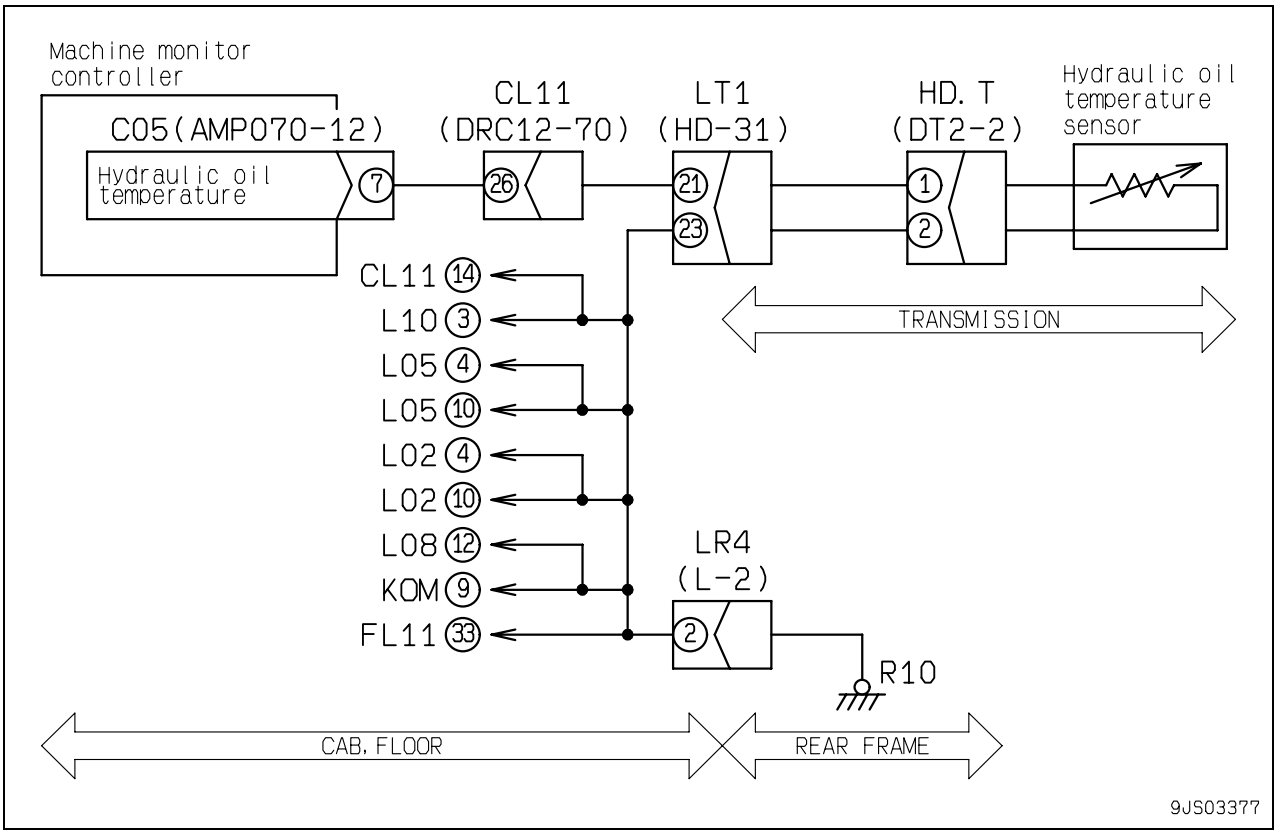


Failure code [B@HANS] (Hydraulic oil: Overheating)

Action code	Failure code	Trouble	Hydraulic oil: Overheating (Machine monitor system)
E02	**B@HANS**		
Contents of trouble	• The hydraulic oil temperature is above 100°C.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The hydraulic oil overheat warning is turned ON (If the machine is used as it is, the pump and cylinder seals may be broken).		
Related information	• The input state (oil temperature) from the hydraulic oil temperature sensor can be checked with the monitoring function (Code: 04401 HYD TEMP). • The input state (voltage) from the hydraulic oil temperature sensor can be checked with the monitoring function (Code: 04404 HYD TEMP). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Overheating of hydraulic oil	The hydraulic oil may be overheating.			
	2	Defective hydraulic oil temperature sensor (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			HD.T (male)	Hydraulic oil temperature	Resistance	
			Between (1) and (2)	25°C (Normal temperature)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C05 (female) (7) – HD.T (female) (1)		Resistance	Min. 1 MΩ
	4	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C05 (female)	Hydraulic oil temperature	Resistance	
			Wiring harness between (7) and chassis ground	25°C (Normal temperature)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	

Circuit diagram related to hydraulic oil temperature sensor

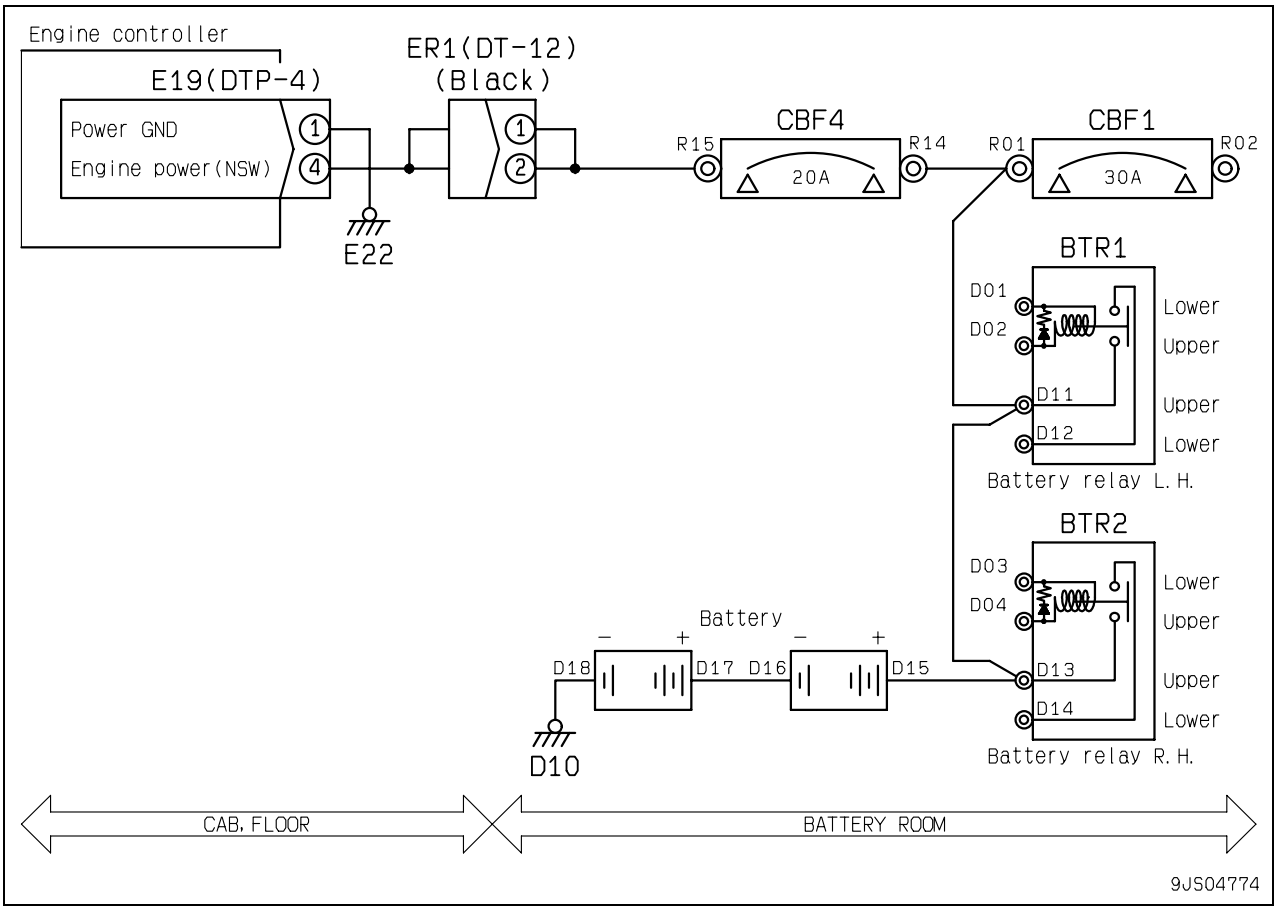


Failure code [CA111] (Abnormality in engine controller)

Action code	Failure code	Trouble	Abnormality in engine controller (Engine controller system)
E03	**CA111**		
Contents of trouble	• Internal defect occurred in controller.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Normal operation is continued; however, the machine may stop during travel or may not start in stopped state.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective circuit breaker (CBF4)	Circuit breaker (CBF4) may be defective. Check it directly. (If the circuit breaker is shut down, the circuit probably has a grounding fault, etc.)		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between E19 (female) (4) – battery (+)	Resistance	Max. 1 Ω
			Wiring harness between E19 (female) (1) – chassis ground	Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between E19 (female) (4) – battery (+)	Resistance	Min. 1 MΩ
			Wiring harness between E19 (female) (1) – chassis ground	Resistance	Min. 1 MΩ
	4	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			E19	Voltage	
			Between (4) and (1)	20 – 30 V	

Circuit diagram related to engine controller power supply



Failure code [CA115] (Engine Ne or Bkup speed sensor error)

Action code	Failure code	Trouble	Engine Ne or Bkup speed sensor error (Engine controller system)
E03	**CA115**		
Contents of trouble	• Abnormality occurred in Ne and Bkup speed sensor circuits at the same time.		
Action of controller	• Stop the engine. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• The engine does not start. (if engine has been stopped.) • Engine stops. (if engine has been running.)		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective Ne speed sensor system	Carry out troubleshooting for failure code [**CA689**].
	2	Defective Bkup speed sensor system	Carry out troubleshooting for failure code [**CA778**].
	3	Defective installation of Ne speed sensor	Ne speed sensor may be installed defectively. Check it directly. (Defective installation of sensor itself, internal defect of flywheel, etc.)
	4	Defective installation of Bkup speed sensor	Bkup speed sensor may be installed defectively. Check it directly. (Defective installation of sensor itself, internal defect of supply pump, etc.)
	5	Defective sensor connection (Improper connection)	Ne and Bkup speed sensors may be connected defectively (improper connection). Check them directly.
	6	Defective engine controller	If causes 1 – 5 are not the cause of the trouble, the engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

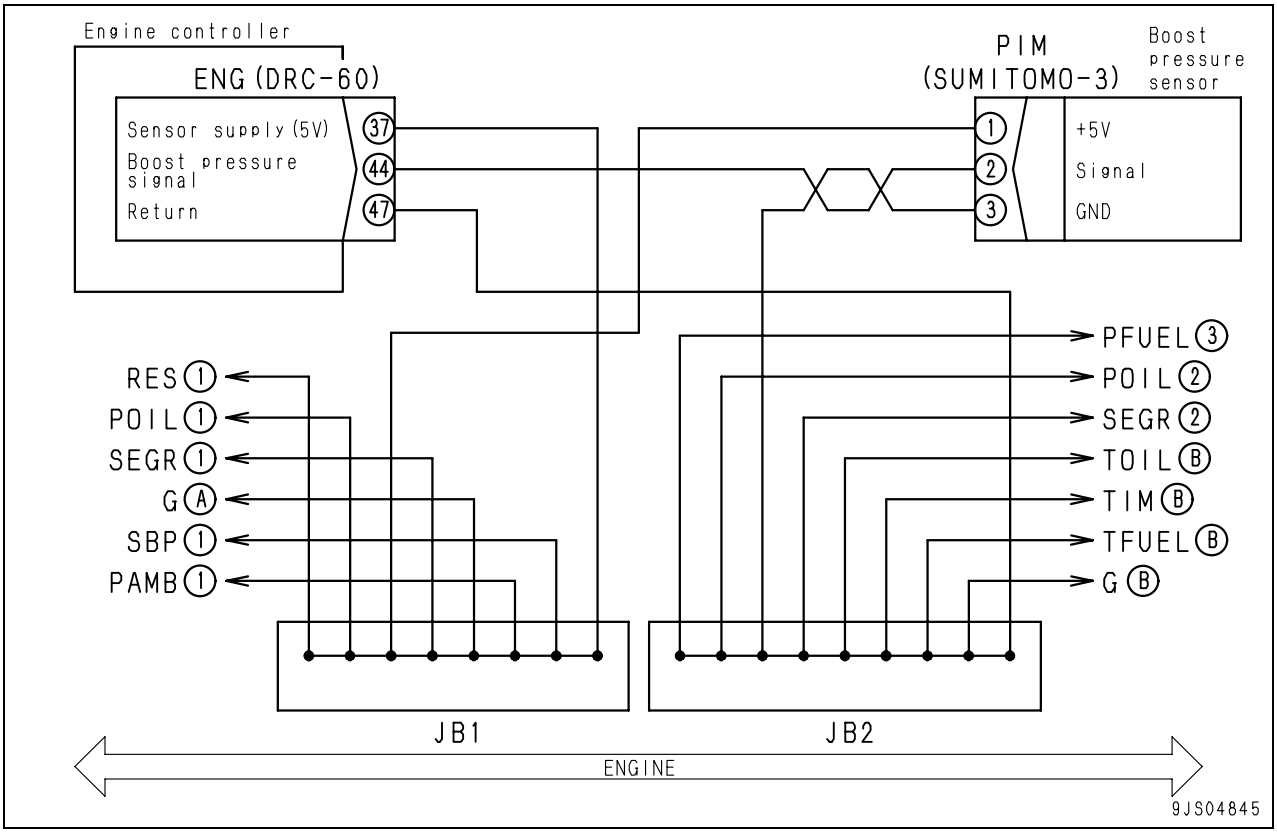
Failure code [CA122] (Charge pressure sensor high error)

Action code	Failure code	Trouble	Charge pressure sensor high error (Engine controller system)
E03	**CA122**		
Contents of trouble	• Charge pressure sensor (boost pressure sensor) circuit is abnormally high.		
Action of controller	• Sets charge pressure (boost pressure) to fixed value (400 kPa {4.1 kg/cm^2}), and continues operation. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine does not accelerate smoothly.		
Related information	• The input state (boost pressure) from the charge pressure sensor (boost pressure sensor) can be checked with the monitoring function (Code: 36500). • The input state (voltage) from the charge pressure sensor (boost pressure sensor) can be checked with the monitoring function (Code: 36502). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective power supply system of charge pressure sensor (boost pressure sensor)	If failure code [**CA187**] or [**CA227**] is also indicated, carry out troubleshooting for it first.			
	2	Defective charge pressure sensor (boost pressure sensor) (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.			
			PIM		Voltage	
			Between (1) and (3)	Power supply	4.75 – 5.25V	
			Charge pressure sensor voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller for another cause of trouble before judgment.			
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (37) – PIM (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – PIM (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (44) – PIM (female) (2)		Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (37) – PIM (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – PIM (female) (3)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (44) – PIM (female) (2)		Resistance	Min. 1 MΩ

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (37) – PIM (female) (1) and between ENG (female) (47) – PIM (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (37) – PIM (female) (1) and between ENG (female) (44) – PIM (female) (3)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – PIM (female) (2) and between ENG (female) (44) – PIM (female) (3)		Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.			
			ENG		Voltage	
			Between (37) and (47)	Power supply	4.75 – 5.25V	
			Between (44) and (47)	Signal	0.3 – 4.7 V	

Circuit diagram related to charge pressure sensor (boost pressure sensor)



Failure code [CA123] (Charge pressure sensor low error)

Action code	Failure code	Trouble	Charge pressure sensor low error (Engine controller system)
E03	**CA123**		
Contents of trouble	• Charge pressure sensor (boost pressure sensor) circuit is abnormally low.		
Action of controller	• Sets charge pressure (boost pressure) to fixed value (400 kPa {4.1 kg/cm^2}), and continues operation. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine does not accelerate smoothly.		
Related information	• The input state (boost pressure) from the charge pressure sensor (boost pressure sensor) can be checked with the monitoring function (Code: 36500). • The input state (voltage) from the charge pressure sensor (boost pressure sensor) can be checked with the monitoring function (Code: 36502). • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA122**].	

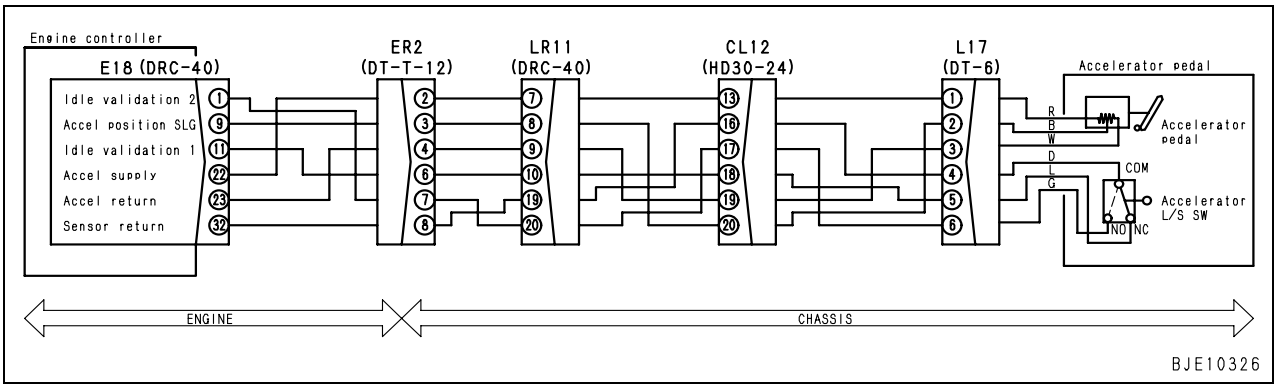
Failure code [CA131] (Throttle sensor high error)

Action code	Failure code	Trouble	Throttle sensor high error (Engine controller system)
E03	**CA131**		
Contents of trouble	• Throttle sensor circuit is abnormally high.		
Action of controller	• Runs the engine at position of throttle 0% when accelerator pedal is OFF and at 50% when it is ON. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine does not reach full throttle.		
Related information	• The input state (position of accelerator pedal) from the throttle sensor can be checked with the monitoring function (Code: 31701). • The input state (voltage) from the throttle sensor can be checked with the monitoring function (Code: 31707). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective throttle sensor power supply system	If failure code [**CA2185**] or [**CA2186**] is also indicated, carry out troubleshooting for it first.			
	2	Defective accelerator pedal (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L17	Accelerator pedal	Voltage	
			Between (1) and (3)	All range (Power supply)	4.75 – 5.25V	
			Between (2) and (3)	When released	(9 ± 2% of power supply)	
				When pressed	(73 ± 2% of power supply)	
			Sensor voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between E18 (female) (22) – L17 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between E18 (female) (9) – L17 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between E18 (female) (23) – L17 (female) (3)		Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between E18 (female) (22) – L17 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between E18 (female) (9) – L17 (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between E18 (female) (23) – L17 (female) (3)		Resistance	Min. 1 MΩ

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	5	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			E18	Accelerator pedal	Voltage
			Between (22) and (23)	All range (Power supply)	4.75 – 5.25V
			Between (9) and (23)	When released	(9 ± 2% of power supply)
				When pressed	(73 ± 2% of power supply)

Circuit diagram related to throttle sensor



Failure code [CA132] (Throttle sensor low error)

Action code	Failure code	Trouble	Throttle sensor low error (Engine controller system)
E03	**CA132**		
Contents of trouble	• Throttle sensor circuit is abnormally low.		
Action of controller	• Runs the engine at position of throttle 0% when accelerator pedal is OFF and at 50% when it is ON. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine does not reach full throttle.		
Related information	• The input state (position of accelerator pedal) from the throttle sensor can be checked with the monitoring function (Code: 31707). • The input state (voltage) from the throttle sensor can be checked with the monitoring function (Code: 31707). • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA131**].	

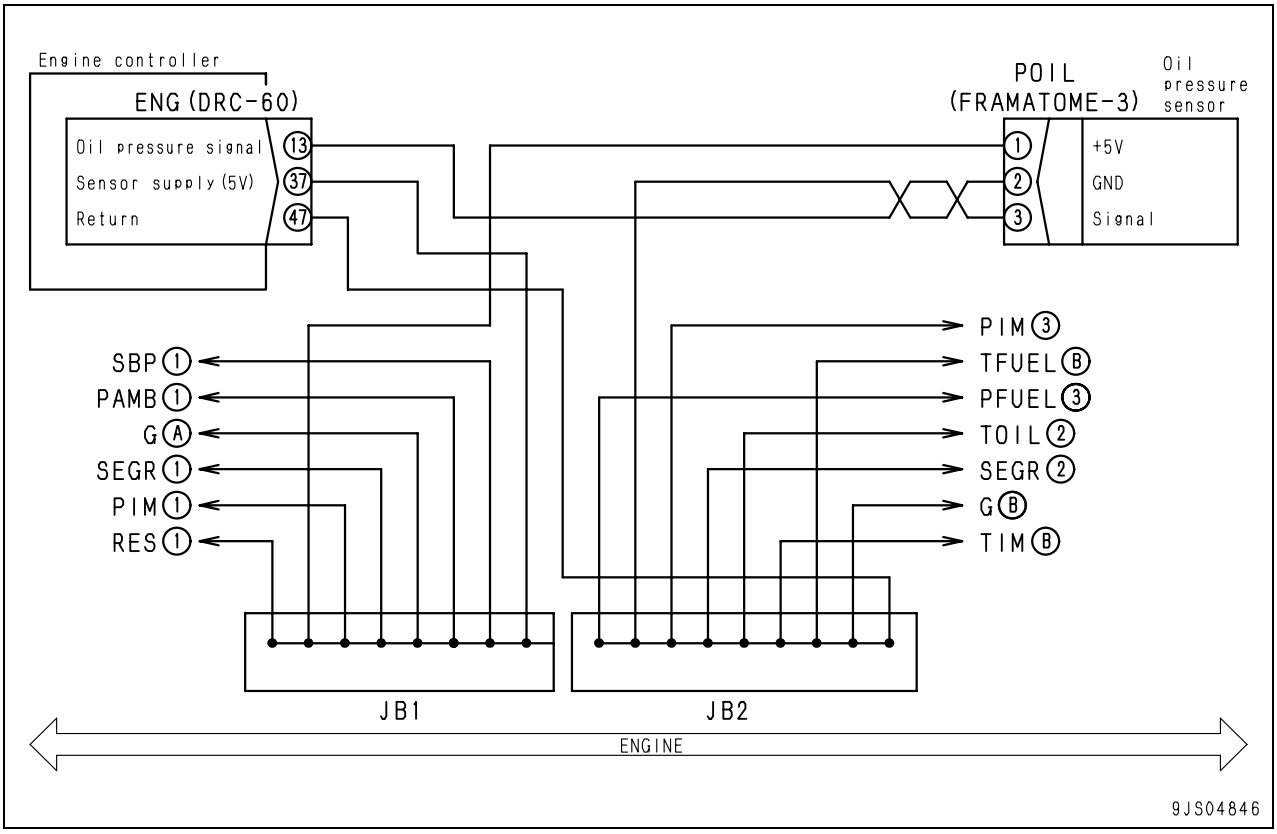
Failure code [CA135] (Engine oil pressure sensor high error)

Action code	Failure code	Trouble	Engine oil pressure sensor high error (Engine controller system)
E01	**CA135**		
Contents of trouble	• Engine oil pressure sensor circuit is abnormally high.		
Action of controller	• Sets engine oil pressure to default (250 kPa {2.5 kg/cm^2}), and continues operation.		
Problem that appears on machine			
Related information	• The input state (oil pressure) from the engine oil pressure sensor can be checked with the monitoring function (Code: 37200). • The input state (voltage) from the engine oil pressure sensor can be checked with the monitoring function (Code: 37201). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective power supply system of engine oil pressure sensor	If failure code [**CA187**] or [**CA227**] is also indicated, carry out troubleshooting for it first.		
	2	Defective engine oil pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.		
			POIL		Voltage
			Between (1) and (2)	Power supply	4.75 – 5.25V
			Sensor voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.		
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (37) – POIL (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – POIL (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (13) – POIL (female) (3)	Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (37) – POIL (female) (1)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – POIL (female) (2)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (13) – POIL (female) (3)	Resistance	Min. 1 MΩ

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (37) – POIL (female) (1) and between ENG (female) (47) – POIL (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (37) – POIL (female) (1) and between ENG (female) (13) – POIL (female) (3)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – POIL (female) (2) and between ENG (female) (13) – POIL (female) (3)		Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.			
			ENG		Voltage	
			Between (37) and (47)	Power supply	4.75 – 5.25V	
			Between (13) and (47)	Signal	0.3 – 4.7 V	

Circuit diagram related to engine oil pressure sensor



Failure code [CA141] (Engine oil pressure sensor low error)

Action code	Failure code	Trouble	Engine oil pressure sensor low error (Engine controller system)
E01	**CA141**		
Contents of trouble	• Engine oil pressure sensor circuit is abnormally low.		
Action of controller	• Sets engine oil pressure to default (250 kPa {2.5 kg/cm^2}), and continues operation.		
Problem that appears on machine			
Related information	• The input state (oil pressure) from the engine oil pressure sensor can be checked with the monitoring function (Code: 37200). • The input state (voltage) from the engine oil pressure sensor can be checked with the monitoring function (Code: 37201). • Method of reproducing failure code: Turn the starting switch ON.		

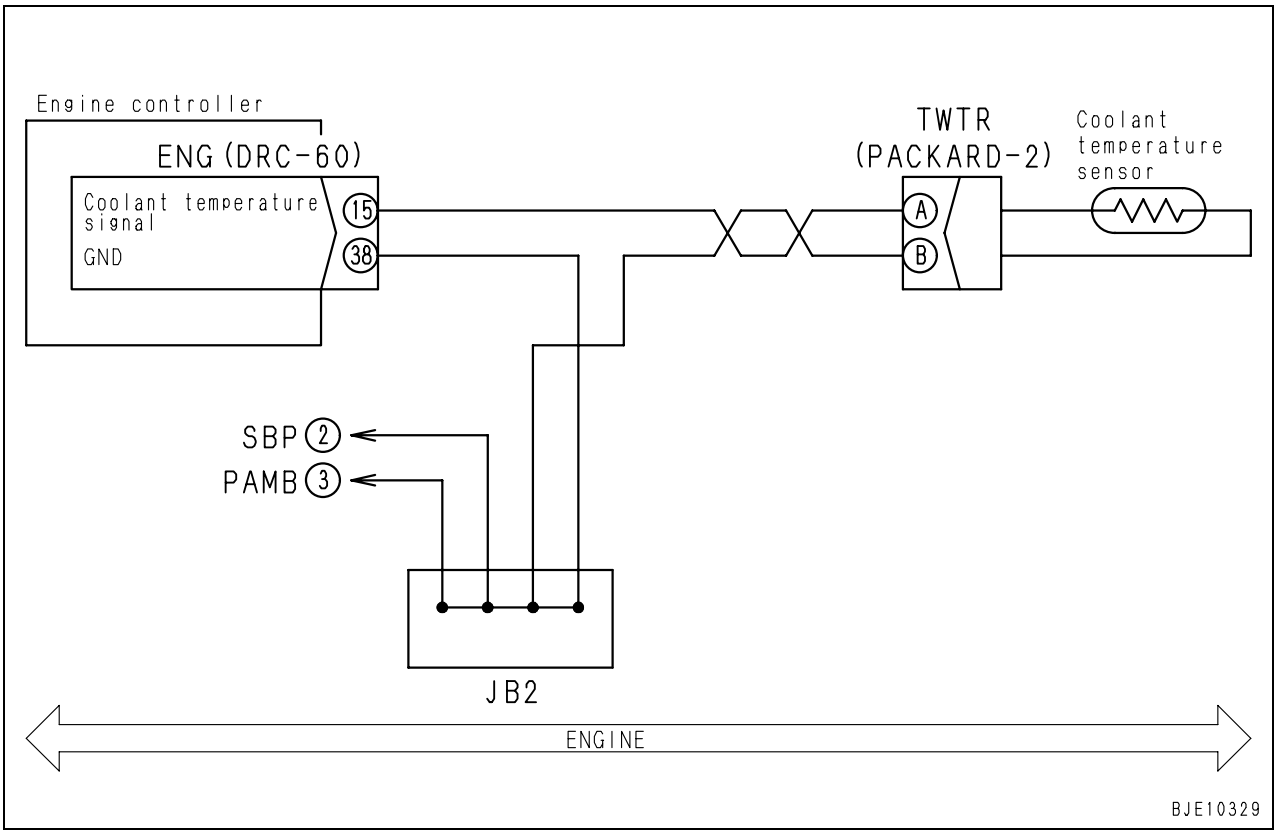
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA135**].	

Failure code [CA144] (Coolant temperature sensor high error)

Action code	Failure code	Trouble	Coolant temperature sensor high error (Engine controller system)
E01	**CA144**		
Contents of trouble	• Coolant sensor circuit is abnormally high.		
Action of controller	• Sets coolant temperature to fixed value (90°C), and continues operation.		
Problem that appears on machine			
Related information	• The input state (temperature) from the coolant temperature sensor can be checked with the monitoring function (Code: 04104). • The input state (voltage) from the coolant temperature sensor can be checked with the monitoring function (Code: 04105). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective coolant temperature sensor (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			TWTR (male)	Coolant temperature	Resistance	
			Between (A) and (B)	10 – 100°C	0.6 – 20 kΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (15) – TWTR (female) (A)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (38) – TWTR (female) (B)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (15) – TWTR (female) (A)		Resistance	Min. 1 MΩ
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Coolant temperature	Resistance	
			Between (15) and (38)	10 – 100°C	0.6 – 20 kΩ	

Circuit diagram related to coolant temperature sensor



Failure code [CA145] (Coolant temperature sensor low error)

Action code	Failure code	Trouble	Coolant temperature sensor low error (Engine controller system)
E01	**CA145**		
Contents of trouble	• Coolant sensor circuit is abnormally low.		
Action of controller	• Sets coolant temperature to fixed value (90°C), and continues operation.		
Problem that appears on machine			
Related information	• The input state (temperature) from the coolant temperature sensor can be checked with the monitoring function (Code: 04104). • The input state (voltage) from the coolant temperature sensor can be checked with the monitoring function (Code: 04105). • Method of reproducing failure code: Turn the starting switch ON.		

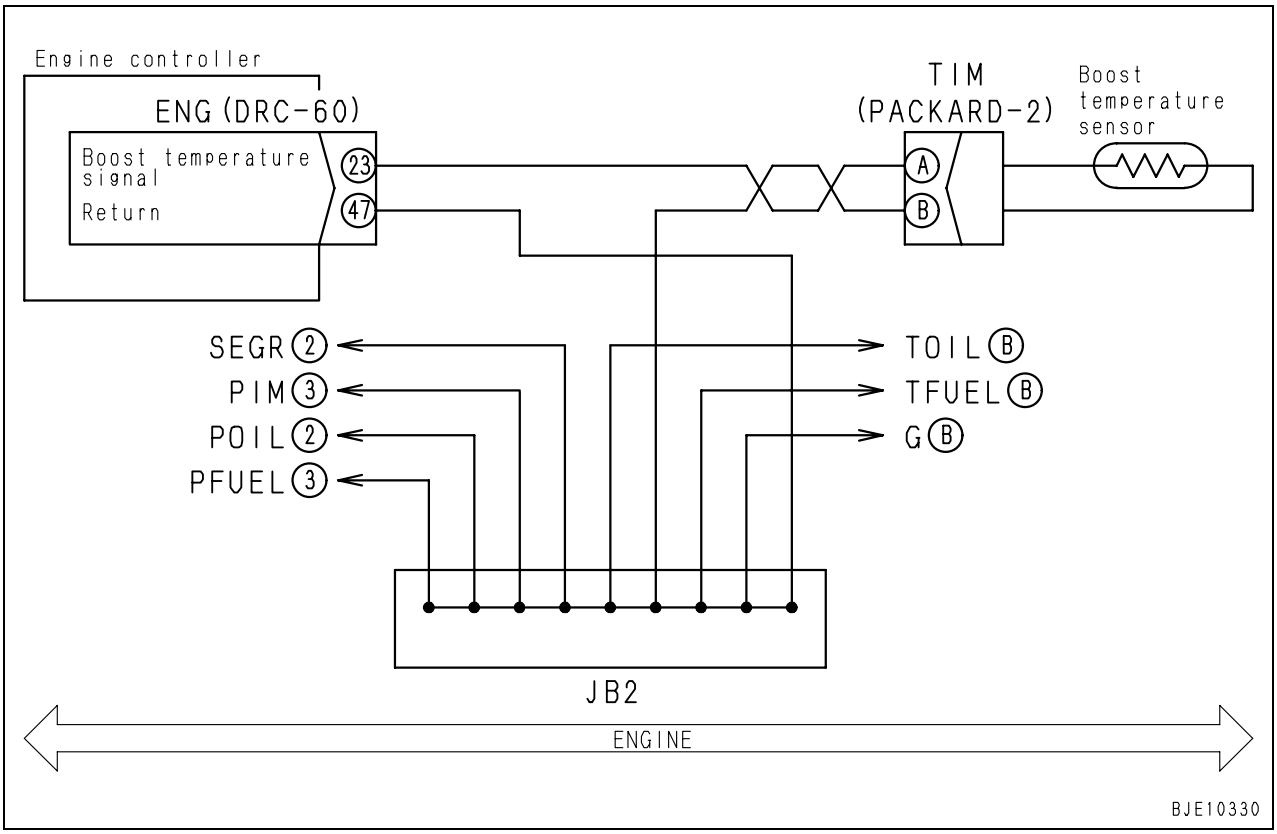
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA144**].	

Failure code [CA153] (Charge temperature sensor high error)

Action code	Failure code	Trouble	Charge temperature sensor high error (Engine controller system)
E01	**CA153**		
Contents of trouble	• Charge temperature sensor (boost temperature sensor) circuit is abnormally high.		
Action of controller	• Sets charge temperature (boost temperature) to fixed value (70°C), and continues operation.		
Problem that appears on machine			
Related information	• The input state (temperature) from the charge temperature sensor (boost temperature sensor) can be checked with the monitoring function (Code: 18500). • The input state (voltage) from the charge temperature sensor (boost temperature sensor) can be checked with the monitoring function (Code: 18501). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective charge temperature sensor (boost temperature sensor) (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			TIM (male)	Air boost temperature	Resistance	
			Between (A) and (B)	10 – 100°C	0.5 – 20 kΩ	
			Between (A) and chassis ground	In all range	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (23) – TIM (female) (A)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – TIM (female) (B)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (23) – TIM (female) (A)		Resistance	Min. 1 MΩ
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Air boost temperature	Resistance	
			Between (23) and (47)	10 – 100°C	0.5 – 20 kΩ	

Circuit diagram related to charge temperature sensor (boost temperature sensor)



Failure code [CA154] (Charge temperature sensor low error)

Action code	Failure code	Trouble	Charge temperature sensor low error (Engine controller system)
E01	**CA154**		
Contents of trouble	• Charge temperature sensor (boost temperature sensor) circuit is abnormally low.		
Action of controller	• Sets charge temperature (boost temperature) to fixed value (70°C), and continues operation.		
Problem that appears on machine			
Related information	• The input state (temperature) from the charge temperature sensor (boost temperature sensor) can be checked with the monitoring function (Code: 18500). • The input state (voltage) from the charge temperature sensor (boost temperature sensor) can be checked with the monitoring function (Code: 18501). • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA153**].	

Failure code [CA187] (Sensor power supply 2 low error)

Action code	Failure code	Trouble	Sensor power supply 2 low error (Engine controller system)
E03	**CA187**		
Contents of trouble	• Sensor power supply 2 (5 V) circuit is abnormally low.		
Action of controller	• Bkup speed sensor: Operates with signal from Ne speed sensor. • Engine oil pressure sensor sets engine oil pressure to default (250 kPa {2.5 kg/cm^2}), and continues operation. • Atmospheric pressure sensor sets atmospheric pressure to default (50.99 kPa {0.52 kg/cm^2}), and continues operation. • Charge pressure sensor sets charge pressure to fixed value (400 kPa {4.1 kg/cm^2}), and continues operation. • EGR valve lift sensor limits output and closes EGR and bypass valves. • Bypass valve lift sensor limits output and closes EGR and bypass valves. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

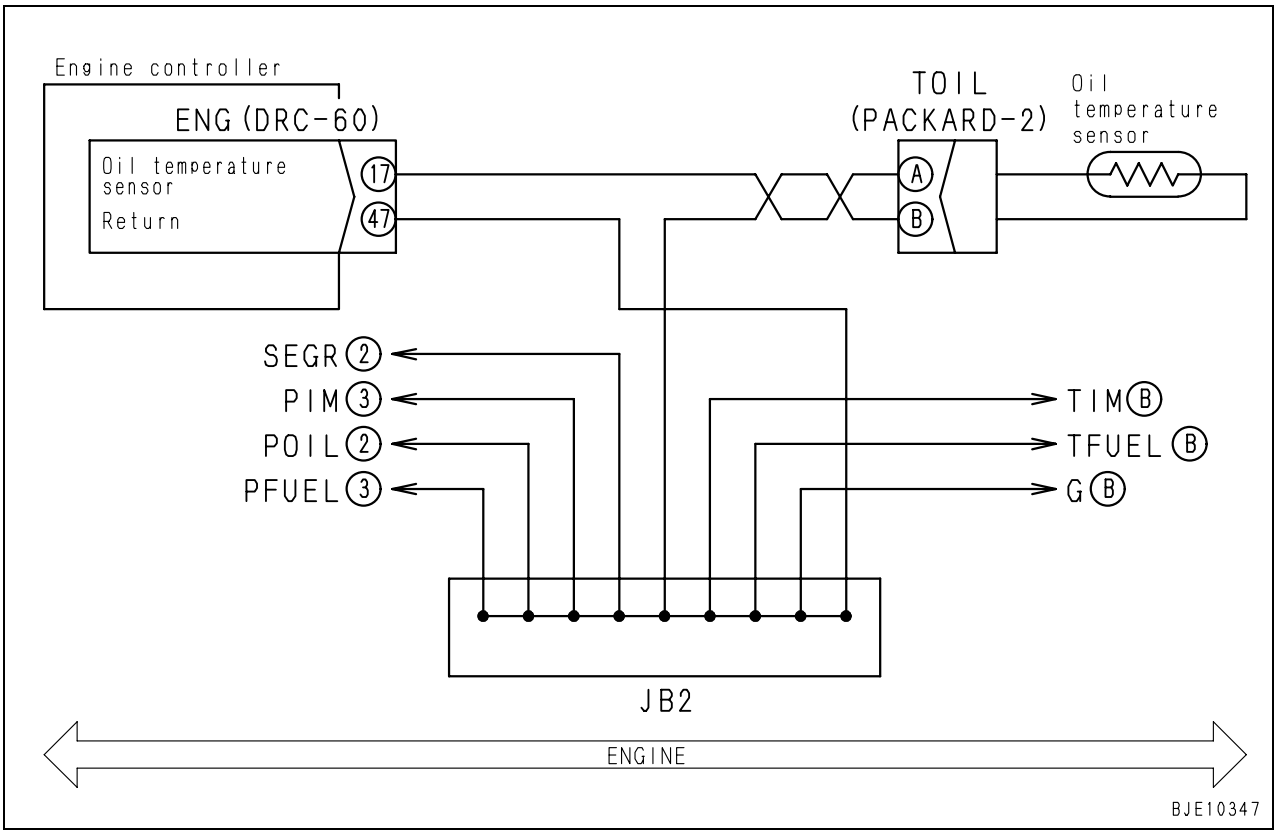
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA227**].	

Failure code [CA212] (Engine oil temperature sensor high error)

Action code	Failure code	Trouble	Engine oil temperature sensor high error (Engine controller system)
E01	**CA212**		
Contents of trouble	• Engine oil temperature sensor circuit is abnormally high.		
Action of controller	• Sets engine oil temperature to fixed value (100°C), and continues operation.		
Problem that appears on machine			
Related information	• The input state (temperature) from the engine oil temperature sensor can be checked with the monitoring function (Code: 42700). • The input state (voltage) from the engine oil temperature sensor can be checked with the monitoring function (Code: 42702). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective engine oil temperature sensor (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			TOIL (male)	Oil temperature	Resistance	
			Between (A) and (B)	10 – 100°C	0.6 – 20 kΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (17) – TOIL (female) (A)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – TOIL (female) (B)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (17) – TOIL (female) (A)		Resistance	Min. 1 MΩ
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Oil temperature	Resistance	
			Between (17) and (47)	10 – 100°C	0.6 – 20 kΩ	

Circuit diagram related to engine oil temperature sensor



Failure code [CA213] (Engine oil temperature sensor low error)

Action code	Failure code	Trouble	Engine oil temperature sensor low error (Engine controller system)
E01	**CA213**		
Contents of trouble	• Engine oil temperature sensor circuit is abnormally low.		
Action of controller	• Sets engine oil temperature to fixed value (100°C), and continues operation.		
Problem that appears on machine			
Related information	• The input state (oil temperature) from the engine oil temperature sensor can be checked with the monitoring function (Code: 42700). • The input state (voltage) from the engine oil temperature sensor can be checked with the monitoring function (Code: 42702). • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA212**].	

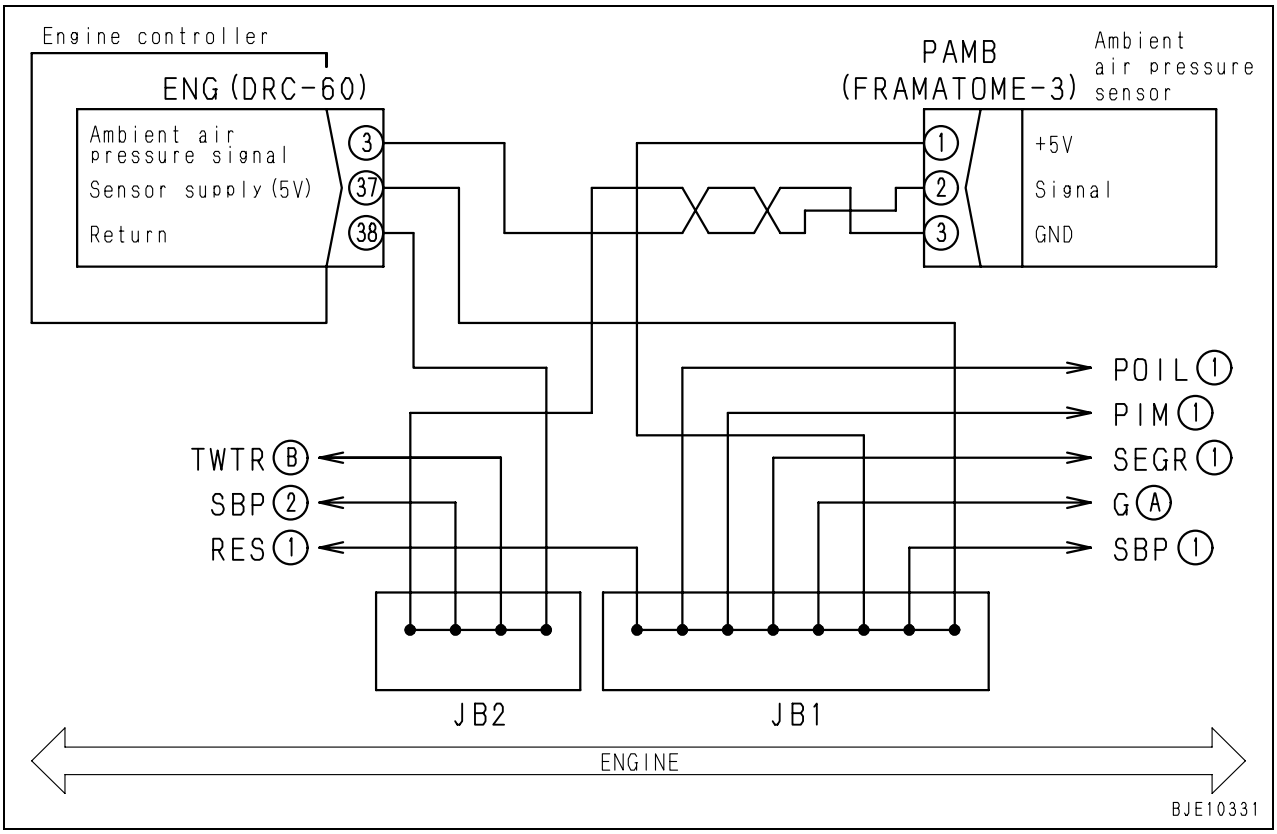
Failure code [CA221] (Atmospheric pressure sensor high error)

Action code	Failure code	Trouble	Atmospheric pressure sensor high error (Engine controller system)
E01	**CA221**		
Contents of trouble	• Atmospheric pressure sensor circuit is abnormally high.		
Action of controller	• Sets atmospheric pressure to default (50.99 kPa {0.52 kg/cm^2}), and continues operation.		
Problem that appears on machine	• Engine output drops.		
Related information	• The input state (atmospheric pressure) from the atmospheric pressure sensor can be checked with the monitoring function (Code: 37400). • The input state (voltage) from the atmospheric pressure sensor can be checked with the monitoring function (Code: 37402). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective power supply system of atmospheric pressure sensor	If failure code [**CA187**] or [**CA227**] is also indicated, carry out troubleshooting for it first.			
	2	Defective atmospheric pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			PAMB		Voltage	
			Between (1) and (3)	Power supply	4.75 – 5.25V	
			Between (2) and (3)	Signal	0.3 – 4.7 V	
			Sensor voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (37) – PAMB (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (38) – PAMB (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (3) – PAMB (female) (2)		Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (37) – PAMB (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (38) – PAMB (female) (3)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (3) – PAMB (female) (2)		Resistance	Min. 1 MΩ

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (37) – PAMB (female) (1) and between ENG (female) (38) – PAMB (female) (3)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (37) – PAMB (female) (1) and between ENG (female) (3) – PAMB (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (38) – PAMB (female) (3) and between ENG (female) (3) – PAMB (female) (2)		Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.			
			ENG	Voltage		
			Between (37) and (38)	4.75 – 5.25V		
			Between (3) and (38)	0.3 – 4.7 V		

Circuit diagram related to atmospheric pressure sensor



Failure code [CA222] (Atmospheric pressure sensor low error)

Action code	Failure code	Trouble	Atmospheric pressure sensor low error (Engine controller system)
E01	**CA222**		
Contents of trouble	• Atmospheric pressure sensor circuit is abnormally low.		
Action of controller	• Sets atmospheric pressure to default (50.99 kPa {0.52 kg/cm^2}), and continues operation.		
Problem that appears on machine	• Engine output drops.		
Related information	• The input state (atmospheric pressure) from the atmospheric pressure sensor can be checked with the monitoring function (Code: 37400). • The input state (voltage) from the atmospheric pressure sensor can be checked with the monitoring function (Code: 37402). • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA221**].	

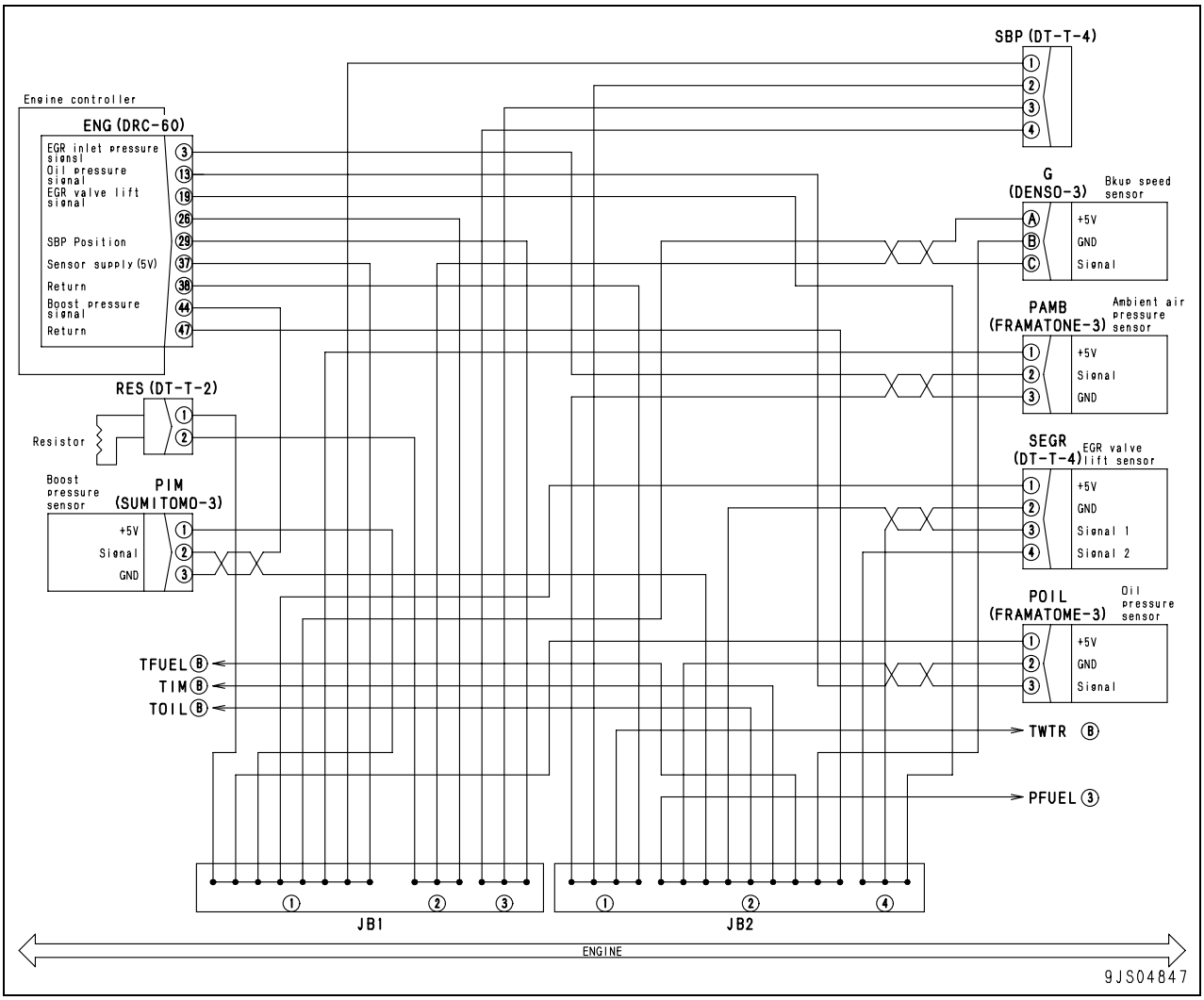
Failure code [CA227] (Sensor power supply 2 high error)

Action code	Failure code	Trouble	Sensor power supply 2 high error (Engine controller system)
E03	**CA227**		
Contents of trouble	• Sensor power supply 2 (5 V) circuit is abnormally high.		
Action of controller	• Bkup speed sensor operates with signal from Ne speed sensor. • Engine oil pressure sensor sets engine oil pressure to default (250 kPa {2.5 kg/cm^2}), and continues operation. • Atmospheric pressure sensor sets atmospheric pressure to default (50.99 kPa {0.52 kg/cm^2}), and continues operation. • Charge pressure sensor (boost pressure sensor) sets charge pressure to fixed value (400 kPa {4.1 kg/cm^2}), and continues operation. • EGR and bypass valve position sensors limit output and close EGR and bypass valves. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Related system defects	If another code is displayed, carry out troubleshooting for it first.			
	2	Defective sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Disconnect device suggested on the right. At this time, if failure code is not indicated, the device is defective.	Bkup speed sensor system	G connector	
				Oil pressure sensor	POIL connector	
				Charge pressure sensor	PIM connector	
				Atmospheric pressure sensor	PAMB connector	
				EGR valve lift sensor	SEGR connector	
				Bypass valve position sensor	SBP connector	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (37) – each sensor (female)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – each sensor (female) (B)		Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (37) – each sensor (female)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – each sensor (female)		Resistance	Min. 1 MΩ

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (37) – each sensor (female) and between ENG (female) (47) – each sensor (female)	Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			ENG	Voltage	
			Between (37) and (47)	4.75 – 5.25V	

Circuit diagram related to sensor power supply 2 (5 V)



WA600-6 Wheel loader

Form No. SEN00559-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

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Troubleshooting by failure code (Display of code), Part 3

Failure code [CA234] (Engine overspeed)

Action code	Failure code	Trouble	Engine overspeed (Engine controller system)
E02	**CA234**		
Contents of trouble	• Engine speed exceeded operating range.		
Action of controller	• Reduce fuel injection rate until engine speed lowers in operating range. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine speed changes.		
Related information	• Engine speed can be checked by monitoring function (Code: 01002). • Method of reproducing failure code: Start engine and keep running at high idle.		

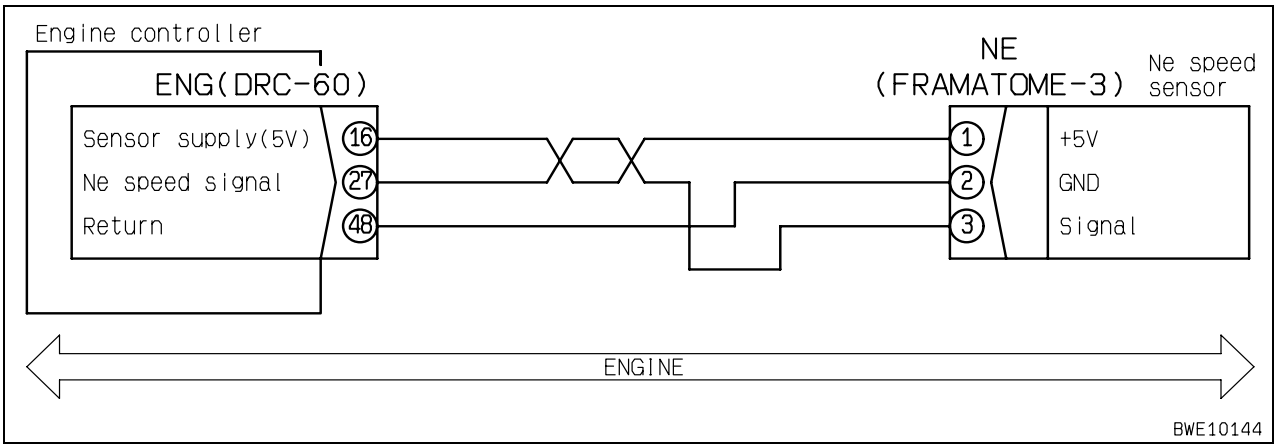
	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defect in related system	If another code is displayed, carry out troubleshooting for it.
	2	Usage is improper	The method of using the installed machine may be improper, so instruct the operator on how to use the machine properly.
	3	Defective engine controller	If causes 1 and 2 are not the cause of the trouble, the engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [CA238] (Ne speed sensor power supply error)

Action code	Failure code	Trouble	Ne speed sensor power supply error (Engine controller system)
E03	**CA238**		
Contents of trouble	• Error occurred in Ne speed sensor power supply (5 V) circuit.		
Action of controller	• Controls with signal from Bkup speed sensor. • Limits output and continues operation. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops. • Engine stops during operation (when Bkup speed sensor is also defective) • Engine cannot start during stop (when Bkup speed sensor is also defective)		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective Ne speed sensor (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Disconnect device suggested on the right. At this time, if failure code is not indicated, the device is defective.	Ne speed sensor	NE connector	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (16) – NE (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (48) – NE (female) (2)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (16) – NE (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (48) – NE (female) (2)		Resistance	Min. 1 MΩ
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (16) – NE (female) (1) and between ENG (female) (48) – NE (female) (2)		Resistance	Min. 1 MΩ
	5	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			ENG	Voltage		
			Between (16) and (48)	4.75 – 5.25 V		

Circuit diagram related to Ne speed sensor power supply

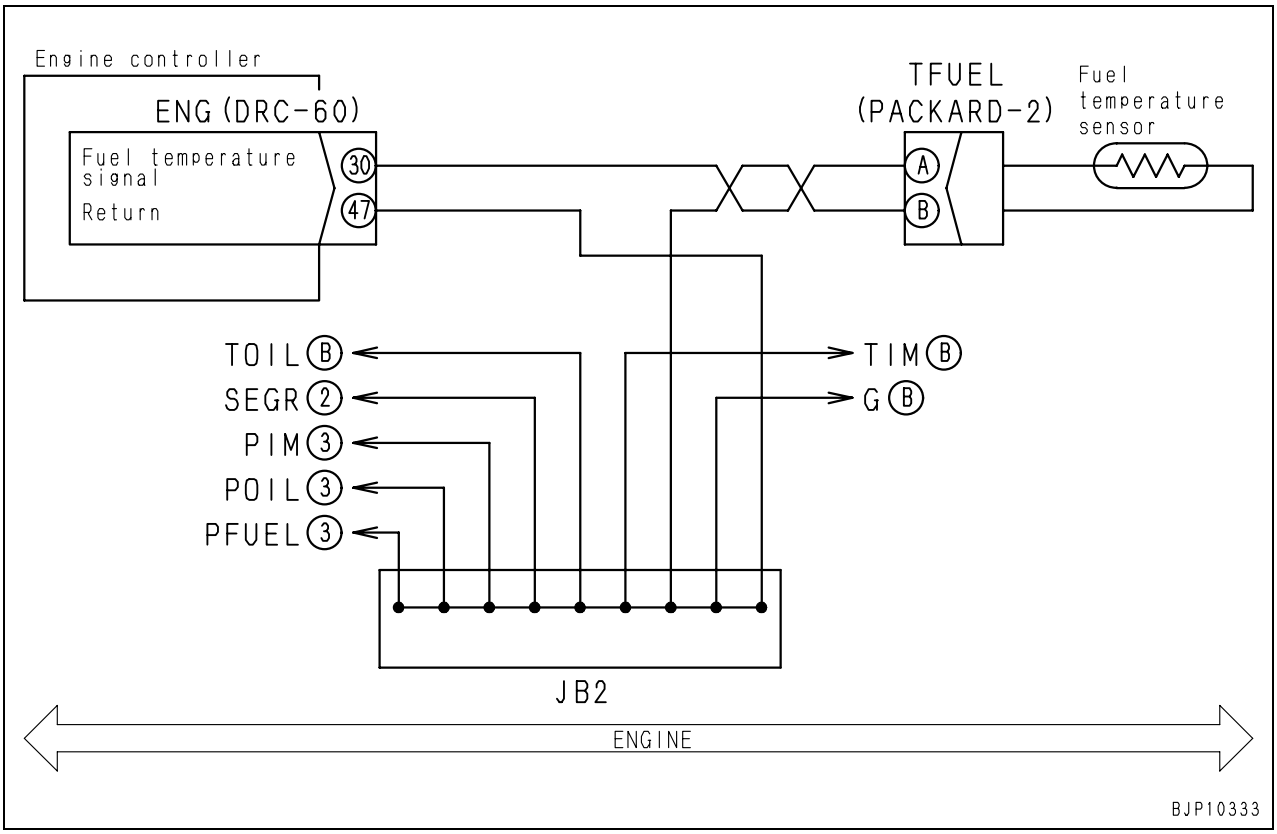


Failure code [CA263] (Fuel temperature sensor high error)

Action code	Failure code	Trouble	Fuel temperature sensor high error (Engine controller system)
E01	**CA263**		
Contents of trouble	• Fuel temperature sensor circuit is abnormally high.		
Action of controller	• Sets fuel temperature to fixed value (90°C), and continues operation.		
Problem that appears on machine			
Related information	• The input state (temperature) from the fuel temperature sensor can be checked with the monitoring function (Code: 04204). • The input state (voltage) from the fuel temperature sensor can be checked with the monitoring function (Code: 14201). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuel temperature sensor (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			TFUEL (male)	Fuel temperature	Resistance	
			Between (A) and (B)	10 – 100°C	0.6 – 20 kΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (30) – TFUEL (female) (A)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – TFUEL (female) (B)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (30) – TFUEL (female) (A)		Resistance	Min. 1 MΩ
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
	4	Defective engine controller	ENG (female)	Fuel temperature	Resistance	
			Between (30) and (47)	10 – 100°C	0.6 – 20 kΩ	

Circuit diagram related to fuel temperature sensor



Failure code [CA265] (Fuel temperature sensor low error)

Action code	Failure code	Trouble	Fuel temperature sensor low error (Engine controller system)
E01	**CA265**		
Contents of trouble	• Fuel temperature sensor circuit is abnormally low.		
Action of controller	• Injection rate by fuel temperature sensor is compensated with coolant temperature sensor (If coolant temperature sensor is abnormal, the controller sets to fixed value (90°C) and continues operation.)		
Problem that appears on machine			
Related information	• The input state (temperature) from the fuel temperature sensor can be checked with the monitoring function (Code: 04204). • The input state (voltage) from the fuel temperature sensor can be checked with the monitoring function (Code: 14201). • Method of reproducing failure code: Turn the starting switch ON.		

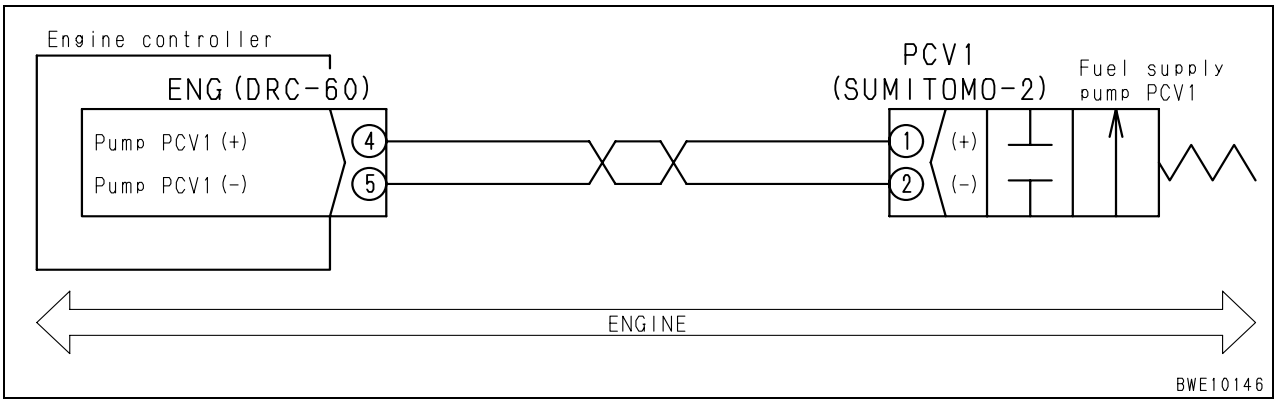
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out trouble shooting for failure code [**CA263**].	

Failure code [CA271] (PCV1 Short circuit)

Action code	Failure code	Trouble	PCV1 short circuit (Engine controller system)
E03	**CA271**		
Contents of trouble	• Short circuit was detected in supply pump PCV1 circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine			
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective supply pump PCV1 (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			PCV1 (male)	Resistance		
			Between (1) and (2)	2.3 – 5.3 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (4) – PCV1 (female) (1)	Resistance	Min. 1 MΩ	
			Wiring harness between ENG (female) (5) – PCV1 (female) (2)	Resistance	Min. 1 MΩ	
	3	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between ENG (female) (4) – PCV1 (female) (1)	Voltage	Max. 1 V	
			Wiring harness between ENG (female) (5) – PCV1 (female) (2)	Voltage	Max. 1 V	
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Resistance		
			Between (4) and (5)	2.3 – 5.3 Ω		
			Between (4), (5) and chassis ground	Min. 1 MΩ		

Circuit diagram related to supply pump PCV1

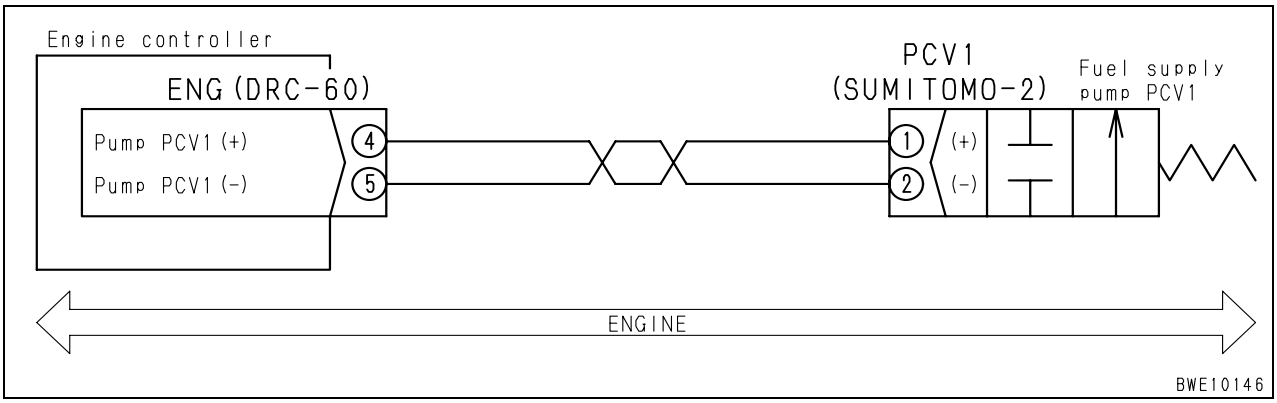


Failure code [CA272] (PCV1 Disconnection)

Action code	Failure code	Trouble	PCV1 disconnection (Engine controller system)
E03	**CA272**		
Contents of trouble	• Disconnection was detected in supply pump PCV1 circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine			
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective supply pump PCV1 (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			PCV1 (male)	Resistance		
			Between (1) and (2)	2.3 – 5.3 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (4) – PCV1 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (5) – PCV1 (female) (2)	Resistance	Max. 1 Ω	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (4) – PCV1 (female) (1)	Resistance	Min. 1 MΩ	
			Wiring harness between ENG (female) (5) – PCV1 (female) (2)	Resistance	Min. 1 MΩ	
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Resistance		
			Between (4) and (5)	2.3 – 5.3 Ω		
			Between (4), (5) and chassis ground	Min. 1 MΩ		

Circuit diagram related to supply pump PCV1

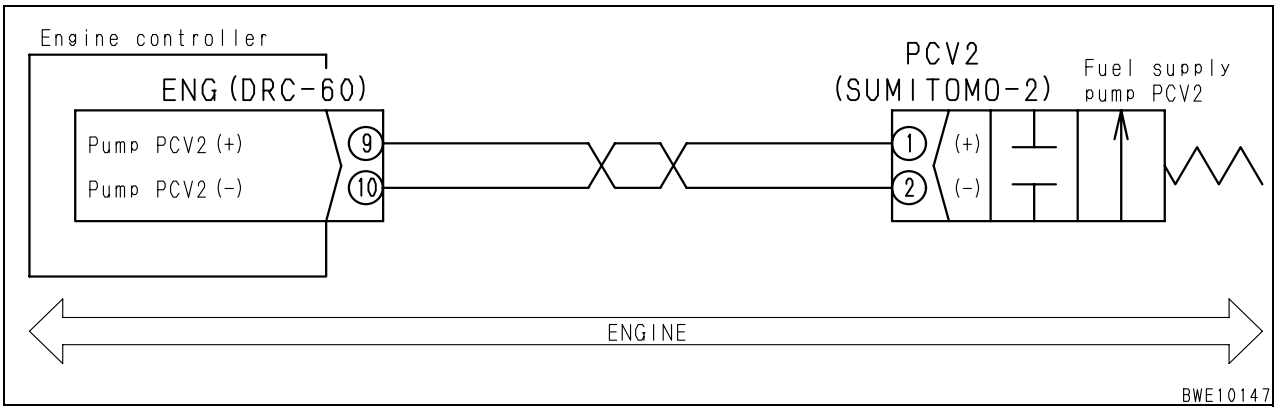


Failure code [CA273] (PCV2 Short circuit)

Action code	Failure code	Trouble	PCV2 short circuit (Engine controller system)
E03	**CA273**		
Contents of trouble	• Short circuit was detected in supply pump PCV2 circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine			
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective supply pump PCV2 (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			PCV2 (male)	Resistance		
			Between (1) and (2)	2.3 – 5.3 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (9) – PCV2 (female) (1)	Resistance	Min. 1 MΩ	
			Wiring harness between ENG (female) (10) – PCV2 (female) (2)	Resistance	Min. 1 MΩ	
	3	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between ENG (female) (9) – PCV2 (female) (1)	Voltage	Max. 1 V	
			Wiring harness between ENG (female) (10) – PCV2 (female) (2)	Voltage	Max. 1 V	
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Resistance		
			Between (9) and (10)	2.3 – 5.3 Ω		
			Between (9), (10) and chassis ground	Min. 1 MΩ		

Circuit diagram related to supply pump PCV2

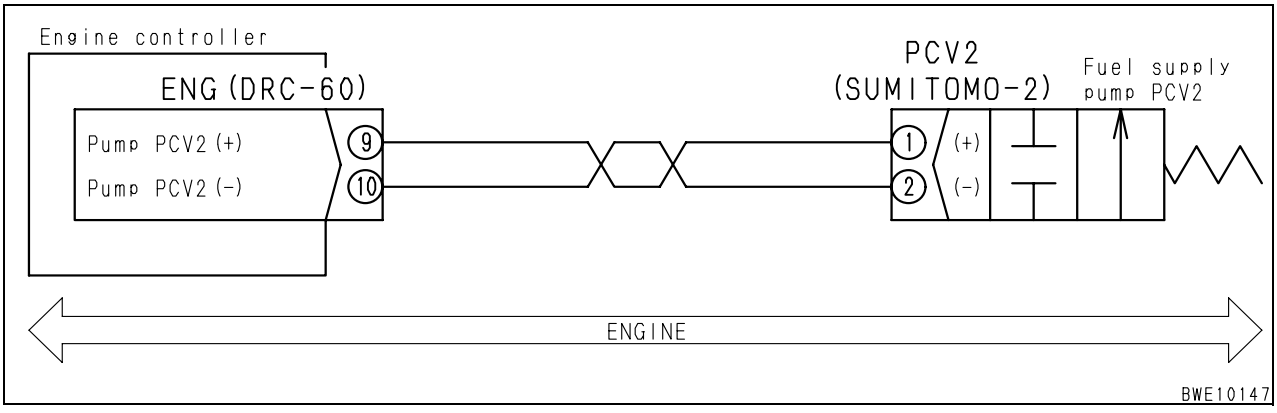


Failure code [CA274] (PCV2 Disconnection)

Action code	Failure code	Trouble	PCV2 disconnection (Engine controller system)
E03	**CA274**		
Contents of trouble	• Disconnection was detected in supply pump PCV2 circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine			
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective supply pump PCV2 (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			PCV2 (male)	Resistance	
			Between (1) and (2)	2.3 – 5.3 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (9) – PCV2 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (10) – PCV2 (female) (2)	Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (9) – PCV2 (female) (1)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (10) – PCV2 (female) (2)	Resistance	Min. 1 MΩ
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ENG (female)	Resistance	
			Between (9) and (10)	2.3 – 5.3 Ω	
			Between (9), (10) and chassis ground	Min. 1 MΩ	

Circuit diagram related to supply pump PCV2

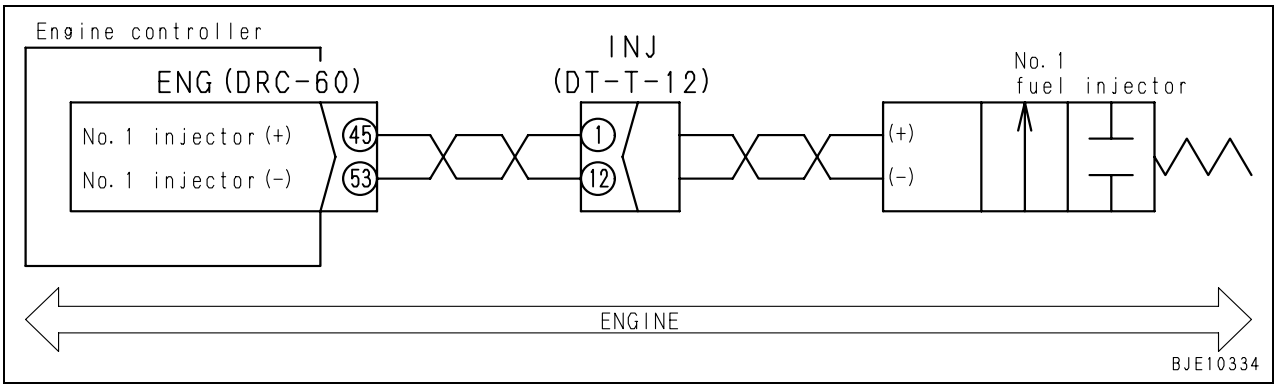


Failure code [CA322] (Injector #1 (L/B #1) open/short error)

Action code	Failure code	Trouble	Injector #1 system disconnection or short circuit (Engine controller system)
E03	**CA322**		
Contents of trouble	• Disconnection or short circuit was detected in injector #1 circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops. • Speed does not become stable		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector #1 (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ (male)	Resistance		
			Between (1) and (12)	0.4 – 1.1 Ω		
			Between (1), (12) and chassis ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (45) – INJ (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (53) – INJ (female) (12)	Resistance	Max. 1 Ω	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (45) – INJ (female) (1)	Resistance	Min. 1 MΩ	
			Wiring harness between ENG (female) (53) – INJ (female) (12)	Resistance	Min. 1 MΩ	
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Resistance		
			Between (45) and (53)	0.4 – 1.1 Ω		
			Between (45), (53) and chassis ground	Min. 1 MΩ		

Circuit diagram related to injector #1

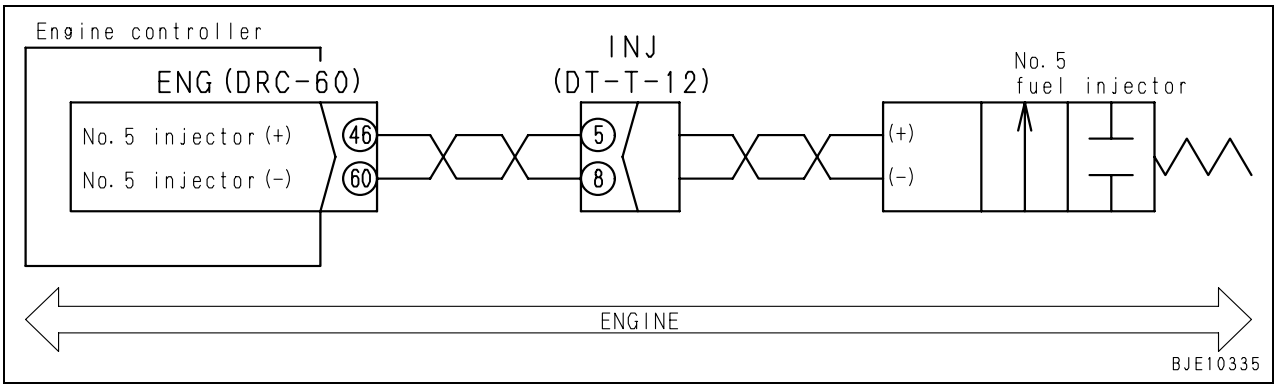


Failure code [CA323] (Injector #5 (L/B #5) open/short error)

Action code	Failure code	Trouble	Injector #5 system disconnection or short circuit (Engine controller system)
E03	**CA323**		
Contents of trouble	• Disconnection or short circuit was detected in injector #5 circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops. • Speed does not become stable		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector #5 (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ (male)	Resistance		
			Between (5) and (8)	0.4 – 1.1 Ω		
			Between (5), (8) and chassis ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (46) – INJ (female) (5)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (60) – INJ (female) (8)	Resistance	Max. 1 Ω	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (46) – INJ (female) (5)	Resistance	Min. 1 MΩ	
			Wiring harness between ENG (female) (60) – INJ (female) (8)	Resistance	Min. 1 MΩ	
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Resistance		
			Between (46) and (60)	0.4 – 1.1 Ω		
			Between (46), (60) and chassis ground	Min. 1 MΩ		

Circuit diagram related to injector #5

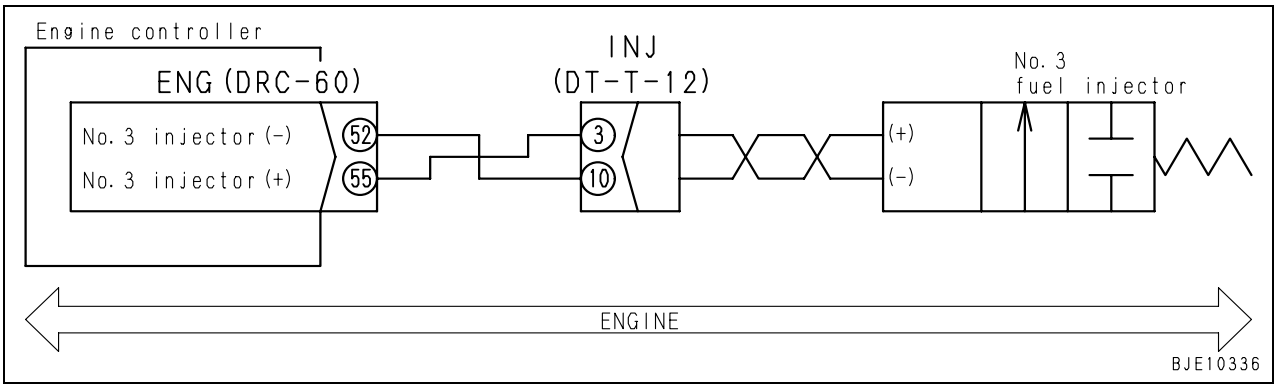


Failure code [CA324] (Injector #3 (L/B #3) open/short error)

Action code	Failure code	Trouble	Injector #3 system disconnection or short circuit (Engine controller system)
E03	**CA324**		
Contents of trouble	• Disconnection or short circuit was detected in injector #3 circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops. • Speed does not become stable.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector #3 (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ (male)	Resistance		
			Between (3) and (10)	0.4 – 1.1 Ω		
			Between (3), (10) – chassis ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (55) – INJ (female) (3)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (52) – INJ (female) (10)	Resistance	Max. 1 Ω	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (55) – INJ (female) (3)	Resistance	Min. 1 MΩ	
			Wiring harness between ENG (female) (52) – INJ (female) (10)	Resistance	Min. 1 MΩ	
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Resistance		
			Between (55) and (52)	0.4 – 1.1 Ω		
			Between (55), (52) and chassis ground	Min. 1 MΩ		

Circuit diagram related to injector #3

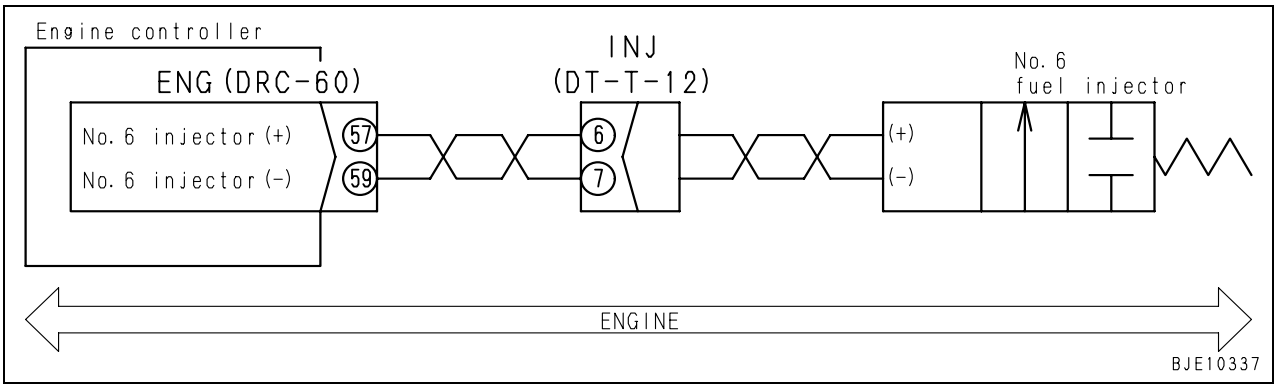


Failure code [CA325] (Injector #6 (L/B #6) open/short error)

Action code	Failure code	Trouble	Injector #6 system disconnection or short circuit (Engine controller system)
E03	**CA325**		
Contents of trouble	• Disconnection or short circuit was detected in injector #6 circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops. • Speed does not become stable.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector #6 (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ (male)	Resistance		
			Between (6) and (7)	0.4 – 1.1 Ω		
			Between (6), (7) and chassis ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (57) – INJ (female) (6)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (59) – INJ (female) (7)	Resistance	Max. 1 Ω	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (57) – INJ (female) (6)	Resistance	Min. 1 MΩ	
			Wiring harness between ENG (female) (59) – INJ (female) (7)	Resistance	Min. 1 MΩ	
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Resistance		
			Between (57) and (59)	0.4 – 1.1 Ω		
			Between (57), (59) and chassis ground	Min. 1 MΩ		

Circuit diagram related to injector #6

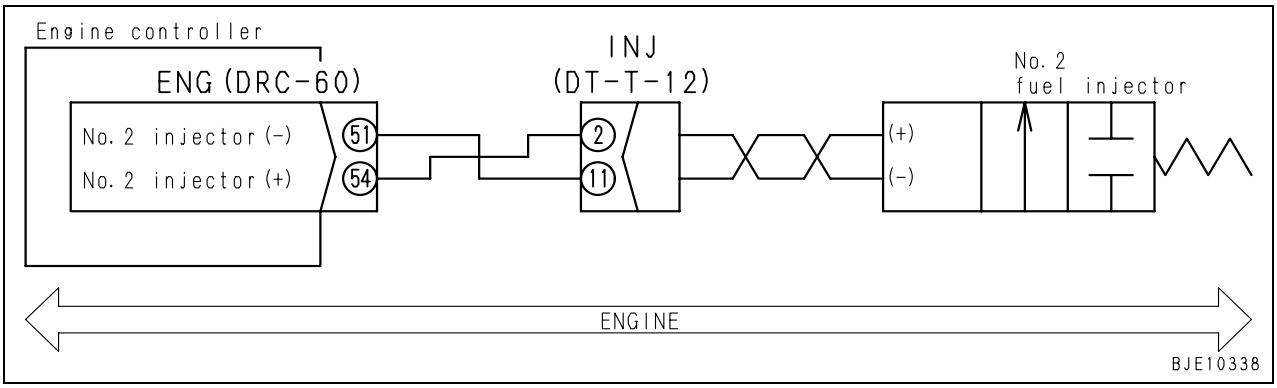


Failure code [CA331] (Injector #2 (L/B #2) open/short error)

Action code	Failure code	Trouble	Injector #2 system disconnection or short circuit (Engine controller system)
E03	**CA331**		
Contents of trouble	• Disconnection or short circuit was detected in injector #2 circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops. • Speed does not become stable.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector #2 (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ (male)	Resistance		
			Between (2) and (11)	0.4 – 1.1 Ω		
			Between (2), (11) and chassis ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (54) – INJ (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (51) – INJ (female) (11)	Resistance	Max. 1 Ω	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (54) – INJ (female) (2)	Resistance	Min. 1 MΩ	
			Wiring harness between ENG (female) (51) – INJ (female) (11)	Resistance	Min. 1 MΩ	
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Resistance		
			Between (54) and (51)	0.4 – 1.1 Ω		
			Between (54), (51) and chassis ground	Min. 1 MΩ		

Circuit diagram related to injector #2

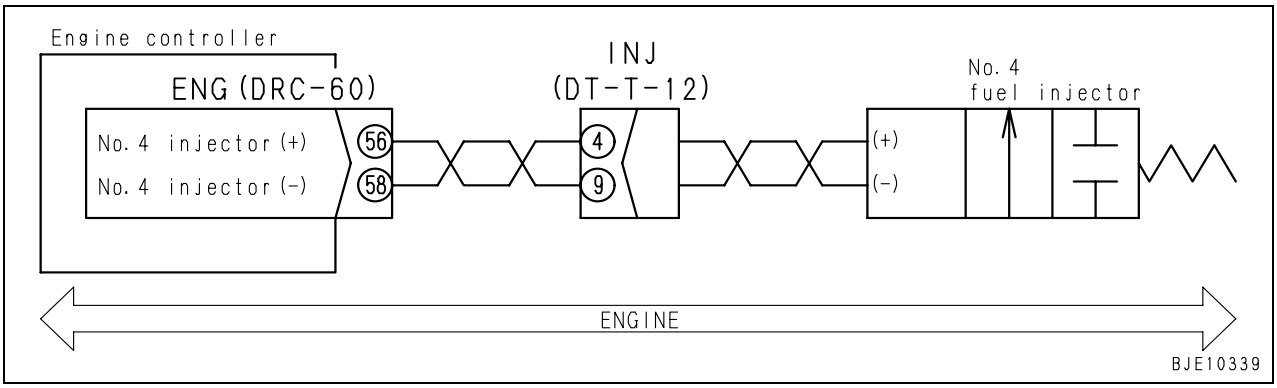


Failure code [CA332] (Injector #4 (L/B #4) open/short error)

Action code	Failure code	Trouble	Injector #4 system disconnection or short circuit (Engine controller system)
E03	**CA332**		
Contents of trouble	• Disconnection or short circuit was detected in injector #4 circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops. • Speed does not become stable.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector #4 (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ (male)	Resistance		
			Between (4) and (9)	0.4 – 1.1 Ω		
			Between (4), (9) and chassis ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (56) – INJ (female) (4)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (58) – INJ (female) (9)	Resistance	Max. 1 Ω	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (56) – INJ (female) (4)	Resistance	Min. 1 MΩ	
			Wiring harness between ENG (female) (58) – INJ (female) (9)	Resistance	Min. 1 MΩ	
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENG (female)	Resistance		
			Between (56) and (58)	0.4 – 1.1 Ω		
			Between (56), (58) and chassis ground	Min. 1 MΩ		

Circuit diagram related to injector #4



Failure code [CA342] (Calibration code inconsistency)

Action code	Failure code	Trouble	Engine controller data inconsistency (Engine controller system)
E03	**CA342**		
Contents of trouble	• Data inconsistency occurred in engine controller.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Normal operation is continued; however, the machine may stop during travel or may not start in stopped state.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

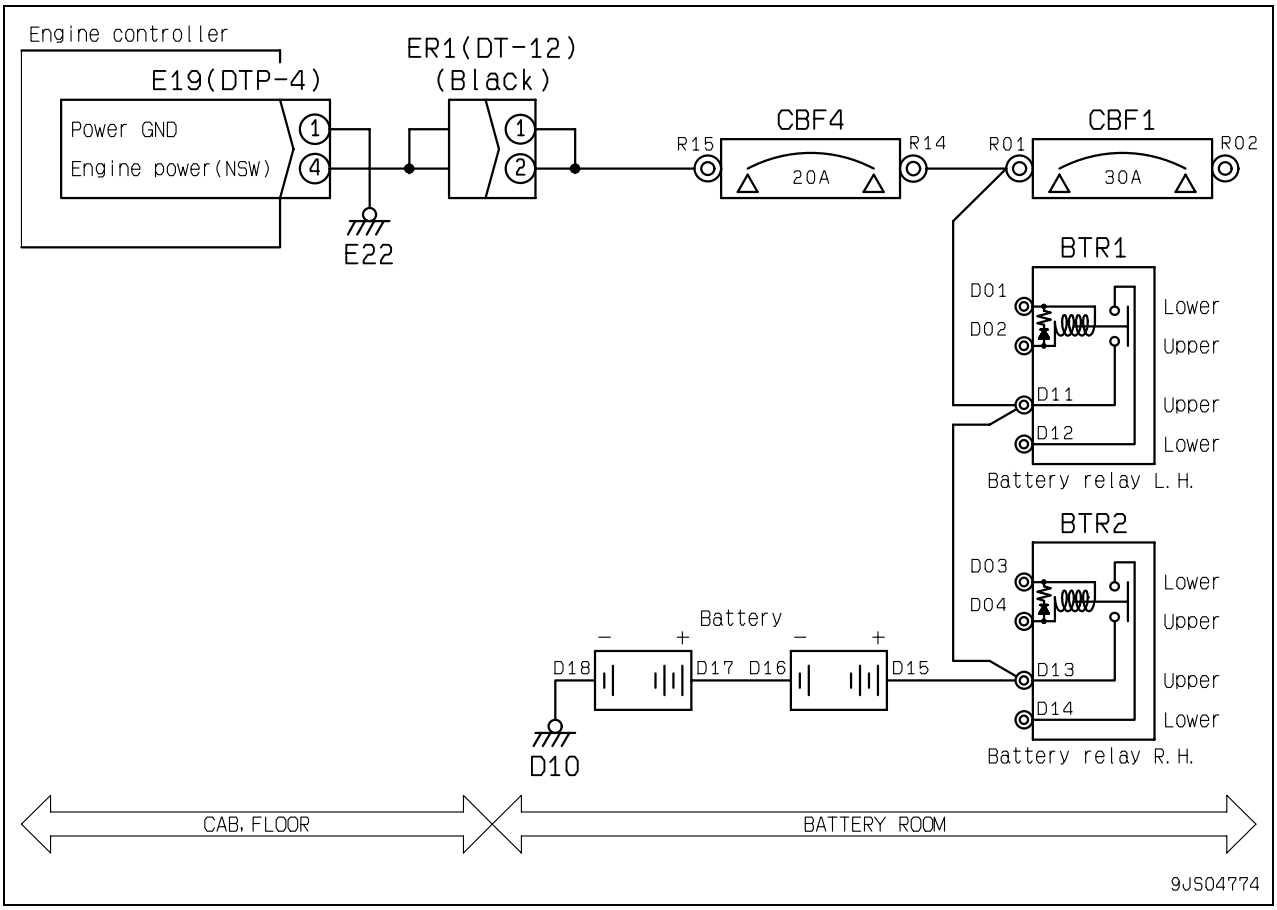
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out trouble shooting for failure code [**CA111**].	

Failure code [CA351] (Injectors drive circuit error)

Action code	Failure code	Trouble	Injector drive circuit error (Engine controller system)
E03	**CA351**		
Contents of trouble	• Error was detected in injector drive circuit.		
Action of controller	• Limits output for travel (Limits common rail pressure) • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defect in related system	Check the failure code (injector system error code) that is displayed at the same time. If another code is displayed, carry out trouble-shooting for it.		
	2	Defective circuit breaker (CBF4)	Circuit breaker (CBF4) may be defective. Check it directly. If circuit breaker is shut down, circuit probably has ground fault.		
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between E19 (female) (4) – battery (+)	Resis-tance	Max. 1 Ω
			Wiring harness between E19 (female) (1) – chassis ground	Resis-tance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between E19 (female) (4) – battery (+)	Resis-tance	Min. 1 MΩ
			Wiring harness between E19 (female) (1) – chassis ground	Resis-tance	Min. 1 MΩ
	5	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			E19	Voltage	
			Between (4) and (1)	20 – 30 V	

Circuit diagram related to engine controller power supply



Failure code [CA352] (Sensor power supply 1 low error)

Action code	Failure code	Trouble	Sensor power supply 1 low error (Engine controller system)
E03	**CA352**		
Contents of trouble	• Sensor power supply 1 (5 V) circuit is abnormally low.		
Action of controller	• Common rail pressure sensor: Limits output for travel (Limits common rail pressure) • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out trouble shooting for failure code [**CA386**].	

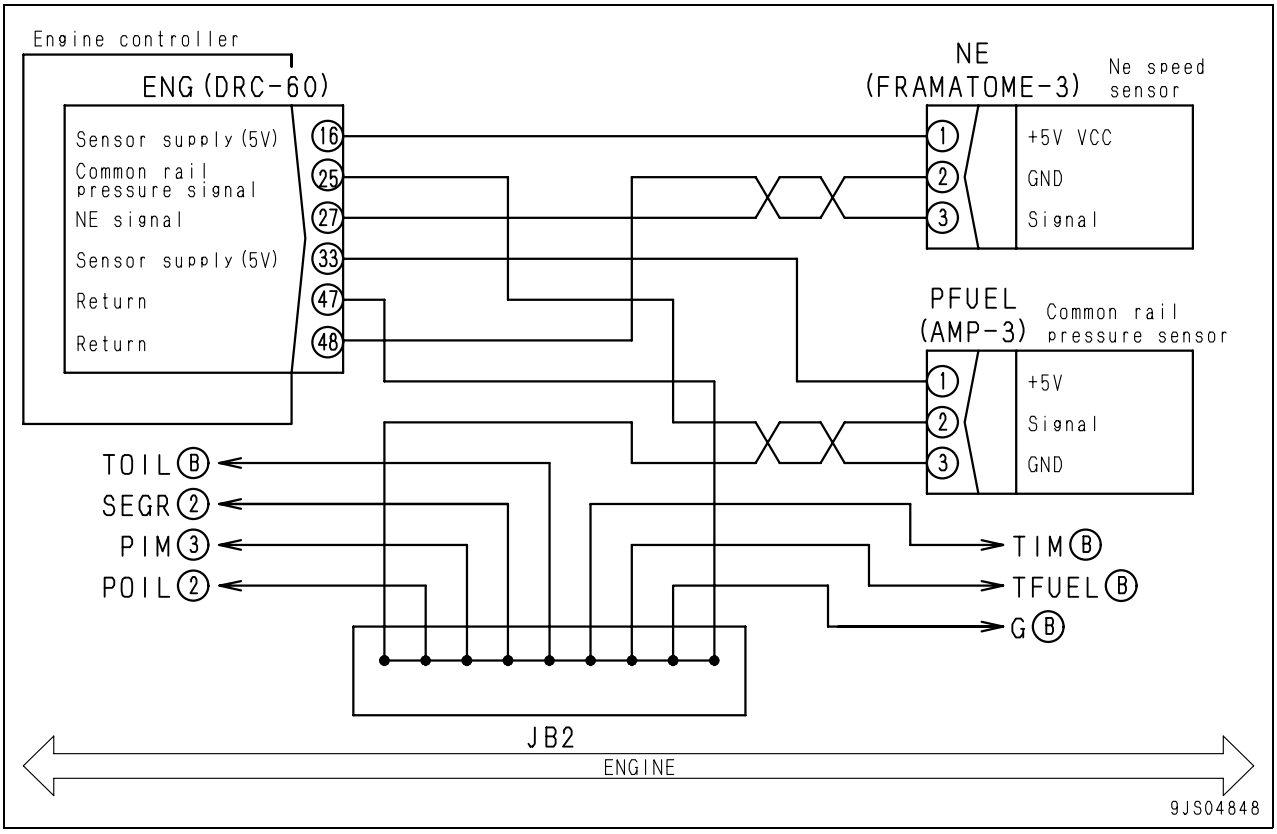
Failure code [CA386] (Sensor power supply 1 high error)

Action code	Failure code	Trouble	Sensor power supply 1 high error (Engine controller system)
E03	**CA386**		
Contents of trouble	• Sensor power supply 1 (5 V) circuit is abnormally high.		
Action of controller	• Common rail pressure sensor: Limits output for travel (Limits common rail pressure) • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defect in related system	If another code is displayed, carry out troubleshooting for it.		
	2	Defective sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Disconnect device suggested on the right. At this time, if failure code is not indicated, the device is defective.	Common rail pressure sensor	PFUEL
				Ne speed sensor	NE connector
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (33) – PFUEL (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (16) and NE (female) (3) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – PFUEL (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (48) – NE (female) (2)	Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (33) – PFUEL (female) (1)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (16) – NE (female) (3)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – PFUEL (female) (3)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (48) – NE (female) (2)	Resistance	Min. 1 MΩ
	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (33) – PFUEL (female) (1) and between ENG (female) (47) – each sensor (female)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (16) – NE (female) (3)	Resistance	Min. 1 MΩ

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting	
			ENG	Voltage
			Between (16) – (48) and (33) – (47)	4.75 – 5.25 V

Circuit diagram related to sensor power supply 1 (5 V)



Failure code [CA431] (Idle validation switch error)

Action code	Failure code	Trouble	Idle validation switch error (Engine controller system)
E01	**CA431**		
Contents of trouble	• Error was detected in idle validation switch circuit.		
Action of controller	• Operates at position of throttle of throttle sensor.		
Problem that appears on machine			
Related information	• The input state (ON/OFF) from the idle validation switch 1 can be checked with the monitoring function (Code: 18300). • The input state (ON/OFF) from the idle validation switch 2 can be checked with the monitoring function (Code: 18301). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective accelerator pedal (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L17	Signal name	Voltage
			Between (5) and (4)	Signal 1	See Fig. 1 on the next page
			Between (6) and (4)	Signal 2	
			Sensor voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between E18 (female) (32) – L17 (female) (4)	Resistance	Max. 1 Ω
			Wiring harness between E18 (female) (11) – L17 (female) (5)	Resistance	Max. 1 Ω
			Wiring harness between E18 (female) (1) – L17 (female) (6)	Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between E18 (female) (32) – L17 (female) (4)	Resistance	Min. 1 MΩ
			Wiring harness between E18 (female) (11) – L17 (female) (5)	Resistance	Min. 1 MΩ
			Wiring harness between E18 (female) (1) – L17 (female) (6)	Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between E18 (female) (32) – L17 (female) (4)	Voltage	Max. 1 V
			Wiring harness between E18 (female) (11) – L17 (female) (5)	Voltage	Max. 1 V
			Wiring harness between E18 (female) (1) – L17 (female) (6)	Voltage	Max. 1 V

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	5	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			E18	Signal name	Voltage
			Between (11) and (32)	Signal 1	See Fig. 1 below
			Between (1) and (32)	Signal 2	

Circuit diagram related to throttle sensor

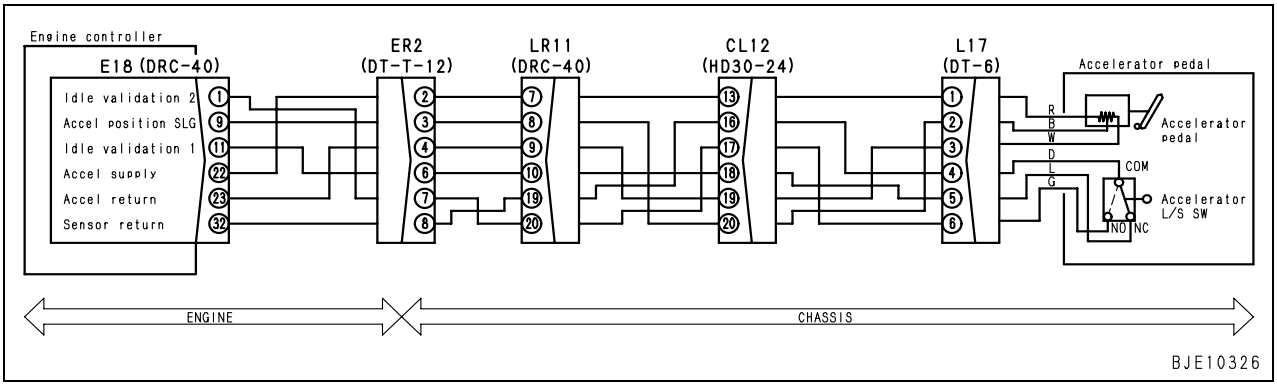
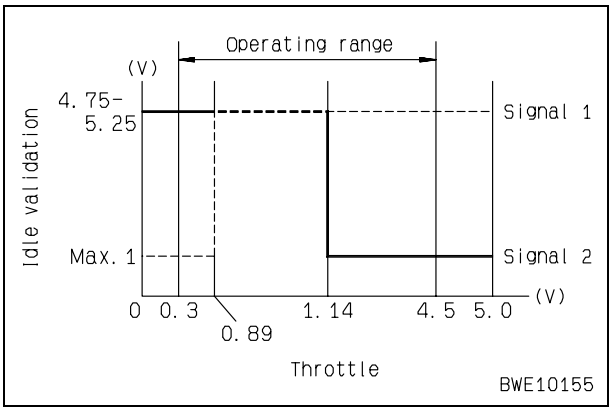


Fig. 1



Throttle: Signal voltage of throttle sensor
Idle validation: Signal voltage of idle validation switch
Operating range: Operating range of accelerator pedal

Failure code [CA432] (Idle validation action error)

Action code	Failure code	Trouble	Idle validation action error (Engine controller system)
E03	**CA432**		
Contents of trouble	• Action error was detected in idle validation switch circuit.		
Action of controller	• Operates at position of throttle of accelerator pedal (throttle sensor). • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine			
Related information	• The input state (ON/OFF) from the idle validation switch 1 can be checked with the monitoring function (Code: 18300). • The input state (ON/OFF) from the idle validation switch 2 can be checked with the monitoring function (Code: 18301). • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out trouble shooting for failure code [**CA431**].	

Failure code [CA441] (Battery voltage low error)

Action code	Failure code	Trouble	Battery voltage low error (Engine controller system)
E03	**CA441**		
Contents of trouble	• Low voltage was detected in battery voltage circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Normal operation is continued; however, the machine may stop during travel or may not start in stopped state.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out trouble shooting for failure code [**CA111**].	

Failure code [CA442] (Battery voltage high error)

Action code	Failure code	Trouble	Battery voltage high error (Engine controller system)
E03	**CA442**		
Contents of trouble	• High voltage was detected in battery voltage circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Normal operation is continued; however, the machine may stop during travel or may not start in stopped state.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out trouble shooting for failure code [**CA111**].	

Failure code [CA449] Common rail pressure high error 2

Action code	Failure code	Trouble	Common rail pressure high error 2 (Engine controller system)
E03	**CA449**		
Contents of trouble	• There is high pressure error (level 2) in common rail pressure sensor circuit.		
Action of controller	• Limits output and continues operation (limits common rail pressure). • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output lowers.		
Related information	• The input state (common rail pressure) from the common rail pressure sensor can be checked with the monitoring function (Code: 36400). • The input state (voltage) from the common rail pressure sensor can be checked with the monitoring function (Code: 36402). • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out trouble shooting for failure code [**CA553**].	

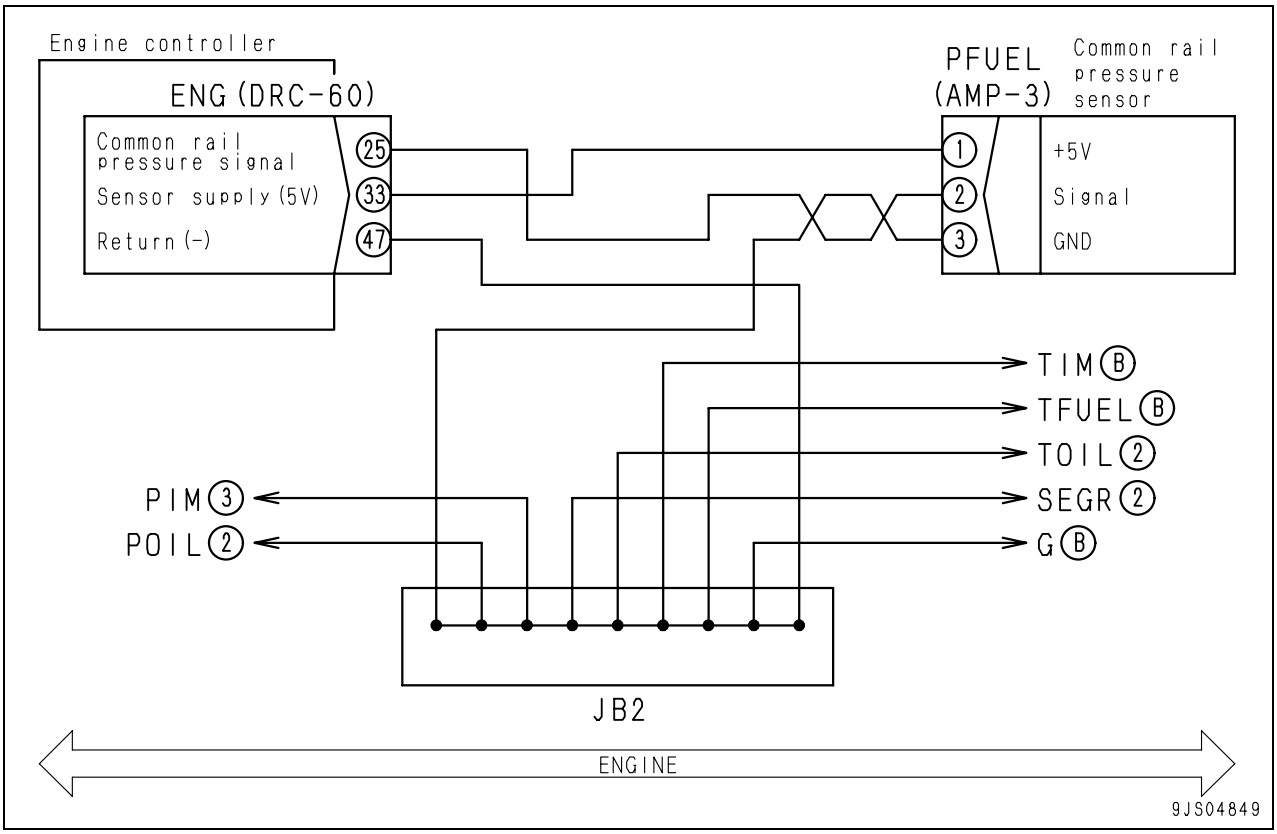
Failure code [CA451] (Common rail pressure sensor high error)

Action code	Failure code	Trouble	Common rail pressure sensor high error (Engine controller system)
E03	**CA451**		
Contents of trouble	• Common rail pressure sensor circuit is abnormally high.		
Action of controller	• Limits output for travel (Limits common rail pressure) • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• The input state (common rail pressure) from the common rail pressure sensor can be checked with the monitoring function (Code: 36400). • The input state (voltage) from the common rail pressure sensor can be checked with the monitoring function (Code: 36402). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective common rail pressure sensor power system	If failure code [**CA352**] or [**CA386**] is also indicated, carry out troubleshooting for it first.			
	2	Defective common rail pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.			
			PFUEL		Voltage	
			Between (1) and (3)	Power supply	4.75 – 5.25 V	
			Between (2) and (3)	Signal	0.25 – 4.6 V	
			Sensor voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller for another cause of trouble before judgment			
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (33) – PFUEL (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (25) – PFUEL (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – PFUEL (female) (3)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (33) – PFUEL (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (25) – PFUEL (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – PFUEL (female) (3)		Resistance	Min. 1 MΩ

<table>
<tr><td rowspan="6">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Short circuit in wiring harness
(with another wiring harness)</td><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>Wiring harness between ENG (female) (33) – PFUEL (female) (1) and between ENG (female) (25) – PFUEL (female) (2)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td>Wiring harness between ENG (female) (33) – PFUEL (female) (1) and between ENG (female) (47) – PFUEL (female) (3)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Defective engine controller</td><td>Wiring harness between ENG (female) (25) – PFUEL (female) (2) and between ENG (female) (47) – PFUEL (female) (3)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.</td></tr>
<tr><td colspan="3"><table><tr><td>ENG</td><td>Voltage</td></tr><tr><td>Between (33) and (47)</td><td>4.75 – 5.25 V</td></tr><tr><td>Between (25) and (47)</td><td>0.25 – 4.6 V</td></tr></table></td></tr>
</table>

Circuit diagram related to common rail pressure sensor



Failure code [CA452] (Common rail pressure sensor low error)

Action code	Failure code	Trouble	Common rail pressure sensor low error (Engine controller system)
E03	**CA452**		
Contents of trouble	• Common rail pressure sensor circuit is abnormally low.		
Action of controller	• Limits output and continues operation (limits common rail pressure). • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output lowers.		
Related information	• The input state (common rail pressure) from the common rail pressure sensor can be checked with the monitoring function (Code: 36400). • The input state (voltage) from the common rail pressure sensor can be checked with the monitoring function (Code: 36402). • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA451**].	

Failure code [CA553] (Common rail pressure high error 1)

Action code	Failure code	Trouble	Common rail pressure high error 1 (Engine controller system)
E03	**CA553**		
Contents of trouble	• There is high pressure error (level 1) in common rail pressure sensor circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine			
Related information	• The input state (common rail pressure) from the common rail pressure sensor can be checked with the monitoring function (Code: 36400). • The input state (voltage) from the common rail pressure sensor can be checked with the monitoring function (Code: 36402). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.
	2	Use of improper fuel	Fuel used may be improper. Check it directly. (Viscosity is high)
	3	Defective electrical system of common rail pressure sensor	Electrical system of common rail pressure sensor may be defective. Carry out troubleshooting for failure code [**CA451**].
	4	Defective mechanical system of common rail pressure sensor	Mechanical system of common rail pressure sensor may be defective. Check it directly.
	5	Defective overflow valve	Spring damage, seat wear, or ball stuck of overflow valve is suspected. Check it directly.
	6	Clogged overflow pipe	Overflow pipe may be clogged. Check it directly.
	7	Defective pressure limiter	Pressure limiter may be damaged mechanically. Check it directly.

Failure code [CA559] (Supply pump pressure very low error)

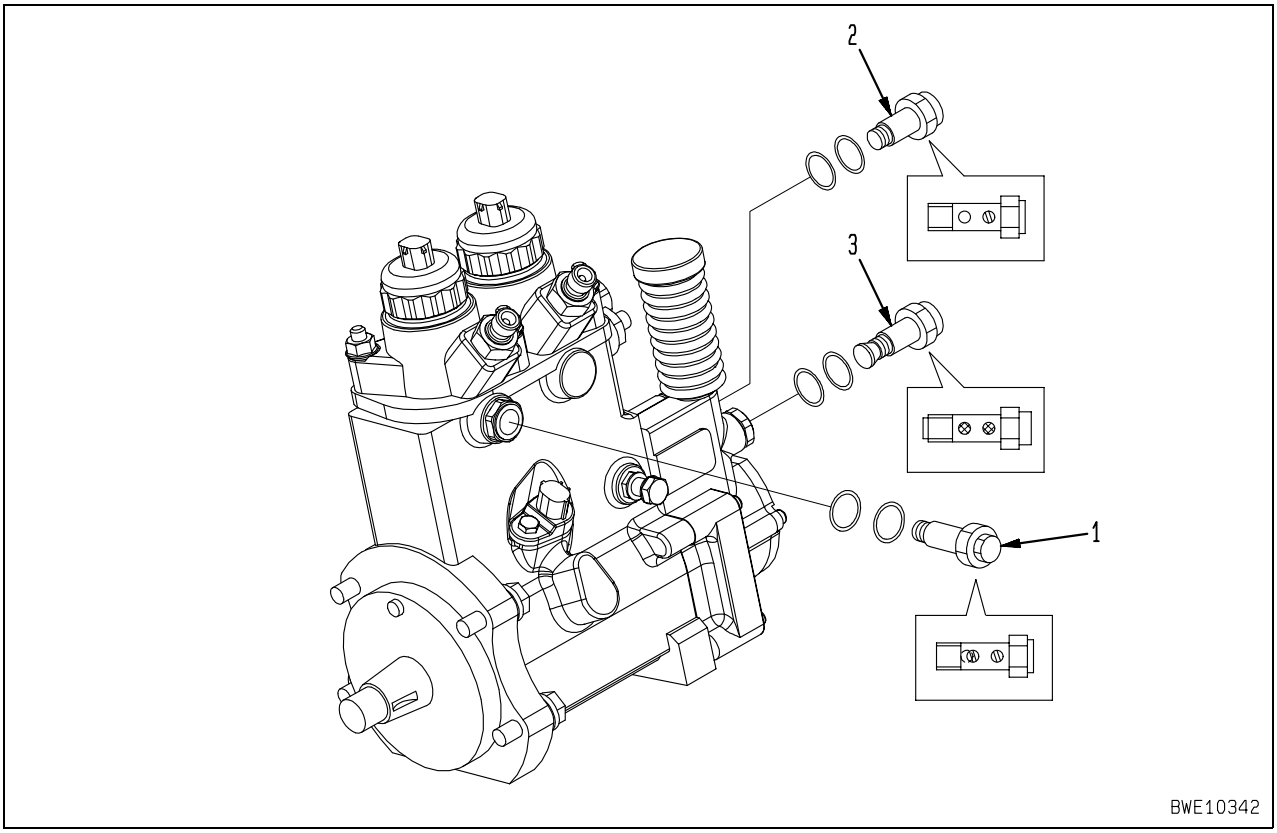
Action code	Failure code	Trouble	Supply pump no-pressure feed error 1 (Engine controller system)
E03	**CA559**		
Contents of trouble	• There is no-pressure feed error (level 1) in supply pump.		
Action of controller	• Limits common rail pressure. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output lowers.		
Related information	• The input state (common rail pressure) from the common rail pressure sensor can be checked with the monitoring function (Code: 36400). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.	
	2	Use of improper fuel	Fuel used may be improper. Check it directly.	
	3	Defect in low pressure circuit parts	★ For more information on troubleshooting, see Note 1. For check of pressure in fuel low pressure circuit, see Testing and adjusting, “Testing fuel pressure”.	
			Pressure in fuel low-pressure circuit	Min. 0.15 MPa {Min. 1.5 kg/cm^2}
	4	Clogged fuel filter, strainer	★ For more information on troubleshooting, see Note 2.	
	5	Defective electrical system of supply pump PCV	Electrical system of supply pump PCV may be defective. Carry out troubleshooting for failure code [**CA271**], [**CA272**], [**CA273**], or [**CA274**].	
	6	Defective common rail pressure sensor	Mechanical system of common rail pressure sensor may be defective. Check whether wiring harness is damaged.	
	7	Defective pressure limiter	★ For check of leakage through pressure limiter, see Testing and adjusting, “Testing fuel return rate and leakage”.	
			Leakage through pressure limiter	Max. 10 cc/min (at full stall or relief)
	8	Defective injector	★ For check of limited return rate (spill) from injector, see Testing and adjusting, “Testing fuel return rate and leakage”.	
			Speed at rated operation (stall load)	Limited return (spill) rate from injector
			1,600 rpm	960 cc/min
			1,700 rpm	1,020 cc/min
			1,800 rpm	1,080 cc/min
			1,900 rpm	1,140 cc/min
			2,000 rpm	1,200 cc/min
	9	Defective supply pump	If causes 1 – 8 are not the cause of the trouble, supply pump may be defective.	

<Using check sheet>
While carrying out troubleshooting above, record troubleshooting contents on the “Check sheet for no-pressure feed” attached separately.

Note 1: When low-pressure circuit is defective, check the following:
1) Fuel level
2) Clogged fuel tank breather
3) Stuck or worn feed pump, clogged filter
4) Leaked or clogged low-pressure fuel pipe
5) Bypass valve malfunction, defective assembly of other parts (See Fig.1.)
6) Clogged fuel filter
7) Fuel in oil pan (fuel leakage in head cover)

Fig. 1: Locations of overflow valve (1), bypass valve (2), and fuel inlet joint (3)
- Overflow valve (1): Spring is seen through both holes.
- Bypass valve (2): Spring is seen through hole on nut side.
- Fuel inlet joint (3): Gauze filter is seen through both holes.



Note 2: Check, clean, and replace the filters and strainers according to the following procedure.
1) Gauze filter: Disassemble and check. If clogged, clean.
2) Upstream strainer of gauze filter: If the gauze filter is clogged, clean the upstream filter, too.
3) Fuel filter: If the trouble is not solved by performing 1) and 2) above, replace the fuel filter.

Check sheet for no-pressure feed

Machine model		Working No.	
Model serial No.	#	Checked on	/ /
Engine		Service meter	h
Engine serial No.	#	Worker name	

A. Visual check		Good	Bad
1	Fuel leakage to outside		
2	Clogged fuel tank breather		

B. Check with machine monitor (Abnormality record, monitoring, cylinder cut-out operation)

			Good	Bad
3	Checking error and failure codes	/ / / /		

Checking monitoring information

	Code	Display item	Check conditions	Unit	Standard value (Reference value)	Measured value	Good	Bad
4	01002	Engine speed	Low idle	rpm	800 ± 25			
			High idle	rpm	2,000 ± 50			
			Full stall (P-mode)	rpm	1,680 ± 100			
	31701	Position of accelerator pedal	Low idle	%	0			
			High idle	%	100			
	36200	Common rail pressure command	Rating or equivalent	MPa				
	36400	Common rail fuel pressure	Rating or equivalent	MPa				
	36300	Injection timing command	Low idle	CA	—		—	—
			High idle	CA	—		—	—
			Rating or equivalent	CA	—		—	—
	36500	Boost pressure	Rating or equivalent	kPa {mmHg}	Min. 147 {Min. 1,100}		—	—
	04104	Engine coolant temperature	Low idle	°C	—		—	—
	04204	Fuel temperature	Low idle	°C	—		—	—

Checking cylinder cut-out operation (Engine speed)

	Function	Cut-out cylinder	Check conditions	Unit	Standard value (Reference value)	Measured value	Good	Bad
5	Cylinder cut-out function	Cylinder 1	Low idle	rpm	—		—	—
		Cylinder 2	Low idle	rpm	—		—	—
		Cylinder 3	Low idle	rpm	—		—	—
		Cylinder 4	Low idle	rpm	—		—	—
		Cylinder 5	Low idle	rpm	—		—	—
		Cylinder 6	Low idle	rpm	—		—	—

C. Checking fuel circuit pressure		Check conditions	Unit	Standard value (Reference value)	Measured value	Good	Bad
6	Pressure in fuel low-pressure circuit	High idle	MPa {kg/cm^2}	Min. 0.15 {Min. 1.5}			

D. Checking strainer, filter		Good	Bad
7	Visual check of strainer		
8	Visual check of gauze filter		
9	Visual check of fuel filter		
10	Visual check of bypass valve		

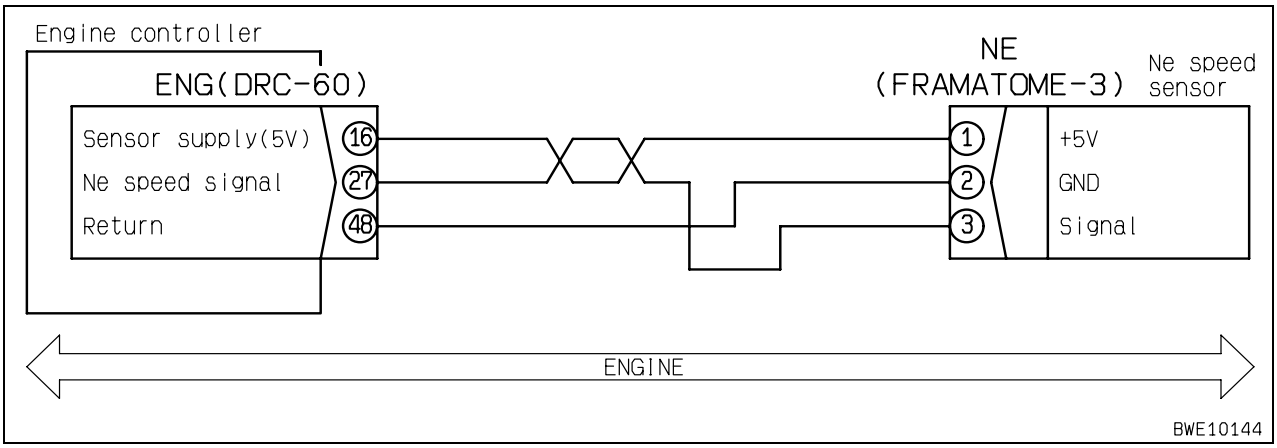
E. Checking leakage and fuel return rate		Check conditions	Unit	Standard value (Reference value)	Measured value	Good	Bad
11	Leakage through pressure limiter	No load, full stall, or relief	cc/min	Max. 10			
12	Return rate from injector	Rating or equivalent <by model> 1,600 rpm	cc/min	960	Speed:		
		Rating or equivalent <by model> 1,700 rpm	cc/min	1,020			
		Rating or equivalent <by model> 1,800 rpm	cc/min	1,080	Return rate:		
		Rating or equivalent <by model> 1,900 rpm	cc/min	1,140			
		Rating or equivalent <by model> 2,000 rpm	cc/min	1,200			

Failure code [CA689] (Engine Ne speed sensor error)

Action code	Failure code	Trouble	Engine Ne speed sensor error (Engine controller system)
E03	**CA689**		
Contents of trouble	• Error was detected in engine Ne speed sensor circuit.		
Action of controller	• Operates the engine with signal from engine Bkup speed sensor. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine stops during operations. (When engine Bkup speed sensor is also defective) • Engine cannot be started during operations. (When engine Bkup speed sensor is also defective)		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power supply system	If failure code [**CA238**] is displayed, carry out troubleshooting for it first.		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENGINE (female) (16) – NE (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENGINE (female) (48) – NE (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between ENGINE (female) (27) – NE (female) (3)	Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (16) – NE (female) (1)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (48) – NE (female) (2)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (27) – NE (female) (3)	Resistance	Min. 1 MΩ
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (16) – NE (female) (1) and between ENG (female) (48) – NE (female) (2)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (16) – NE (female) (1) and between ENG (female) (27) – NE (female) (3)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (48) – NE (female) (2) and between ENG (female) (27) – NE (female) (3)	Resistance	Min. 1 MΩ
	5	Defective engine Ne speed sensor	If causes 1 – 4 are not the cause of the trouble, engine Ne speed sensor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		
	6	Defective engine controller	If causes 1 – 4 are not the cause of the trouble, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to engine Ne speed sensor



Failure code [CA731] (Engine Bkup speed sensor phase error)

Action code	Failure code	Trouble	Engine Bkup speed sensor phase error (Engine controller system)
E03	**CA731**		
Contents of trouble	• There is phase error in engine Bkup speed sensor circuit.		
Action of controller	• Controls the engine with signal from engine Ne speed sensor. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine stops during operations. (When engine Ne speed sensor is also defective) • Engine cannot be started during operations. (When engine Ne speed sensor is also defective)		
Related information	• Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective engine Ne speed sensor system	Engine Ne speed sensor may be defective. Carry out troubleshooting for failure code [**CA689**].
	2	Defective engine Bkup speed sensor system	Engine Bkup speed sensor may be defective. Carry out troubleshooting for failure code [**CA778**].

Failure code [CA757] (All continuous data lost error)

Action code	Failure code	Trouble	All continuous data lost error (Engine controller system)
E03	**CA757**		
Contents of trouble	• All data in engine controller are lost.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Operations are continued, but engine may stop during operations or may not start in stopped state.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

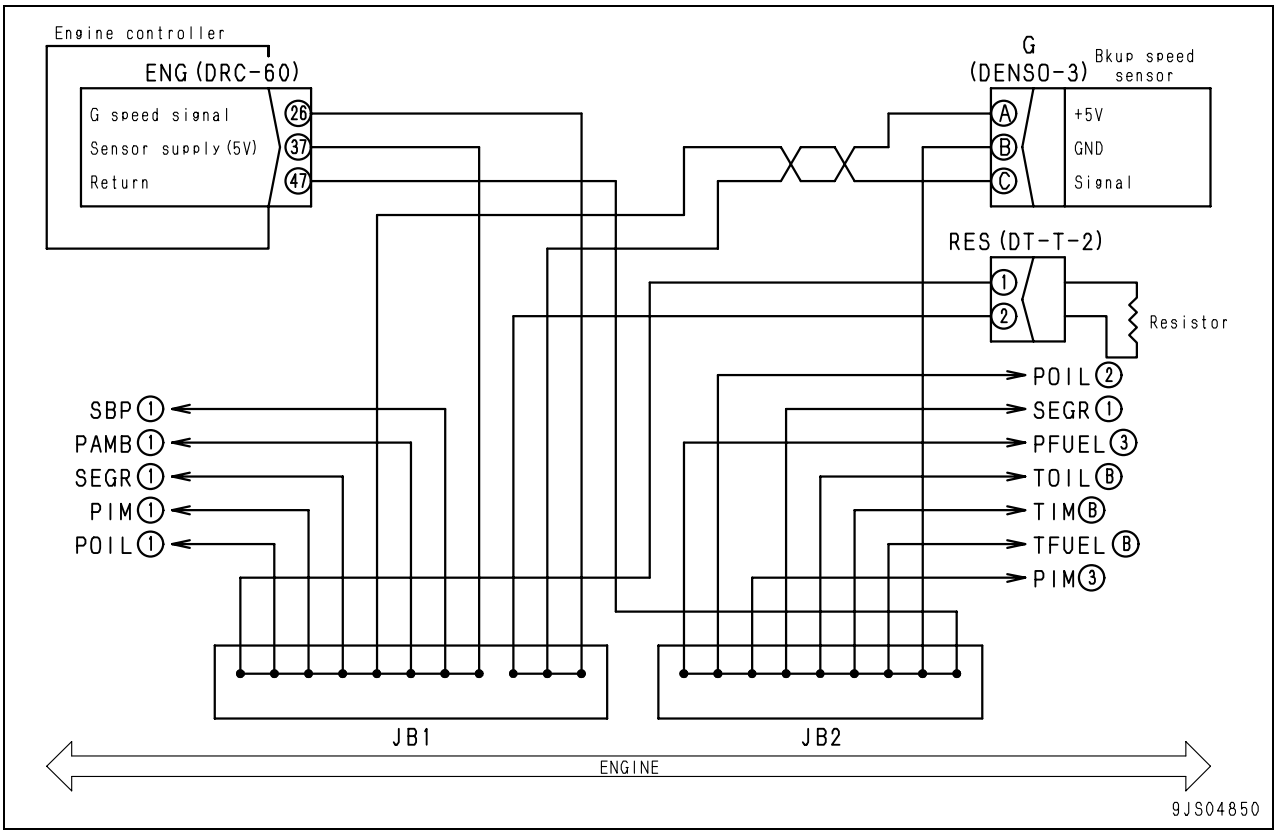
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA111**].	

Failure code [CA778] (Engine Bkup speed sensor error)

Action code	Failure code	Trouble	Engine Bkup speed sensor error (Engine controller system)
E03	**CA778**		
Contents of trouble	• Error was detected in engine Bkup speed sensor circuit.		
Action of controller	• Operates the engine with signal from engine Ne speed sensor. • Limits output and continues operation. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine stops during operations. (When engine Ne speed sensor is also defective) • Engine cannot be started during operations. (When engine Ne speed sensor is also defective)		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power supply system	If failure code [**CA187**] or [**CA227**] is displayed, carry out troubleshooting for it first.		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (37) – G (female) (A)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – G (female) (B)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (26) – G (female) (C)	Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (37) – G (female) (A)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – G (female) (B)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (26) – G (female) (C)	Resistance	Min. 1 MΩ
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (37) – G (female) (A) and between ENG (female) (47) – G (female) (B)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (37) – G (female) (A) and between ENG (female) (26) – G (female) (C)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – G (female) (B) and between ENG (female) (29) – G (female) (C)	Resistance	Min. 1 MΩ
	5	Defective engine Bkup speed sensor	If causes 1 – 4 are not the cause of the trouble, engine Bkup speed sensor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		
	6	Defective engine controller	If causes 1 – 4 are not the cause of the trouble, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to engine Bkup speed sensor



Failure code [CA1228] (EGR valve servo error 1)

Action code	Failure code	Trouble	EGR valve servo error 1 (Engine controller system)
E03	**CA1228**		
Contents of trouble	• There is servo error (level 1) of EGR valve.		
Action of controller	• Performs open control. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine			
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.	
	2	Defective engine oil pressure system (main circuit)	★ For check of engine oil pressure, see Testing and adjusting, “Testing engine oil pressure”.	
			Engine	Engine oil pressure
			Low idle	0.08 MPa {0.8 kg/cm^2}
			High idle	0.21 MPa {2.1 kg/cm^2}
			If engine oil pressure is not normal, carry out troubleshooting (S-mode) for mechanical system. (S-12 Oil pressure lowers.)	
	3	Defective EGR valve oil pump	Oil pump or relief valve for EGR valve circuit may be defective. Check it directly.	
	4	Defective EGR valve oil pressure supply piping	[ ]Oil pressure supply piping for EGR valve circuit may be defective. Check it directly.	
	5	Defective EGR valve oil pressure return piping	Oil pressure return piping for EGR valve circuit may be defective. Check it directly.	
	6	Defective EGR valve	EGR valve may be damaged mechanically. Check it directly.	
	7	Defective engine controller	If causes 1 – 6 are not the cause of the trouble, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)	

Failure code [CA1625] (EGR valve servo error 2)

Action code	Failure code	Trouble	EGR valve servo error 2 (Engine controller system)
E03	**CA1625**		
Contents of trouble	• There is servo error (level 2) of EGR valve.		
Action of controller	• Limits output and continues operation. • Close EGR and bypass valves. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

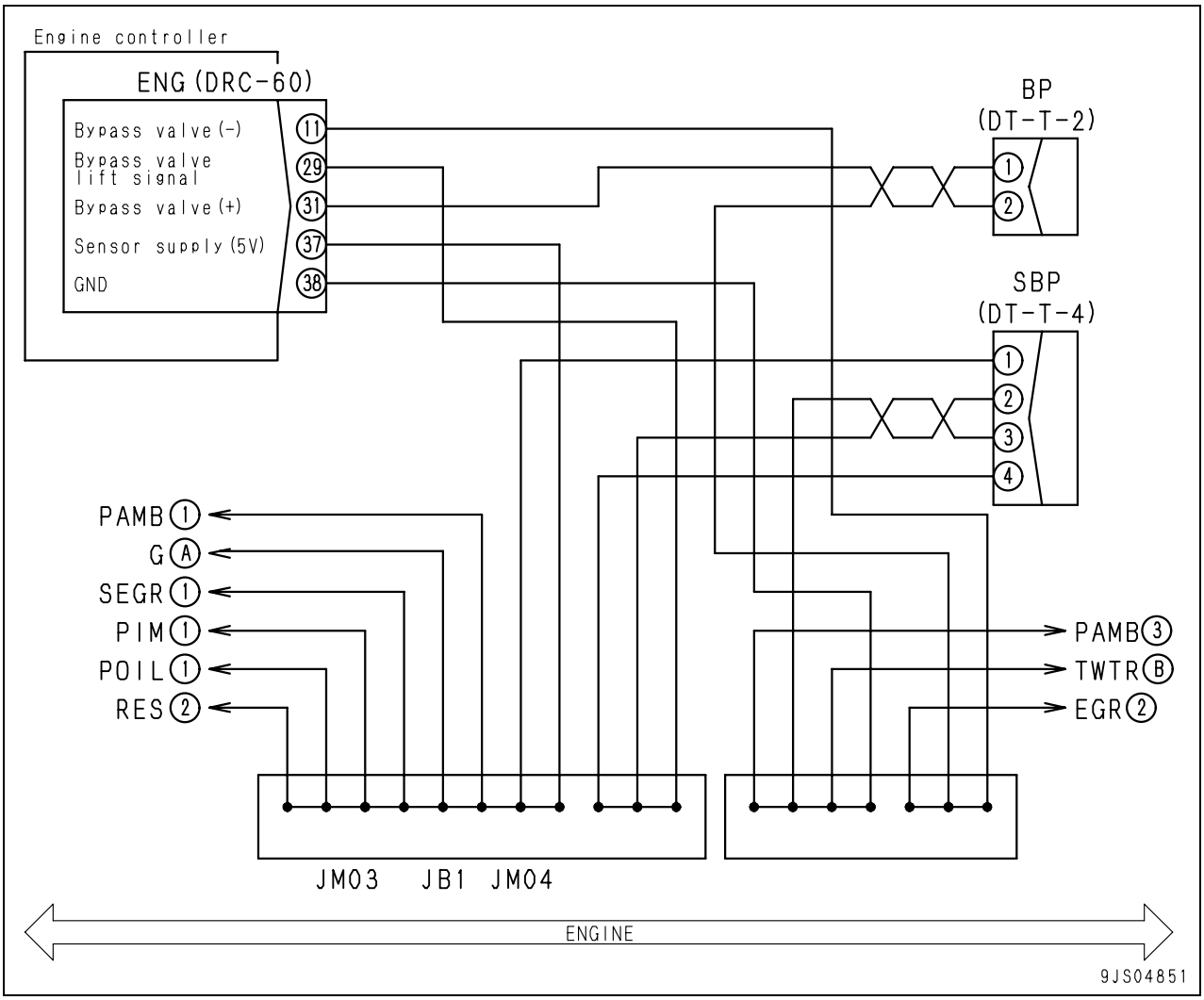
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA1228**].	

Failure code [CA1626] (Bypass valve solenoid current high error)

Action code	Failure code	Trouble	Bypass valve solenoid current high error (Engine controller system)
E03	**CA1626**		
Contents of trouble	• High current was detected in drive circuit of bypass valve solenoid.		
Action of controller	• Limits output and continues operation. • Close EGR and bypass valves. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective bypass valve solenoid (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			BP (male)	Resistance	
			Between (1) and (2)	10 – 21 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (31) – BP (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (11) – BP (female) (2)	Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (31) – BP (female) (1)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (11) – BP (female) (2)	Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between ENG (female) (31) – BP (female) (1)	Voltage	Max. 1 V
			Wiring harness between ENG (female) (11) – BP (female) (2)	Voltage	Max. 1 V
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ENG (female)	Resistance	
			Between (31) and (11)	10 – 21 Ω	

Circuit diagram related to bypass valve solenoid & lift sensor



Failure code [CA1627] (Bypass valve solenoid current low error)

Action code	Failure code	Trouble	Bypass valve solenoid drive circuit disconnection error (Engine controller system)
E03	**CA1627**		
Contents of trouble	• Disconnection error was detected in drive circuit of bypass valve solenoid.		
Action of controller	• Limits output and continues operation. • Close EGR and bypass valves. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA1626**].	

Failure code [CA1628] (Bypass valve servo error 1)

Action code	Failure code	Trouble	Bypass valve servo error 1 (Engine controller system)
E03	**CA1628**		
Contents of trouble	• There is servo error (level 1) of bypass valve.		
Action of controller	• Performs open control. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine			
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.	
	2	Defective engine oil pressure system (main circuit)	★ For check of engine oil pressure, see Testing and adjusting, “Testing engine oil pressure”.	
			Engine	Engine oil pressure
			Low idle	0.08 MPa {0.8 kg/cm^2}
			High idle	0.21 MPa {2.1 kg/cm^2}
			If engine oil pressure is not normal, carry out troubleshooting (S-mode) for mechanical system. (S-12 Oil pressure drops)	
	3	Defective bypass valve oil pump	Oil pump or relief valve for bypass valve circuit may be defective. Check it directly.	
	4	Defective bypass valve oil pressure supply piping	Oil pressure supply piping for bypass valve circuit may be defective. Check it directly.	
	5	Defective bypass valve oil pressure return piping	Oil pressure return piping for bypass valve circuit may be defective. Check it directly.	
	6	Defective bypass valve	Bypass valve may be damaged mechanically. Check it directly.	
	7	Defective engine controller	If causes 1 – 6 are not the cause of the trouble, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)	

Failure code [CA1629] (Bypass valve servo error 2)

Action code	Failure code	Trouble	Bypass valve servo error 2 (Engine controller system)
E03	**CA1629**		
Contents of trouble	• There is servo error (level 2) of bypass valve.		
Action of controller	• Limits output and continues operation. • Close EGR and bypass valves. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA1628**].	

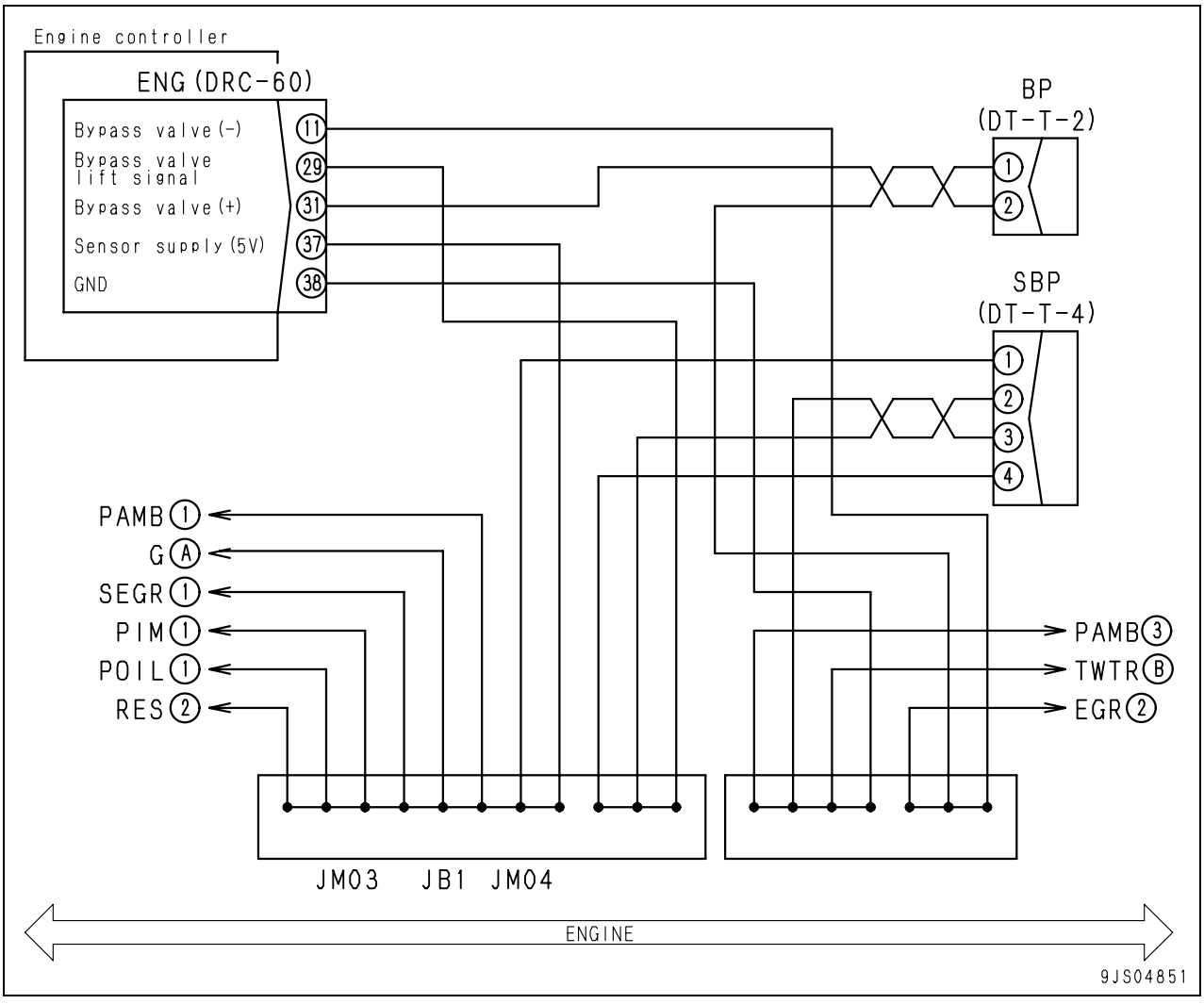
Failure code [CA1631] (Bypass valve lift sensor high error)

Action code	Failure code	Trouble	Bypass valve lift sensor high error (Engine controller system)
E03	**CA1631**		
Contents of trouble	• Bypass valve lift sensor circuit is abnormally high.		
Action of controller	• Limits output and continues operation. • Close EGR and bypass valves. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output lowers.		
Related information	• The input state (position: mm) from the bypass valve lift sensor can be checked with the monitoring function (Code: 18200). • The input state (voltage) from the bypass valve lift sensor can be checked with the monitoring function (Code: 18202). • Method of reproducing failure code: Start engine		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power supply system	If failure code [**CA187**] or [**CA227**] is displayed, carry out troubleshooting for it first.		
	2	Defective bypass valve lift sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.		
			SBP		Voltage
			Between (1) and (2)	Voltage	4.75 – 5.25 V
			Sensor voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller for another cause of trouble before judgment		
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (37) – SBP (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (38) – SBP (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (29) – SBP (female) (3), (4)	Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (37) – SBP (female) (1)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (38) – SBP (female) (2)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (29) – SBP (female) (3), (4)	Resistance	Min. 1 MΩ

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENG (female) (37) – SBP (female) (1) and between ENG (female) (38) – SBP (female) (2)	Resistance	Min. 1 MΩ	
			Wiring harness between ENG (female) (37) – SBP (female) (1) and between ENG (female) (29) – SBP (female) (3), (4)	Resistance	Min. 1 MΩ	
			Between wiring harness of ENG (female) (38) – SBP (female) (2) and between ENG (female) (29) – SBP (female) (3), (4)	Resistance	Min. 1 MΩ	
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.			
			ENG	Voltage		
			Between (37) and (38)	4.75 – 5.25 V		

Circuit diagram related to bypass valve solenoid & lift sensor



Failure code [CA1632] (Bypass valve lift sensor low error)

Action code	Failure code	Trouble	Bypass valve lift sensor low error (Engine controller system)
E03	**CA1632**		
Contents of trouble	• Bypass valve lift sensor circuit is abnormally low.		
Action of controller	• Limits output and continues operation. • Close EGR and bypass valves. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output lowers.		
Related information	• The input state (position: mm) from the bypass valve lift sensor can be checked with the monitoring function (Code: 18200). • The input state (voltage) from the bypass valve lift sensor can be checked with the monitoring function (Code: 18202). • Method of reproducing failure code: Start engine		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA1631**].	

Failure code [CA1633] (KOMNET datalink timeout error)

Action code	Failure code	Trouble	KOMNET datalink timeout error (Engine controller system)
E03	**CA1633**		
Contents of trouble	• There is error in KOMNET communication circuit with applicable machine.		
Action of controller	• Operates in default mode or holds the state set when error occurred. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine			
Related information	• Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Carry out troubleshooting for failure code [**DB2RKR**].	

WA600-6 Wheel loader

Form No. SEN00560-00

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Printed in Japan 01-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 4

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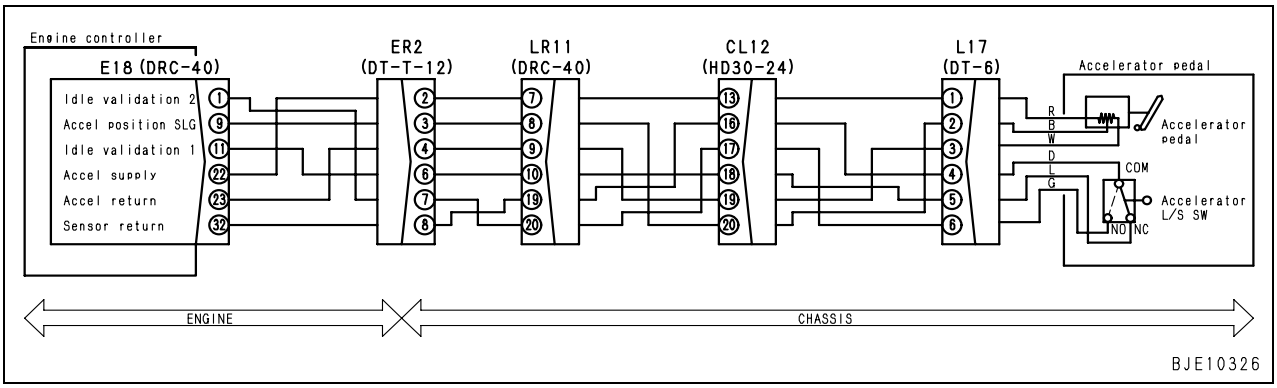
Troubleshooting by failure code (Display of code), Part 4

Failure code [CA2185] (Throttle sensor supply voltage high error)

Action code	Failure code	Trouble	Throttle sensor supply voltage high error (Engine controller system)
E03	**CA2185**		
Contents of trouble	• Voltage of throttle sensor power supply (5V) circuit is high.		
Action of controller	• Runs the engine at position of throttle 0% when accelerator pedal is OFF and at 50% when it is ON. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• The engine does not reach full throttle.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective accelerator pedal (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Disconnect device suggested on the right. At this time, if failure code is not indicated, the device is defective.	Accelerator pedal	L17 connector	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between E18 (female) (22) – L17 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between E18 (female) (23) – L17 (female) (3)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between E18 (female) (22) – L17 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between E18 (female) (23) – L17 (female) (3)		Resistance	Min. 1 MΩ
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between E18 (female) (22) – L17 (female) (1) and E18 (female) (23) – L17 (female) (3)		Resistance	Min. 1 MΩ
	5	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			E18	Voltage		
			Between (22) and (23)	4.75 – 5.25 V		

Circuit diagram related to throttle sensor



Failure code [CA2186] (Throttle sensor power supply low error)

Action code	Failure code	Trouble	Throttle sensor power supply low error (Engine controller system)
E03	**CA2186**		
Contents of trouble	• Voltage of throttle sensor power supply (5V) circuit is low.		
Action of controller	• Runs the engine at position of throttle 0% when accelerator pedal is OFF and at 50% when it is ON. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine does not reach full throttle.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out trouble shooting for failure code [**CA2185**].	

Failure code [CA2249] (Supply pump pressure very low error 2)

Action code	Failure code	Trouble	Supply pump pressure very low error 2 (Engine controller system)
E03	**CA2249**		
Contents of trouble	• There is no-pressure feed error (level 2) in supply pump.		
Action of controller	• Limits common rail pressure. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• The input state (common rail pressure) from the common rail pressure sensor can be checked with the monitoring function (Code: 36400). • The input state (voltage) from the common rail pressure sensor can be checked with the monitoring function (Code: 36402). • Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out trouble shooting for failure code [**CA559**].	

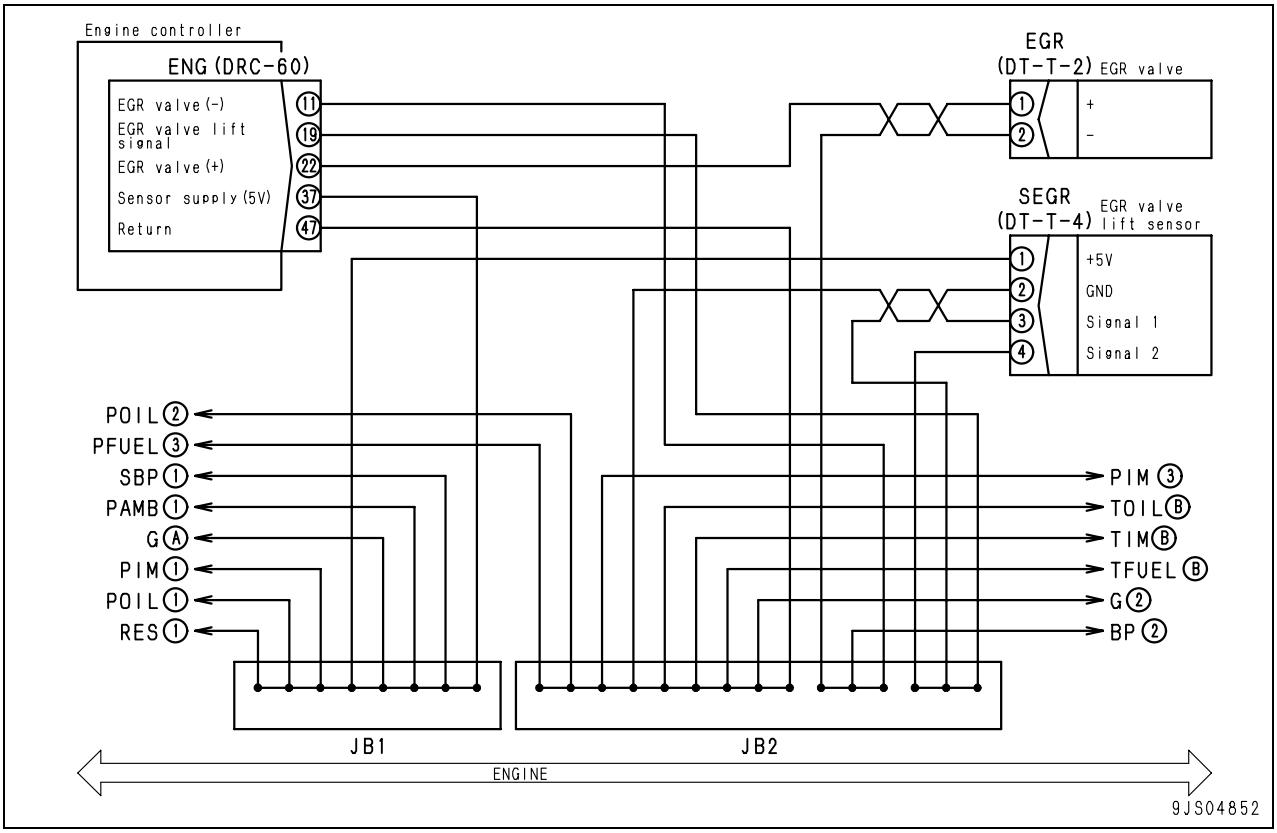
Failure code [CA2271] (EGR valve lift sensor high error)

Action code	Failure code	Trouble	EGR valve lift sensor high error (Engine controller system)
E03	**CA2271**		
Contents of trouble	• EGR valve lift sensor circuit is abnormally high.		
Action of controller	• Limits output and continues operation. • Closes EGR valve. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• The input state (position: mm) from the EGR valve lift sensor can be checked with the monitoring function (Code: 18100). • The input state (voltage) from the EGR valve lift sensor can be checked with the monitoring function (Code: 18101). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power supply system	If failure code [**CA187**] or [**CA227**] is also indicated, carry out troubleshooting for it first.		
	2	Defective EGR valve lift sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.		
			SEGR		Voltage
			Between (1) and (2)	Power supply	4.75 – 5.25 V
			Sensor voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.		
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (37) – SEGR (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – SEGR (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (19) – SEGR (female) (3), (4)	Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (37) – SEGR (female) (1)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – SEGR (female) (2)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (19) – SEGR (female) (3), (4)	Resistance	Min. 1 MΩ

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (37) – SEGR (female) (1) and ENG (female) (47) – SEGR (female) (2)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (37) – SEGR (female) (1) and ENG (female) (19) – SEGR (female) (3), (4)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – SEGR (female) (2) and ENG (female) (19) – SEGR (female) (3), (4)	Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.		
			ENG	Voltage	
			Between (37) and (47)	4.75 – 5.25 V	

Circuit diagram related to EGR valve solenoid & lift sensor



Failure code [CA2272] (EGR valve lift sensor low error)

Action code	Failure code	Trouble	EGR valve lift sensor low error (Engine controller system)
E03	**CA2272**		
Contents of trouble	• EGR valve lift sensor circuit is abnormally low.		
Action of controller	• Limits output and continues operation. • Closes EGR valve. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• The input state (position: mm) from the EGR valve lift sensor can be checked with the monitoring function (Code: 18100). • The input state (voltage) from the EGR valve lift sensor can be checked with the monitoring function (Code: 18101). • Method of reproducing failure code: Start engine.		

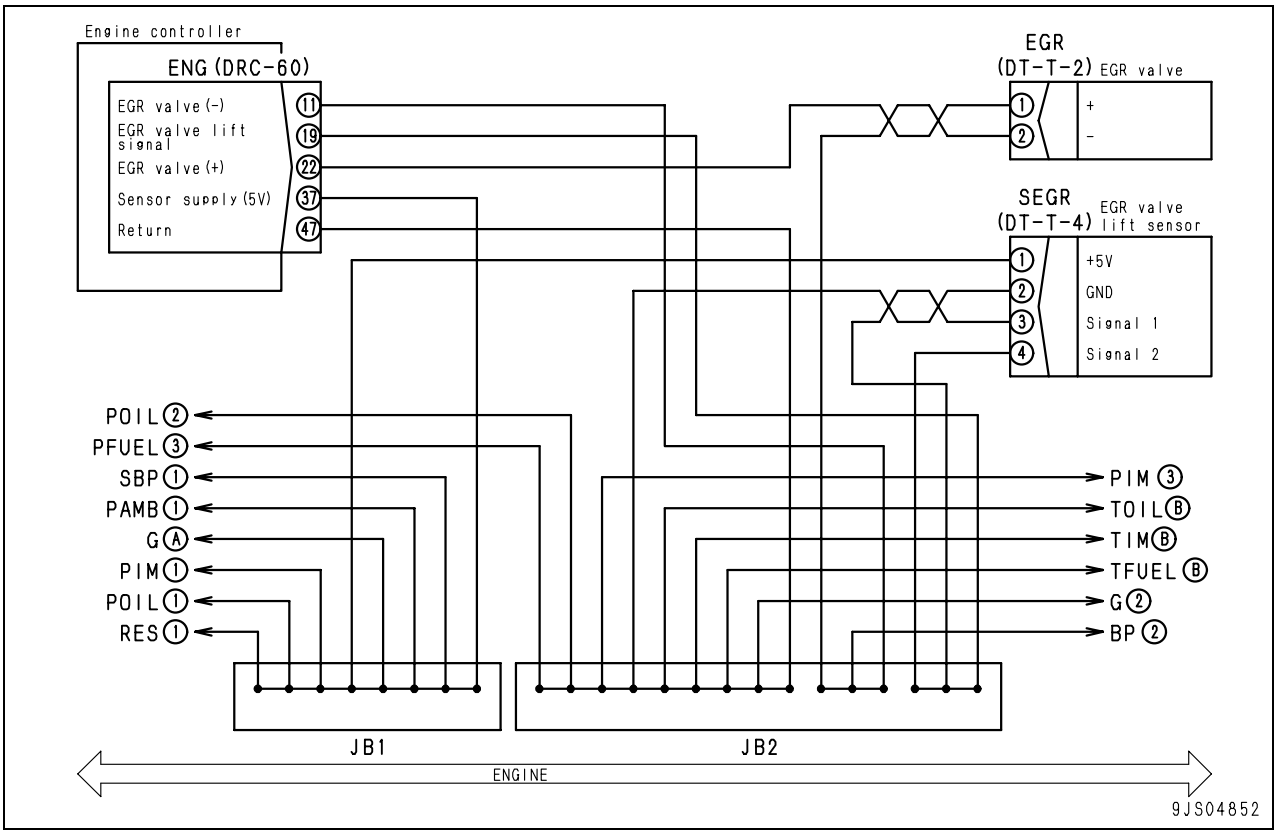
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out trouble shooting for failure code [**CA2271**].	

Failure code [CA2351] (EGR valve solenoid operation short circuit)

Action code	Failure code	Trouble	EGR valve solenoid operation short circuit error (Engine controller system)
E03	**CA2351**		
Contents of trouble	• High current was detected in drive circuit of EGR valve solenoid.		
Action of controller	• Limits output and continues operation. • Closes EGR valve. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective EGR valve solenoid (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			EGR (male)	Resistance	
			Between (1) and (2)	10 – 21 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (22) – EGR (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (11) – EGR (female) (2)	Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (22) – EGR (female) (1)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (11) – EGR (female) (2)	Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between ENG (female) (22) – EGR (female) (1)	Voltage	Max. 1 V
			Wiring harness between ENG (female) (11) – EGR (female) (2)	Voltage	Max. 1 V
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ENG (female)	Resistance	
			Between (22) and (11)	10 – 21Ω	

Circuit diagram related to EGR valve solenoid & lift sensor



Failure code [CA2352] (EGR valve solenoid operation disconnect)

Action code	Failure code	Trouble	EGR valve solenoid operation disconnection error (Engine controller system)
E03	**CA2352**		
Contents of trouble	• Disconnection error was detected in drive circuit of EGR valve solenoid.		
Action of controller	• Limits output and continues operation. • Closes EGR valve. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out trouble shooting for failure code [**CA2351**].	

Failure code [CA2555] (Intake heater relay voltage low error)

Action code	Failure code	Trouble	Intake heater relay voltage low error (Engine controller system)
E01	**CA2555**		
Contents of trouble	• Disconnection error was detected in intake air heater relay circuit.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine does not start easily at low temperature.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

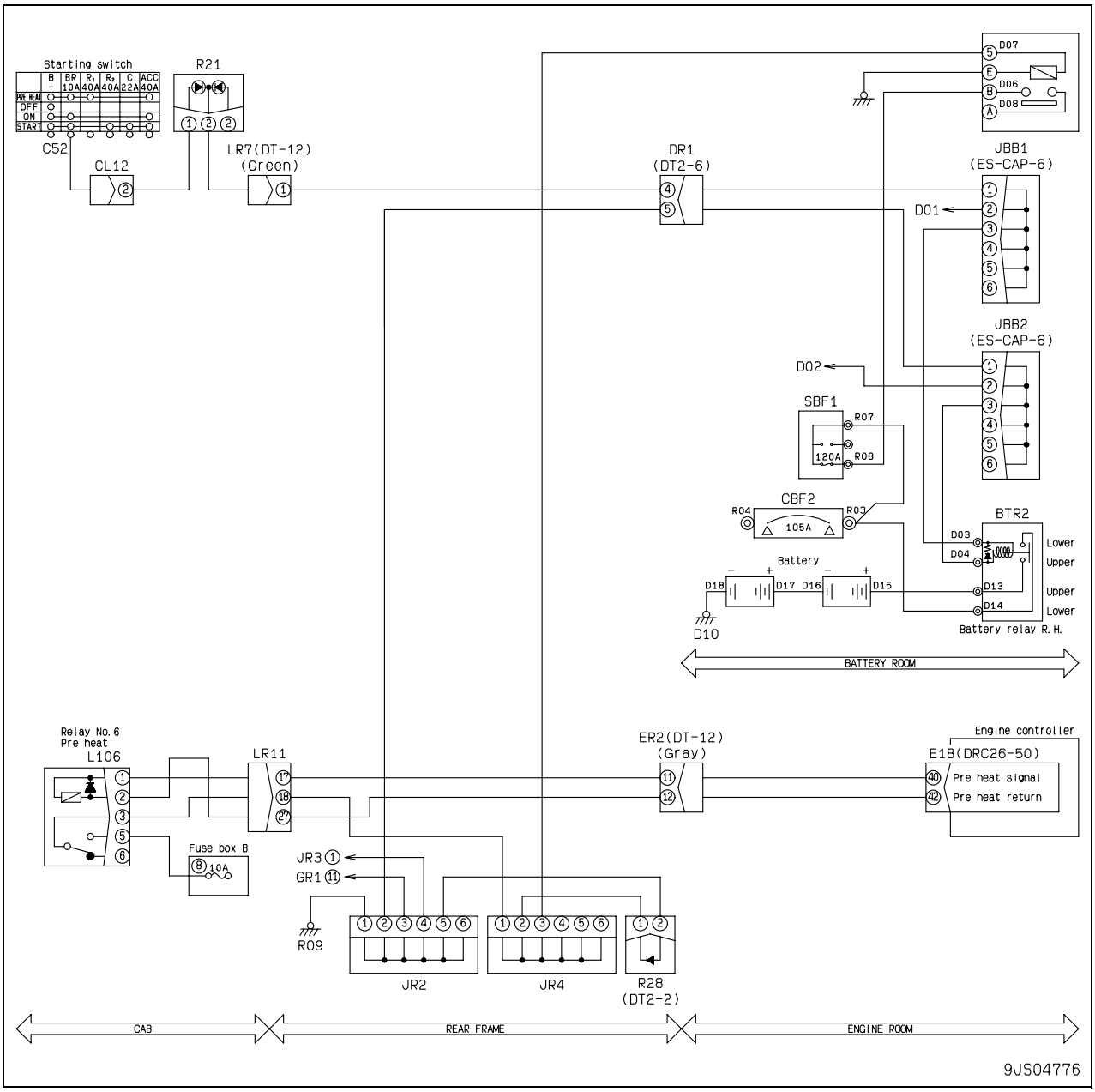
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out trouble shooting for failure code **CA2556**].	

Failure code [CA2556] (Intake heater relay voltage high error)

Action code	Failure code	Trouble	Intake heater relay voltage high error (Engine controller system)
E01	**CA2556**		
Contents of trouble	• Short circuit was detected in intake heater relay circuit.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine does not start easily at low temperature.		
Related information	• Heater relay drive conditions vary depending on applicable machine. • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective intake heater relay (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L106 (male)		Resistance	
			Between (1) and (2)		200 – 400 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between E18 (female) (40) – L106 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between E18 (female) (42) – L106 (female) (2)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between E18 (female) (40) – L106 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between E18 (female) (42) – L106 (female) (2)		Resistance	Min. 1 MΩ
	4	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			E18	Heater relay	Voltage	
			Between (40) and (42)	Operating condition	20 – 30 V	
				Stop condition	Max. 1 V	

Circuit diagram related to intake heater relay

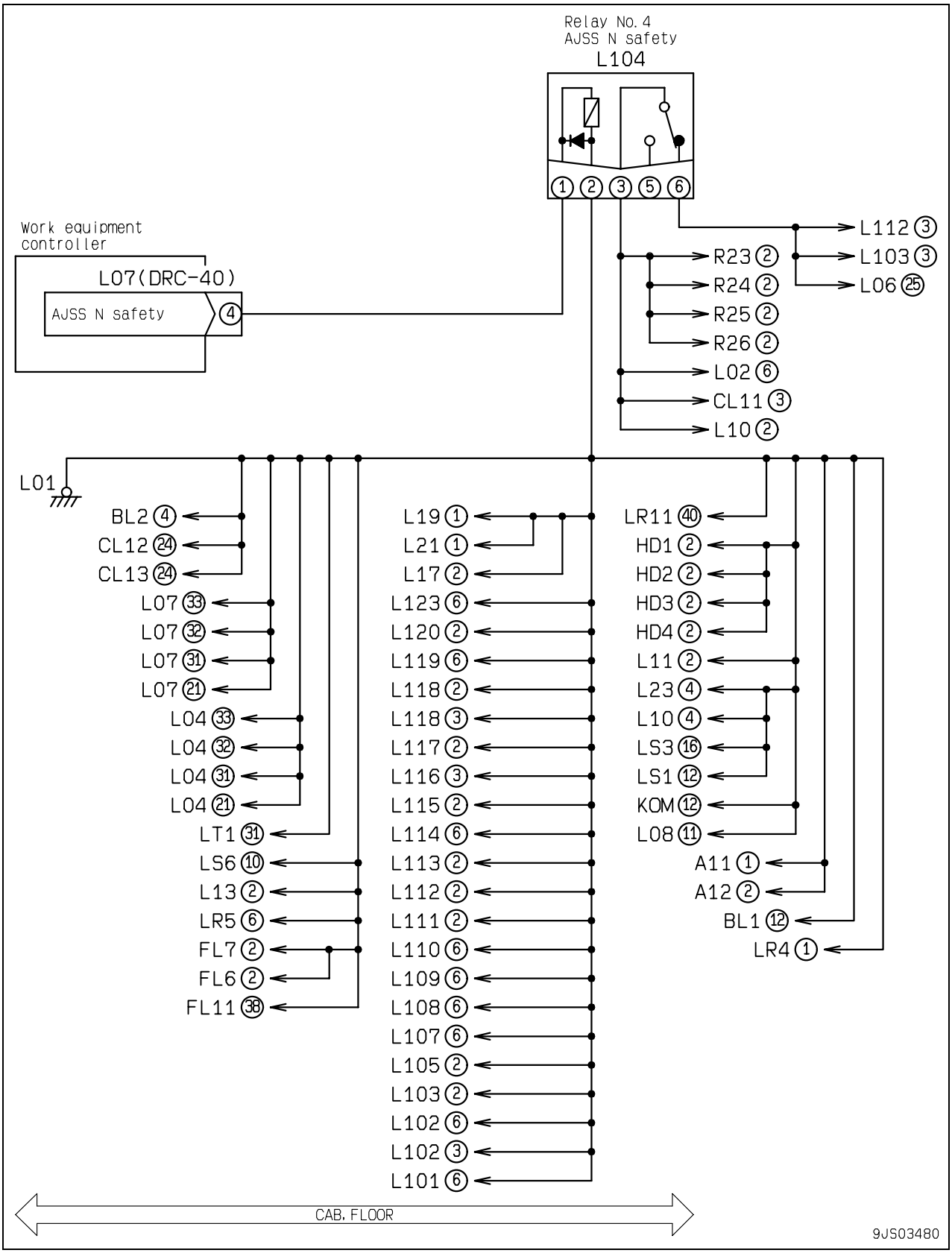


Failure code [D191KA] (AJSS neutral safety relay: Disconnection)

Action code	Failure code	Trouble	AJSS neutral safety relay: Disconnection (Work equipment controller system)
E01	**D191KA**		
Contents of trouble	• Since the AJSS neutral safety relay output system is disconnected, signals are not output to the neutral safety relay.		
Action of controller	• If cause of failure disappears, system resets itself.		
Problem that appears on machine	• While operating AJSS lever, engine can be started (Steering moves immediately after engine start.).		
Related information	• Applicable only to AJSS specification machines (if equipped) • Method of reproducing failure code: While engine is stopped, operate AJSS lever. • If the AJSS neutral position is not adjusted (initialized), the neutral safety relay does not operate.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective AJSS neutral safety relay (L104) (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L104 (male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L07 (female) (4) – L104 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between L104 (female) (2) – chassis ground	Resistance	Max. 1 Ω
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and operate AJSS lever.		
			L07	Voltage	
			Between (4) and chassis ground	20 – 30 V	

Circuit diagram related to AJSS neutral safety relay

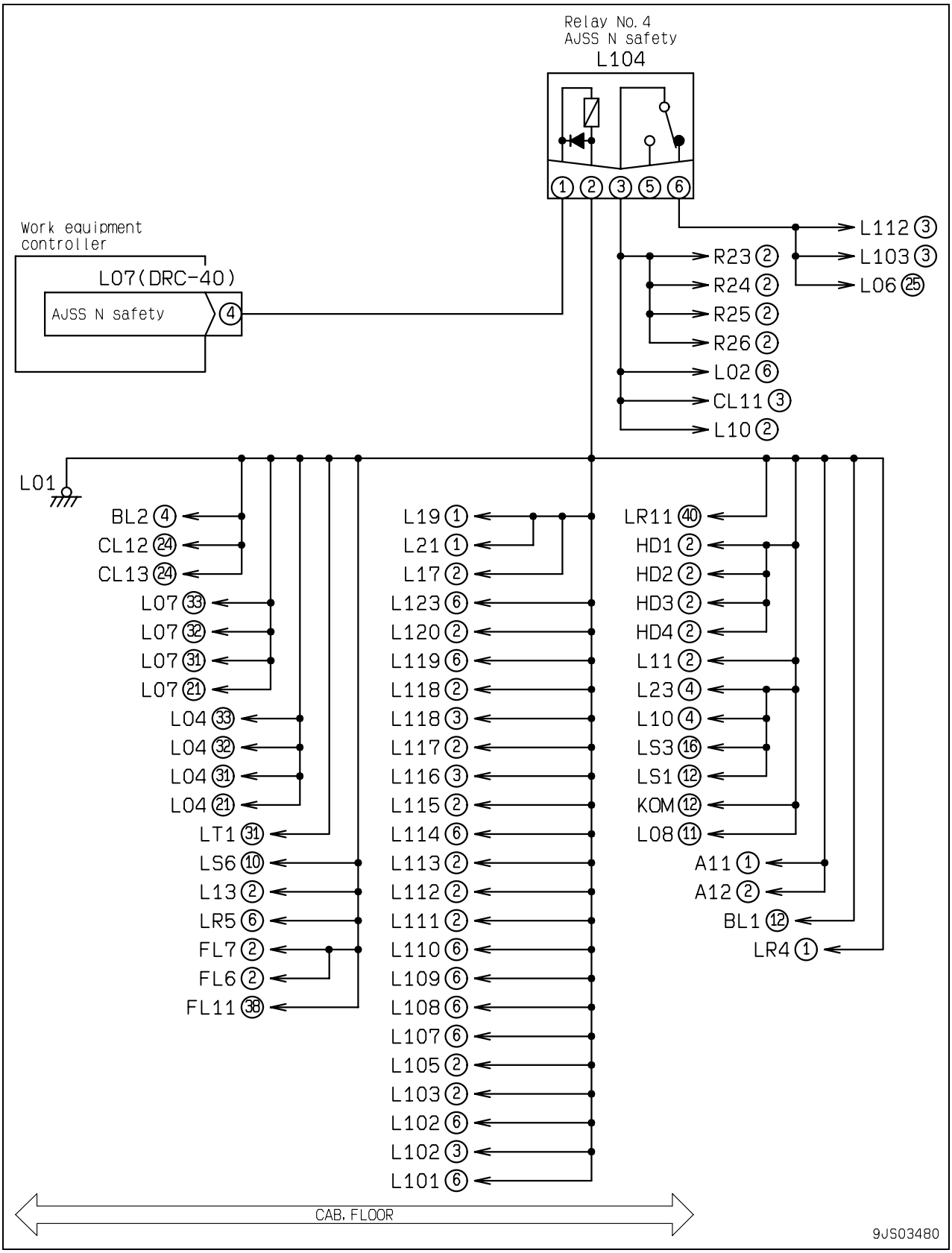


Failure code [D191KB] (AJSS neutral safety relay: Short circuit)

Action code	Failure code	Trouble	AJSS neutral safety relay: Short circuit (Work equipment controller system)
E01	**D191KB**		
Contents of trouble	• Since the AJSS neutral safety relay output system is shorted, signals are not output to the neutral safety relay.		
Action of controller	• Turns the output to the AJSS neutral safety relay OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• While operating AJSS lever, engine can be started (Steering moves immediately after engine starts.).		
Related information	• Applicable only to AJSS specification machines (if equipped) • Method of reproducing failure code: While engine is stopped, operate AJSS lever. • If the AJSS neutral position is not adjusted (initialized), the neutral safety relay does not operate. • While error is detected, controller does not output voltage.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective AJSS neutral safety relay (L104) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L104 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (4) – L104 (female) (1)	Resis-tance	Min. 1 MΩ	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and operate AJSS lever.			
			L07	Voltage		
			Between (4) and chassis ground	20 – 30 V		

Circuit diagram related to AJSS neutral safety relay

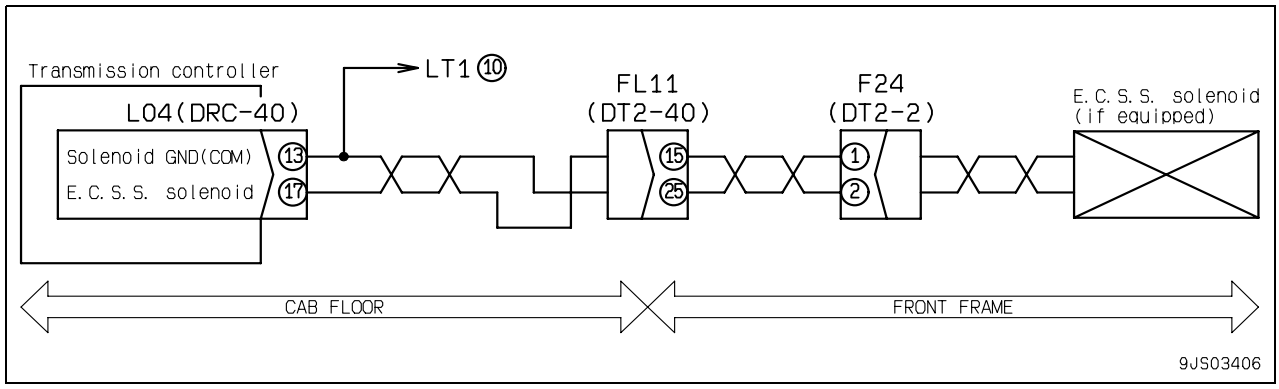


Failure code [D192KA] (ECSS solenoid: Disconnection)

Action code	Failure code	Trouble	ECSS solenoid: Disconnection (Transmission controller system)
E01	**D192KA**		
Contents of trouble	• Since the ECSS solenoid system is disconnected, no current flows when ECSS solenoid output is turned ON.		
Action of controller	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The ECSS does not operate.		
Related information	• The output state (current) to the ECSS solenoid can be checked with the monitoring function (Code: 93300 ECSS V DIR). • Applicable only to ECSS specification machines (if equipped) • Method of reproducing failure code: Turn the starting switch and ECSS switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective ECSS solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F24 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L04 (female) (17) – F24 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between F24 (female) (2) – L04 (female) (13)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Wiring harness between (17) and (13)	5 – 15 Ω	

Circuit diagram related to ECSS solenoid

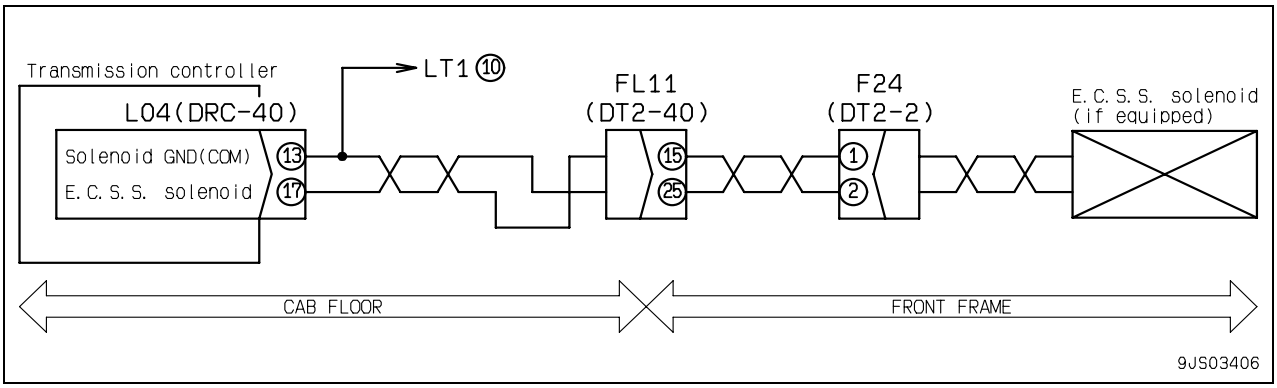


Failure code [D192KB] (ECSS solenoid: Short circuit)

Action code	Failure code	Trouble	ECSS solenoid: Short circuit (Transmission controller system)
E01	**D192KB**		
Contents of trouble	• Since the ECSS solenoid system is shorted with the chassis ground, abnormal current flowed when ECCS solenoid output is ON		
Action of controller	• Turns the output to the ECSS solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The ECSS does not operate.		
Related information	• The output state (current) to the ECSS solenoid can be checked with the monitoring function (Code: 93300 ECSS V DIR). • Applicable only to ECSS specification machines (if equipped) • Method of reproducing failure code: Turn the starting switch and ECSS switch ON and drive in a gear speed other than 1st.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective ECSS solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F24 (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (17) – F24 (female) (1) wiring harness and chassis ground	Resistance	Min. 1 MΩ	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (17) and (13)	5 – 15 Ω		
			Between (17), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to ECSS solenoid

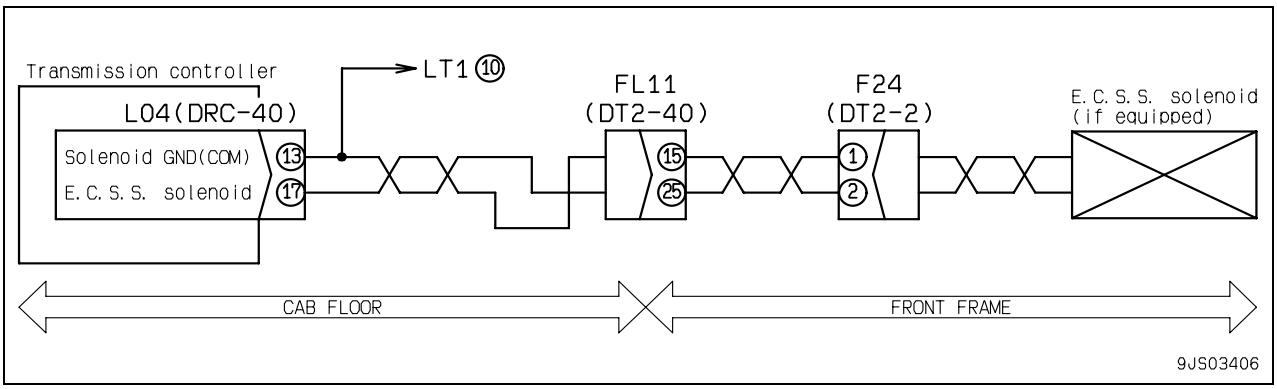


Failure code [D192KY] (ECSS solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	ECSS solenoid: Short circuit with power supply line (Transmission controller system)
E01	**D192KY**		
Contents of trouble	• Since the ECSS solenoid system is shorted with the power source, abnormal voltage was applied when ECSS solenoid output was turned OFF.		
Action of controller	• If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The ECSS keeps operating.		
Related information	• The output state (current) to the ECSS solenoid can be checked with the monitoring function (Code: 93300 ECSS V DIR). • Applicable only to ECSS specification machines (if equipped) • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective ECSS solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F24 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L04 (female) (17) – F24 (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (17) and (13)	5 – 15 Ω	
			Between (17), (13) and chassis ground	Min. 1 MΩ	

Circuit diagram related to ECSS solenoid



Failure code [D198KA] (Transmission oil pressure bypass solenoid: Disconnection)

Action code	Failure code	Trouble	Transmission oil pressure bypass solenoid: Disconnection (Transmission controller system)
E01	**D198KA**		
Contents of trouble	• Transmission oil pressure bypass solenoid trouble is detected.		
Action of controller	• None in particular.		
Problem that appears on machine	—		
Related information	• Transmission oil pressure bypass solenoid is not set in WA600-6.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	1	Option may be set defectively. Referring to Testing and adjusting, “Special functions of machine monitor (EMMS)”, “11. Optional device selecting function”, check that the very cold region specification (COLD SPEC) is set to “NO ADD”.

Failure code [D198KB] (Transmission oil pressure bypass solenoid: Short circuit)

Action code	Failure code	Trouble	Transmission oil pressure bypass solenoid: Short circuit (Transmission controller system)
E01	**D198KB**		
Contents of trouble	• Transmission oil pressure bypass solenoid trouble is detected.		
Action of controller	• None in particular.		
Problem that appears on machine	—		
Related information	• Transmission oil pressure bypass solenoid is not set in WA600-6.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	1	Option may be set defectively. Referring to Testing and adjusting, “Special functions of machine monitor (EMMS)”, “11. Optional device selecting function”, check that the very cold region specification (COLD SPEC) is set to “NO ADD”.

Failure code [D198KY] (Transmission oil pressure bypass solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	Transmission oil pressure bypass solenoid: Short circuit with power line (Transmission controller system)
E01	**D198KY**		
Contents of trouble	• Transmission oil pressure bypass solenoid trouble is detected.		
Action of controller	• None in particular.		
Problem that appears on machine	—		
Related information	• Transmission oil pressure bypass solenoid is not set in WA600-6.		

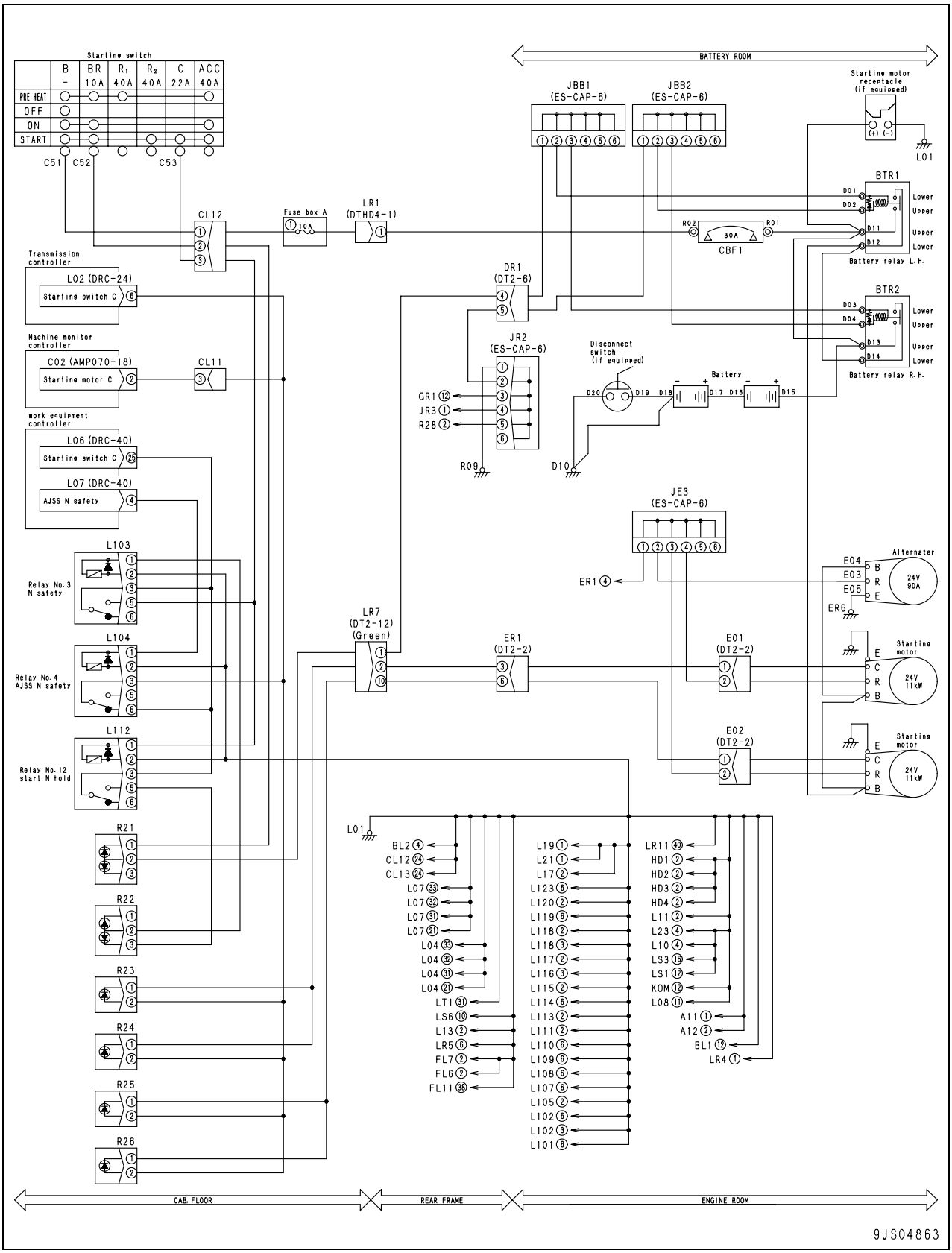
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	1	Option may be set defectively. Referring to Testing and adjusting, “Special functions of machine monitor (EMMS)”, “11. Optional device selecting function”, check that the very cold region specification (COLD SPEC) is set to “NO ADD”.

Failure code [D5ZHKA] (Terminal C signal: Disconnection)

Action code	Failure code	Trouble	Terminal C signal: Disconnection (Transmission controller system)
E01	**D5ZHKA**		
Contents of trouble	• Terminal C system is disconnected or shorted with the chassis ground (Engine speed is above 500 rpm and no starting switch terminal C signal has been input.).		
Action of controller	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The engine does not start.		
Related information	• The input state (ON/OFF) from starting switch terminal C to transmission controller can be checked with the monitoring function (Code: 40905, D-IN-7) (Transmission controller system). • Method of reproducing failure code: Set the starting switch to START position		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No.1 of fuse box A	If the fuse is broken, the circuit probably has a grounding fault, etc. (See cause 4.)			
	2	Defective starting switch (Internal disconnection)	★ Prepare with starting switch OFF, then turn starting switch ON, OFF or START and carry out troubleshooting			
			CL12	Starting switch	Resistance	
			Between (1) and (3)	START	Max. 1 Ω	
				OFF, ON	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CL12 (female) (3) – L103 (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between L103 (female) (3) and L104 (female) (6)		Resistance	Max. 1 Ω
			Wiring harness between L104 (female) (3) – L02(female) (6)		Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CL12 (female) (3) – L103 (female) (5) and CL12 (female) (3) – circuit branch end point and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L103 (female) (3) – L104 (female) (6) and L103 (female) (3) – circuit branch end point and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L104 (female) (3) – L02 (female) (6) and 104 (female) (3) – circuit branch end point and chassis ground		Resistance	Min. 1 MΩ
	5	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON, OFF or START and carry out troubleshooting			
			L02	Starting switch	Voltage	
			Between (6) and chassis ground	START	20 – 30 V	
				OFF, ON	Max. 1 V	

Circuit diagram related to engine starting system

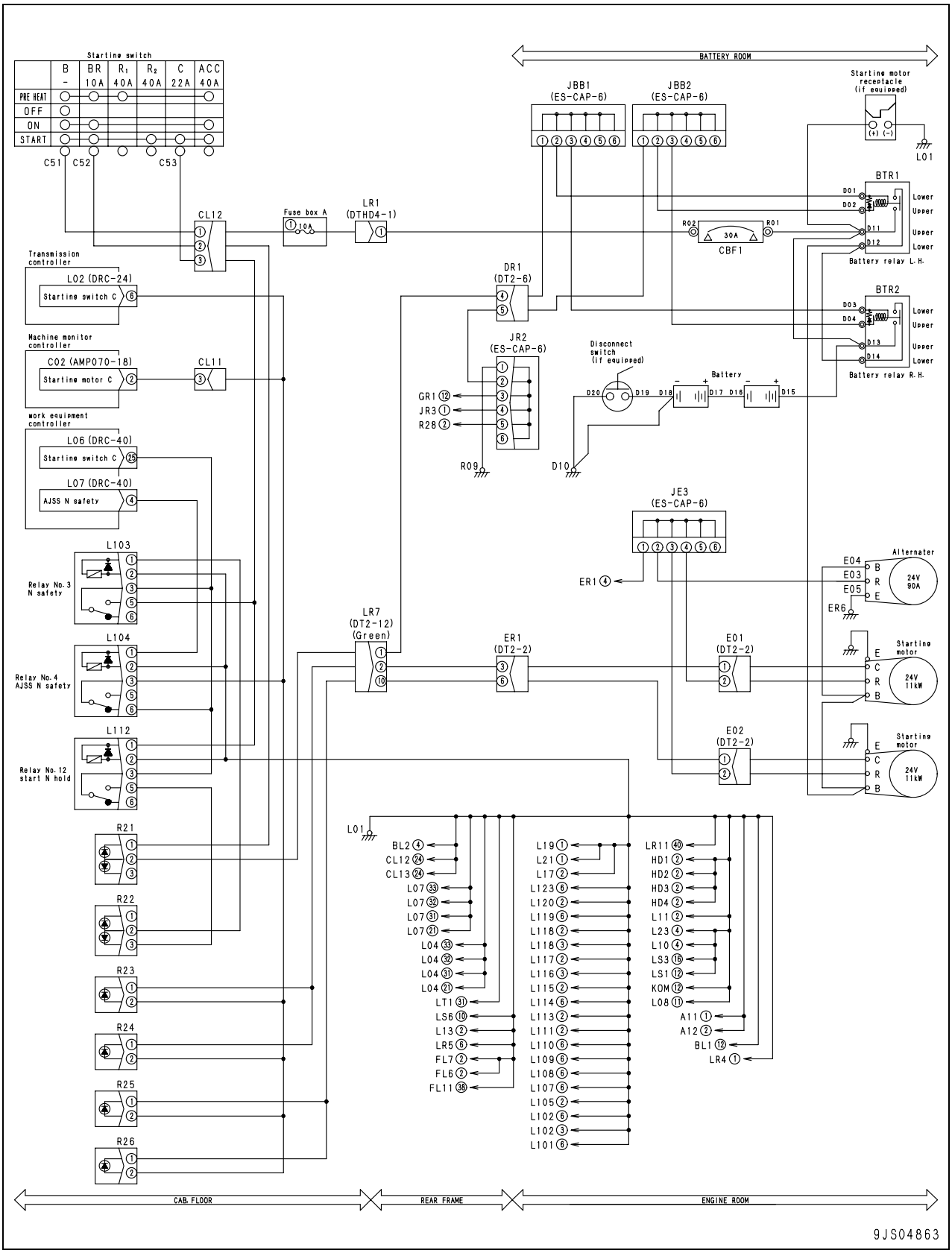


Failure code [D5ZHKB] (Terminal C signal: Short circuit)

Action code	Failure code	Trouble	Terminal C signal: Short circuit (Transmission controller system)
E01	**D5ZHKB**		
Contents of trouble	• Terminal C system is shorted with the power source (Engine speed is above 500 rpm and starting switch terminal C signal has been input.).		
Action of controller	• Engine start assistance is not working. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The engine does not start.		
Related information	• The input state (ON/OFF) from starting switch terminal C to transmission controller can be checked with the monitoring function (Code: 40905, D-IN-7) (Transmission controller system). • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective starting switch (Internal disconnection)	★ Prepare with starting switch OFF, then turn starting switch ON, OFF or START and carry out troubleshooting			
			CL12	Starting switch	Resistance	
			Between (1) and (3)	START	Max. 1 Ω	
				OFF, ON	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting after engine start and during engine operation			
			Wiring harness between CL12 (female) (3) – L103 (female) (5) and CL12 (female) (3) – circuit branch end point and chassis ground		Voltage	Max. 1 V
			Wiring harness between L103 (female) (3) – L104 (female) (6) and L103 (female) (3) – circuit branch end point and chassis ground		Voltage	Max. 1 V
			Wiring harness between L104 (female) (3) – L02 (female) (6) and L104 (female) (3) – circuit branch end point and chassis ground		Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON, OFF or START and carry out troubleshooting			
			L02	Starting switch	Voltage	
			Between (6) and chassis ground	START	20 – 30 V	
				OFF, ON	Max. 1 V	

Circuit diagram related to engine starting system

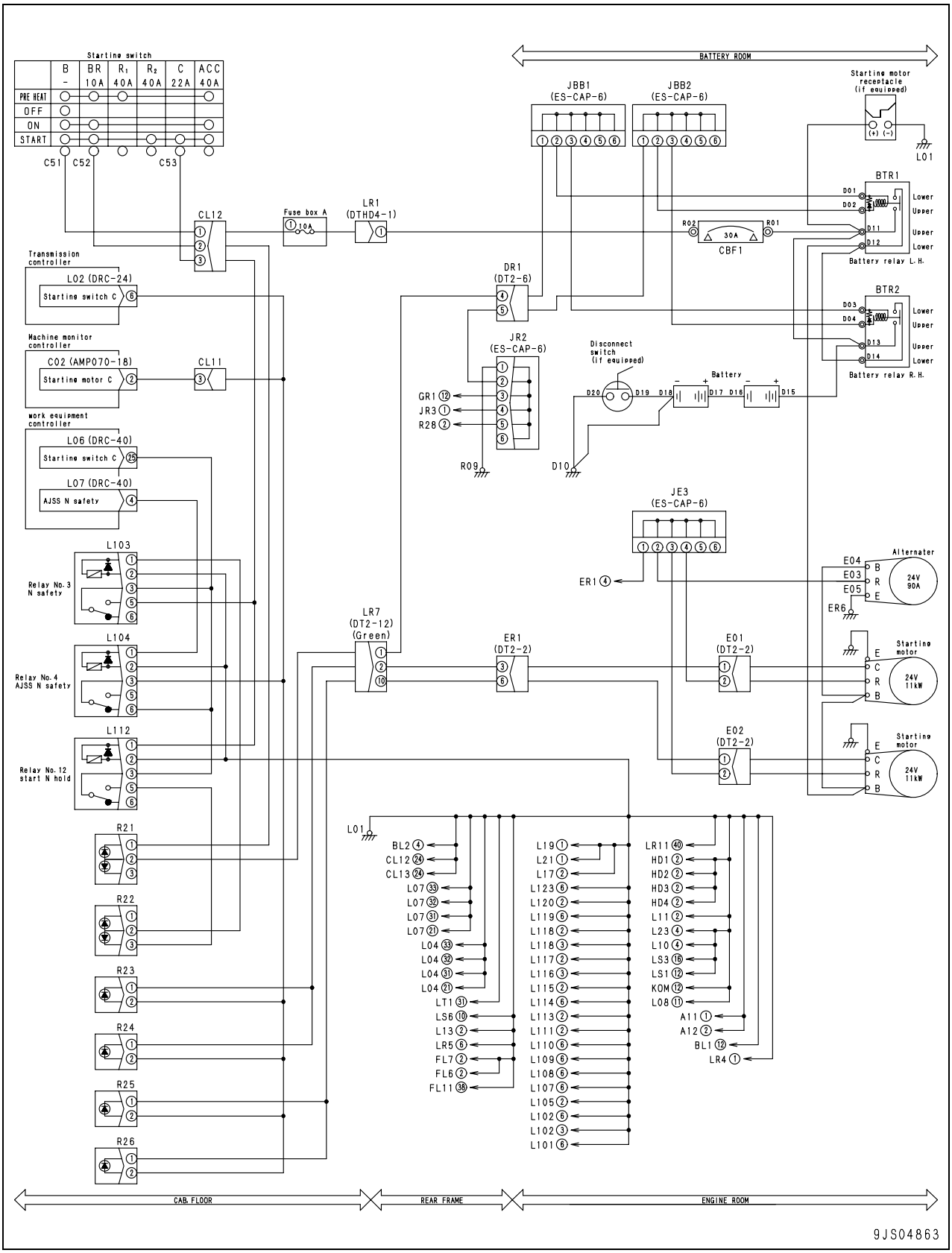


Failure code [D5ZHKZ] (Terminal C signal: Disconnection or short circuit)

Action code	Failure code	Trouble	Terminal C signal: Disconnection or short circuit (Work equipment controller system)
E01	**D5ZHKZ**		
Contents of trouble	• Terminal C system is disconnected (Engine speed is above 500 rpm and no starting switch terminal C signal has been input.)		
Action of controller	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Engine starts when work equipment control lever is not at Neutral		
Related information	• The input state (ON/OFF) from starting switch terminal C to work equipment controller can be checked with the monitoring function (Code: 40912, D-IN-17) (Work equipment controller system). • Method of reproducing failure code: Set the starting switch to START position		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No.1 of fuse box A	If the fuse is broken, the circuit probably has a grounding fault, etc. (See cause 4.)			
	2	Defective starting switch (Internal disconnection)	★ Prepare with starting switch OFF, then turn starting switch ON, OFF or START and carry out troubleshooting			
			CL12	Starting switch	Resistance	
			Between (1) and (3)	START	Max. 1 Ω	
				OFF, ON	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CL12 (female) (3) – L103 (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between L103 (female) (3) – L06 (female) (25)		Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CL12 (female) (3) – L103 (female) (5) and CL12 (female) (3) – circuit branch end point and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L103 (female) (3) – L06 (female) (25) and L103 (female) (3) – circuit branch end point and chassis ground		Resistance	Min. 1 MΩ
	5	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON, OFF or START and carry out troubleshooting			
			L06	Starting switch	Voltage	
			Between (25) and chassis ground	START	20 – 30 V	
				OFF, ON	Max. 1 V	

Circuit diagram related to engine starting system

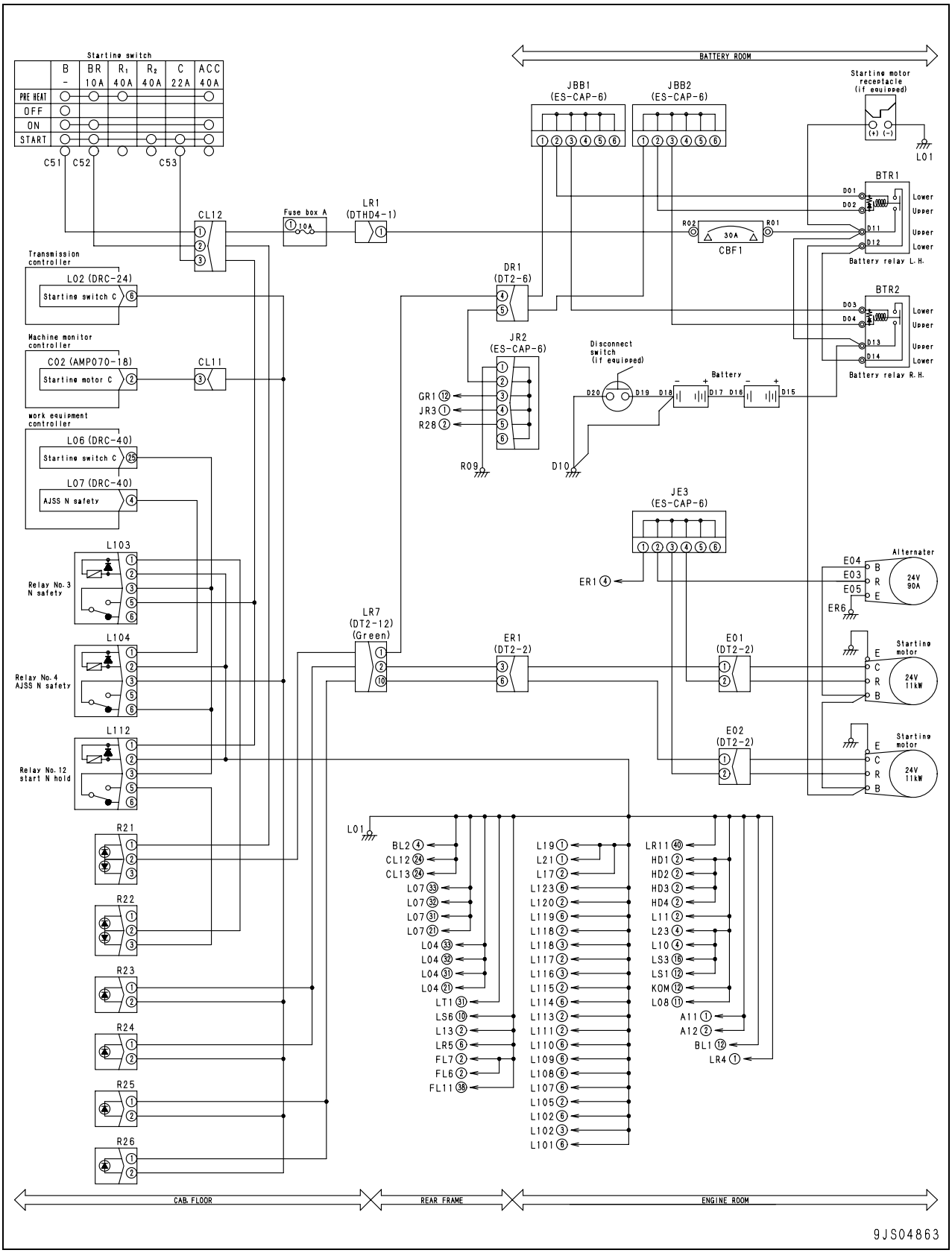


Failure code [D5ZHL6] (Terminal C signal: Signal does not match engine running or stopped state)

Action code	Failure code	Trouble	Terminal C signal: Signal disagrees with operation and stop of engine (Machine monitor system)
E01	**D5ZHL6**		
Contents of trouble	• Terminal C system is disconnected or shorted with the chassis ground (Engine speed is above 500 rpm and no starting switch terminal C signal has been input.)		
Action of controller	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The engine does not start.		
Related information	• The input state (ON/OFF) from starting switch terminal C to machine monitor can be checked with the monitoring function (Code: 40900, D-IN-2) (Machine monitor system). • Method of reproducing failure code: Set the starting switch to START position		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No.1 of fuse box A	If the fuse is broken, the circuit probably has a grounding fault, etc. (See cause 2.)			
	2	Defective starting switch (Internal disconnection)	★ Prepare with starting switch OFF, then turn starting switch ON, OFF or START and carry out troubleshooting			
			CL12	Starting switch	Resistance	
			Between (1) and (3)	START	Max. 1 Ω	
				OFF, ON	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CL12 (female) (3) – L103 (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between L103 (female) (3) – L104 (female) (6)		Resistance	Max. 1 Ω
			Wiring harness between L104 (female) (3) – C02 (female) (2)		Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CL12 (female) (3) – L103 (female) (5) and CL12 (female) (3) – circuit branch end point and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L103 (female) (3) – L104 (female) (6) and L103 (female) (3) – circuit branch end point and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L104 (female) (3) – C02 (female) (2) and L104 (female) (3) – circuit branch end point and chassis ground		Resistance	Min. 1 MΩ
	5	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON, OFF or START and carry out troubleshooting			
			C02	Starting switch	Voltage	
			Between (2) and chassis ground	START	20 – 30 V	
				OFF, ON	Max. 1 V	

Circuit diagram related to engine starting system



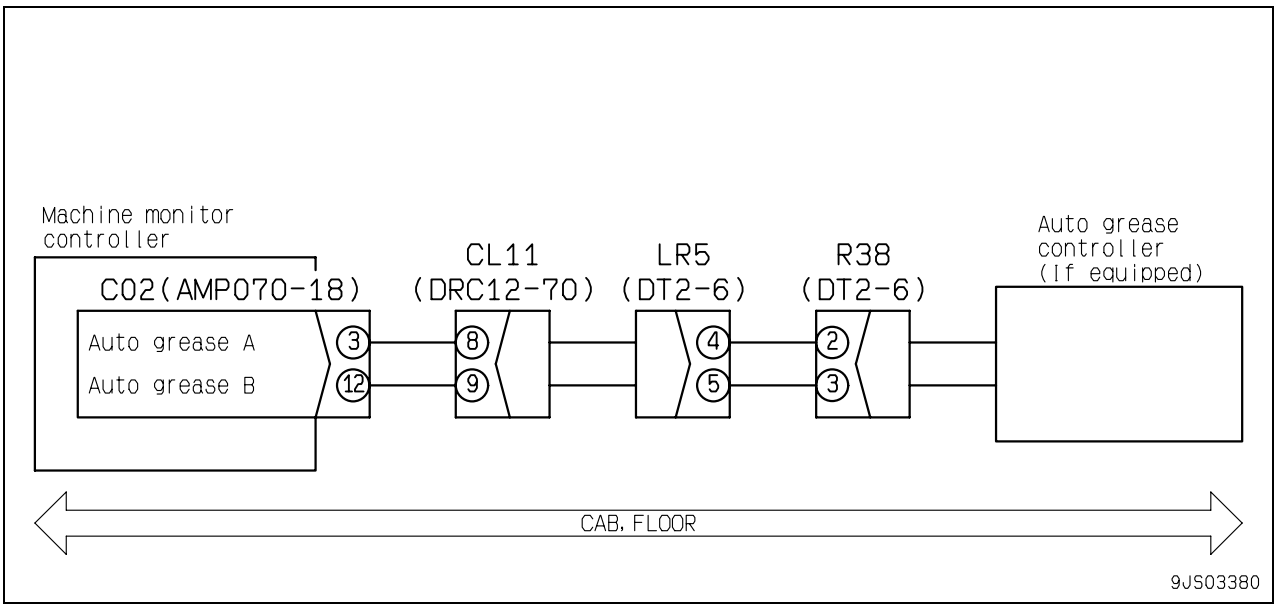
Failure code [DA80L4] (Auto grease controller: ON/OFF signals disagree)

Action code	Failure code	Trouble	Auto grease controller: ON/OFF signals disagree (Machine monitor system)
—	**DA80L4**		
Contents of trouble	• Both auto grease sensor input circuits A and B are in the same state (OPEN or CLOSE).		
Action of controller	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Auto grease does not work.		
Related information	• The input state (ON/OFF) from the auto grease controller can be checked with the monitoring function (Code: 40900, D-IN-4, D-IN-5). • Applicable only to machines equipped with auto grease function (if equipped) • Method of reproducing failure code: Turn the starting switch and auto grease start button ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (3) – R38 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between C02 (female) (12) – R38 (female) (3)		Resistance	Max. 1 Ω
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (3) and R38 (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between C02 (female) (12) – R38 (female) (3)		Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between C02 (female) (3) and R38 (female) (2)		Voltage	Max. 1 V
			Wiring harness between C02 (female) (12) and R38 (female) (3)		Voltage	Max. 1 V
	4	Defective auto grease controller (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			R38	Auto grease start button ON	Voltage	
			Between (2) and chassis ground	In operation	Max. 1 V	
				Not in operation (with empty tank)	20 – 30 V	
			Between (3) and chassis ground	In operation	20 – 30 V	
				Not in operation (with empty tank)	Max. 1 V	
			★ If the above troubleshooting results are normal, refer to and carry out troubleshootings for auto grease system.			

<table>
<tr><td rowspan="8">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="7">5</td><td rowspan="7">Defective machine monitor</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td>C02</td><td>Auto grease start button ON</td><td>Voltage</td></tr>
<tr><td rowspan="2">Between (3) and chassis ground</td><td>In operation</td><td>Max. 1 V</td></tr>
<tr><td>Not in operation (with empty tank)</td><td>20 – 30 V</td></tr>
<tr><td rowspan="2">Between (12) and chassis ground</td><td>In operation</td><td>20 – 30 V</td></tr>
<tr><td>Not in operation (with empty tank)</td><td>Max. 1 V</td></tr>
<tr><td colspan="3">★ If the above troubleshooting results are normal, refer to and carry out troubleshootings for auto grease system.</td></tr>
</table>

Circuit diagram related to auto grease



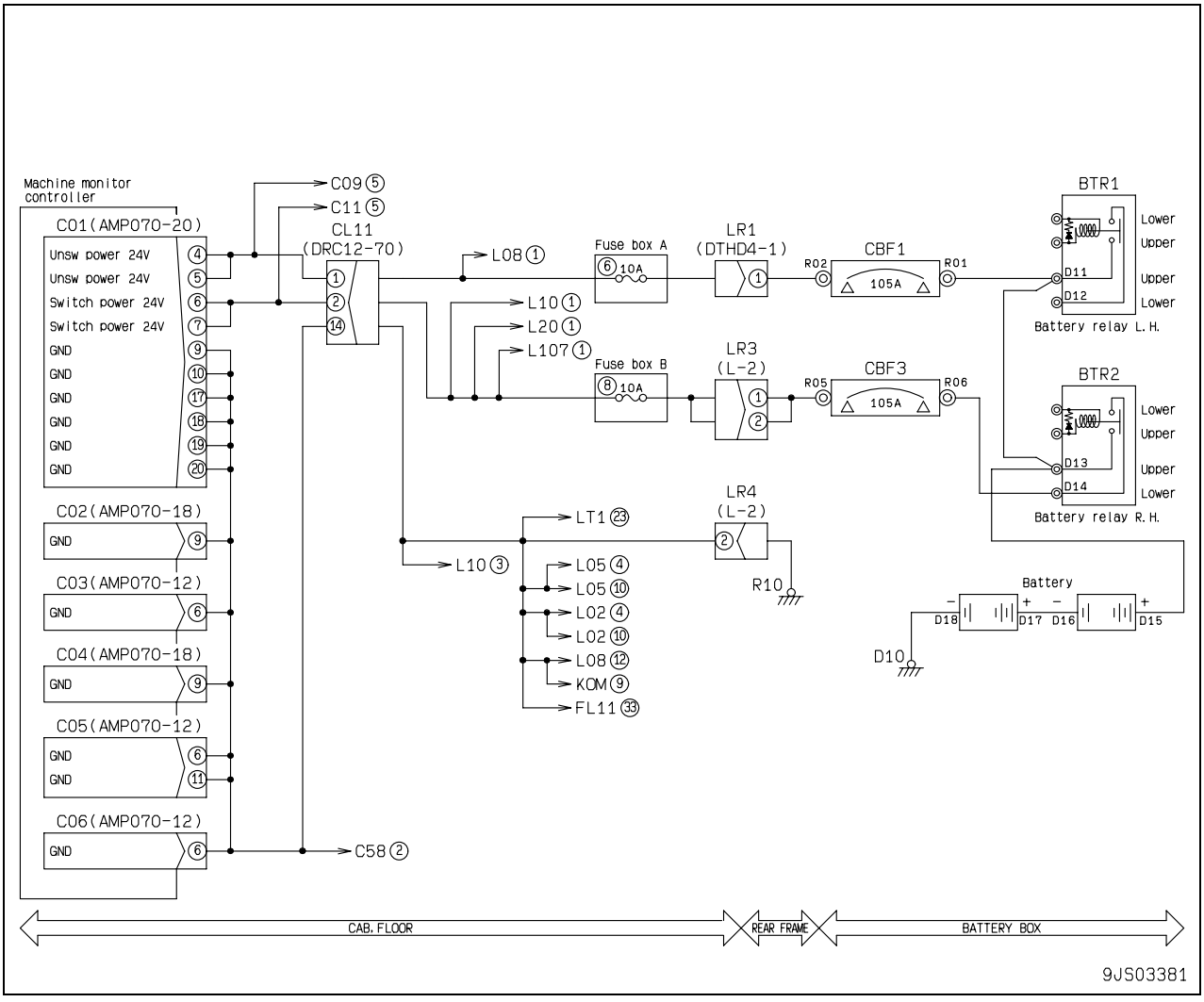
Failure code [DAF3KK] (Machine monitor: Low source voltage (input))

Action code	Failure code	Trouble	Machine monitor: Low source voltage (input) (Machine monitor system)
E03	**DAF3KK**		
Contents of trouble	• When the voltage of the SW power supply (power supply for operation) is above 17 V, the voltage of the UNSW power supply (power supply for memory) is below 17 V.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The service meter reading is abnormal, the odometer does not advance and fault history data is not saved.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Shut down of circuit breaker (CBF1)	If the circuit breaker is shut down, the circuit probably has a grounding fault, etc. (See cause 4.)		
	2	Defective fuse No.6 of fuse box A	If the fuse is broken, the circuit probably has a grounding fault, etc. (See cause 4.)		
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between battery relay BTR2 D13 – battery relay BTR1 D11 – circuit breaker CBF1 R01	Resistance	Max. 1 Ω
			Wiring harness between circuit breaker CBF1 R02 – fuse No.6 of fuse box A	Resistance	Max. 1 Ω
			Wiring harness between fuse No.6 of fuse box A – C01 (female) (4) (5)	Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between battery relay BTR2 D13 – battery relay BTR1 D11 – circuit breaker CBF1 R01 and chassis ground	Resistance	Max. 1 Ω
			Wiring harness between circuit breaker CBF1 R02 – fuse No.6 of fuse box A and chassis ground	Resistance	Max. 1 Ω
			Wiring harness between fuse No.6 of fuse box A – C01 (female) (4), (5) and fuse No.6 of fuse box A – circuit branch end point and chassis ground	Resistance	Max. 1 Ω
	5	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between battery relay BTR2 D14 – circuit breaker CBF3 R06 and chassis ground	Voltage	Max. 1 V
			Wiring harness between circuit breaker CBF3 R05 – fuse No.8 of fuse box B and chassis ground	Voltage	Max. 1 V
			Wiring harness between fuse No.8 of fuse box B – C01 (female) (6), (7) and fuse No.8 of fuse box B – circuit branch end point and chassis ground	Voltage	Max. 1 V

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	6	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting	
			C01	Voltage
			Between (4), (5) and (9), (10), (17), (18), (19), (20)	20 – 30 V
			Between (6), (7) and (9), (10), (17), (18), (19), (20)	20 – 30 V

Circuit diagram related to machine monitor power supply



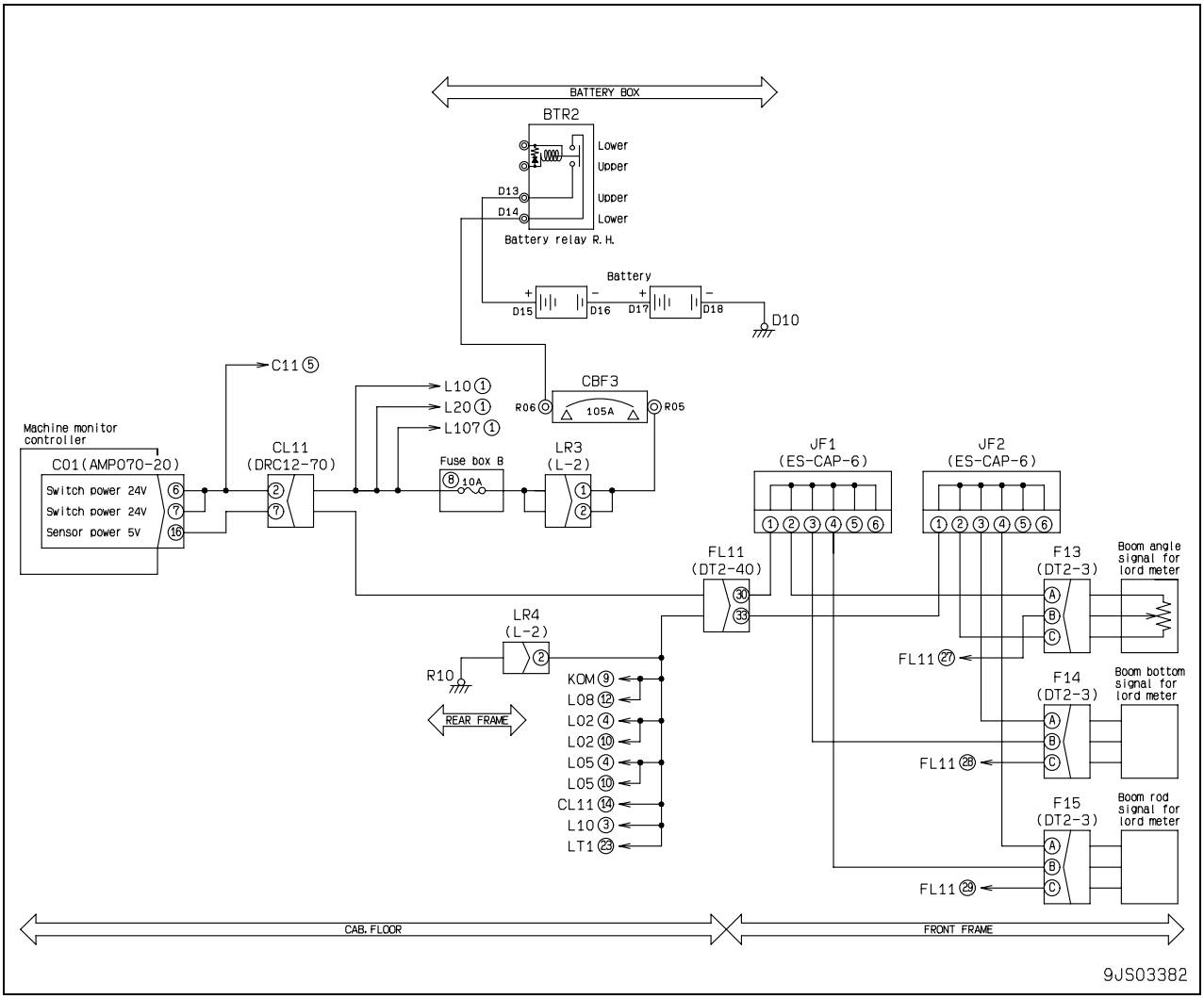
Failure code [DAF5KP] (Machine monitor: Low output voltage)

Action code	Failure code	Trouble	Machine monitor: Low output voltage (Machine monitor system)
E01	**DAF5KP**		
Contents of trouble	• When the voltage of the SW power supply (power supply for operation) is above 17 V, the voltage of the sensor is below 5 V.		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until it is restarted.		
Problem that appears on machine	• Machine monitor does not display load.		
Related information	• Applicable only to machines equipped with load meter (if equipped) • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective lift arm angle sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F13 (male)		Resistance
			Between (C) and (A)		5 kΩ ± 20%
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			F13	Lift arm cylinder	Voltage
			Between (C) and (A)	Constant	4.85 – 5.15 V
			Between (B) and (A)	Constant	0.83 – 4.1 V
				At max. length	3.50 – 4.1 V
				At min. length	0.83 – 1.88 V
	2	Defective lift arm bottom pressure sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F14 (male)		Resistance
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			F14 (male)	Lift arm bottom pressure	Voltage
			Between (C) and (B)	Constant	4.85 – 5.15 V
			Between (C) and (A)	Constant	0.50 – 4.50 V
				When released	0.50 – 0.90 V
				When relieved	3.02 – 3.42 V
	3	Defective lift arm rod pressure sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F15 (male)		Resistance
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			F15 (male)	Lift arm rod pressure	Voltage
			Between (C) and (B)	Constant	4.85 – 5.15 V

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	3	Defective lift arm rod pressure sensor (Internal short circuit)	Between (C) and (A)	Constant	0.50 – 4.50 V	
				When released	0.50 – 0.90 V	
				When relieved	3.02 – 3.42 V	
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (16) and JF1 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between JF1 (female) (2) – F13 (female) (A)		Resistance	Min. 1 MΩ
			Wiring harness between JF1 (female) (3) – F14 (female) (B)		Resistance	Min. 1 MΩ
			Wiring harness between JF1 (female) (4) – F15 (female) (B)		Resistance	Min. 1 MΩ
	5	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C01	Lift arm cylinder	Voltage	
			Between (16) and chassis ground	Constant	4.85 – 5.15 V	

Circuit diagram related to machine monitor sensor

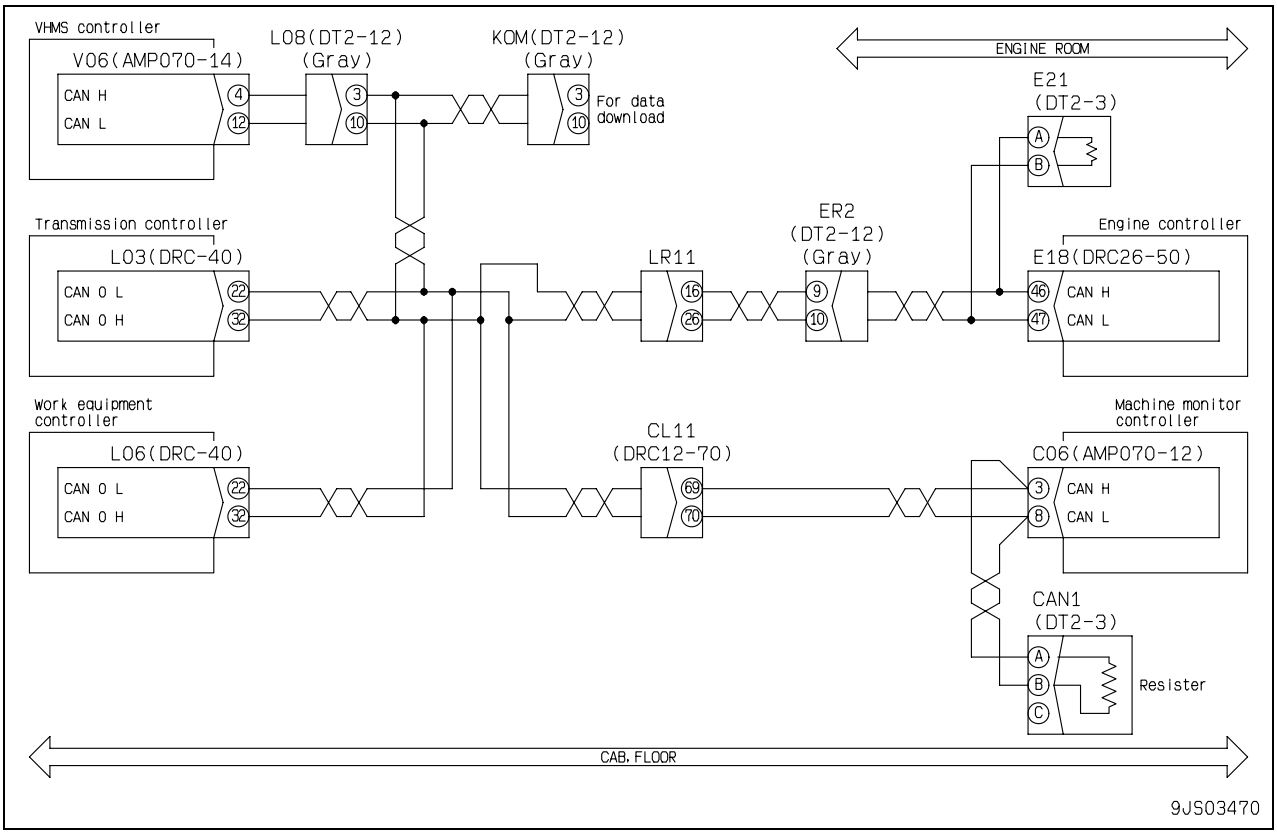


Failure code [DAFRKR] (CAN communication with machine monitor: Defective communication (Abnormality in target component system))

Action code	Failure code	Trouble	CAN communication with machine monitor: Defective communication (Abnormality in target component system) (Transmission controller system)
E03	**DAFRKR**		
Contents of trouble	• Communication via CAN signal line between the machine monitor and transmission controller is defective.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • Uses CAN information that was sent from machine monitor before the occurrence of the error. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The monitor does not display normally		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C06 (female) (3), (8) – L03 (female) (22), (32)		Resistance	Max. 1 Ω
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C06 (female) (3), (8) – L03 (female) (22), (32)		Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between C06 (female) (3), (8) – L03 (female) (22), (32)		Voltage	Max. 1 V
	4	Contact of wiring harness (Between CANH – CANL)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C06 (female)		Resistance	
			Between (3) – (8)		Min. 1 MΩ	
	5	Defective terminal resistor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CAN1 (male)	Between (A) – (B)	Resistance	120 ± 12 Ω
			E21 (male)	Between (A) – (B)	Resistance	120 ± 12 Ω
	6	Defective machine monitor	If causes 1 – 5 are not detected, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to CAN communication

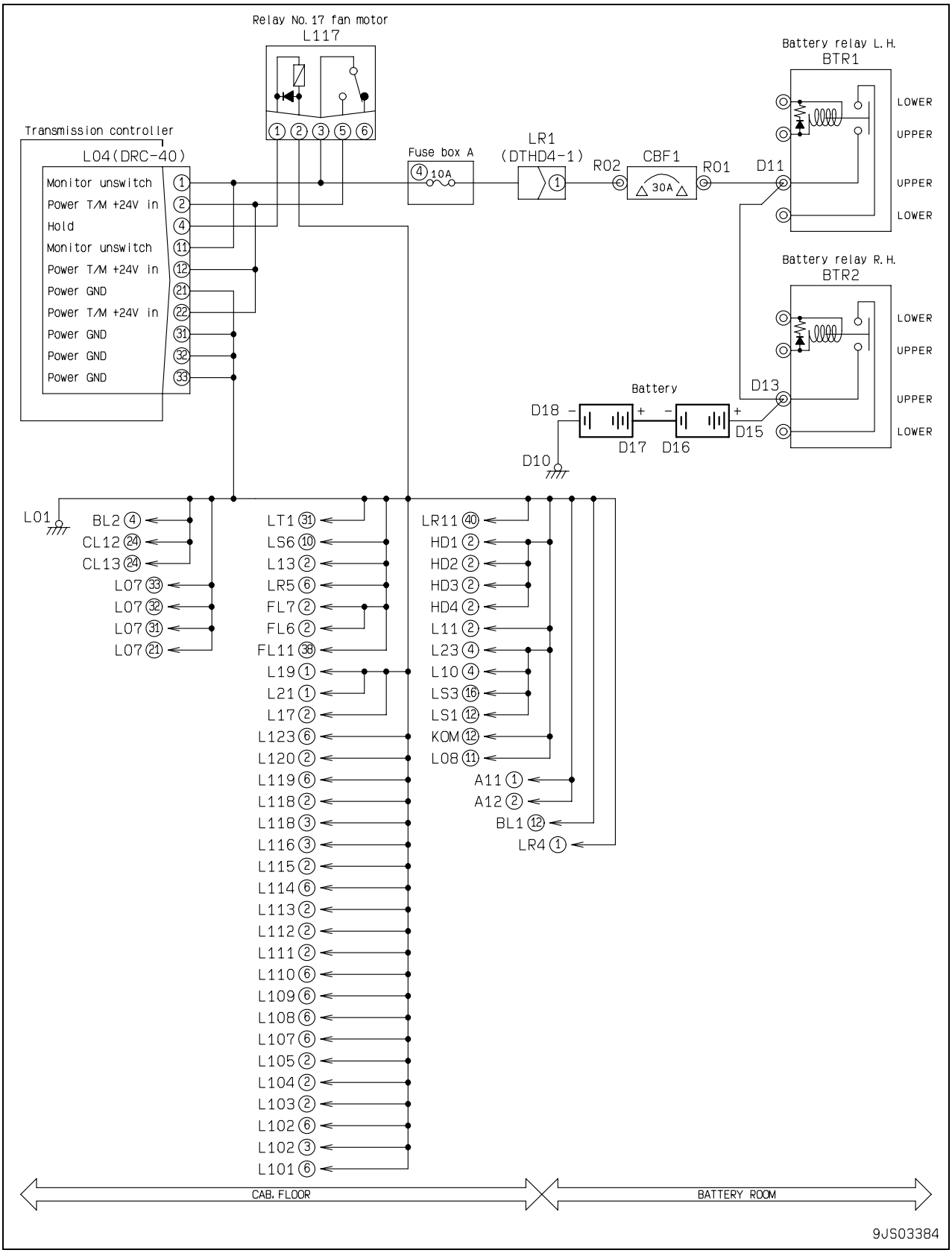


Failure code [DAQ0KK] (Transmission controller: Low source voltage)

Action code	Failure code	Trouble	Transmission controller: Low source voltage (Transmission controller system)
E03	**DAQ0KK**		
Contents of trouble	• Voltage of UNSW power supply (battery direct power supply) of the transmission controller is low. • Voltage of UNSW power supply (battery direct power supply) is below 18 V and engine speed is below 500 rpm.		
Action of controller	• Cannot sense the input signals normally. • Even if cause of failure disappears, system does not reset itself until directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The machine cannot operate normally.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Shut down of circuit breaker (CBF1)	If the circuit breaker is shut down, the circuit probably has a grounding fault, etc. (See cause 4.)		
	2	Defective fuse No.4 of fuse box A	If the fuse is broken, the circuit probably has a grounding fault, etc. (See cause 4.)		
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between battery relay BTR2 D13 – battery relay BTR1 D11 – circuit breaker CBF1 R01	Resistance	Max. 1 Ω
			Wiring harness between circuit breaker CBF1 R02 – fuse No.4 of fuse box A	Resistance	Max. 1 Ω
			Wiring harness between fuse No.4 of fuse box A – L04 (female) (1), (11), – circuit branch end point	Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between battery relay BTR2 D13 – battery relay BTR1 D11 – circuit breaker CBF1 R01 and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between circuit breaker CBF1 R02 – fuse No.4 of fuse box A	Resistance	Min. 1 MΩ
			Wiring harness between fuse No.4 of fuse box A – L04 (female) (1), (11), – circuit branch end point	Resistance	Min. 1 MΩ
	5	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L04	Voltage	
			Between (1), (11) and (21), (31), (32), (33)	20 – 30 V	

Circuit diagram related to transmission controller power supply



Failure code [DAQ0KT] (Transmission controller: Abnormality in controller)

Action code	Failure code	Trouble	Transmission controller: Abnormality in controller (Transmission controller system)
E01	**DAQ0KT**		
Contents of trouble	• The information in the ROM (non-volatile memory) of the transmission controller is abnormal.		
Action of controller	• Sets the internal adjustment values to the default values. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The gear shifting feeling of the transmission may become bad.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

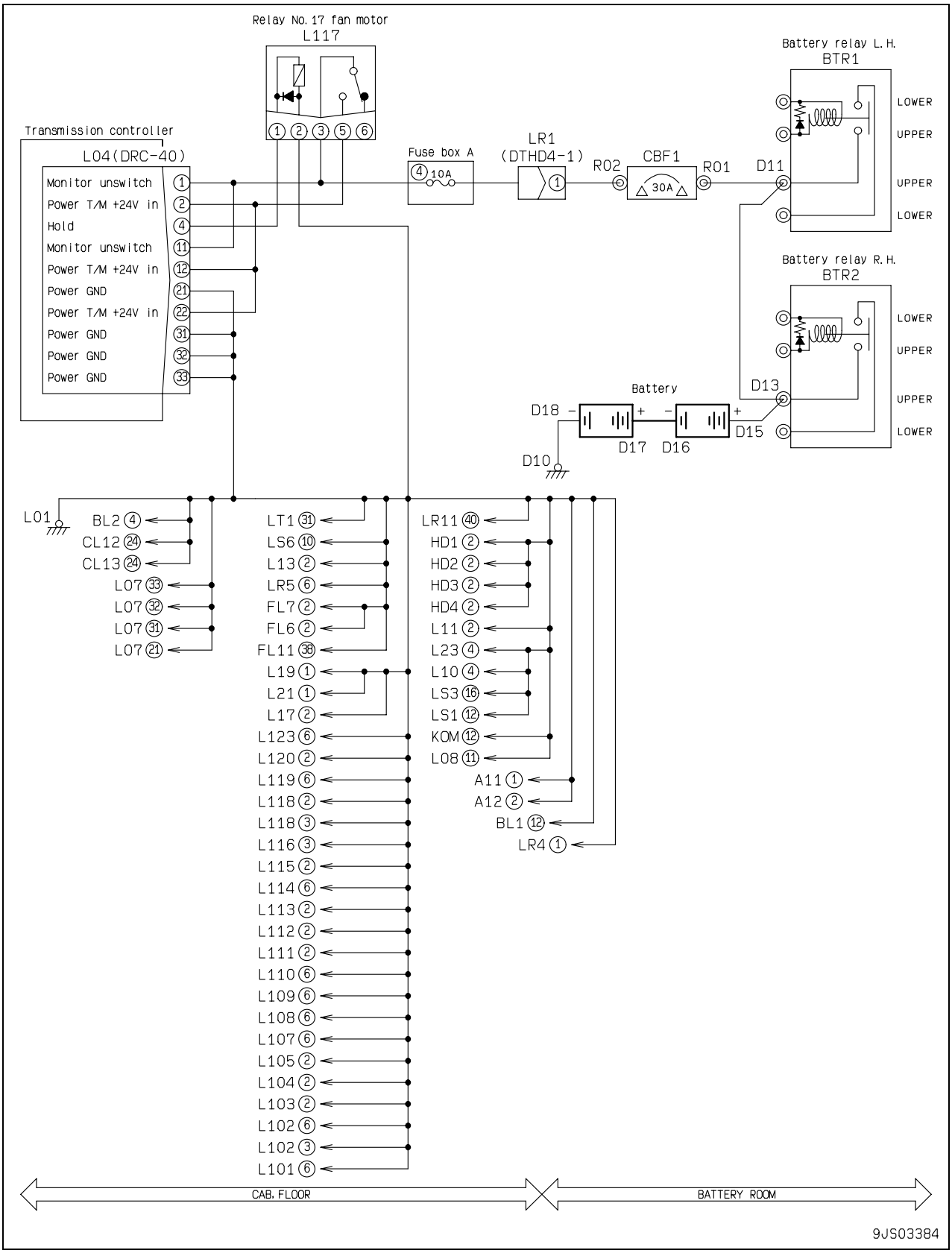
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective transmission controller	Since trouble is in system, troubleshooting cannot be carried out. (Replace controller.)

Failure code [DAQ2KK] (Transmission controller load power supply line: Low source voltage (input))

Action code	Failure code	Trouble	Transmission controller load power supply line: Low source voltage (input) (Transmission controller system)
E03	**DAQ2KK**		
Contents of trouble	• The voltage of the 24 V solenoid power supply system is low. • Detection conditions: Terminal C input is turned OFF, UNSW power supply (battery direct power supply) is above 20 V and solenoid power supply is below 18 V		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • Strain itself not to display failure codes that may be false detected due to low 24 V solenoid source voltage • Even if cause of failure disappears, system does not reset itself until directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• Transmission is stuck in Neutral.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fan motor relay (L117) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L117 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			When fan motor relay (L117) is replaced with a relay of the same type (5-pin type), if the condition becomes normal, the fan motor relay is defective.			
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (2), (12), (22) – L117 (female) (5)	Resistance	Max. 1 Ω	
			Wiring harness between L117(female) (3) – fuse No.4 of fuse box A	Resistance	Max. 1 Ω	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (2), (12), (22) – L117 (female) (5)	Resistance	Min. 1 MΩ	
			Wiring harness between L117(female) (3) – fuse No.4 of fuse box A	Resistance	Min. 1 MΩ	
	4	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L04	Voltage		
			Between (2), (12), (22) and (21), (31), (32), (33)	20 – 30 V		

Circuit diagram related to transmission controller power supply



Failure code [DAQ9KQ] (Transmission controller model selection: Disagreement of model selection signals)

Action code	Failure code	Trouble	Transmission controller model selection: Disagreement of model selection signals (Machine monitor system)
E03	**DAQ9KQ**		
Contents of trouble	• The transmission controller model is mistaken for another one.		
Action of controller	• Operates on the assumption that the controller model which has been used before occurrence of the failure code is still used. • Turns the centralized warning lamp and alarm buzzer ON. • Strain itself not to display failure codes which may be false detected. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Gear shifting shocks may be made.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

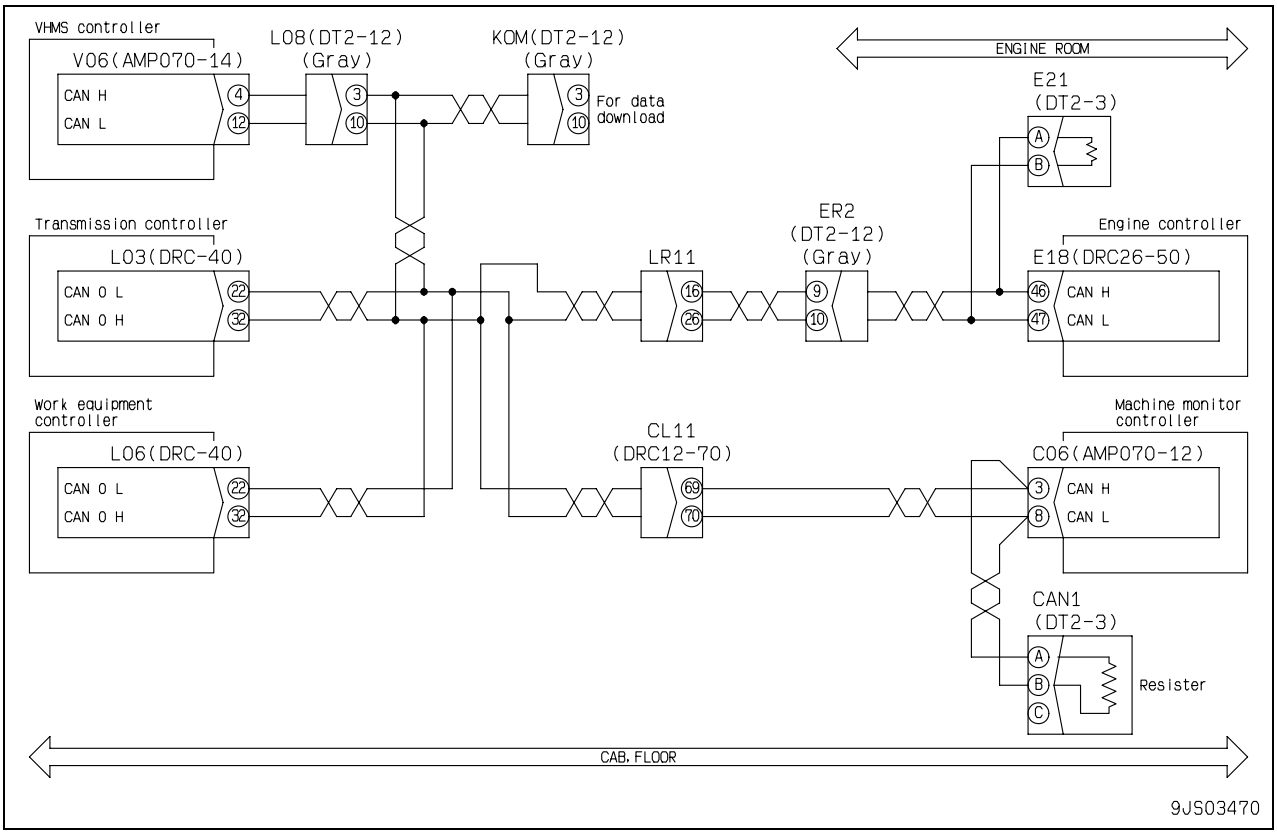
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Improper machine monitor model selection	Set the controller model of the machine monitor (See Testing and adjusting.)

Failure code [DAQRKR] (CAN communication with transmission controller: Defective communication (Abnormality in target component system))

Action code	Failure code	Trouble	CAN communicationwith transmission controller: Defective communication (Abnormality in target component system) (Machine monitor system)
E03	**DAQRKR**		
Contents of trouble	• Communication via CAN signal line between the machine monitor and transmission controller is defective.		
Action of controller	• Uses CAN information that was sent from transmission controller before the occurrence of the error. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The monitor does not display normally		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (22) – C06 (female) (8)		Resistance	Max. 1 Ω
			Wiring harness between L03 (female) (32) – C06 (female) (3)		Resistance	Max. 1 Ω
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (22) – C06 (female) (8)		Resistance	Min. 1 MΩ
			Wiring harness between L03 (female) (32) – C06 (female) (3)		Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L03 (female) (22) – C06 (female) (8)		Voltage	Max. 1 V
			Wiring harness between L03 (female) (32) – C06 (female) (3)		Voltage	Max. 1 V
	4	Contact of wiring harness (Between CANH – CANL)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C06 (female)		Resistance	
			Between (3) – (8)		Min. 1 MΩ	
	5	Defective terminal resistor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CAN1 (male)	Between (A) – (B)	Resistance	120 ± 12 Ω
			E21 (male)	Between (A) – (B)	Resistance	120 ± 12 Ω
	6	Defective transmission controller	If causes 1 – 5 are not detected, transmission controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to CAN communication

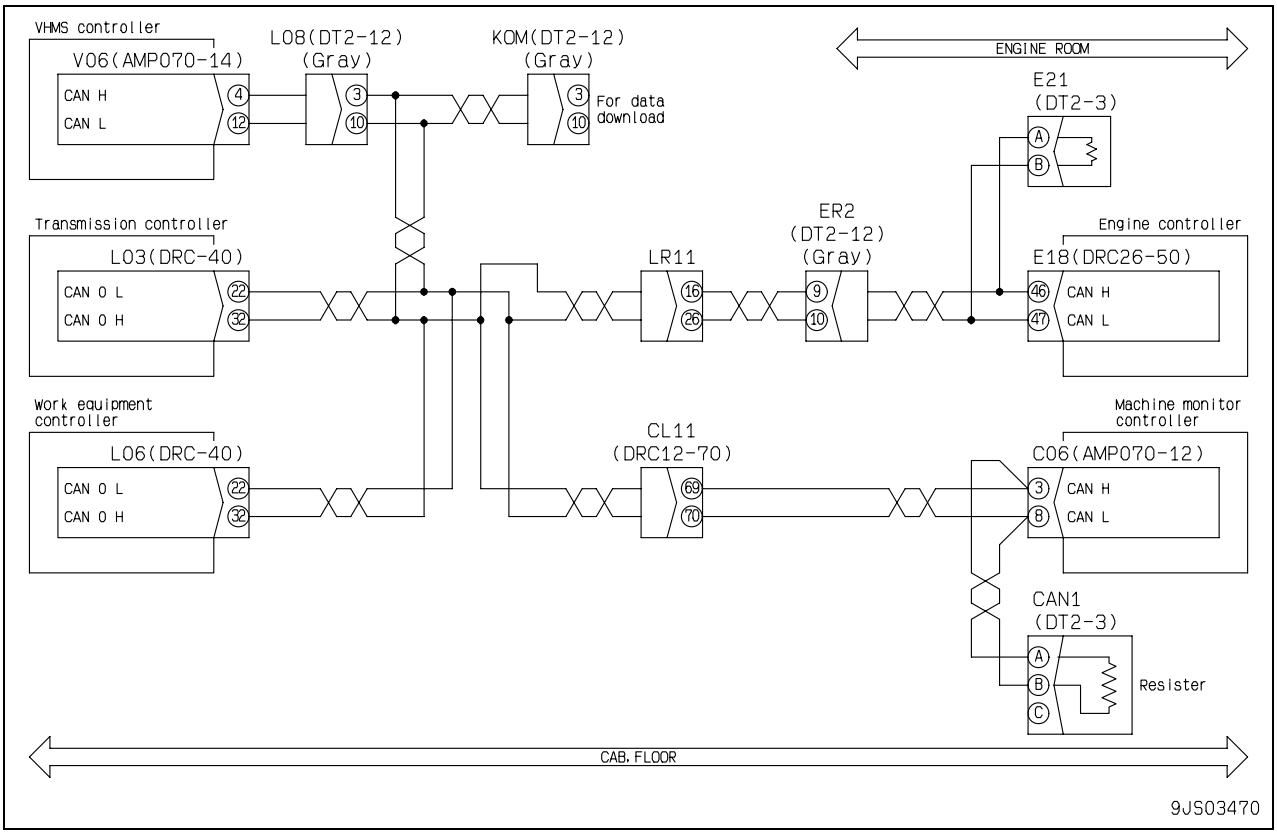


Failure code [DAQRMA] (Transmission controller CAN communication: Malfunction)

Action code	Failure code	Trouble	Transmission controller CAN communication (optional setting): Malfunction (Machine monitor system)
E03	**DAQRMA**		
Contents of trouble	• Options set by machine monitor are different from those recognized by transmission controller.		
Action of controller	• The transmission controller takes setting of options which the transmission controller recognizes itself. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	—		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Wrong setting of options	Set options correctly.		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L03 (female) (22) – C06 (female) (8)	Resistance	Max. 1 Ω
			Wiring harness between L03 (female) (32) – C06 (female) (3)	Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L03 (female) (22) – C06 (female) (8)	Resistance	Min. 1 MΩ
			Wiring harness between L03 (female) (32) – C06 (female) (3)	Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L03 (female) (22) – C06 (female) (8)	Voltage	Max. 1 V
			Wiring harness between L03 (female) (32) – C06 (female) (3)	Voltage	Max. 1 V
	5	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L03	Voltage	
			Between (22), (32) and chassis ground	4 – 8 V	

Circuit diagram related to CAN communication



WA600-6 Wheel loader

Form No. SEN00561-01

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

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Failure code [DD1GLD] (Load meter mode selector switch (+/–):
Switch is kept pressed for long time)..... 52

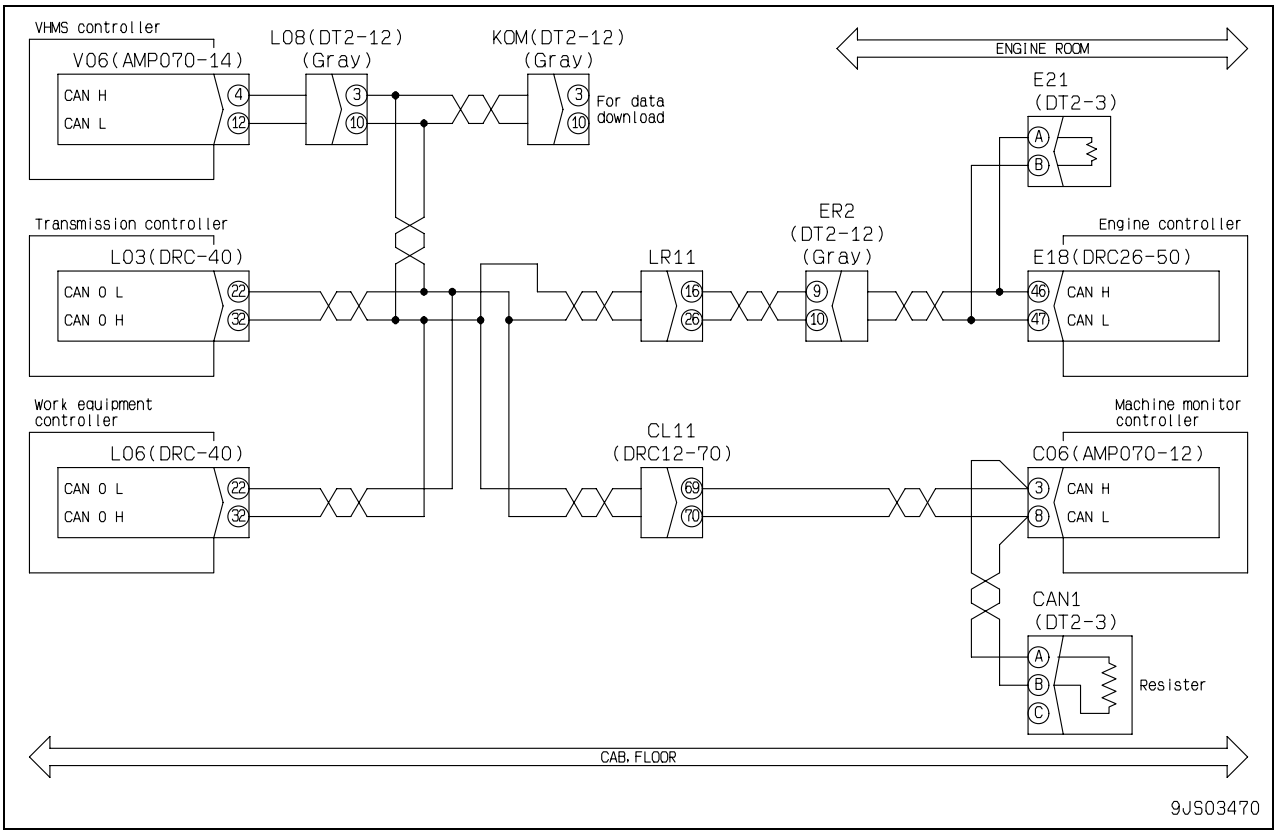
Troubleshooting by failure code (Display of code), Part 5

Failure code [DB2RKR] CAN communication from engine controller: Defective communication (Abnormality in target component system)

Action code	Failure code	Trouble	CAN communication from engine controller: Defective communication (Abnormality in target component system) (Transmission controller system)
E03	**DB2RKR**		
Contents of trouble	• Communication via CAN signal line between the transmission controller and engine controller is defective.		
Action of controller	• Does not update CAN communication information from engine controller. • Keeps engine speed at 2,100 rpm. • Holds recognized position of accelerator at 80%. • Does not sense modulation clutch slip. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The monitor does not display normally		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between E18 (female) (47) – L03 (female) (22)		Resistance	Max. 1 Ω
			Wiring harness between E18 (female) (46) – L03 (female) (32)		Resistance	Max. 1 Ω
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between E18 (female) (47) – L03 (female) (22)		Resistance	Min. 1 MΩ
			Wiring harness between E18 (female) (46) – L03 (female) (32)		Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between E18 (female) (47) – L03 (female) (22)		Voltage	Max. 1 V
			Wiring harness between E18 (female) (46) – L03 (female) (32)		Voltage	Max. 1 V
	4	Contact of wiring harness (Between CANH – CANL)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C06 (female)		Resistance	
			Between (3) – (8)		Min. 1 MΩ	
	5	Defective terminal resistor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CAN1 (male)	Between (A) – (B)	Resistance	120 ± 12 Ω
			E21 (male)	Between (A) – (B)	Resistance	120 ± 12 Ω
	6	Defective engine controller	If causes 1 – 5 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to CAN communication

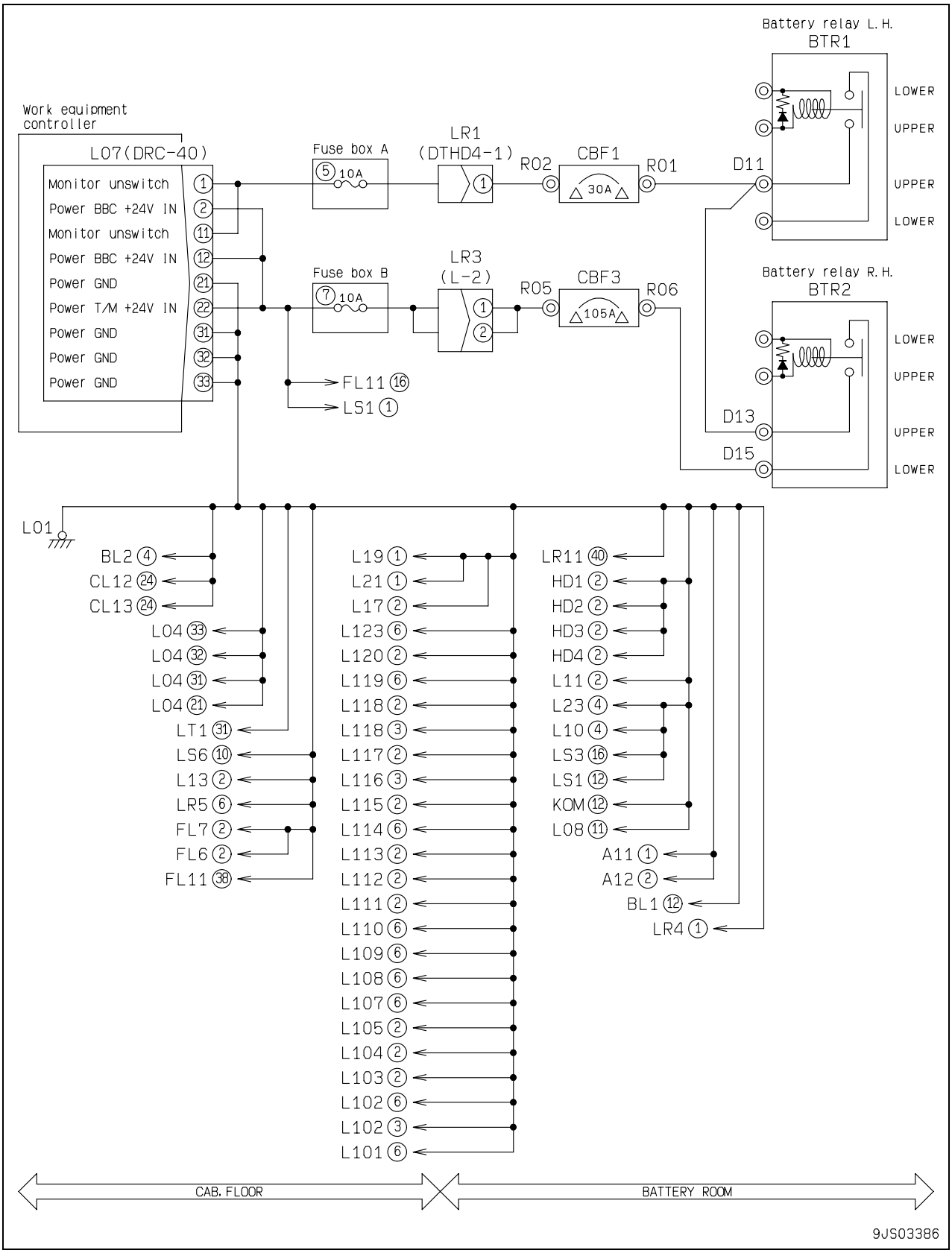


Failure code [DB90KK] Work equipment controller: Low source voltage (input)

Action code	Failure code	Trouble	Work equipment controller: Low source voltage (Work equipment controller system)
E03	**DB90KK**		
Contents of trouble	• Voltage of work equipment controller UNSW power supply (battery direct power supply) is low. • Voltage of UNSW power supply (battery direct power supply) is 18 V or less.		
Action of controller	• Does not display failure codes other than this code if voltage of UNSW power supply (battery direct power supply) remains under 18 V for more than 2 seconds. • Even if cause of failure disappears, system does not reset itself until AJSS lever and work equipment control lever are set to N (Neutral). • Turns the centralized warning lamp and alarm buzzer ON. • Cannot operate normally since it cannot sense the input signals properly.		
Problem that appears on machine	• The machine cannot operate normally.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Shut down of circuit breaker (CBF1)	If the circuit breaker is shut down, the circuit probably has a grounding fault, etc. (See cause 4.)		
	2	Defective fuse No.5 of fuse box A	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 4.)		
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between battery relay BTR2 D13 – battery relay BTR1 D11 – circuit breaker CBF1 R01	Resistance	Max. 1 Ω
			Wiring harness between circuit breaker CBF1 R02 – fuse No.5 of fuse box A	Resistance	Max. 1 Ω
			Wiring harness between fuse No.5 of fuse box A – L07 (female) (1), (11)	Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between battery relay BTR2 D13 – battery relay BTR1 D11 – circuit breaker CBF1 R02	Resistance	Min. 1 MΩ
			Wiring harness between circuit breaker CBF1 R02 – fuse No.5 of fuse box A	Resistance	Min. 1 MΩ
			Wiring harness between fuse No.5 of fuse box A – L07 (female) (1), (11)	Resistance	Min. 1 MΩ
	5	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L07	Voltage	
			Between (1), (11) and (21), (31), (32), (33)	20 – 30 V	

Circuit diagram related to work equipment controller power supply



Failure code [DB90KT] (Work equipment controller: Abnormality in controller)

Action code	Failure code	Trouble	Work equipment controller system: Abnormality in controller (Work equipment controller system)
E01	**DB90KT**		
Contents of trouble	• The information in the ROM (non-volatile memory) of the work equipment controller system is abnormal.		
Action of controller	• Sets the internal adjustment values to the default values. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The machine may false detect errors. • Performance degrades since the machine is controlled with improper data.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

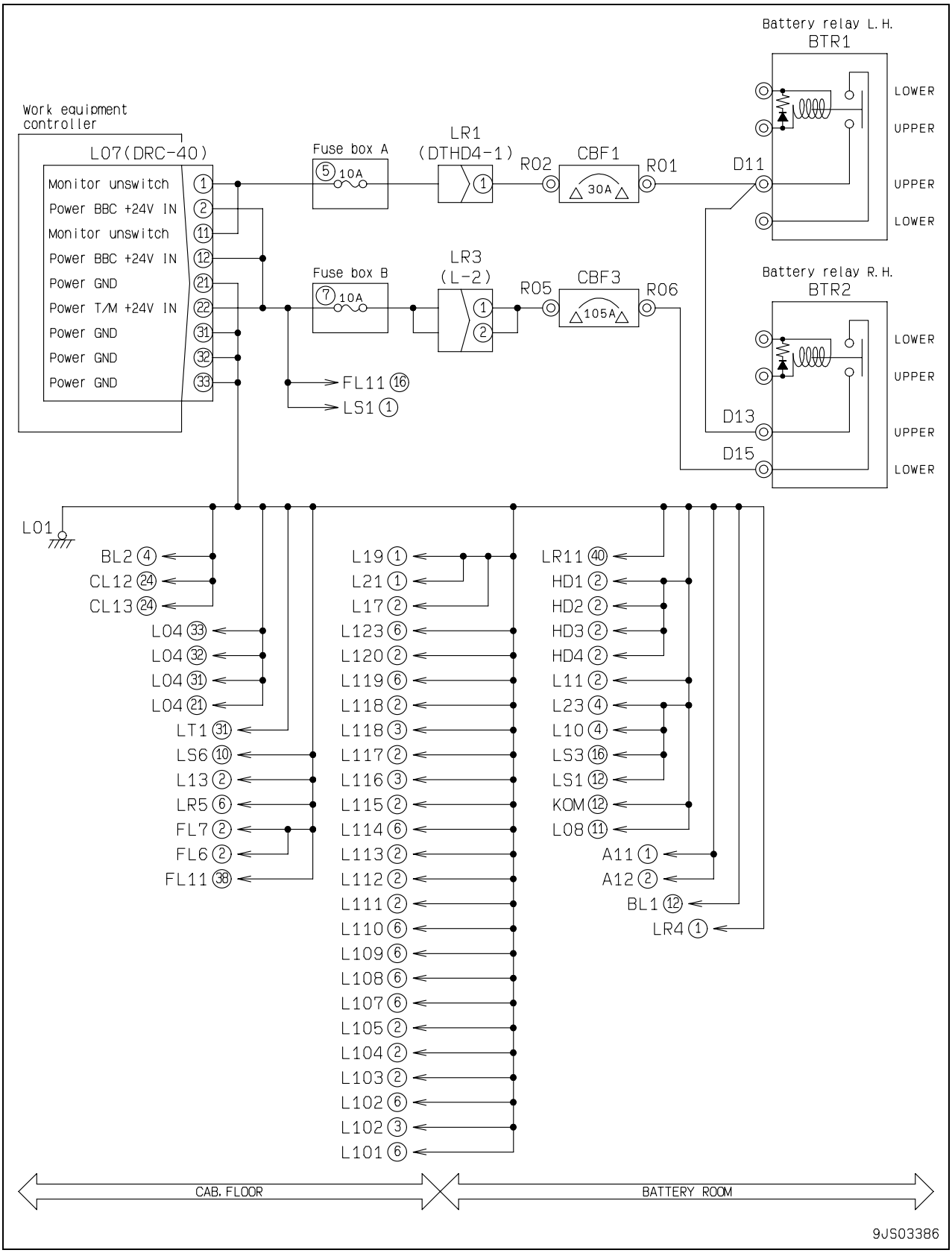
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective work equipment controller	Since trouble is in system, troubleshooting cannot be carried out. (Replace controller.)

Failure code [DB92KK] Work equipment controller load power supply line: Low source voltage (input)

Action code	Failure code	Trouble	Work equipment controller load power supply line: Low source voltage (input) (Work equipment controller system)
E03	**DB92KK**		
Contents of trouble	• The voltage of the 24 V solenoid power supply system is low. • Detection conditions: Terminal C input turned OFF, UNSW power supply (battery direct power supply) above 20 V and solenoid power supply below 18 V		
Action of controller	• Cannot supply voltage to the solenoid. (If the voltage is below 18 V, all outputs are turned OFF.) • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until AJSS lever and work equipment control lever are set to N (Neutral).		
Problem that appears on machine	• Work equipment does not move.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between battery relay BTR2 D15 – circuit breaker CBF3 R06	Resistance	Max. 1 Ω
			Wiring harness between circuit breaker CBF3 R05 – fuse No.7 of fuse box B	Resistance	Max. 1 Ω
			Wiring harness between fuse No.7 of fuse box B – L07 (female) (2), (12), (22)	Resistance	Max. 1 Ω
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between battery relay BTR2 D15 – circuit breaker CBF3 R06	Resistance	Min. 1 MΩ
			Wiring harness between circuit breaker CBF3 R05 – fuse No.7 of fuse box B	Resistance	Min. 1 MΩ
			Wiring harness between fuse No.7 of fuse box B – L07 (female) (2), (12), (22)	Resistance	Min. 1 MΩ
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L07	Voltage	
			Between (2), (12), (22) – (21), (31), (32), (33)	20 – 30 V	

Circuit diagram related to work equipment controller 24 V power supply

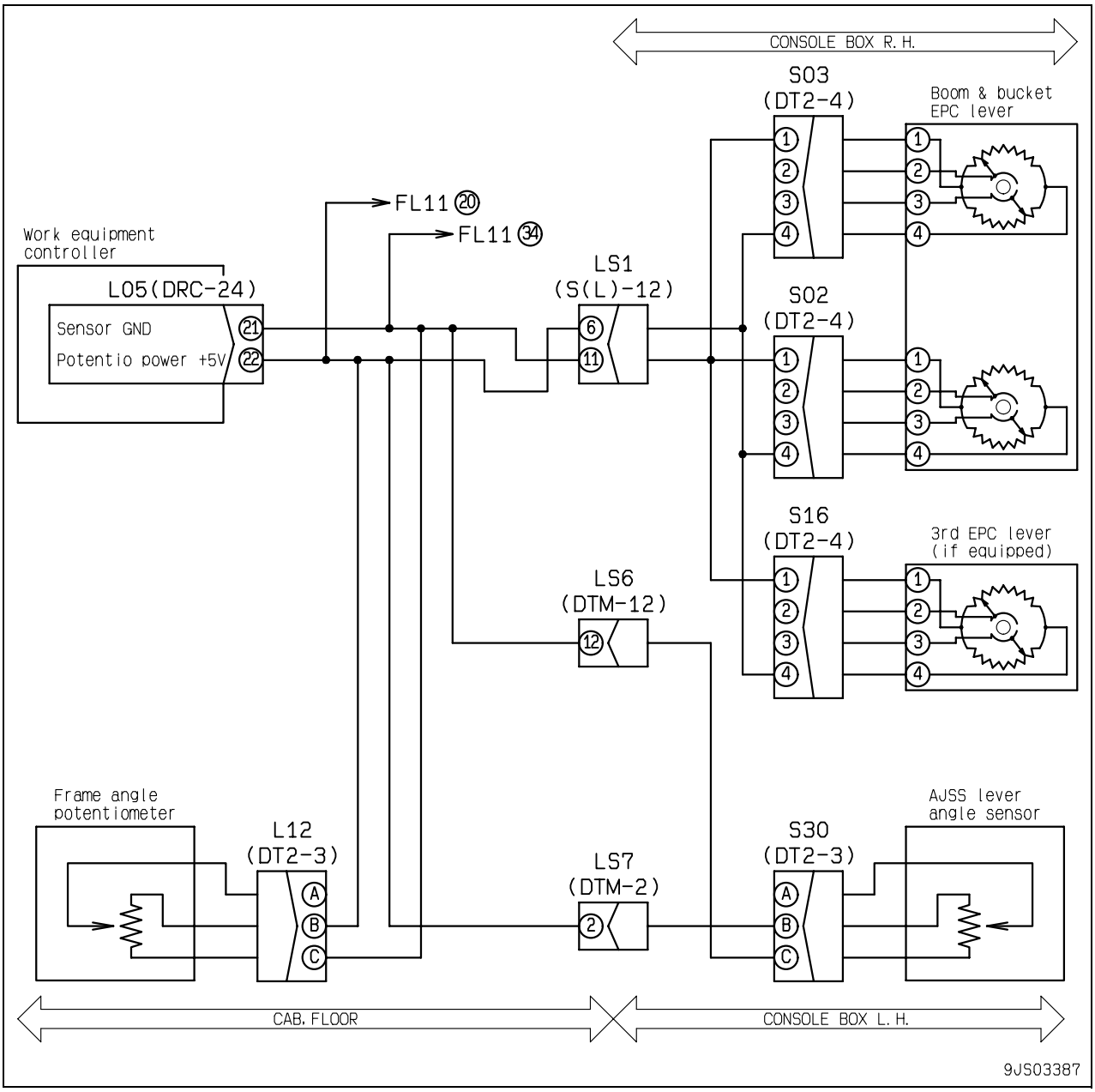


Failure code [DB95KX] (Work equipment controller power supply output: Out of input signal range)

Action code	Failure code	Trouble	Work equipment controller power supply output: Out of input signal range (Work equipment controller system)
E03	**DB95KX**		
Contents of trouble	• Nominal voltage output of 5 V sensor power supply system is out of range (Outside 4.7 – 5.3 V)		
Action of controller	• Cannot sense the input signals normally due to abnormal potentiometer signal. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The operator cannot operate the work equipment and AJSS (Machine stops entirely). • The following potentiometer error is appeared.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

		Cause	Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective frame angle potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L12 (male)	Resistance	
			Between (B) and (C)	4 – 6 kΩ	
	2	Defective AJSS lever potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			S30 (male)	Resistance	
			Between (B) and (C)	4 – 6 kΩ	
	3	Defective 3-spool valve EPC lever potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			S16 (male)	Resistance	
			Between (4) and (1)	2.5 – 3.9 kΩ	
	4	Defective lift arm EPC lever potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			S03 (male)	Resistance	
			Between (4) and (1)	2.5 – 3.9 kΩ	
	5	Defective bucket EPC lever potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			S02 (male)	Resistance	
			Between (4) and (1)	2.5 – 3.9 kΩ	
	6	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L05 (female) (22) – chassis ground	Resistance	Min. 1 MΩ
	7	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L05	Voltage	
			Between (22) and (21)	4.85 – 5.15 V	

Circuit diagram related to work equipment controller 5 V power supply



Failure code [DB99KQ] (Work equipment controller model selection: Disagreement of model selection signals)

Action code	Failure code	Trouble	Work equipment controller model selection: Disagreement of model selection signals (Machine monitor system)
E03	**DB99KQ**		
Contents of trouble	• Work equipment controller model is mistaken for another one.		
Action of controller	• Operates on the assumption that the controller model which has been used before occurrence of the failure code is still used. • Does not display failure codes which may be false detected. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Gear shifting shocks may be made.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

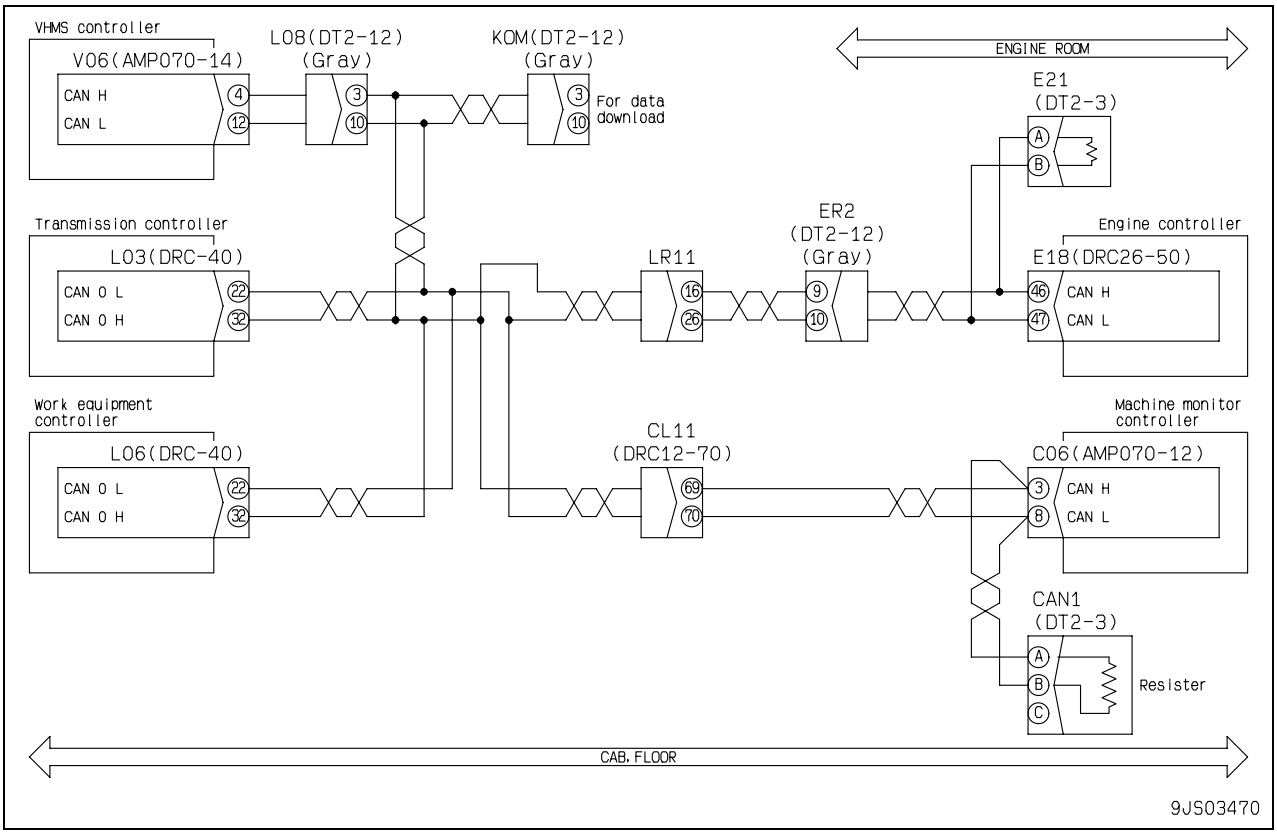
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Improper machine monitor model selection	Set the controller model of the machine monitor (See Testing and adjusting.)

Failure code [DB9RKR] CAN communication with work equipment controller: Defective communication (Abnormality in target component system)

Action code	Failure code	Trouble	CAN communication with work equipment controller: Defective communication (Abnormality in target component system) (Transmission controller system)
E03	**DB9RKR**		
Contents of trouble	• Communication via CAN signal line between the work equipment controller and transmission controller is defective.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • Uses CAN information that was sent from work equipment controller before the occurrence of the error. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	—		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

		Cause	Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L06 (female) (22) – L03 (female) (22)		Resistance	Max. 1 Ω
			Wiring harness between L06 (female) (32) – L03 (female) (32)		Resistance	Max. 1 Ω
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L06 (female) (22) – L03 (female) (22)		Resistance	Min. 1 MΩ
			Wiring harness between L06 (female) (32) – L03 (female) (32)		Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L06 (female) (22) – L03 (female) (22)		Voltage	Max. 1 V
			Wiring harness between L06 (female) (32) – L03 (female) (32)		Voltage	Max. 1 V
	4	Contact of wiring harness (Between CANH – CANL)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C06 (female)		Resistance	
			Between (3) – (8)		Min. 1 MΩ	
	5	Defective terminal resistor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CAN1 (male)	Between (A) – (B)	Resistance	120 ± 12 Ω
			E21 (male)	Between (A) – (B)	Resistance	120 ± 12 Ω
	6	Defective work equipment controller	If causes 1 – 5 are not detected, work equipment controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to CAN communication

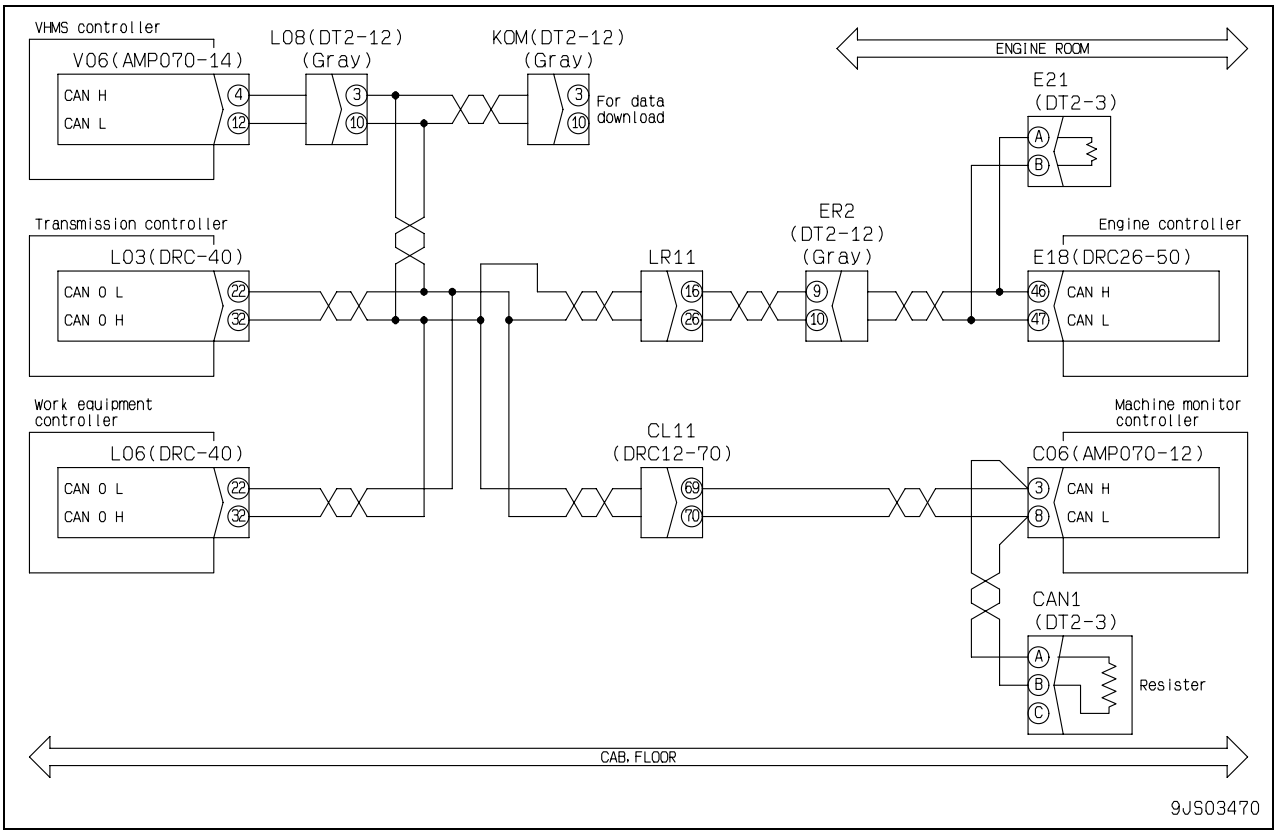


Failure code [DB9RMA] (Work equipment controller CAN communication: Malfunction)

Action code	Failure code	Trouble	Work equipment controller CAN communication (optional setting): Malfunction (Machine monitor system)
E03	**DB9RMA**		
Contents of trouble	• Options set by machine monitor are different from those recognized by work equipment controller.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • The work equipment controller takes setting of options which the work equipment controller recognizes itself.		
Problem that appears on machine	—		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Wrong setting of options	Set options correctly.		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L06 (female) (22) – C06 (female) (8)	Resistance	Max. 1 Ω
			Wiring harness between L06 (female) (32) – C06 (female) (3)	Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L06 (female) (22) – C06 (female) (8)	Resistance	Min. 1 MΩ
			Wiring harness between L06 (female) (32) – C06 (female) (3)	Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L06 (female) (22) – C06 (female) (8)	Voltage	Max. 1 V
			Wiring harness between L06 (female) (32) – C06 (female) (3)	Voltage	Max. 1 V
	5	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L06	Voltage	
			Between (22), (32) and chassis ground	4 – 8 V	

Circuit diagram related to CAN communication

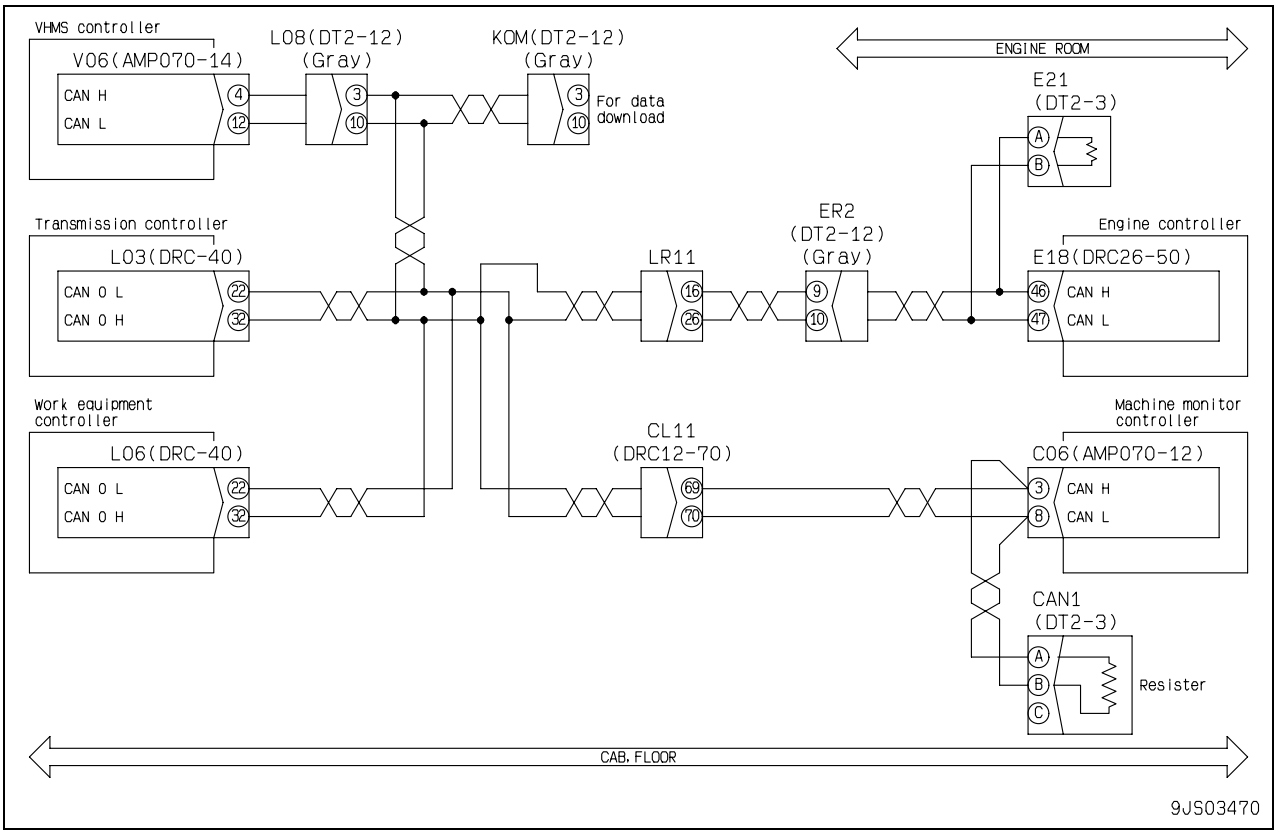


Failure code [DB9RMC] (CAN communication with transmission controller: Defective operation)

Action code	Failure code	Trouble	CAN communication with transmission controller: Defective operation (Work equipment controller system)
E03	**DB9RMC**		
Contents of trouble	• Communication via CAN signal line between the work equipment controller and transmission controller is defective. • The travel speed signal cannot be transmitted from transmission controller. • The engine start prohibition signal cannot be transmitted from transmission controller. • If cause of failure disappears, system resets itself.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • Judges that the travel speed is at 0 km/h. • Uses CAN information that was sent from transmission controller before the occurrence of the error.		
Problem that appears on machine	• The operator may not use semiautomatic digging occasionally or cannot use it entirely. • The engine can start when the AJSS lever is not in neutral • Swing speed increases because AJSS cannot sense travel speed properly.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L06 (female) (22) – L03 (female) (22)		Resistance	Max. 1 Ω
			Wiring harness between L06 (female) (32) – L03 (female) (32)		Resistance	Max. 1 Ω
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L06 (female) (22) – L03 (female) (22)		Resistance	Min. 1 MΩ
			Wiring harness between L06 (female) (32) – L03 (female) (32)		Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L06 (female) (22) – L03 (female) (22)		Voltage	Max. 1 V
			Wiring harness between L06 (female) (32) – L03 (female) (32)		Voltage	Max. 1 V
	4	Contact of wiring harness (Between CANH – CANL)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C06 (female)		Resistance	
			Between (3) – (8)		Min. 1 MΩ	
	5	Defective terminal resistor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CAN1 (male)	Between (A) – (B)	Resistance	120 ± 12 Ω
			E21 (male)	Between (A) – (B)	Resistance	120 ± 12 Ω
	6	Defective transmission controller	If causes 1 – 5 are not detected, transmission controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to CAN communication

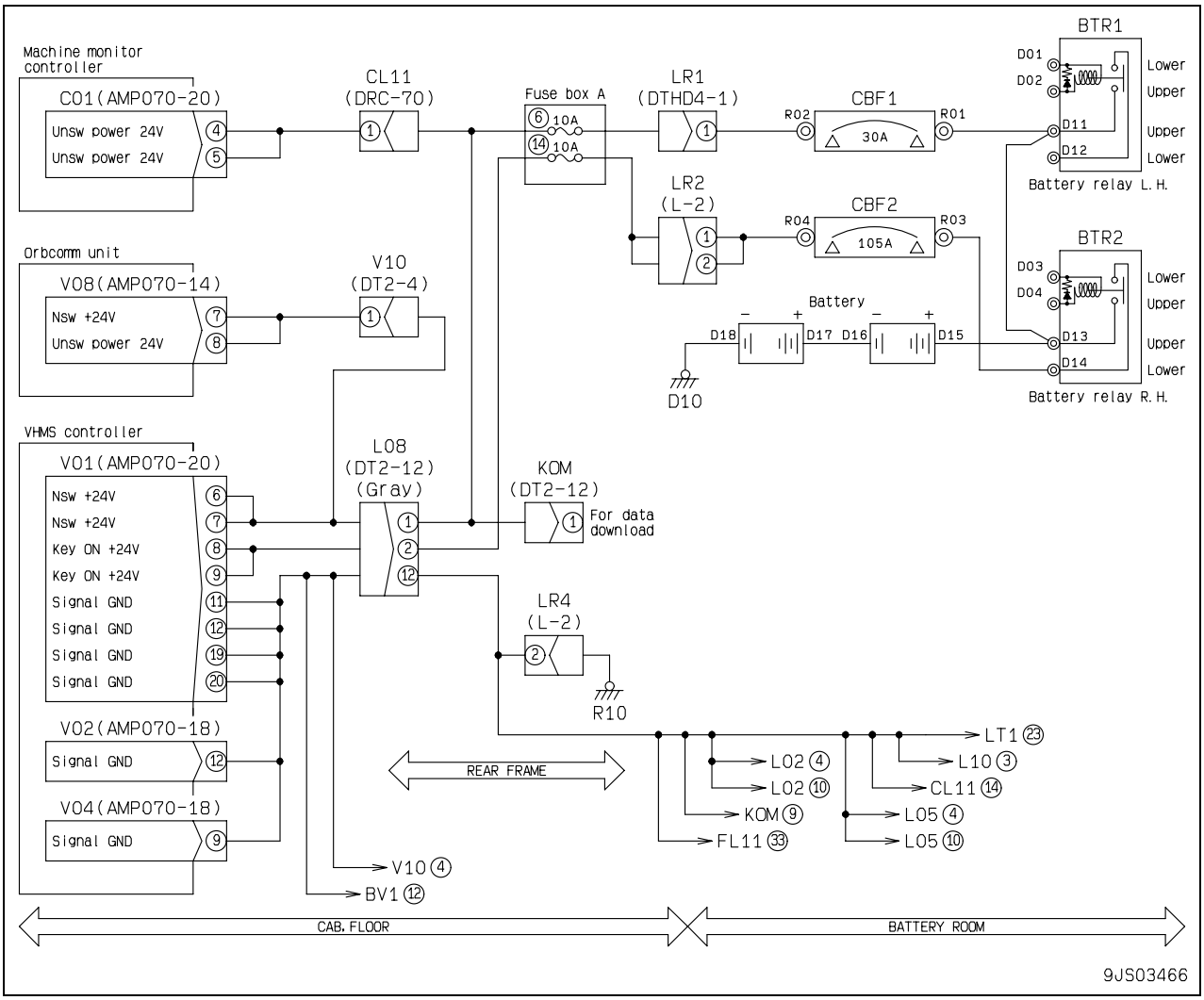


Failure code [DBB0KK] (or VHMS_LED display: “n9” → “01”) VHMS controller: Low source voltage (input)

Action code	Failure code	Trouble	VHMS controller: Low source voltage (input) (VHMS controller system)
—	**DBB0KK**		
Contents of trouble	• Voltage of VHMS controller switch fell to below 19.5 V while the engine speed is above 500 rpm)		
Action of controller	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	—		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n9” → “01”. • If failure code [**DAF3KK**] (Machine monitor: Low source voltage (input)) is displayed, carry out troubleshooting for it first. • Method of reproducing failure code: Start engine and raise the engine speed above 500 rpm		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse No.14 of fuse box A	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 3.)		
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No.14 of fuse box A – V01 (female) (8), (9)	Resistance	Max. 1 Ω
			Wiring harness between V01 (female) (11), (12), (19), (20), V02 (female) (12), V04 (female) (9) and chassis ground	Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No.14 of fuse box A – V01 (female) (8), (9)	Resistance	Min. 1 MΩ
	4	Defective VHMS controller	★ Prepare with starting switch OFF, then carry out troubleshooting after starting engine and raising the engine speed above 500 rpm		
			V01	Voltage	
			Between (8), (9) and (11), (12), (19), (20) or chassis ground	20 – 30 V	

Circuit diagram related to VHMS controller power supply



Failure code [DBB0KQ] (or VHMS_LED display: “nF” → “11”) (VHMS controller: Disagreement of model selection signals)

Action code	Failure code	Trouble	VHMS controller: Disagreement of model selection signals (VHMS controller system)
—	**DBB0KQ**		
Contents of trouble	• Improperly connected connectors were detected.		
Action of controller	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The system may not work properly.		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “nF” → “11”. • Method of reproducing failure code: Turn the starting switch ON.		

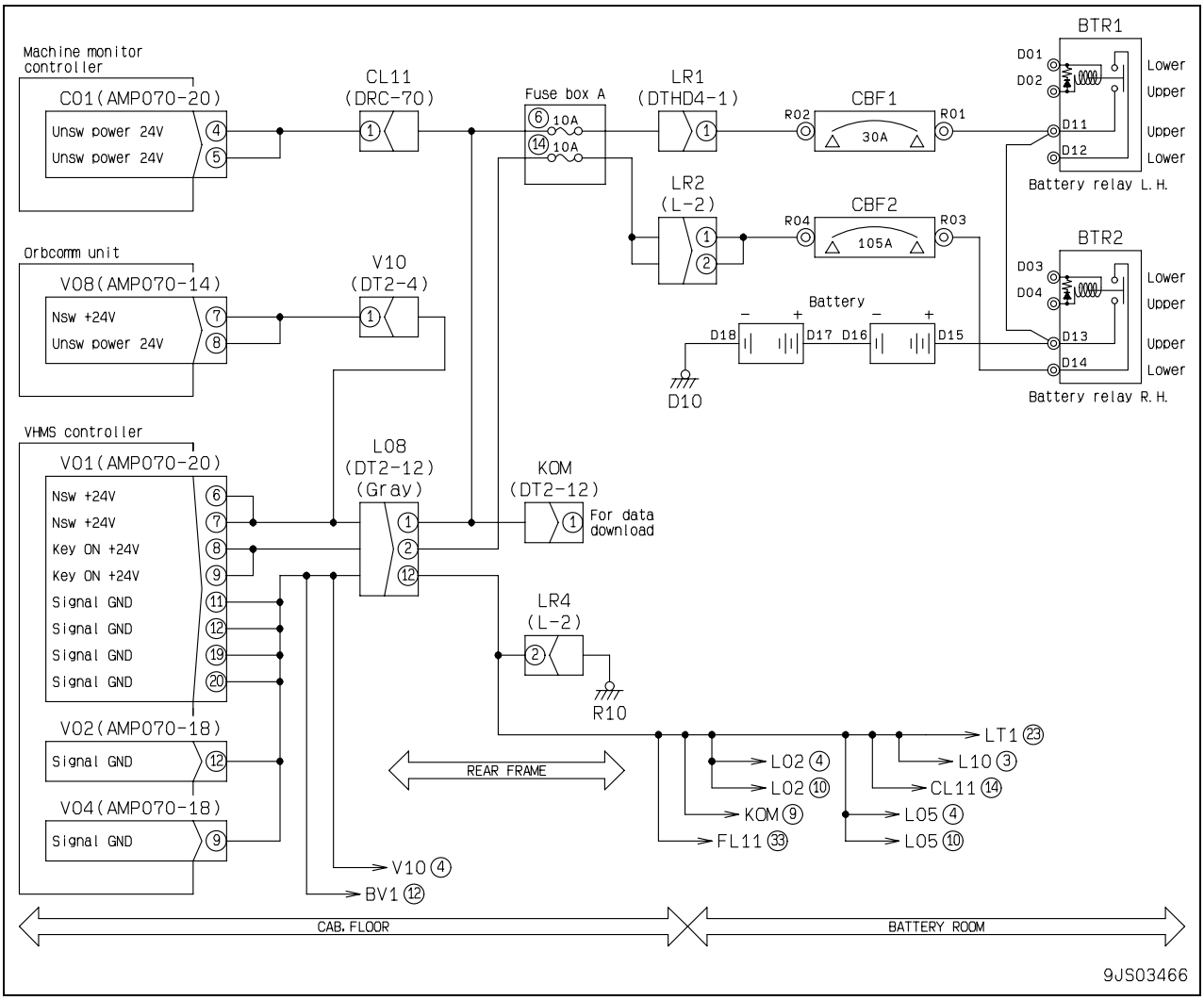
	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Improperly connected connectors in VHMS controller (when the system is normal)	Check connection between V02 and V04 connectors, and V03 and V05 connectors for abnormality.
	2	Defective VHMS controller	If the above is normal, VHMS controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [DBB3KK] (or VHMS_LED display: “n9” → “05”) VHMS controller battery power supply: Low source voltage (input)

Action code	Failure code	Trouble	VHMS controller: Low source voltage (input) (VHMS controller system)
—	**DBB3KK**		
Contents of trouble	• Constant voltage of VHMS controller fell to below 10 V.		
Action of controller	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	—		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n9” → “05”. • Method of reproducing failure code: Keep the starting switch turned OFF		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse No.6 of fuse box A	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 3.)		
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No.6 of fuse box A – V01 (female) (6), (7)	Resistance	Max. 1 Ω
			Wiring harness between V01 (female) (11), (12), (19), (20), V02 (female) (12), V04 (female) (9) and chassis ground	Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No.6 of fuse box A – V01 (female) (6), (7)	Resistance	Min. 1 MΩ
	4	Defective VHMS controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			V01	Voltage	
			Between (6), (7) and (11), (12), (19), (20) or chassis ground	20 – 30 V	

Circuit diagram related to VHMS controller power supply

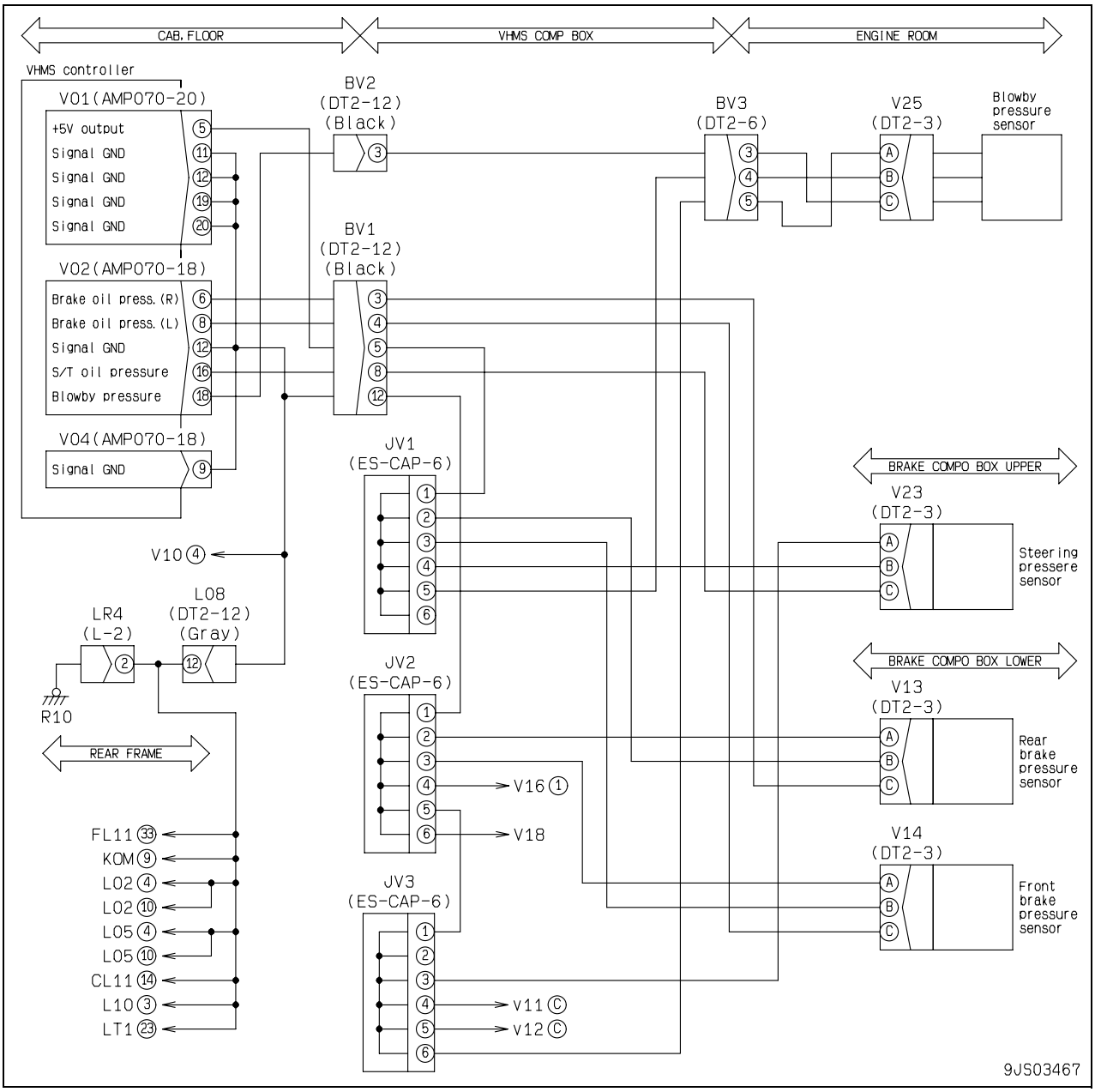


Failure code [DBB5KP] (or VHMS_LED display: “n9” → “04”) (VHMS controller 5 V power supply output: Low output voltage)

Action code	Failure code	Trouble	VHMS controller 5 V power supply output: Low output voltage (VHMS controller system)
—	**DBB5KP**		
Contents of trouble	• VHMS controller 5 V sensor power supply is shorted with the chassis ground.		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	—		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n9” → “04”. • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V01 (female) (5) – V13 (female) (B), – V14 (female) (B), – V23 (female) (B), – V25 (female) (B)	Resistance	Min. 1 MΩ	
	2	Defective VHMS controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			V01	Voltage		
			Between (5) and (11), (12), (19), (20) or chassis ground	4.5 – 5.5 V		

Circuit diagram related to VHMS controller 5 V sensor power supply

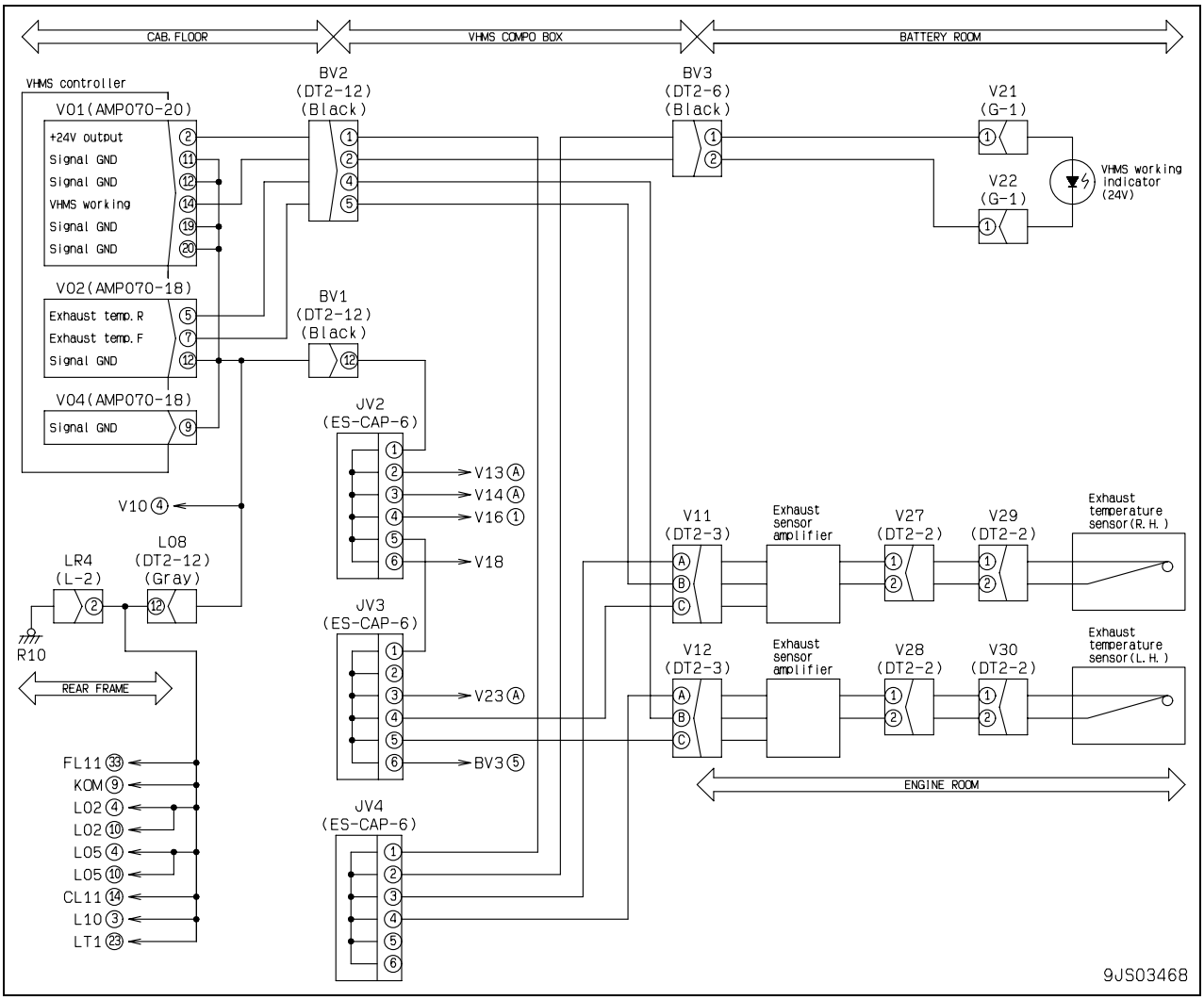


Failure code [DBB6KP] (or VHMS_LED display: “n9” → “02”) (VHMS controller 24 V power supply output: Low output voltage)

Action code	Failure code	Trouble	VHMS controller 24 V power supply output: Low output voltage (VHMS controller system)
—	**DBB6KP**		
Contents of trouble	• VHMS controller 24 V sensor and indicator lamp power supply is shorted with the chassis ground.		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	—		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n9” → “02”. • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V01 (female) (2) – V21 (female) (1), – V29 (female) (1), – V30 (female) (1)	Resistance	Min. 1 MΩ	
	2	Defective VHMS controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			V01	Voltage		
			Between (2) and (11), (12), (19), (20) or chassis ground	20 – 30 V		

Circuit diagram related to VHMS controller 24 V sensor power supply

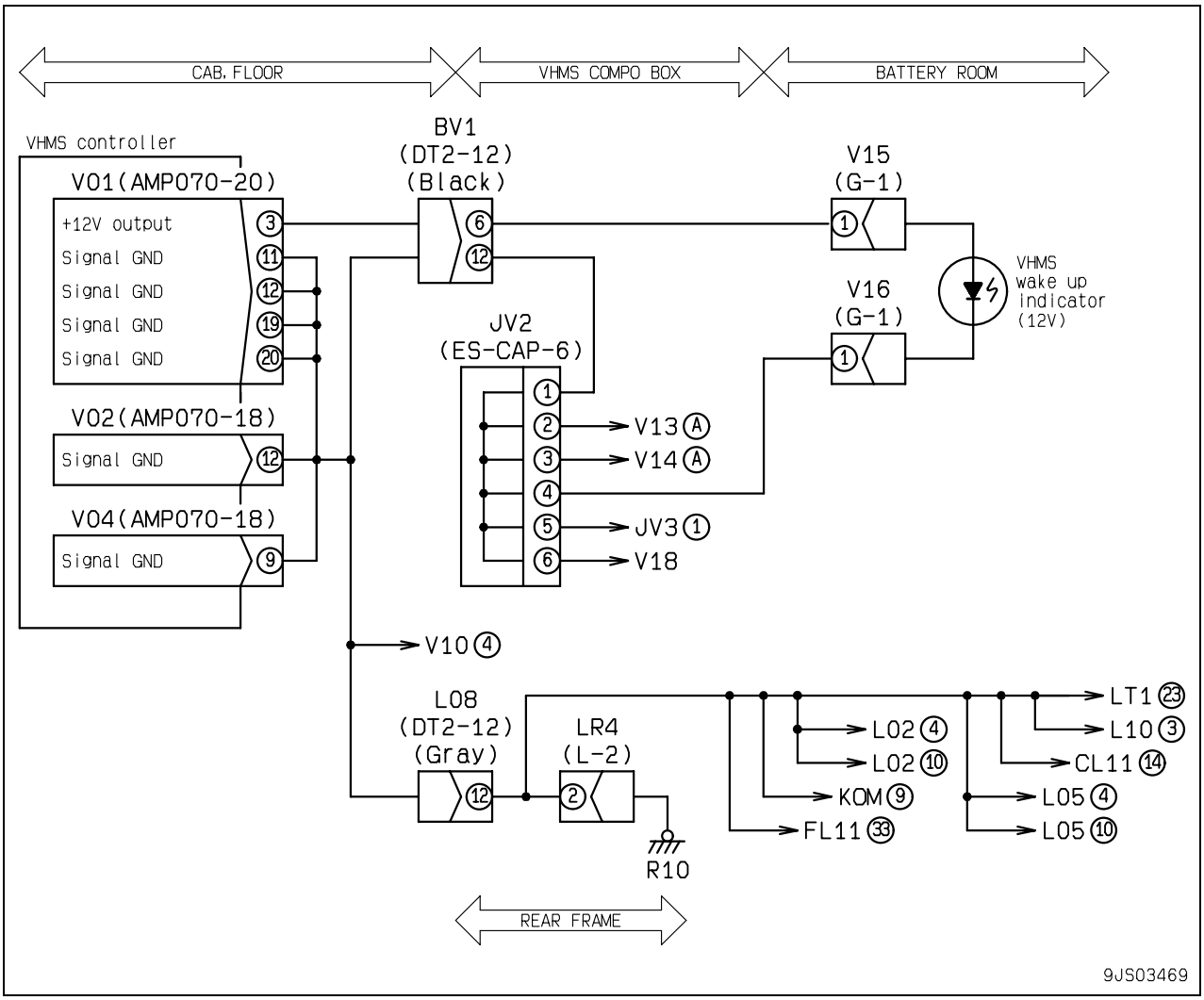


Failure code [DBB7KP] (or VHMS_LED display: “n9” → “03”) (VHMS controller 12 V power supply output: Low output voltage)

Action code	Failure code	Trouble	VHMS controller 12 V power supply output: Low output voltage (VHMS controller system)
—	**DBB7KP**		
Contents of trouble	• VHMS controller 12 V indicator lamp power supply is shorted with the chassis ground.		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	—		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n9” → “03”. • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between V01 (female) (3) – V15 (female) (1)	Resistance	Min. 1 MΩ
	2	Defective VHMS controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			V01	Voltage	
			Between (3) and (11), (12), (19), (20) or chassis ground	11.5 – 12.5 V	

Circuit diagram related to VHMS controller 12 V sensor power supply



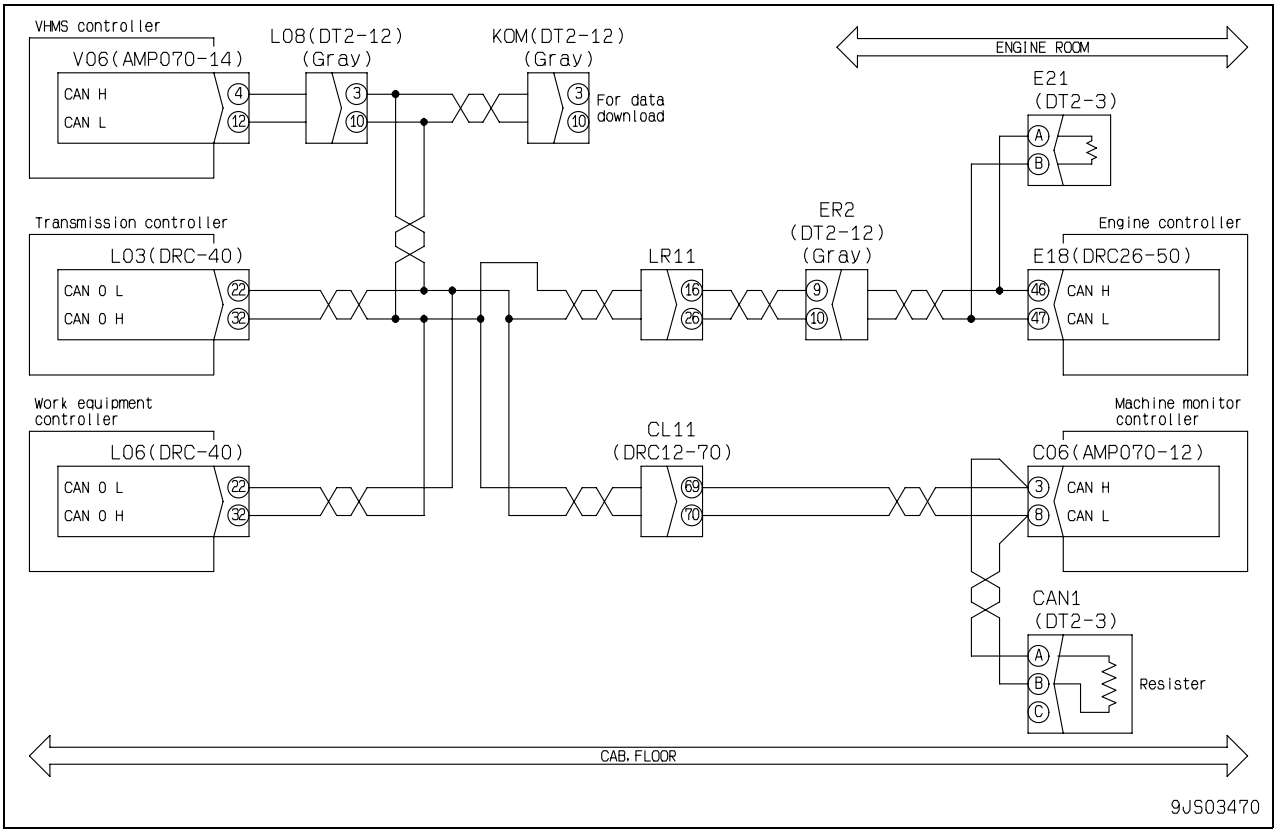
Failure code [DBBQKR] (or VHMS_LED display: “n8” → “02”) VHMS controller CAN communication: Defective communication (Abnormality in target component system)

Action code	Failure code	Trouble	VHMS controller CAN communication: Defective communication (Abnormality in target component system) (VHMS controller system)
—	**DBBQKR**		
Contents of trouble	• CAN communication information from each controller cannot be received.		
Action of controller	• None in particular.		
Problem that appears on machine	• The system may not work properly.		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n8” → “02”. • If failure code [**CA1633**], [**DAFRKR**], [**DAQRMA**], [**DB2RKR**], [**DB9RKR**], [**DB9RMA**] or [**DB9RMC**] is displayed, carry out troubleshooting for it first. • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between V06 (female) (12) – C06 (female) (8), – E18 (female) (47), – L03 (female) (22), – L06 (female) (22)	Resistance	Max. 1 Ω
			Wiring harness between V06 (female) (4) – C06 (female) (3), – E18 (female) (46), – L03 (female) (32), – L06 (female) (32)	Resistance	Max. 1 Ω
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between V06 (female) (12) – C06 (female) (8), – E18 (female) (47), – L03 (female) (22), – L06 (female) (22)	Resistance	Min. 1 MΩ
			Wiring harness between V06 (female) (4) – C06 (female) (3), – E18 (female) (46), – L03 (female) (32), – L06 (female) (32)	Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between V06 (female) (12) – C06 (female) (8), – E18 (female) (47), – L03 (female) (22), – L06 (female) (22)	Voltage	Max. 1 V
			Wiring harness between V06 (female) (4) – C06 (female) (3), – E18 (female) (46), – L03 (female) (32), – L06 (female) (32)	Voltage	Max. 1 V
	4	Defective CAN end point resistance	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			E21 (male)	Resistance	
			Between (A) and (B)	110 – 140 Ω	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CAN1 (male)	Resistance	
			Between (A) and (B)	110 – 140 Ω	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	5	Defective VHMS controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting	
			V06	Voltage
			Between (4), (12) and chassis ground	4 – 8 V

Circuit diagram related to VHMS controller CAN communication

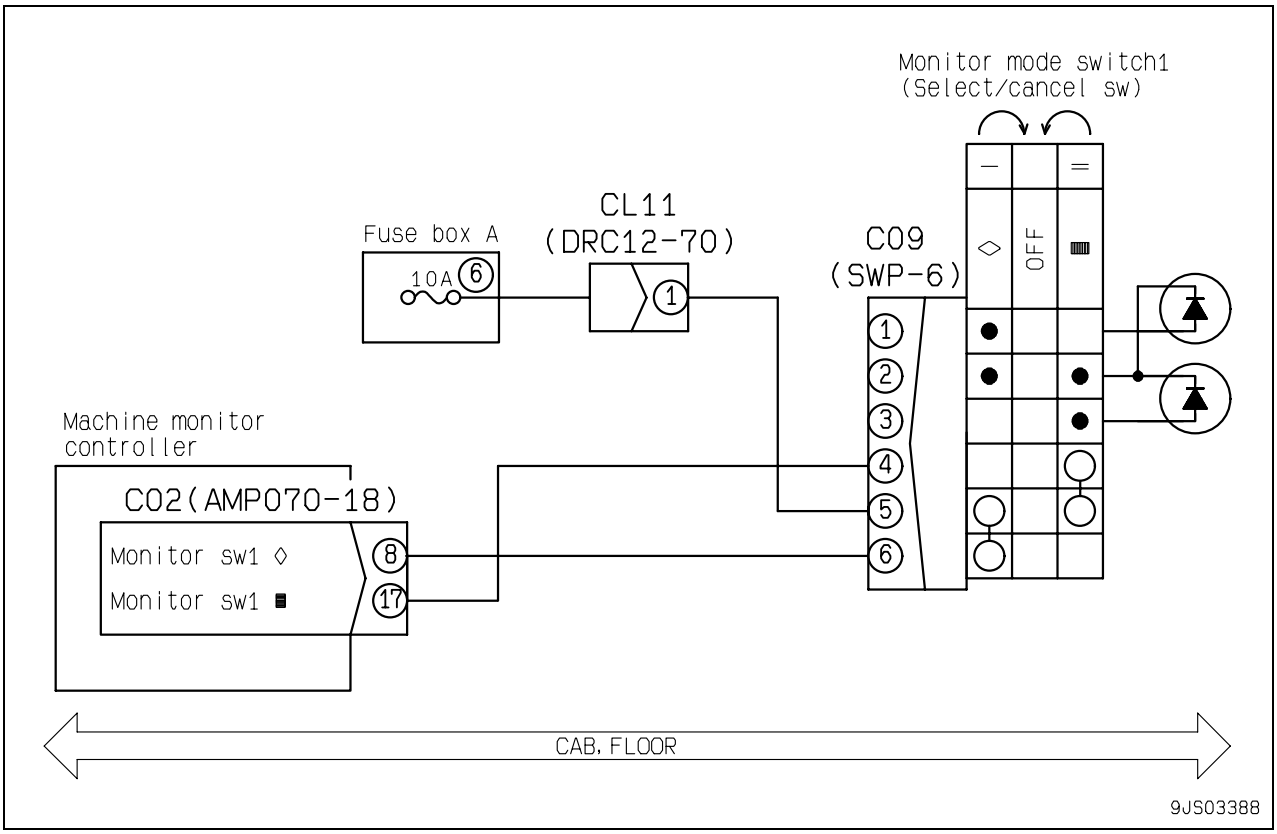


Failure code [DD15LD] (■ switch (Panel switch 1): Switch is kept pressed for long time)

Action code	Failure code	Trouble	■ switch (Panel switch 1): Switch is kept pressed for long time (Machine monitor system)
E01	**DD15LD**		
Contents of trouble	• The input circuit of the machine monitor mode selector switch 1 “■” (Panel switch 1) is kept CLOSED for more than continuous 1 minute.		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The operator cannot operate the monitor (cannot enter the service mode).		
Related information	• The input state (ON/OFF) from the machine monitor mode selector switch 1 “■” (Panel switch 1) can be checked with the monitoring function (Code: 40901 D-IN-15). • The operator may not be able to use the monitoring function because of the ■ switch trouble. • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective ■ switch (Panel switch 1) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C09 (male)	■ switch (Panel switch 1)	Resistance	
			Between (4) and (5)	ON	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between C02 (female) (17) – C09 (female) (4)		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C02	■ switch (Panel switch 1)	Voltage	
			Between (17) and chassis ground	ON	20 – 30 V	
				Other than above	Max. 1 V	

Circuit diagram related to ■ switch and ◇ switch

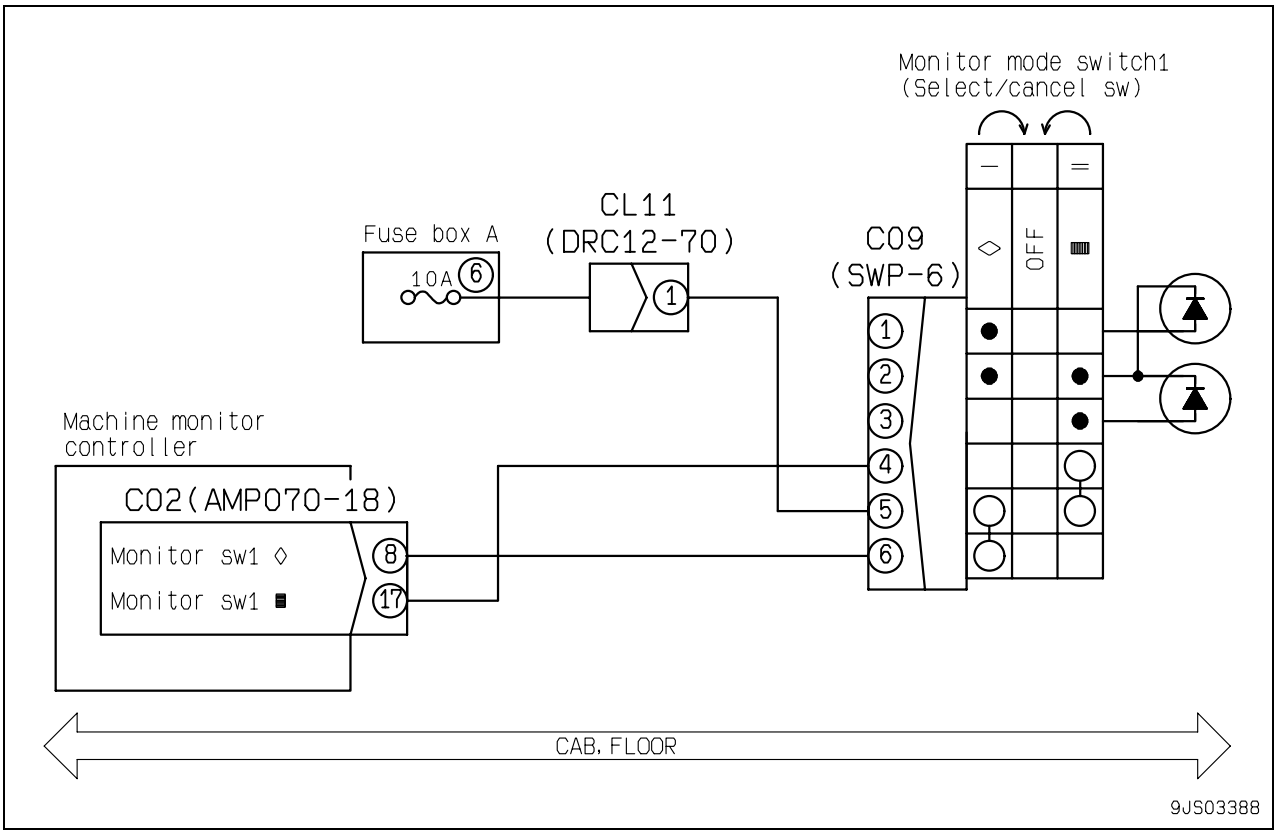


Failure code [DD16LD] (◇ switch (Panel switch 2): Switch is kept pressed for long time)

Action code	Failure code	Trouble	◇ switch (Panel switch 2): Switch is kept pressed for long time (Machine monitor system)
E01	**DD16LD**		
Contents of trouble	• The input circuit of the machine monitor mode selector switch 2 "◇" (Panel switch 2) is kept CLOSED for more than continuous 1 minute.		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The operator cannot operate the monitor.		
Related information	• The input state (ON/OFF) from the machine monitor mode selector switch 2 "◇" (Panel switch 2) can be checked with the monitoring function (Code: 40901 D-IN-14). • The operator may not be able to use the monitoring function because of the ◇ switch trouble. • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective ◇ switch (Panel switch 2) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C09 (male)	◇ switch (Panel switch 2)	Resistance	
			Between (5) and (6)	ON	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between C02 (female) (8) – C09 (female) (6)		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C02	◇ switch (Panel switch 2)	Voltage	
			Between (8) and chassis ground	ON	20 – 30 V	
				Other than above	Max. 1 V	

Circuit diagram related to ■ switch and ◇ switch

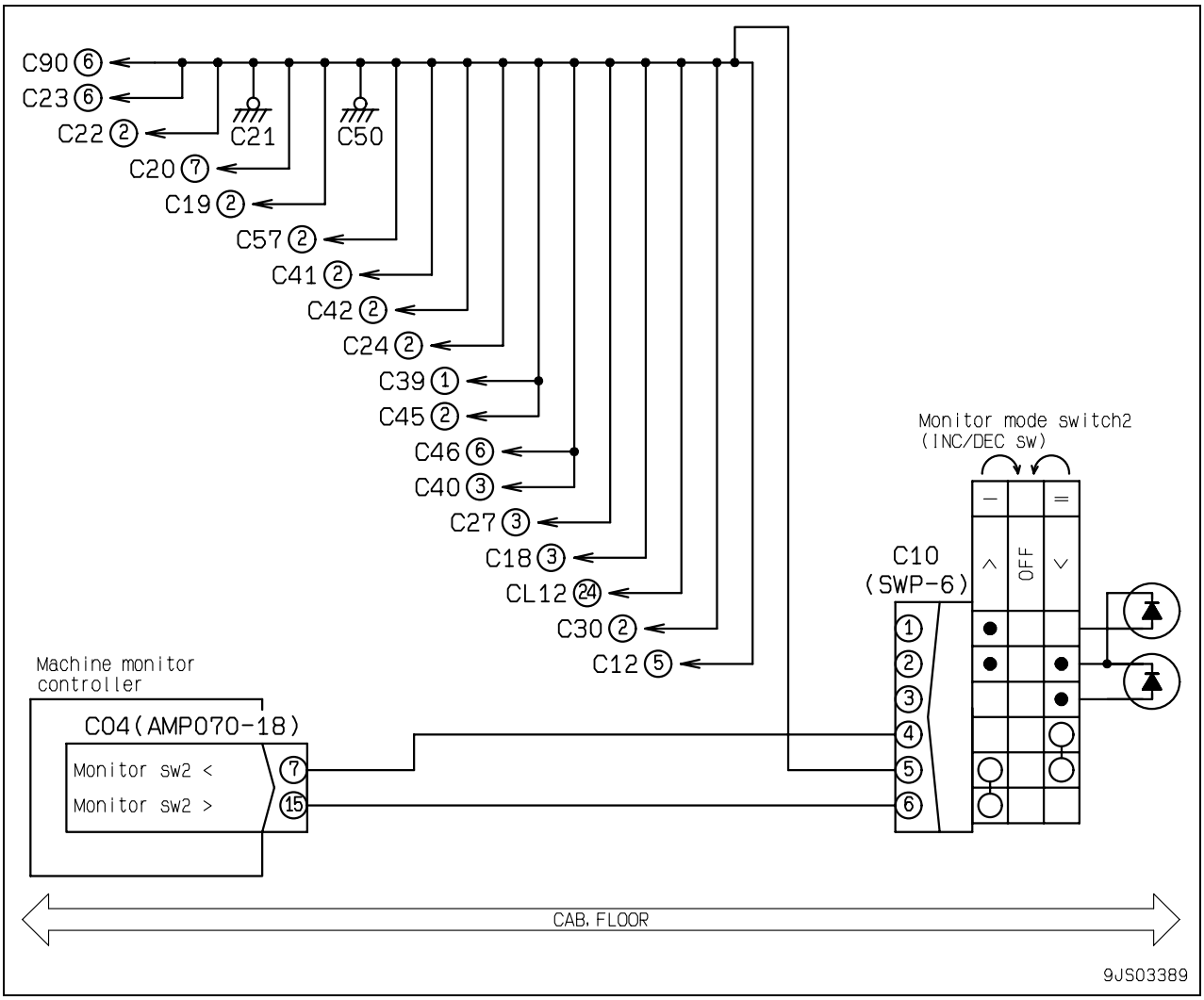


Failure code [DD17LD] (< switch (Panel switch 3): Switch is kept pressed for long time)

Action code	Failure code	Trouble	< switch (Panel switch 3): Switch is kept pressed for long time (Machine monitor system)
E01	**DD17LD**		
Contents of trouble	• The input circuit of the machine monitor mode selector switch 3 “<” (Panel switch 3) is kept CLOSED for more than continuous 1 minute.		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The operator cannot operate the monitor.		
Related information	• The input state (ON/OFF) from the machine monitor mode selector switch 3 “<” (Panel switch 3) can be checked with the monitoring function (Code: 40904 D-IN-38). • The operator may not be able to use the monitoring function because of the < switch trouble. • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective < switch (Panel switch 3) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C10 (female)	< switch (Panel switch 3)	Resistance	
			Between (4) and (5)	ON	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C10 (female) (4) – C04 (female) (7)		Resistance	Min. 1 MΩ
	3	Defective monitor panel	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C04 (female)	< switch (Panel switch 3)	Voltage	
			Between (7) and chassis ground	ON	Max. 1 V	
				Other than above	20 – 30 V	

Circuit diagram related to > switch and < switch

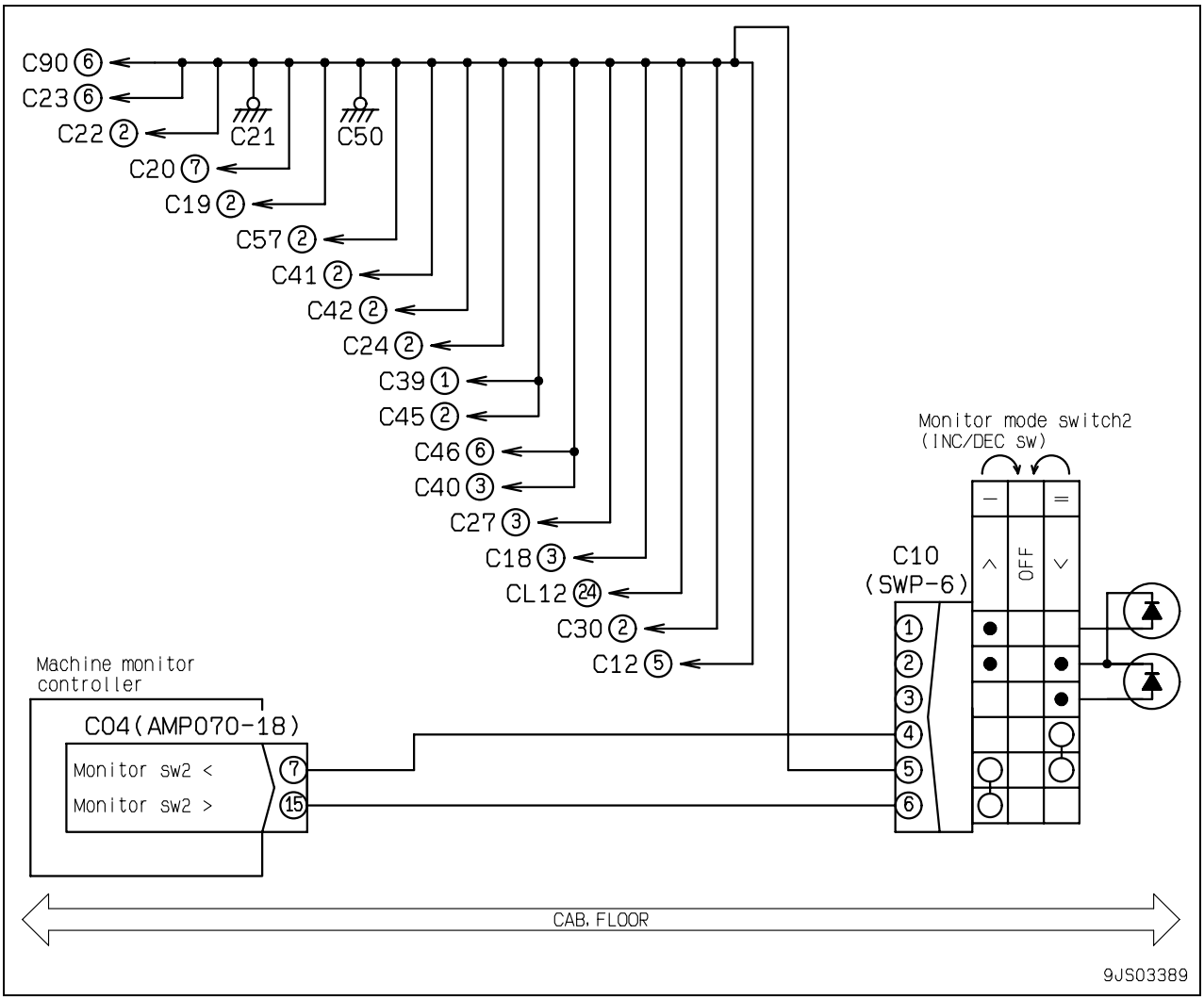


Failure code [DD18LD] (> switch (Panel switch 4): Switch is kept pressed for long time)

Action code	Failure code	Trouble	> switch (Panel switch 4): Switch is kept pressed for long time (Machine monitor system)
E01	**DD18LD**		
Contents of trouble	• The input circuit of the machine monitor mode selector switch 4 “>” (Panel switch 4) is kept CLOSED for more than continuous 1 minute.		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The operator cannot operate the monitor.		
Related information	• The input state (ON/OFF) from the machine monitor mode selector switch 4 “>” (Panel switch 4) can be checked with the monitoring function (Code: 40904 D-IN-37). • The operator may not be able to use the monitoring function because of the > switch trouble. • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective > switch (Panel switch 4) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C10 (female)	> switch (Panel switch 3)	Resistance	
			Between (5) and (6)	ON	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C10 (female) (6) – C04 (female) (15)		Resistance	Min. 1 MΩ
	3	Defective monitor panel	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C04 (female)	> switch (Panel switch 3)	Voltage	
			Between (15) and chassis ground	ON	Max. 1 V	
				Other than above	20 – 30 V	

Circuit diagram related to > switch and < switch

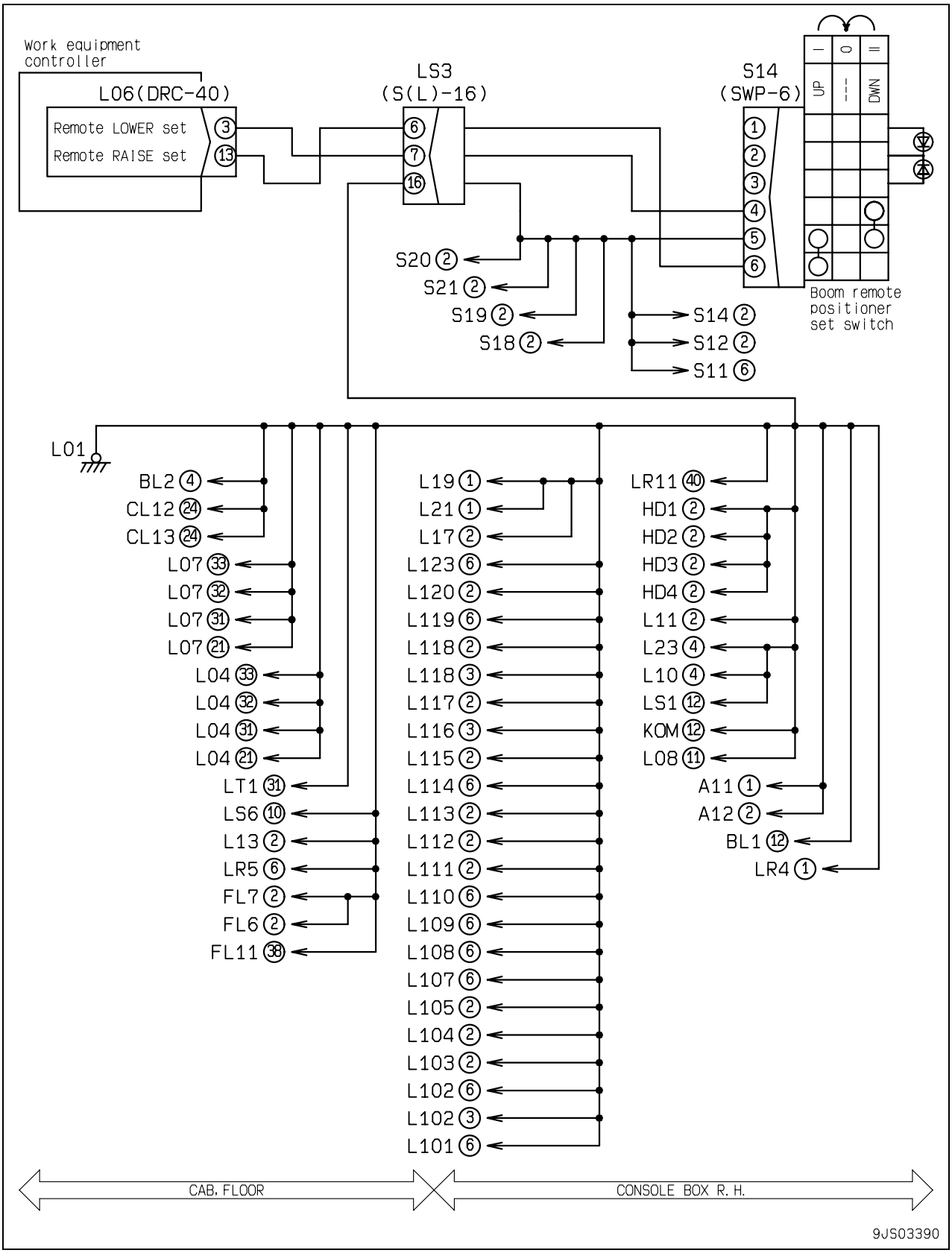


Failure code [DD1ALD] (Remote positioner raise/lower set switch (raise): Switch is kept pressed for long time)

Action code	Failure code	Trouble	Remote positioner raise/lower set switch (raise): Switch is kept pressed for long time (Work equipment controller system)
E01	**DD1ALD**		
Contents of trouble	• Since the remote positioner raise/lower set switch (raise) system has a grounding fault, operator cannot set raising.		
Action of controller	• Stops setting the lift arm raise set position. • Stops the remote raise stop operation. • Turns the lift arm raise set indicator OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The operator cannot set the lift arm raise set position. • The remote positioner raise stop function does not work.		
Related information	• The input state (ON/OFF) from the remote positioner raise/lower set switch (raise) can be checked with the monitoring function (Code: 40913 D-IN-28). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective remote positioner raise/lower set switch (raise) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S14 (male)	Remote positioner raise/lower set switch	Resistance	
			Between (5) and (6)	Raise	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
			Between (5), (6) and chassis ground	Constant	Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L06 (female) (13) – S14 (female) (6)		Resistance	Min. 1 MΩ
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L06 (male)	Remote positioner raise/lower set switch	Voltage	
			Between (13) and chassis ground	Raise	Max. 1 V	
				Other than above	7 – 10 V	

Circuit diagram related to remote positioner raise/lower set switch

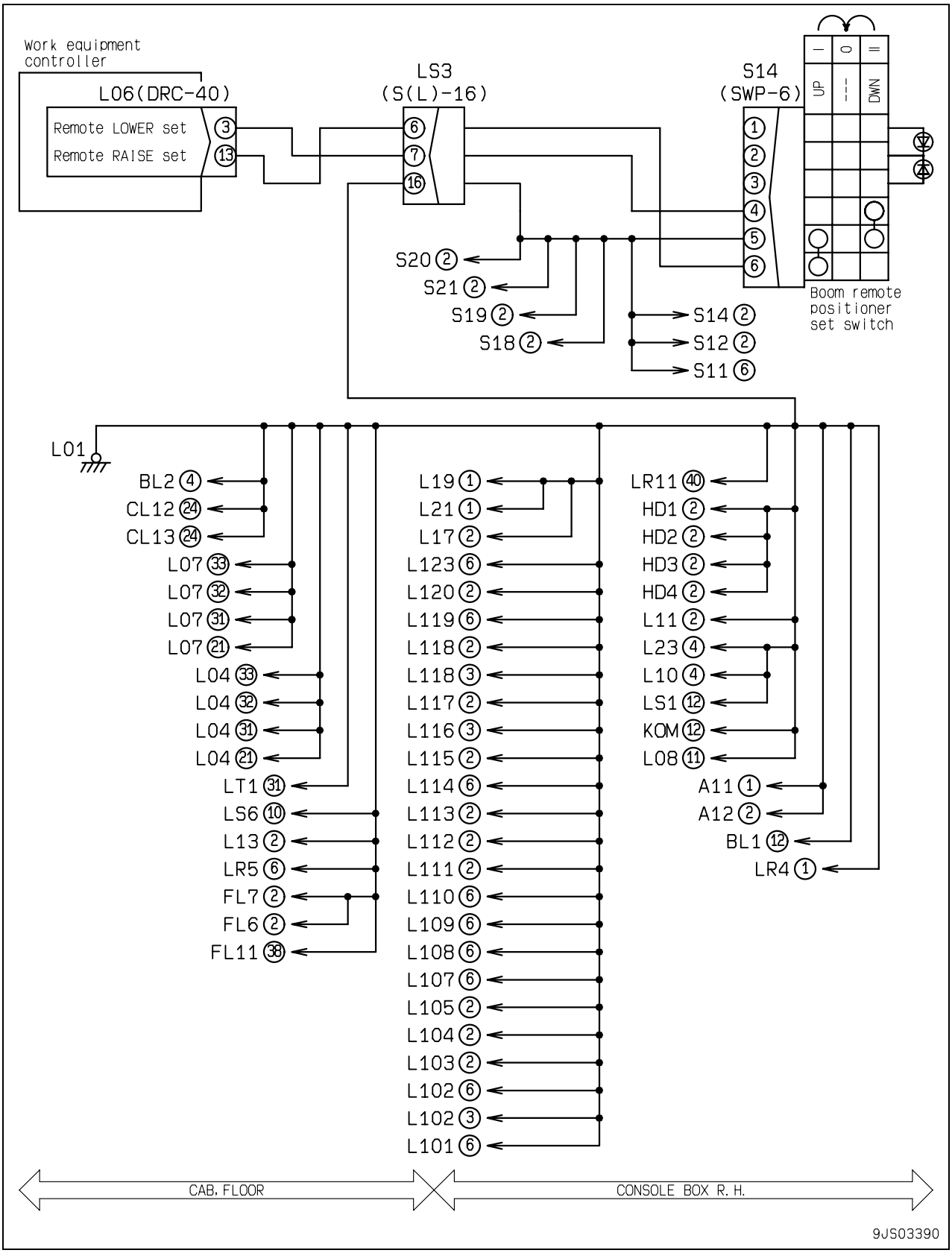


Failure code [DD1BLD] (Remote positioner raise/lower set switch (lower): Switch is kept pressed for long time)

Action code	Failure code	Trouble	Remote positioner raise/lower set switch (lower): Switch is kept pressed for long time (Work equipment controller system)
E01	**DD1BLD**		
Contents of trouble	• Since the remote positioner raise/lower set switch (lower) system has a grounding fault, operator cannot set lowering.		
Action of controller	• Stops setting the lift arm lower set position. • Stops the remote lower stop operation. • Turns the lift arm lower set indicator OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The operator cannot set the lower set position. • The remote positioner raise stop function does not work.		
Related information	• The input state (ON/OFF) from the remote positioner raise/lower set switch (lower) can be checked with the monitoring function (Code: 40913 D-IN-29). • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective remote positioner raise/lower set switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S14 (male)	Remote positioner raise/lower set switch	Resistance	
			Between (4) and (5)	Lower	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
			Between (4), (5) and chassis ground	Constant	Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L06 (female) (3) – LS3 (female) (4)		Resistance	Min. 1 MΩ
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L06 (male)	Remote positioner raise/lower set switch	Voltage	
			Between (3) and chassis ground	Lower	Max. 1 V	
				Other than above	7 – 10 V	

Circuit diagram related to remote positioner raise/lower set switch

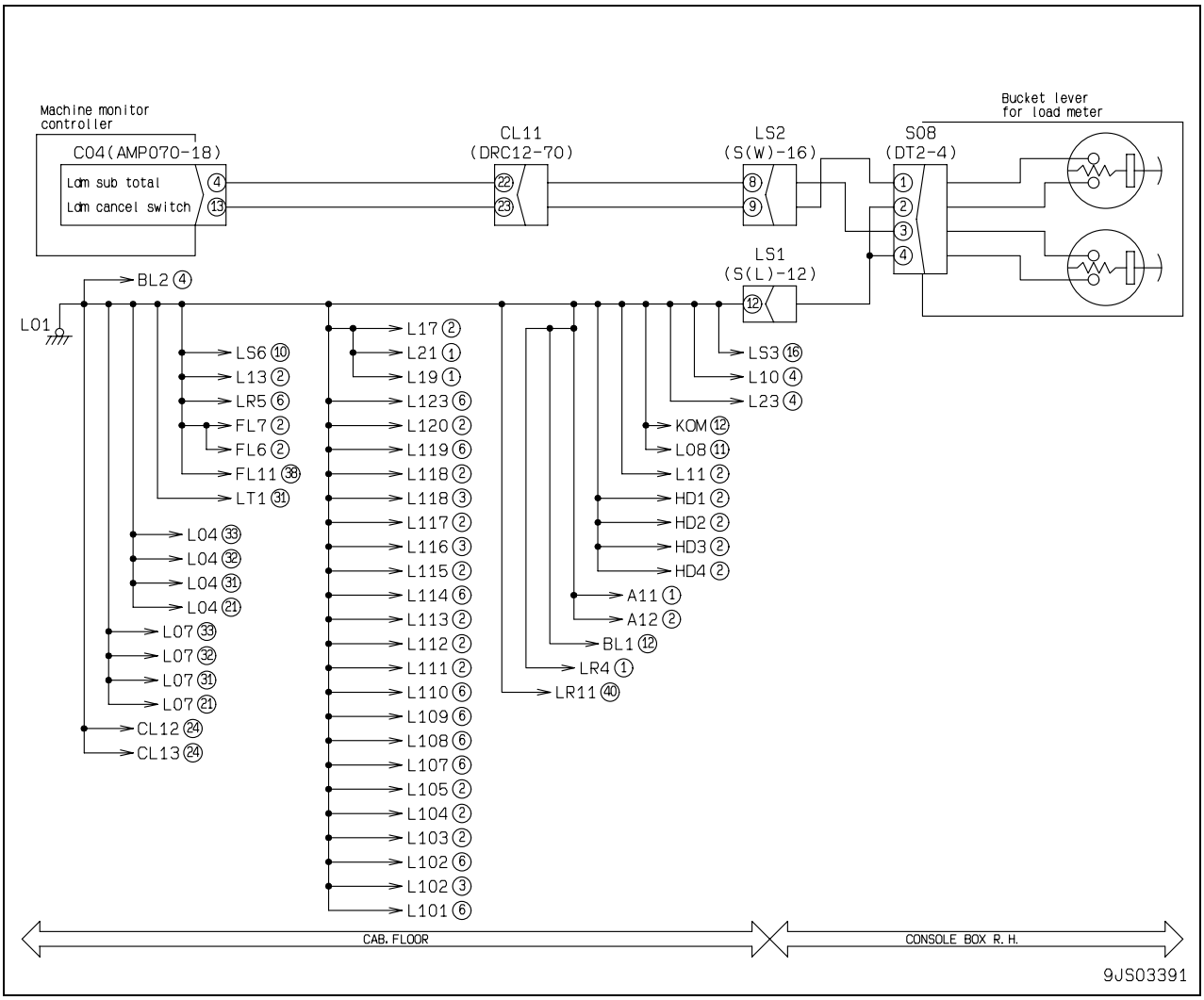


Failure code [DD1CLD] (Load meter subtotal switch: Switch is kept pressed for long time)

Action code	Failure code	Trouble	Load meter subtotal switch: Switch is kept pressed for long time (Machine monitor system)
E01	**DD1CLD**		
Contents of trouble	• The load meter subtotal switch may not operate because of grounding fault in load meter subtotal switch system.		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The total amount of load cannot be set to 0 on the screen.		
Related information	• The input state (ON/OFF) from the load meter subtotal switch can be checked with the monitoring function (Code: 40904 D-IN-32). • Applicable only to machines equipped with load meter (if equipped) • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective load meter subtotal switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S08 (male)	Load meter subtotal switch	Resistance	
			Between (3) and (4)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (3), (4) and chassis ground	Constant	Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C04 (female) (4) – S08 (female) (3)		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C04 (male)	Load meter subtotal switch	Voltage	
			Between (4) and chassis ground	ON	Max. 1 V	
				OFF	20 – 30 V	

Circuit diagram related to load meter cancel switch & subtotal switch

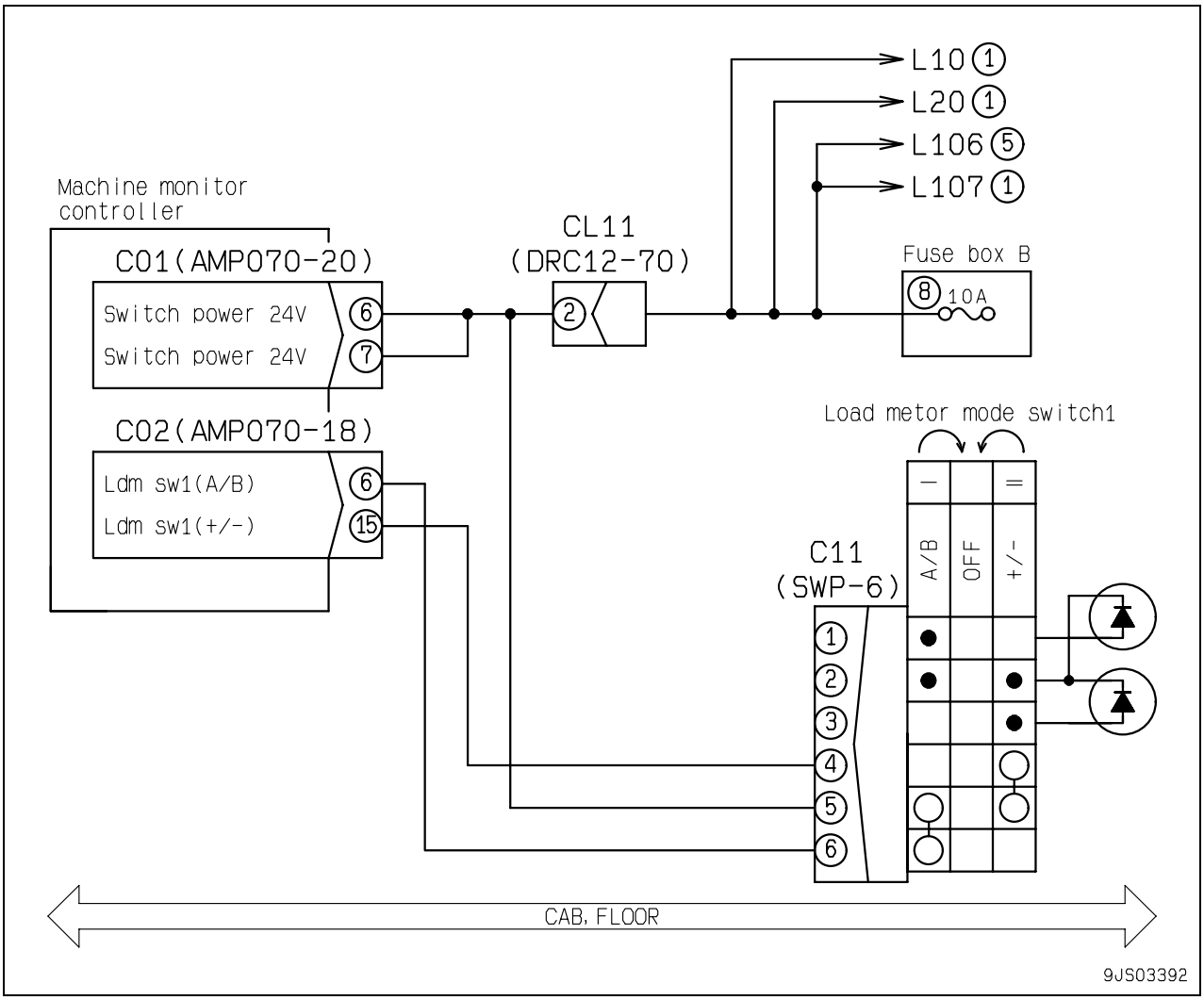


Failure code [DD1FLD] (Load meter mode selector switch (A/B): Switch is kept pressed for long time)

Action code	Failure code	Trouble	Load meter mode selector switch (A/B): Switch is kept pressed for long time (Machine monitor system)
E01	**DD1FLD**		
Contents of trouble	• The input circuit of the load meter mode selector switch (A/B) is kept CLOSED for more than continuous 1 minute		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The working object cannot be changed.		
Related information	• The input state (ON/OFF) from the load meter mode selector switch (A/B) can be checked with the monitoring function (Code: 40901 D-IN-10). • Applicable only to machines equipped with load meter (if equipped) • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective load meter mode selector switch (A/B) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C11 (male)	Load meter mode selector switch (A/B)	Resistance	
			Between (5) and (6)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (5), (6) and chassis ground	Constant	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between C02 (female) (6) – C11 (female) (6)		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C02 (female)	Load meter mode selector switch (A/B)	Voltage	
			Between (6) and chassis ground	ON	20 – 30 V	
				OFF	Max. 1 V	

Circuit diagram related to load meter mode selector switch

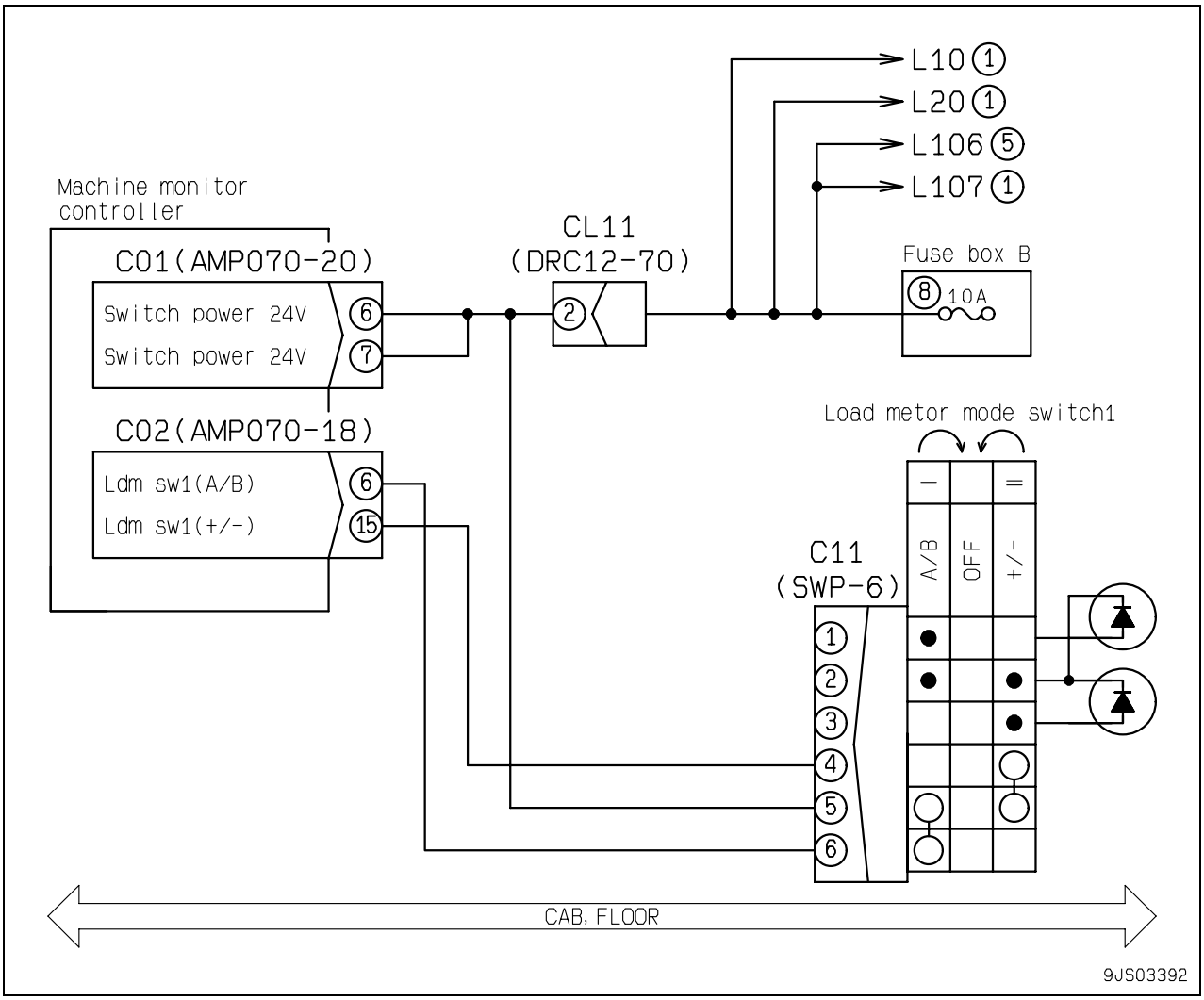


Failure code [DD1GLD] (Load meter mode selector switch (+/–): Switch is kept pressed for long time)

Action code	Failure code	Trouble	Load meter mode selector switch (+/–): Switch is kept pressed for long time (Machine monitor system)
E01	**DD1GLD**		
Contents of trouble	• The input circuit of the load meter mode selector switch (+/–) is kept CLOSED for more than continuous 1 minute		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The operator cannot make settings of load meter addition mode.		
Related information	• The input state (ON/OFF) from the load meter mode selector switch (+/–) can be checked with the monitoring function (Code: 40901 D-IN-11). • Applicable only to machines equipped with load meter (if equipped) • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective load meter mode selector switch (+/–) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C11 (male)	Load meter mode selector switch (+/–)	Resistance	
			Between (4) and (5)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (4), (5) and chassis ground	Constant	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between C02 (female) (15) – C11 (female) (4)		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C02 (female)	Load meter mode selector switch (+/–)	Voltage	
			Between (15) and chassis ground	ON	20 – 30 V	
				OFF	Max. 1 V	

Circuit diagram related to load meter mode selector switch



WA600-6 Wheel loader

Form No. SEN00562-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 6

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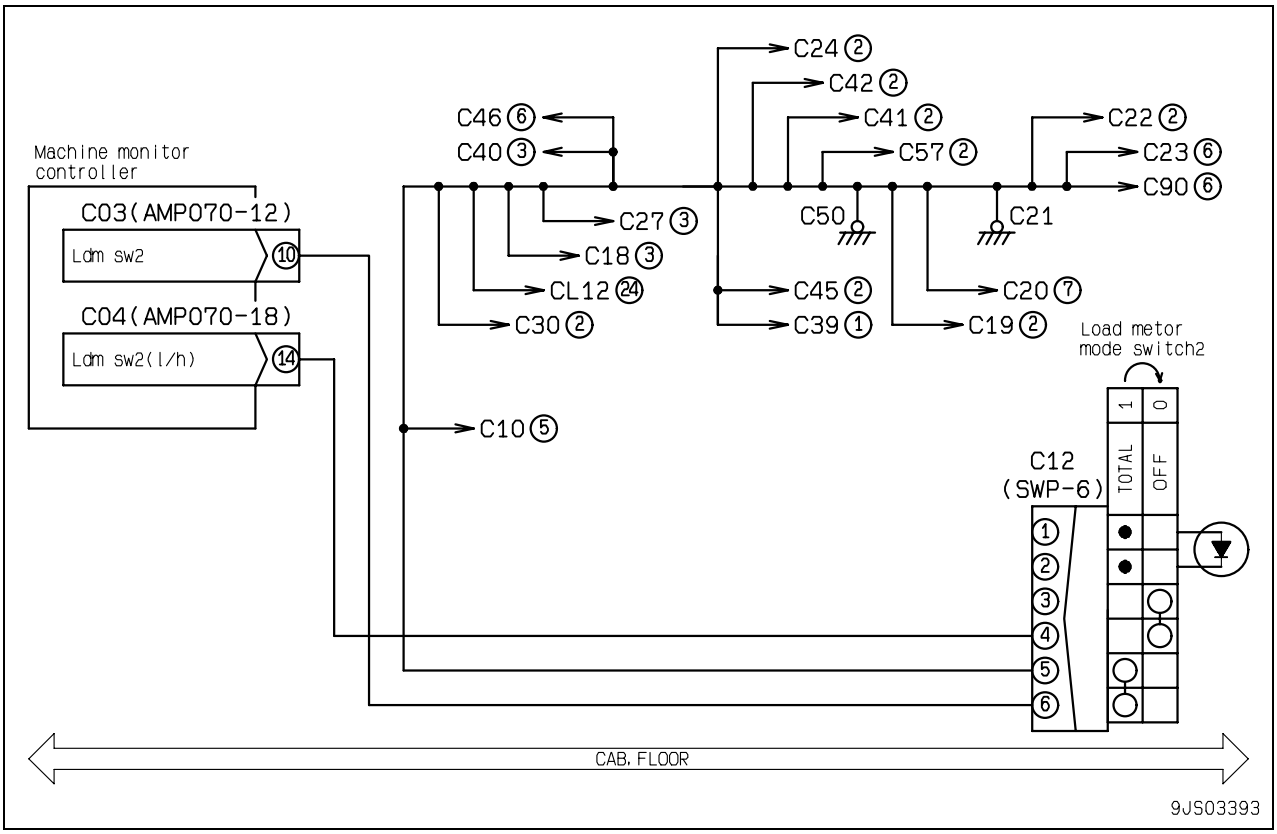
Troubleshooting by failure code (Display of code), Part 6

Failure code [DD1HLD] (Load meter display selector switch: Switch is kept pressed for long time)

Action code	Failure code	Trouble	Load meter display selector switch: Switch is kept pressed for long time (Machine monitor system)
E01	**DD1HLD**		
Contents of trouble	• The load meter display selector switch does not operate because of grounding fault in the load meter display selector switch system.		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Unable to display cumulative data		
Related information	• The input state (weight) from the load meter display selector switch can be checked with the monitoring function (Code: 40800 MES LOAD). • Only for load meter (if equipped) • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective load meter display selector switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C12 (male)	Load meter display selector switch	Resistance	
			Between (5) and (6)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (5), (6) and chassis ground	Normal	Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C03 (female) (10) – C12 (female) (6)		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C03 (male)	Load meter display selector switch	Voltage	
			Between (10) and chassis ground	ON	Max. 1 V	
				OFF	20 – 30 V	

Circuit diagram related to load meter display selector switch

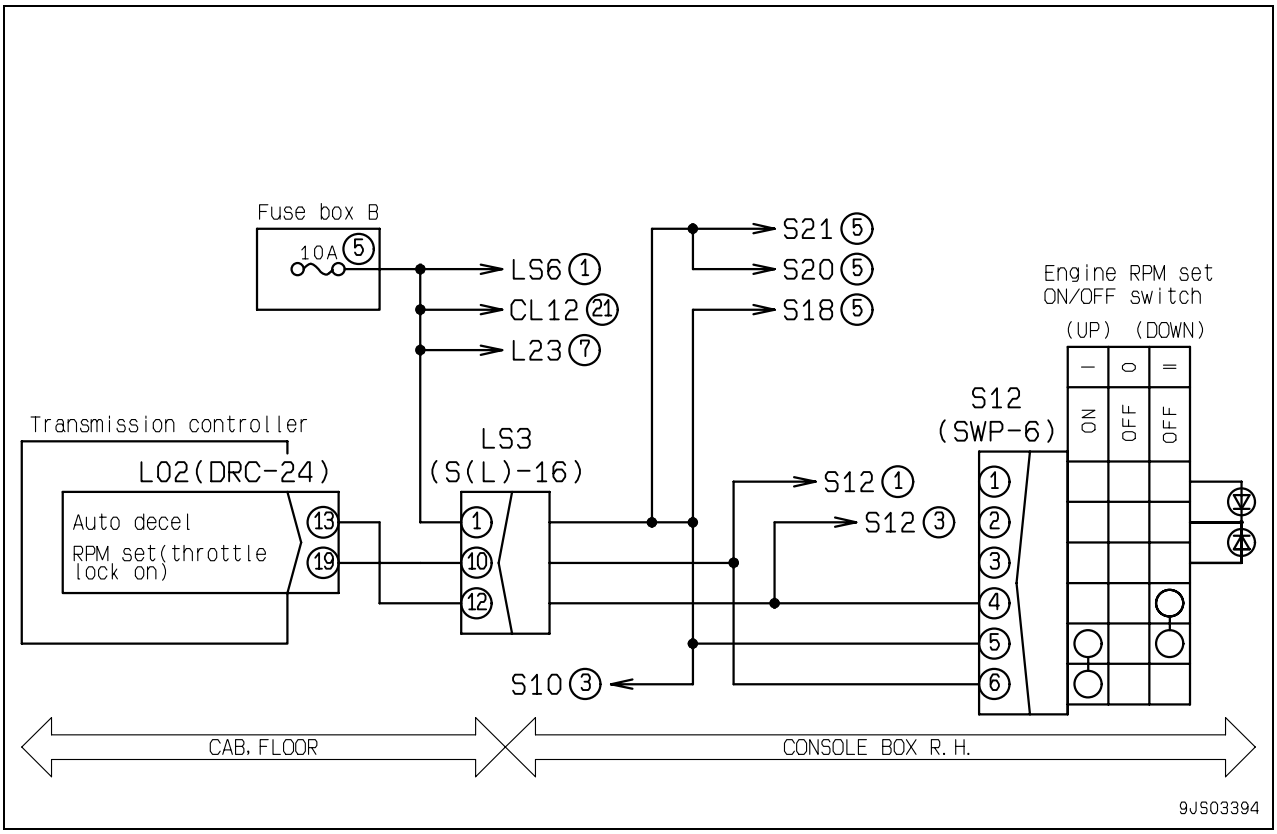


Failure code [DDA7L4] (RPM set ON/OFF switch: ON-OFF signals disagree

Action code	Failure code	Trouble	RPM set ON/OFF switch: ON/OFF signals disagree (Transmission controller system)
E01	**DDA7L4**		
Contents of trouble	• RPM set does not function because of a hot short circuit in RPM set ON-OFF switch system.		
Action of controller	• Turns RPM set function OFF • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• RPM setting is disabled		
Related information	• The input state (ON/OFF) from the RPM set ON-OFF switch can be checked with the monitoring function (Code: 40906 D-IN-13). • Method of reproducing failure code: Turn the starting switch and RPM set ON/OFF switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective RPM set ON/OFF switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S12 (male)	RPM set ON/OFF switch	Resistance	
			Between (4) and (5)	ON	Min. 1 MΩ	
				OFF	Max. 1 Ω	
			Between (5) and (6)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (4), (5), (6) and chassis ground	Normal	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L02 (female) (13) – S12 (female) (4)		Voltage	Max. 1 V
			Wiring harness between L02 (female) (19) – S12 (female) (6)		Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L02	RPM set ON/OFF switch	Voltage	
			Between (13) and chassis ground	ON	Max. 1 V	
				OFF	20 – 30 V	
			Between (19) and chassis ground	ON	20 – 30 V	
				OFF	Max. 1 V	

Circuit diagram related to RPM set ON/OFF switch

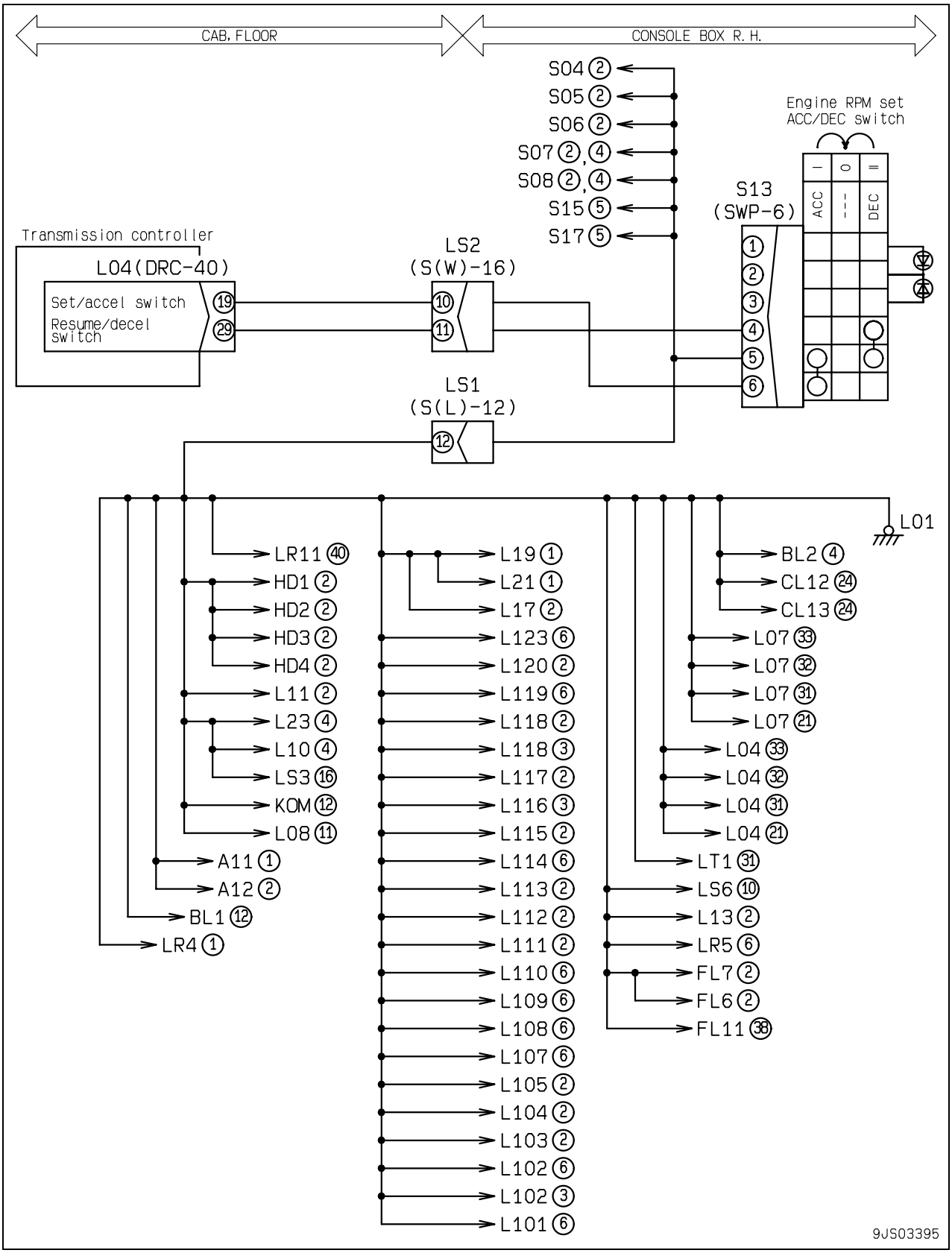


Failure code [DDA8KB] (RPM set idle-up/down selector switch (idle-up): Short circuit)

Action code	Failure code	Trouble	RPM set idle-up/down selector switch (idle-up): Short circuit (Transmission controller system)
E01	**DDA8KB**		
Contents of trouble	• Idle-up does not function due to ground fault in RPM set idle-up/down selector switch (idle-up) system.		
Action of controller	• Turns RPM set function OFF • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• RPM setting is disabled		
Related information	• The input state (ON/OFF) from the RPM set idle-up/down selector switch can be checked with the monitoring function (Code: 40906 D-IN-13, D-IN-14). • The input state (switching state) from the RPM set idle-up/down selector switch (up side) can be checked with the monitoring function (Code: 95500 THROT LOCK A). • The input state (switching state) from the RPM set idle-up/down selector switch (down side) can be checked with the monitoring function (Code: 95501 THROT LOCK B). • Method of reproducing failure code: Turn the starting switch and RPM set ON-OFF switch ON and operate the RPM set idle-up/down selector switch (idle-up)		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective RPM set idle-up/down selector switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S13 (male)	RPM set idle-up/down selector switch	Resistance	
			Between (4) and (5)	Idle-up position	Min. 1 MΩ	
				Idle-down position	Max. 1 Ω	
			Between (5) and (6)	Idle-up position	Max. 1 Ω	
				Idle-down position	Min. 1 MΩ	
			Between (4), (5), (6) and chassis ground	Normal	Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L04 (female) (19) – S13 (female) (6)		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L04	RPM set idle-up/down selector switch	Voltage	
			Between (29) and chassis ground	Idle-up position or neutral	7 – 10 V	
				Idle-down position	Max. 1 V	
			Between (19) and chassis ground	Idle-up position	Max. 1 V	
				Idle-down position or neutral	7 – 10 V	

Circuit diagram related to RPM set idle-up/down selector switch

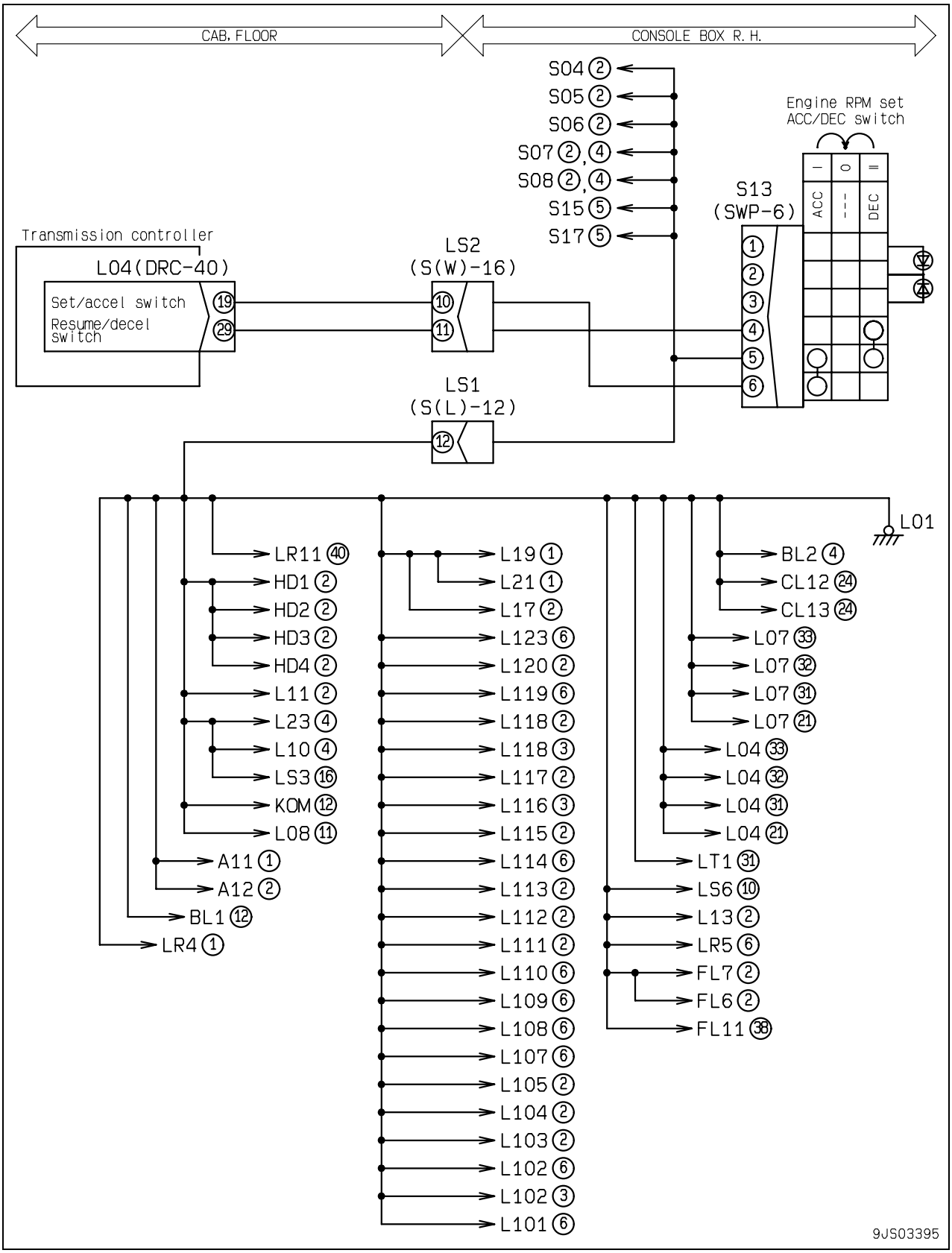


Failure code [DDA9KB] (RPM set idle-up/down selector switch (idle-down): Short circuit)

Action code	Failure code	Trouble	RPM set idle-up/down selector switch (idle-down): Short circuit (Transmission controller system)
E01	**DDA9KB**		
Contents of trouble	• Engine speed cannot be set to optional speed due to ground fault in the RPM set idle-up/down selector switch system.		
Action of controller	• Turns RPM set function OFF • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• RPM setting is disabled		
Related information	• The input state (ON/OFF) from the RPM set idle-up/down selector switch can be checked with the monitoring function (Code: 40906 D-IN-13, D-IN-14). • The input state (switching state) from the RPM set idle-up/down selector switch (up side) can be checked with the monitoring function (Code: 95500 THROT LOCK A). • The input state (switching state) from the RPM set idle-up/down selector switch (down side) can be checked with the monitoring function (Code: 95501 THROT LOCK B). • Method of reproducing failure code: Turn the starting switch and RPM set ON-OFF switch ON and operate the RPM set idle-up/down selector switch (idle-down)		

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="8">1</td><td rowspan="8">Defective RPM set idle-up/down selector switch (Internal short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>S13 (male)</td><td>RPM set idle-up/down selector switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (4) and (5)</td><td>Idle-up position</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>Idle-down position</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td rowspan="2">Between (5) and (6)</td><td>Idle-up position</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Idle-down position</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>Between (4), (5), (6) and chassis ground</td><td>Normal</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Grounding fault in wiring harness
(Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between L04 (female) (29) – S13 (female) (4)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="6">3</td><td rowspan="6">Defective transmission controller</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td>L04</td><td>RPM set idle-up/down selector switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (29) and chassis ground</td><td>Idle-up position or neutral</td><td colspan="2">7 – 10 V</td></tr>
<tr><td>Idle-down position</td><td colspan="2">Max. 1 V</td></tr>
<tr><td rowspan="2">Between (19) and chassis ground</td><td>Idle-up position</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>Idle-down position or neutral</td><td colspan="2">7 – 10 V</td></tr>
</table>

Circuit diagram related to RPM set idle-up/down selector switch



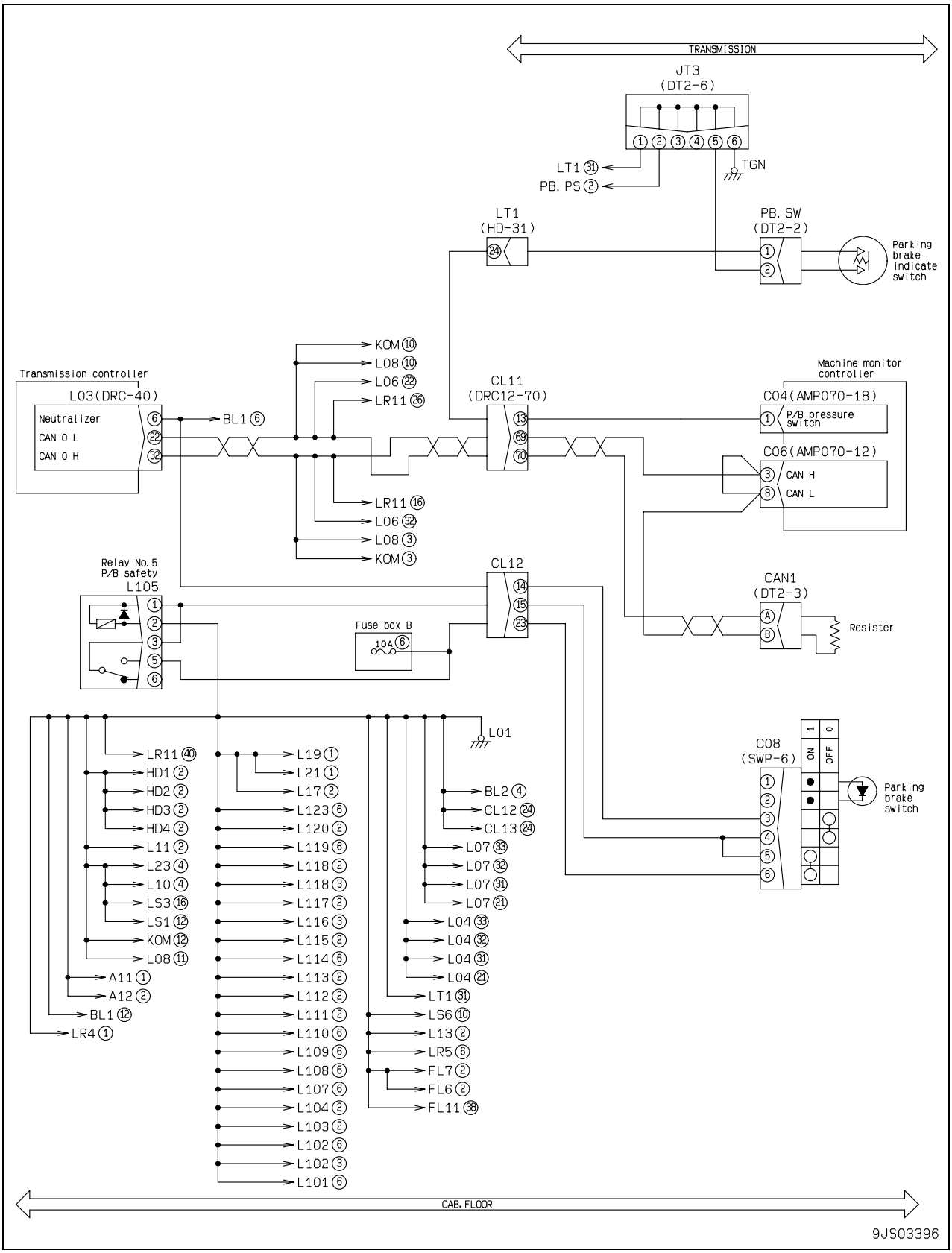
Failure code [DDB6L4] (Turn parking brake switch (Neutralizer): ON/OFF signals disagree)

Action code	Failure code	Trouble	Turn parking brake switch (Neutralizer): ON/OFF signals disagree) (Transmission controller system)
E03	**DDB6L4**		
Contents of trouble	(This failure code may be displayed when parking brake emergency release switch is turned ON.) • Controller outputs a failure signal when all conditions are satisfied. 1) Parking brake switch signal ON (neutralizer signal OPEN) 2) Parking brake released (by CAN communication from the machine monitor) 3) Hydraulic oil temperature under 25°C		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The machine cannot travel or parking brake indicator is kept OFF.		
Related information	• The input state (ON/OFF) from the parking switch can be checked with the monitoring function (Code: 40903 D-IN-26). • The input state (ON/OFF) from the parking brake indicator switch can be checked with the monitoring function (Code: 40907 D-IN-23). • If failure code [**DGH2KX**] (Hydraulic oil temperature sensor: Out of input signal range) is displayed, carry out troubleshooting for it first. • If failure code [**DAFRKR**] (Machine monitor CAN communication: Defective communication (Abnormality in target component system) is displayed, carry out troubleshooting for it first. • Method of reproducing failure code: Turn the starting switch and parking brake switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective parking brake indicator switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			PB.SW (male)	Parking brake oil pressure	Resistance	
			Between (1) and (2)	When parking brake is released, Min. 0.61 MPa {Min. 6.2 kg/cm^2}	Max. 1 Ω	
				When parking brake applied, Max. 0.34 MPa {Max. 3.5 kg/cm^2}	Min. 1 MΩ	
	2	Defective parking brake switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C08 (male)	Parking brake switch	Resistance	
			Between (3) and (4)	ON	Min. 1 MΩ	
				OFF	Max. 1 Ω	
			Between (5) and (6)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (3) and (6)	Normal	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C04 (female) (1) – PB.SW (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between PB.SW (female) (2) – chassis ground		Resistance	Max. 1 Ω
			Wiring harness between C08 (female) (3) – L03 (female) (6)		Resistance	Max. 1 Ω

<table>
<tr><td rowspan="5">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective transmission controller</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td>L03</td><td>Parking brake switch</td><td>Voltage</td></tr>
<tr><td rowspan="2">Between (6) and chassis ground</td><td>ON</td><td>Max. 1 V</td></tr>
<tr><td>OFF</td><td>20 – 30 V</td></tr>
</table>

Circuit diagram related to parking brake switch

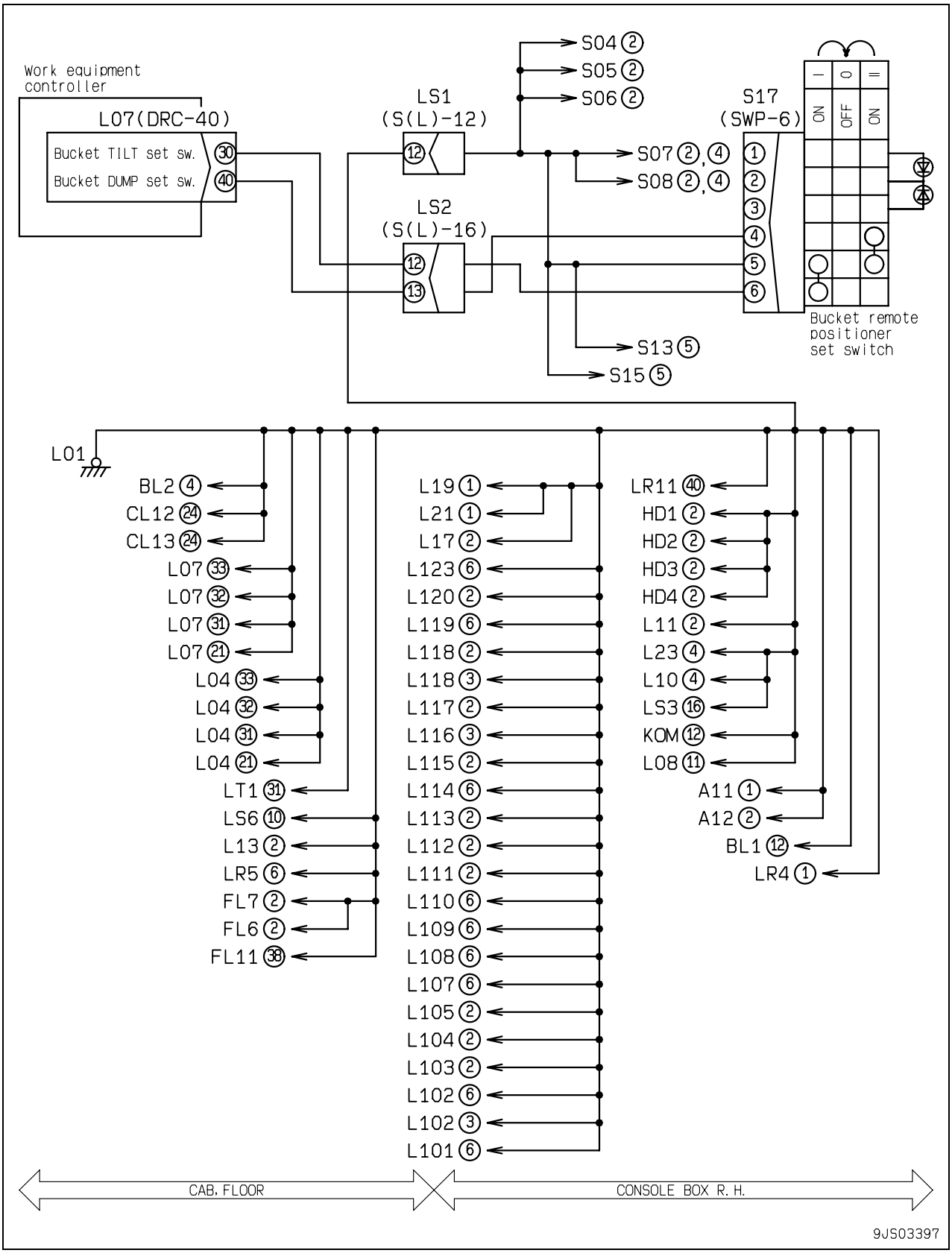


Failure code [DDD1LD] (Remote positioner bucket angle set switch: Switch is kept pressed for long time)

Action code	Failure code	Trouble	Remote positioner bucket angle set switch: Switch is kept pressed for long time (Work equipment controller system)
E01	**DDD1LD**		
Contents of trouble	• Unable to set the bucket to a specified angle due to ground fault in the remote positioner bucket angle set switch system. • Detected continuous operation for 30 seconds and longer.		
Action of controller	• Judged that remote positioner bucket angle set switch is turned ON • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Remote positioner raise set signal: Setting is changed to upward by 1° (degree) and the monitor displays the changed angle • Remote positioner lower set signal: Setting is changed to downward by 1° (degree) and the monitor displays the changed angle • Direction setting cannot be changed to upward or downward.		
Related information	• The input state (ON/OFF) from the remote positioner bucket angle set switch can be checked with the monitoring function (Code: 40911 D-IN-10, D-IN-11). • Only for load meter specification (if equipped) • Method of reproducing failure code: Turn the starting switch and remote positioner bucket angle set switch ON		

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="7">1</td><td rowspan="7">Defective remote positioner bucket angle set switch (Internal short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>S17 (male)</td><td>Remote positioner bucket angle set switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (4) and (5)</td><td>Upward ON</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="2">Between (5) and (6)</td><td>Downward ON</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>Between (4), (5), (6) and chassis ground</td><td>Normal</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Grounding fault in wiring harness (Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between L07 (female) (30) – S17 (female) (6)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L07 (female) (40) – S17 (female) (4)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="7">3</td><td rowspan="7">Defective work equipment controller</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td>L07 (female)</td><td>Remote positioner bucket angle set switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (40) and chassis ground</td><td>Upward ON</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>OFF</td><td colspan="2">7 – 10 V</td></tr>
<tr><td rowspan="2">Between (30) and chassis ground</td><td>Downward ON</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>OFF</td><td colspan="2">7 – 10 V</td></tr>
</table>

Circuit diagram related to remote positioner bucket angle set switch

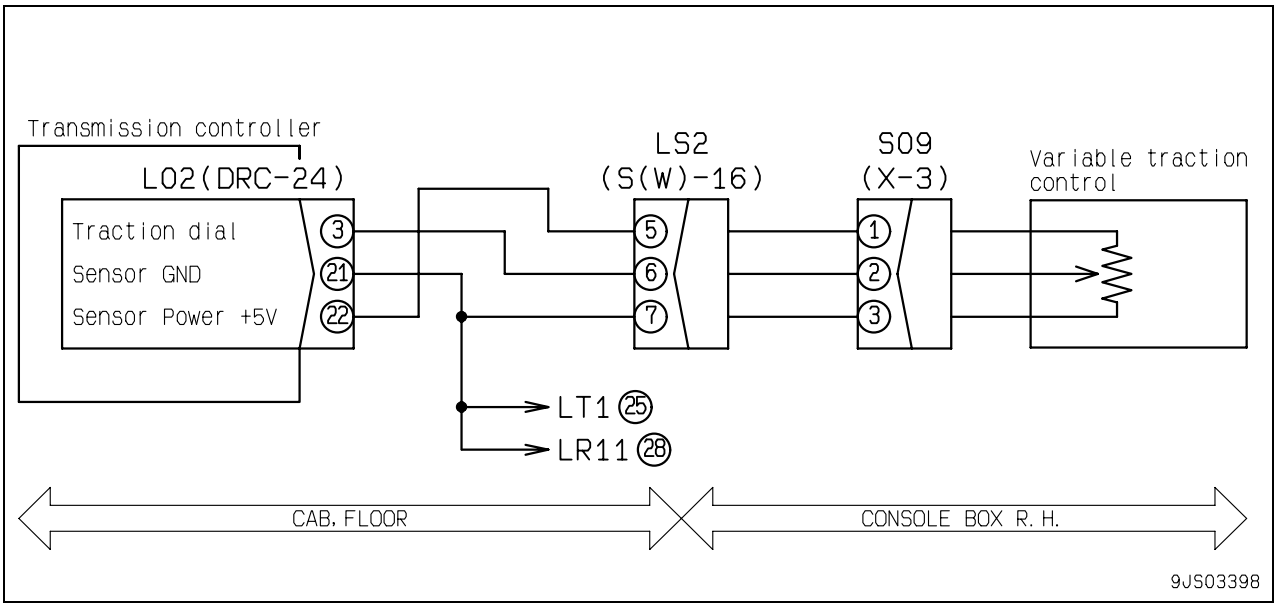


Failure code [DDDBKA] (Traction adjustment dial: Disconnection)

Action code	Failure code	Trouble	Traction adjustment dial: Disconnection (Transmission controller system)
E01	**DDDBKA**		
Contents of trouble	• Traction adjustment disabled because of disconnection in the traction adjustment dial system (Traction adjustment dial signal voltage: Max. 0.3 V)		
Action of controller	• For the traction adjustment dial value, use the value immediately before abnormality occurs. • Even if cause of failure disappears, system does not reset itself until directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• Traction adjustment is disabled		
Related information	• The input state (%) from the traction adjustment dial can be checked with the monitoring function (Code: 94000 TRACTION DIAL). • The input state (Voltage) from the traction adjustment dial can be checked with the monitoring function (Code: 94001 TRACTION DIAL). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective traction adjustment dial (Internal disconnection)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			S09 (male)	Dial position	Voltage	
			Between (1) and (3)	Normal	4.75 – 5.25 V	
			Between (2) and (3)	Normal	0.5 – 4.5 V	
				MAX position	0.5 – 1.0 V	
				MIN position	4.0 – 4.5 V	
	2	Disconnection in wiring harness (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (3) – S09 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L02 (female) (21) – S09 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between L02 (female) (22) – S09 (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L02	Dial position	Voltage	
			Between (3) and chassis ground	Normal	4.75 – 5.25 V	
			Between (22) and chassis ground	Normal	0.5 – 4.5 V	
				MAX position	0.5 – 1.0 V	
				MIN position	4.0 – 4.5 V	

Circuit diagram related to traction adjustment dial

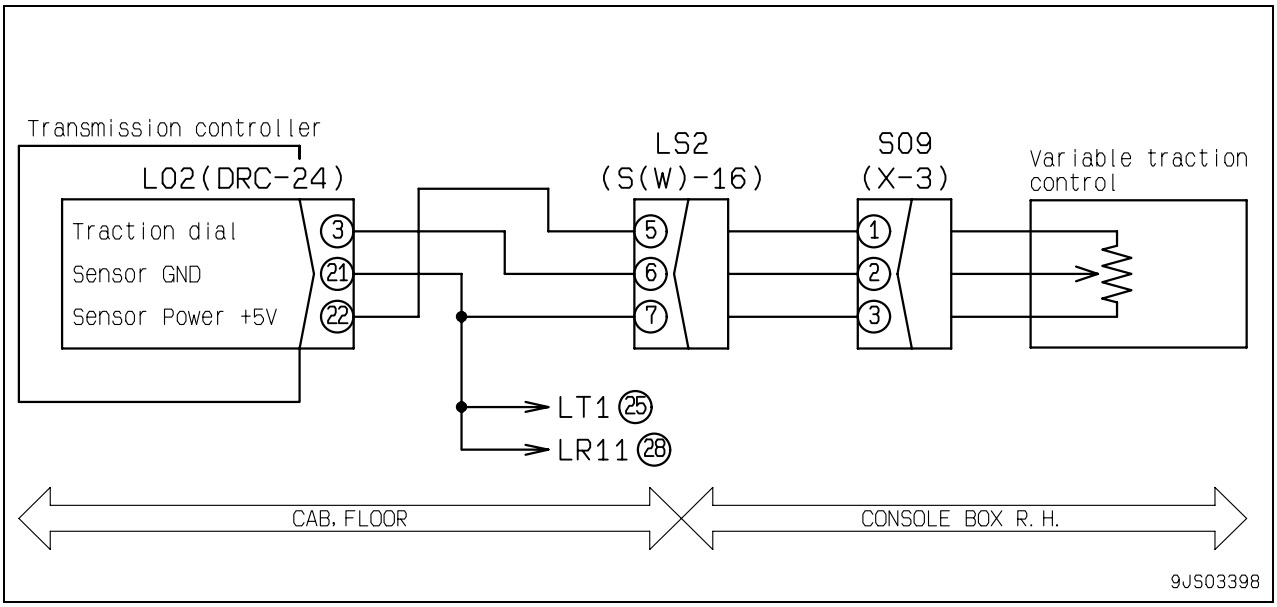


Failure code [DDDBKB] (Traction adjustment dial: Short circuit)

Action code	Failure code	Trouble	Traction adjustment dial: Short circuit (Transmission controller system)
E01	**DDDBKB**		
Contents of trouble	• Traction adjustment disabled because of hot short circuit in the traction adjustment dial system (Traction adjustment dial signal voltage: Min 4.7 V)		
Action of controller	• For the traction adjustment dial value, use the value immediately before abnormality occurs. • Even if cause of failure disappears, system does not reset itself until directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• Traction adjustment is disabled		
Related information	• The input state (%) from the traction adjustment dial can be checked with the monitoring function (Code: 94000 TRACTION DIAL). • The input state (Voltage) from the traction adjustment dial can be checked with the monitoring function (Code: 94001 TRACTION DIAL). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective traction adjustment dial (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S09 (male)	Dial position	Voltage	
			Between (1) and (3)	Normal	4.75 – 5.25 V	
			Between (2) and (3)	Normal	0.5 – 4.5 V	
				MAX position	0.5 – 1.0 V	
				MIN position	4.0 – 4.5 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L02 (female) (3) – S09 (female) (2)		Voltage	Max. 1 V
			Wiring harness between L02 (female) (22) – S09 (female) (1)		Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L02	Dial position	Voltage	
			Between (3) and chassis ground	Normal	4.75 – 5.25 V	
			Between (22) and chassis ground	Normal	0.5 – 4.5 V	
				MAX position	0.5 – 1.0 V	
				MIN position	4.0 – 4.5 V	

Circuit diagram related to traction adjustment dial

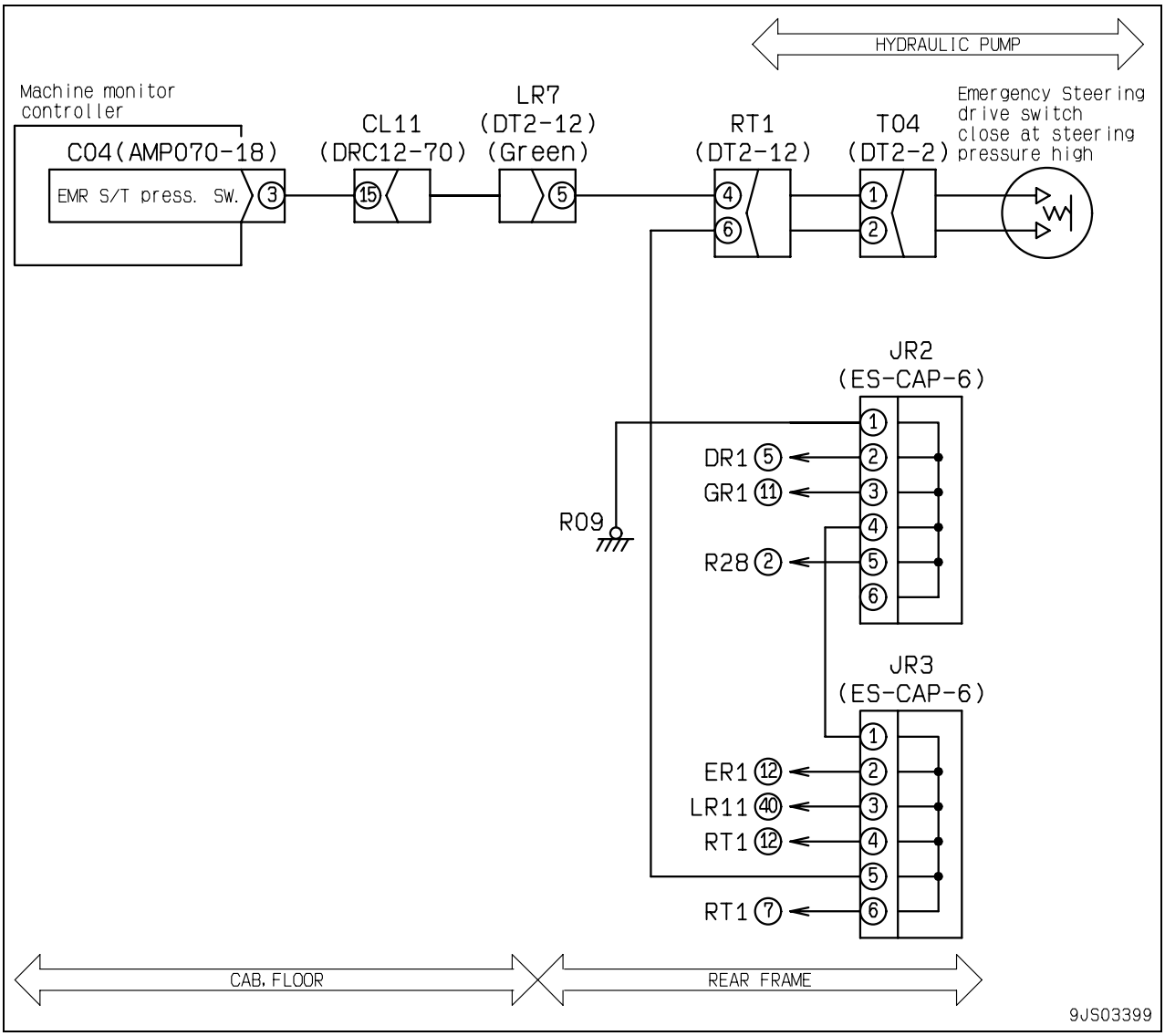


Failure code [DDE5MA] (Emergency steering drive switch: Malfunction)

Action code	Failure code	Trouble	Emergency steering drive switch: Malfunction (Machine monitor system)
E01	**DDE5MA**		
Contents of trouble	• When engine stopped, steering pump pressure detected because of ground fault in the emergency steering drive switch system.		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The emergency steering operates.		
Related information	• The input state (ON/OFF) from the emergency steering motor can be checked with the monitoring function (Code: 40903 D-IN-30). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective emergency steering drive switch (Internal defect)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Relieve the steering circuit			
			T04 (male)	Steering relief oil pressure	Resistance	
			Between (1) and (2)	Low	Min. 1 MΩ	
				Normal	Max. 1 Ω	
			Between (1), (2) and chassis ground	Normal	Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C04 (female) (3) – T04 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Relieve the steering circuit			
			C04 (female)	Steering relief oil pressure	Voltage	
			Between (3) and chassis ground	Low	20 – 30 V	
				Normal	Max. 1 V	

Circuit diagram related to emergency steering drive switch



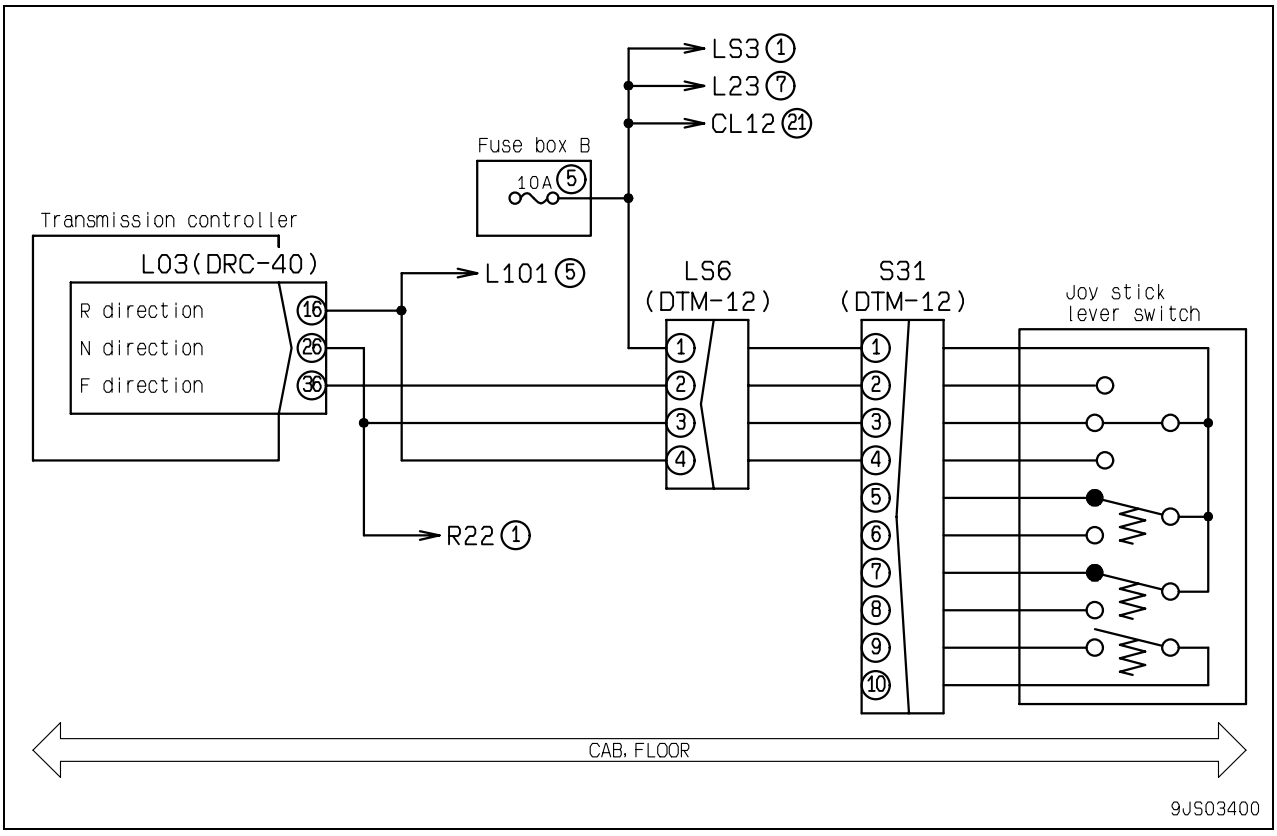
Failure code [DDK4KA] (AJSS FNR switch: Disconnection)

Action code	Failure code	Trouble	AJSS FNR switch: Disconnection (Transmission controller system)
E03	**DDK4KA**		
Contents of trouble	• AJSS FNR signal input is disabled because of disconnection in the AJSS FNR input signal system.		
Action of controller	• Sets to neutral • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until AJSS FNR switch is set to N (Neutral).		
Problem that appears on machine	• The machine does not travel.		
Related information	• The input signal (ON/OFF) from the AJSS FNR switch can be checked with the monitoring function (Code: 40907 D-IN-20, D-IN-21 or D-IN-22). • Only for AJSS specification (if equipped) • Method of reproducing failure code: Turn the starting switch and AJSS FNR switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No.5 of fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 4.)			
	2	Defective AJSS FNR switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S31 (male)	AJSS FNR switch	Resistance	
			Between (1) and (2)	F (Forward)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
			Between (1) and (3)	N (Neutral)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
			Between (1) and (4)	R (Reverse)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
			Between (1), (2), (3), (4) and chassis ground	Normal	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (16) – S31 (female) (4)	Resistance	Max. 1 Ω	
			Wiring harness between L03 (female) (26) – S31 (female) (3)	Resistance	Max. 1 Ω	
			Wiring harness between L03 (female) (36) – S31 (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between fuse No. 5 of fuse box B – S31 (female) (1)	Resistance	Max. 1 Ω	
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03(female) (16) – S31 (female) (4)	Resistance	Min. 1 MΩ	
			Wiring harness between L03(female) (26) – S31 (female) (3)	Resistance	Min. 1 MΩ	
			Wiring harness between L03(female) (36) – S31 (female) (2)	Resistance	Min. 1 MΩ	
			Wiring harness between fuse No. 5 of fuse box B – S31 (female) (1)	Resistance	Min. 1 MΩ	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	5	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L03	AJSS FNR switch	Voltage
			Between (36) and chassis ground	F (Forward)	20 – 30 V
				Other than above	Max. 1 V
			Between (26) and chassis ground	N (Neutral)	20 – 30 V
				Other than above	Max. 1 V
			Between (16) and chassis ground	R (Reverse)	20 – 30 V
				Other than above	Max. 1 V

Circuit diagram related to AJSS FNR switch

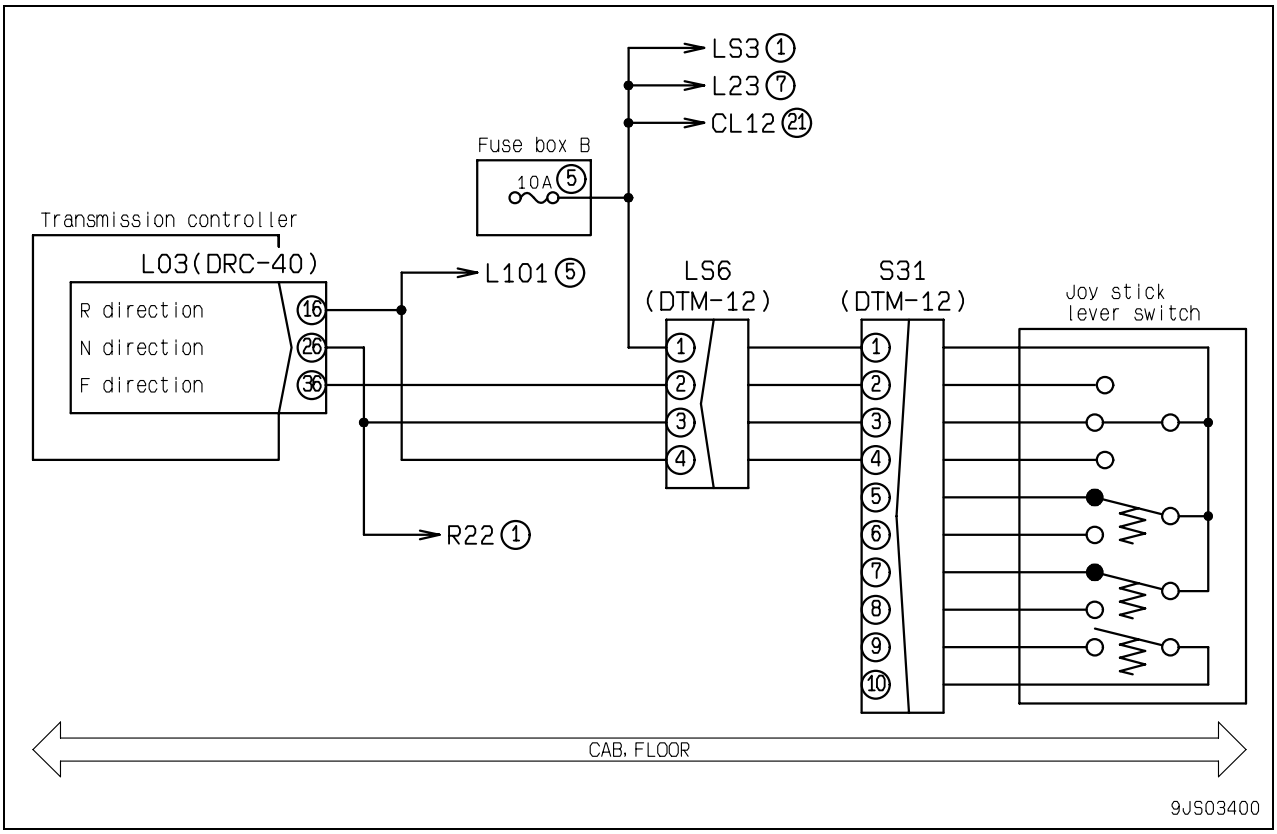


Failure code [DDK4KB] (AJSS FNR switch: Short circuit)

Action code	Failure code	Trouble	AJSS FNR switch: Short circuit (Transmission controller system)
E03	**DDK4KB**		
Contents of trouble	• Multiple signal input because of hot short circuit in the AJSS FNR input signal system.		
Action of controller	• Sets to neutral • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until AJSS steering FNR switch is set to N (Neutral).		
Problem that appears on machine	• The machine does not travel.		
Related information	• The input signal (ON/OFF) from the AJSS steering FNR switch can be checked with the monitoring function (Code: 40907 D-IN-20, D-IN-21 or D-IN-22). • Only for AJSS specification (if equipped) • Method of reproducing failure code: Turn the starting switch and AJSS steering FNR switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective AJSS FNR switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S31 (male)	AJSS FNR switch	Resistance	
			Between (1) and (2)	F (Forward)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
			Between (1) and (3)	N (Neutral)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
			Between (1) and (4)	R (Reverse)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
			Between (1), (2), (3), (4) and chassis ground	Normal	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L03 (female) (16) – S31 (female) (4) • Set the AJSS FNR switch to other than R (Reverse)		Voltage	Max. 1 V
			Wiring harness between L03 (female) (26) – S31 (female) (3) • Set the AJSS FNR switch to other than N (Neutral)		Voltage	Max. 1 V
			Wiring harness between L03 (female) (36) – S31 (female) (2) • Set the AJSS FNR switch to other than F (Forward)		Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L03	AJSS FNR switch	Voltage	
			Between (36) and chassis ground	F (Forward)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (26) and chassis ground	N (Neutral)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (16) and chassis ground	R (Reverse)	20 – 30 V	
				Other than above	Max. 1 V	

Circuit diagram related to AJSS FNR switch



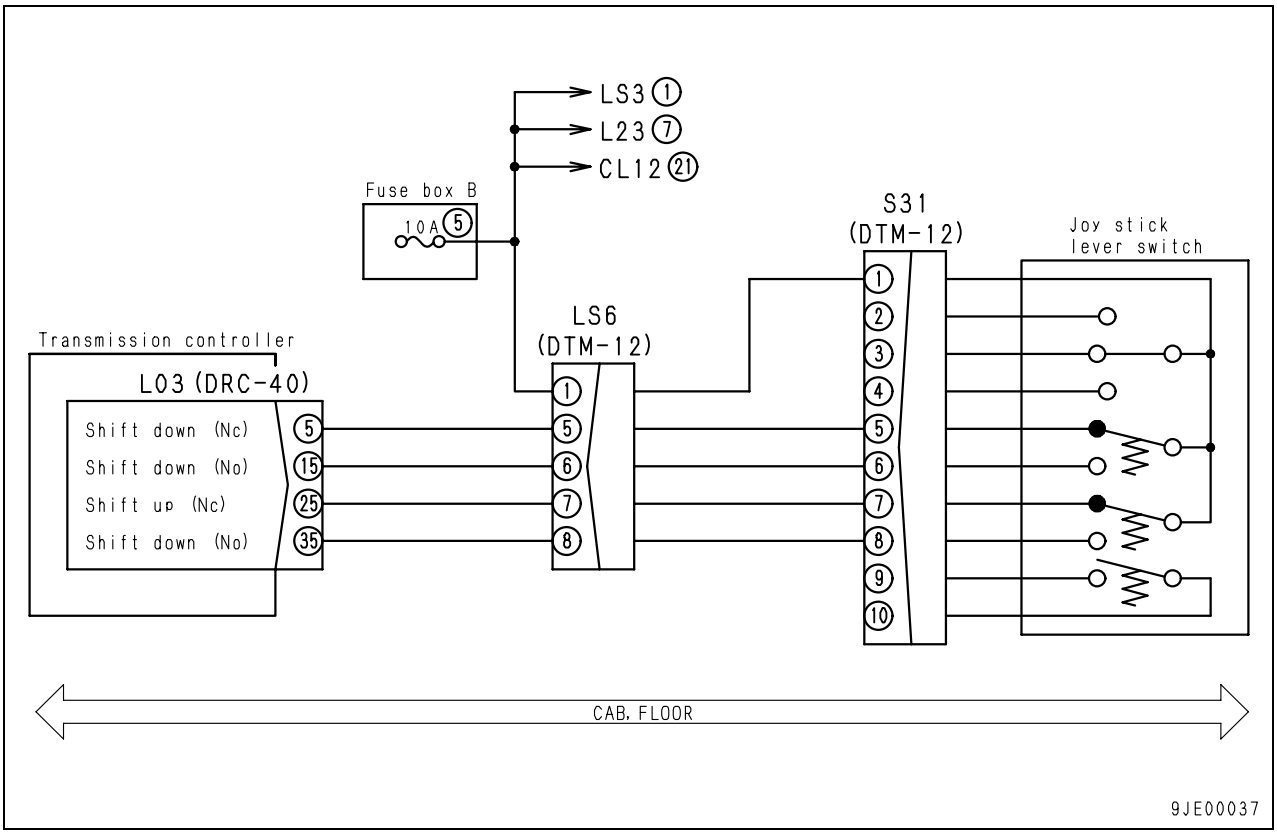
Failure code [DDK5L4] (AJSS shit-up/down switch: ON/OFF signals disagree)

Action code	Failure code	Trouble	AJSS shit-up/down switch: ON/OFF signals disagree (Transmission controller system)
E01	**DDK5L4**		
Contents of trouble	• AJSS shift-up/down switch system has disconnection, ground fault or hot short.		
Action of controller	• Turns the shift-up/down function of AJSS OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Gear cannot be shift up and down with AJSS.		
Related information	• The input signal (OFF input) from the AJSS shift-up switch can be checked with the monitoring function (Code: 40907 D-IN-16). • The input signal (ON input) from the AJSS shift-up switch can be checked with the monitoring function (Code: 40907 D-IN-17). • The input signal (OFF input) from the AJSS shift-down switch can be checked with the monitoring function (Code: 40907 D-IN-18). • The input signal (ON input) from the AJSS shift-down switch can be checked with the monitoring function (Code: 40907 D-IN-19). • Method of reproducing failure code: Turn starting switch and AJSS shift-up/down switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No. 5 in fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 4).			
	2	Defective AJSS shift-up/down switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S31 (male)	AJSS shift-up/down switch	Resistance	
			Between (1) – (5)	Shift-up ON	Min. 1 MΩ	
				Shift-up OFF	Max. 1 Ω	
			Between (1) – (6)	Shift-up ON	Max. 1 Ω	
				Shift-up OFF	Min. 1 MΩ	
			Between (1) – (7)	Shift-up ON	Min. 1 MΩ	
				Shift-up OFF	Max. 1 Ω	
			Between (1) – (8)	Shift-up ON	Max. 1 Ω	
				Shift-up OFF	Min. 1 MΩ	
			Between (5), (6), (7), (8) – chassis ground	Normal	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 5 in fuse box B – S31 (female) (1)		Resis-tance	Max. 1 Ω
			Wiring harness between L03 (female) (5) – S31 (female) (5)		Resis-tance	Max. 1 Ω
			Wiring harness between L03 (female) (15) – S31 (female) (15)		Resis-tance	Max. 1 Ω
			Wiring harness between L03 (female) (25) – S31 (female) (25)		Resis-tance	Max. 1 Ω
			Wiring harness between L03 (female) (35) – S31 (female) (35)		Resis-tance	Max. 1 Ω

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Ground fault in wiring harness (Contact with GND circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between fuse No. 5 in fuse box B – S31 (female) (1)</td><td>Resis-tance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">Wiring harness between L03 (female) (5) – S31 (female) (5)</td><td>Resis-tance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">Wiring harness between L03 (female) (15) – S31 (female) (15)</td><td>Resis-tance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">Wiring harness between L03 (female) (25) – S31 (female) (25)</td><td>Resis-tance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">Wiring harness between L03 (female) (35) – S31 (female) (35)</td><td>Resis-tance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Hot short (Contact with 24V circuit) in wiring harness</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between L03 (female) (5) – S31 (female) (5)</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td colspan="3">Wiring harness between L03 (female) (15) – S31 (female) (15)</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td colspan="3">Wiring harness between L03 (female) (25) – S31 (female) (25)</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td colspan="3">Wiring harness between L03 (female) (35) – S31 (female) (35)</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td rowspan="9">6</td><td rowspan="9">Defective transmission controller</td><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>L03</td><td colspan="2">AJSS shift-up/down switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (5) – chassis ground</td><td colspan="2">Shift-down ON</td><td colspan="2">Max. 1 V</td></tr>
<tr><td colspan="2">Shift-down OFF</td><td colspan="2">20 – 30 V</td></tr>
<tr><td rowspan="2">Between (15) – chassis ground</td><td colspan="2">Shift-down ON</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="2">Shift-down OFF</td><td colspan="2">Max. 1 V</td></tr>
<tr><td rowspan="2">Between (25) – chassis ground</td><td colspan="2">Shift-up ON</td><td colspan="2">Max. 1 V</td></tr>
<tr><td colspan="2">Shift-up OFF</td><td colspan="2">20 – 30 V</td></tr>
<tr><td rowspan="2">Between (35) – chassis ground</td><td colspan="2">Shift-up ON</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="2">Shift-up OFF</td><td colspan="2">Max. 1 V</td></tr>
</table>

Circuit diagram related to AJSS shift-up/down switch



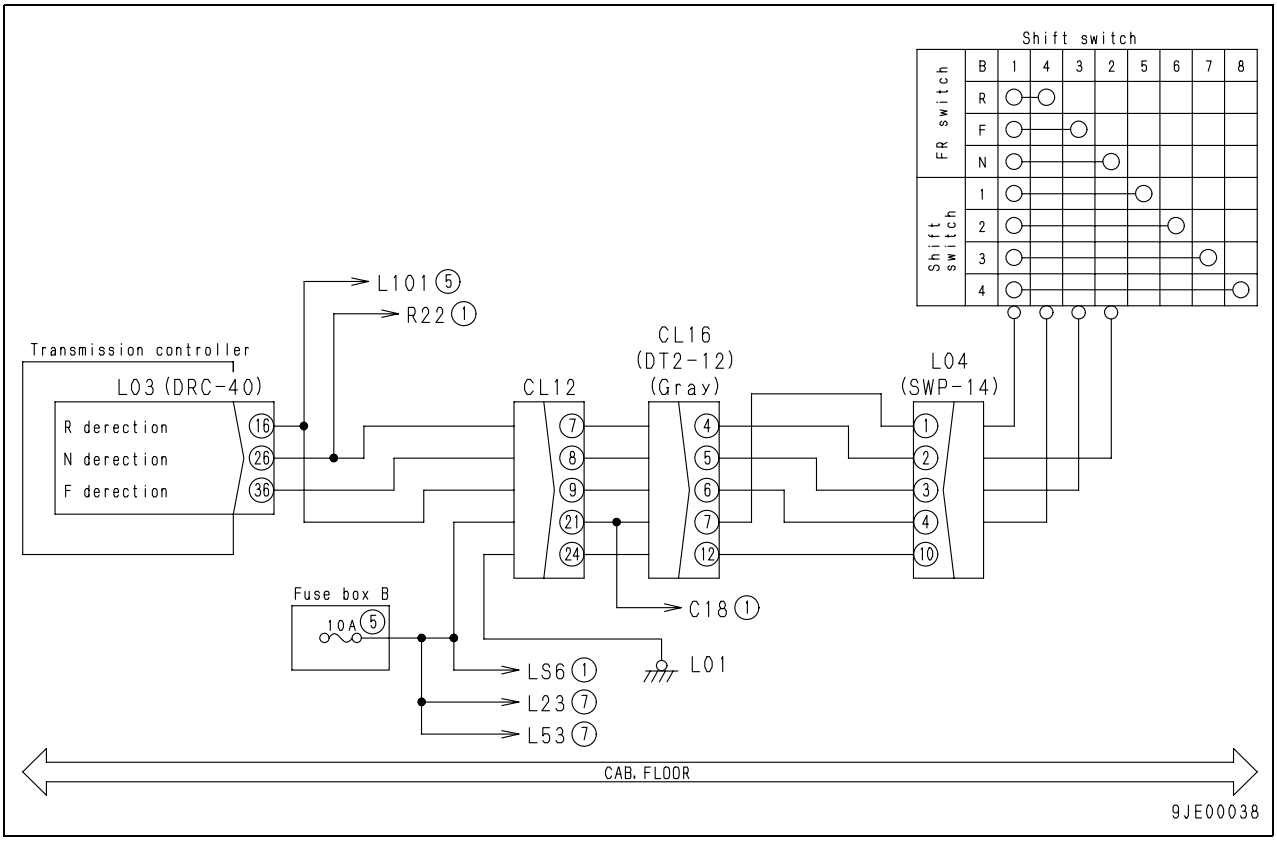
Failure code [DDK6KA] (FNR lever switch: Disconnection)

Action code	Failure code	Trouble	FNR lever switch: Disconnection (Transmission controller system)
E03	DDK6KA		
Contents of trouble	• Since the FNR (directional) lever switch signal system is disconnected or in ground fault, all the lever signals are not input		
Action of controller	• Sets to neutral • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until FNR (directional) lever is set to N (Neutral).		
Problem that appears on machine	• The machine does not travel. • Shift indicator turns out.		
Related information	• The input state (ON/OFF) from the FNR (directional) lever switch can be checked with the monitoring function (Code: 40907 D-IN-20, D-IN-21 or D-IN-22). • Only for steering wheel specification (STD) • Method of reproducing failure code: Turn the starting switch and FNR (directional) switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No. 5 in fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 4).			
	2	Defective FNR (directional) lever switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L04	FNR (directional) lever	Voltage	
			Between (1) and (10)	Normal	20 – 30 V	
			Between (2) and (10)	N (Neutral)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (3) and (10)	F (Forward)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (4) and (10)	R (Reverse)	20 – 30 V	
				Other than above	Max. 1 V	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 5 of fuse box B – L04 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L03 (female) (16) – L04 (female) (4)		Resistance	Max. 1 Ω
			Wiring harness between L03 (female) (26) – L04 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L03 (female) (36) – L04 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between chassis ground – L04 (female) (10)		Resistance	Max. 1 Ω

<table>
<tr><td rowspan="10">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Grounding fault in wiring harness
(Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between fuse No. 5 of fuse box B – L04 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L03 (female) (16) – L04 (female) (4)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L03 (female) (26) – L04 (female) (2)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Defective transmission controller</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td>L03</td><td>FNR (directional) lever</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (36) and chassis ground</td><td>F (Forward)</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Other than above</td><td colspan="2">Max. 1 V</td></tr>
<tr><td rowspan="2">Between (26) and chassis ground</td><td>N (Neutral)</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Other than above</td><td colspan="2">Max. 1 V</td></tr>
<tr><td rowspan="2">Between (16) and chassis ground</td><td>R (Reverse)</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Other than above</td><td colspan="2">Max. 1 V</td></tr>
</table>

Circuit diagram related to FNR (directional) lever switch

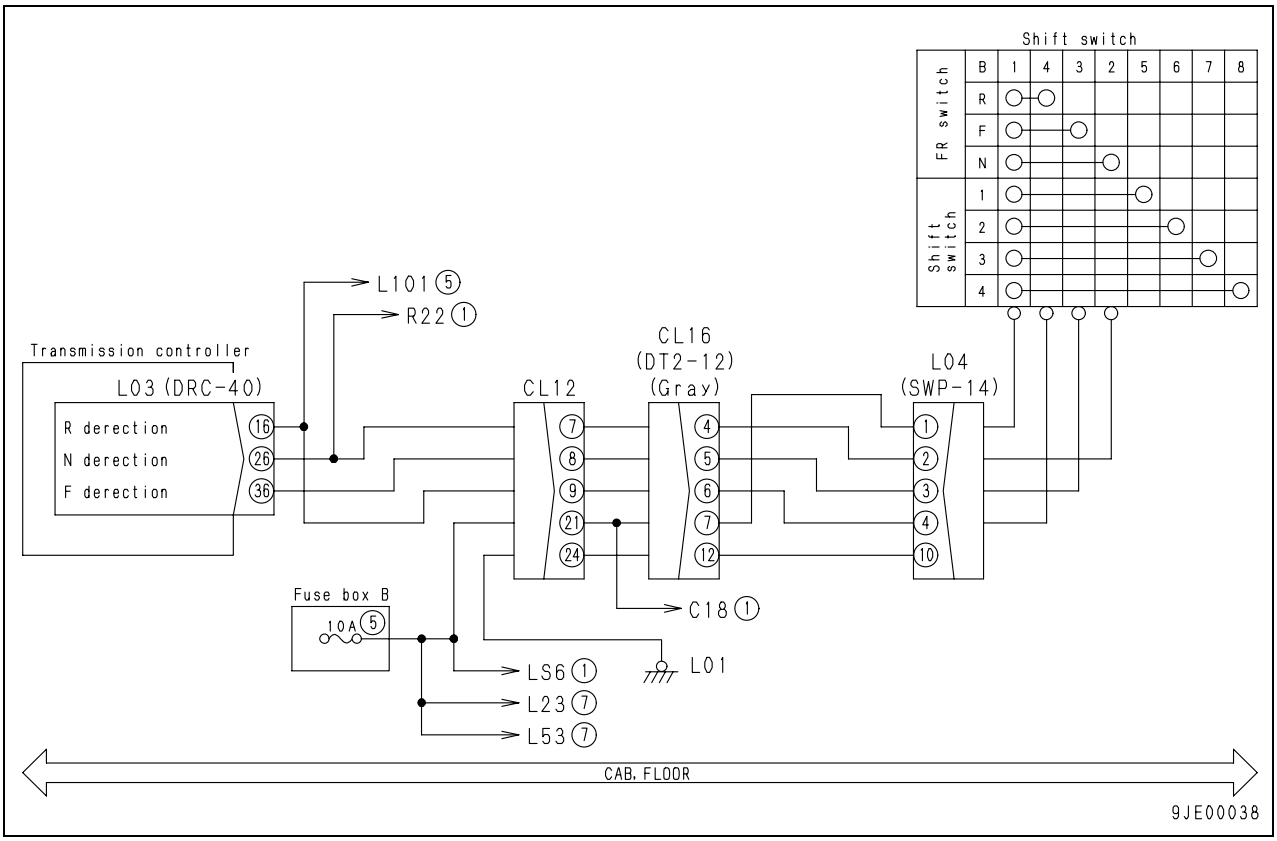


Failure code [DDK6KB] (FNR lever switch: Short circuit)

Action code	Failure code	Trouble	FNR lever switch: Short circuit (Transmission controller system)
E03	**DDK6KB**		
Contents of trouble	• Since the FNR (directional) lever switch signal system is hot short, all the FNR (directional) lever signals are not input.		
Action of controller	• Sets to neutral • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until FNR (directional) lever is set to N (Neutral).		
Problem that appears on machine	• The machine does not travel. • Multiple shift indicator turns on. • Travel is enabled by using joystick FNR switch after setting the shift to neutral.		
Related information	• The input state (ON/OFF) from the FNR (directional) lever switch can be checked with the monitoring function (Code: 40907 D-IN-20, D-IN-21 or D-IN-22). • Only for steering wheel specification (STD) • Method of reproducing failure code: Turn the starting switch ON and operate FNR (directional) lever		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective FNR (directional) lever switch (Internal short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L04	FNR (directional) lever	Voltage	
			Between (2) and (10)	N (Neutral)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (3) and (10)	F (Forward)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (4) and (10)	R (Reverse)	20 – 30 V	
				Other than above	Max. 1 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (16) – L04 (female) (4)		Voltage	Max. 1 V
			Wiring harness between L03 (female) (26) – L04 (female) (2)		Voltage	Max. 1 V
			Wiring harness between L03 (female) (36) – L04 (female) (3)		Voltage	Max. 1 V
			Wiring harness between L04 (female) (10) – chassis ground		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L03	FNR (directional) lever	Voltage	
			Between (36) and chassis ground	F (Forward)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (26) and chassis ground	N (Neutral)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (16) and chassis ground	R (Reverse)	20 – 30 V	
				Other than above	Max. 1 V	

Circuit diagram related to FNR (directional) lever switch

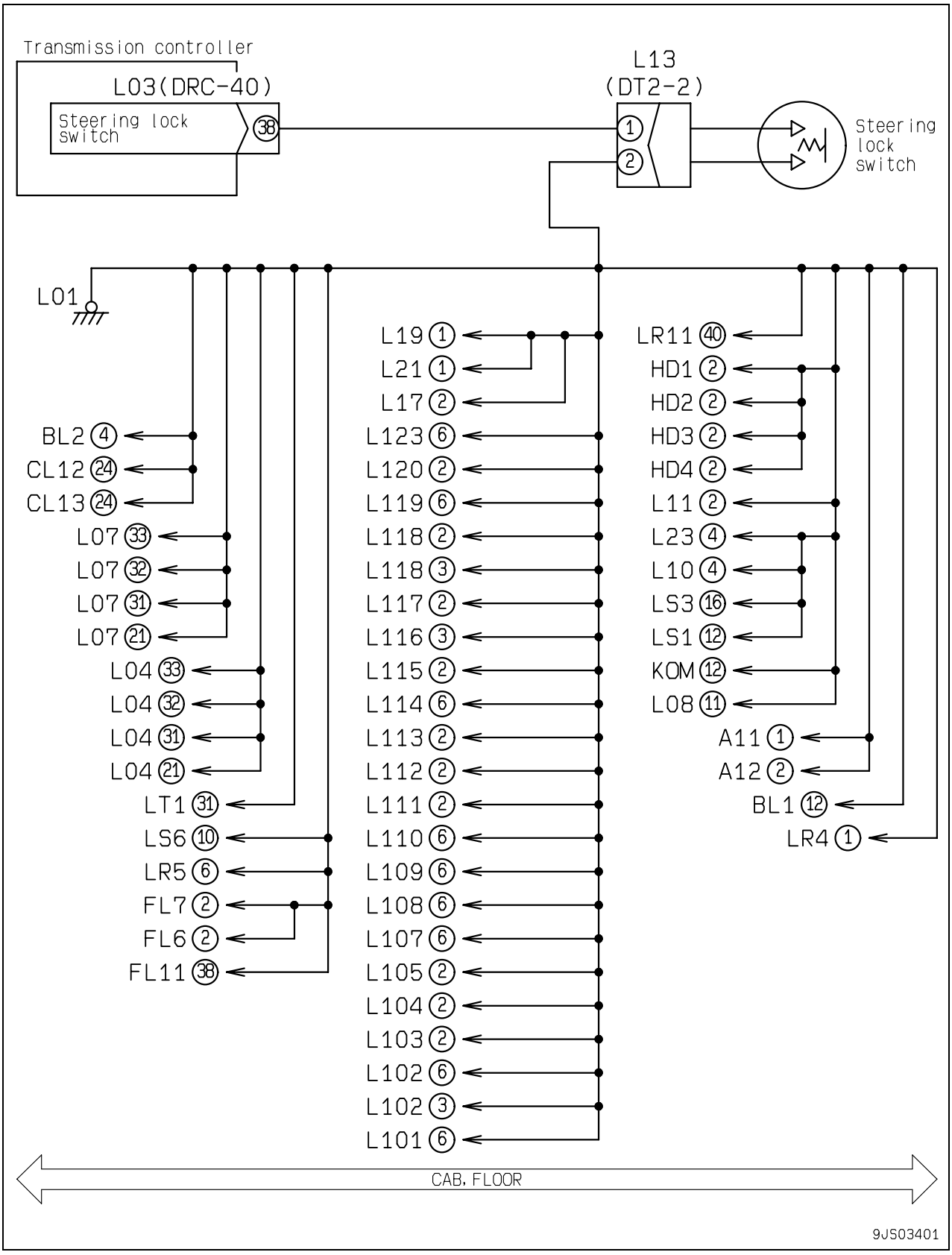


Failure code [DDP5KA] (Lock detection pressure switch of steering lock lever: Disconnection)

Action code	Failure code	Trouble	Lock detection pressure switch of steering lock lever: Disconnection (Transmission controller system)
E01	**DDP5KA**		
Contents of trouble	• Steering lock lever lock signal cannot be detected because of disconnection of lock detection pressure switch of steering lock lever.		
Action of controller	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If steering lock lever is locked, steering can be operated.		
Related information	• The input state (ON/OFF) from the lock detection pressure switch of the steering lock lever can be checked with the monitoring function (Code: 40908 D-IN-31). • Method of reproducing failure code: Turn the starting switch ON and lock the steering lock lever		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lock detection pressure switch of steering lock lever (Internal disconnection)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L13 (male)	Steering lock lever	Resistance	
			Between (1) and (2)	Lock	Min. 1 MΩ	
				Release	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (38) – L13 (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L03	Steering lock lever	Voltage	
			Between (38) and chassis ground	Lock	8 – 10 V	
				Release	Max. 1 V	

Circuit diagram related to lock detection pressure switch of steering lock lever



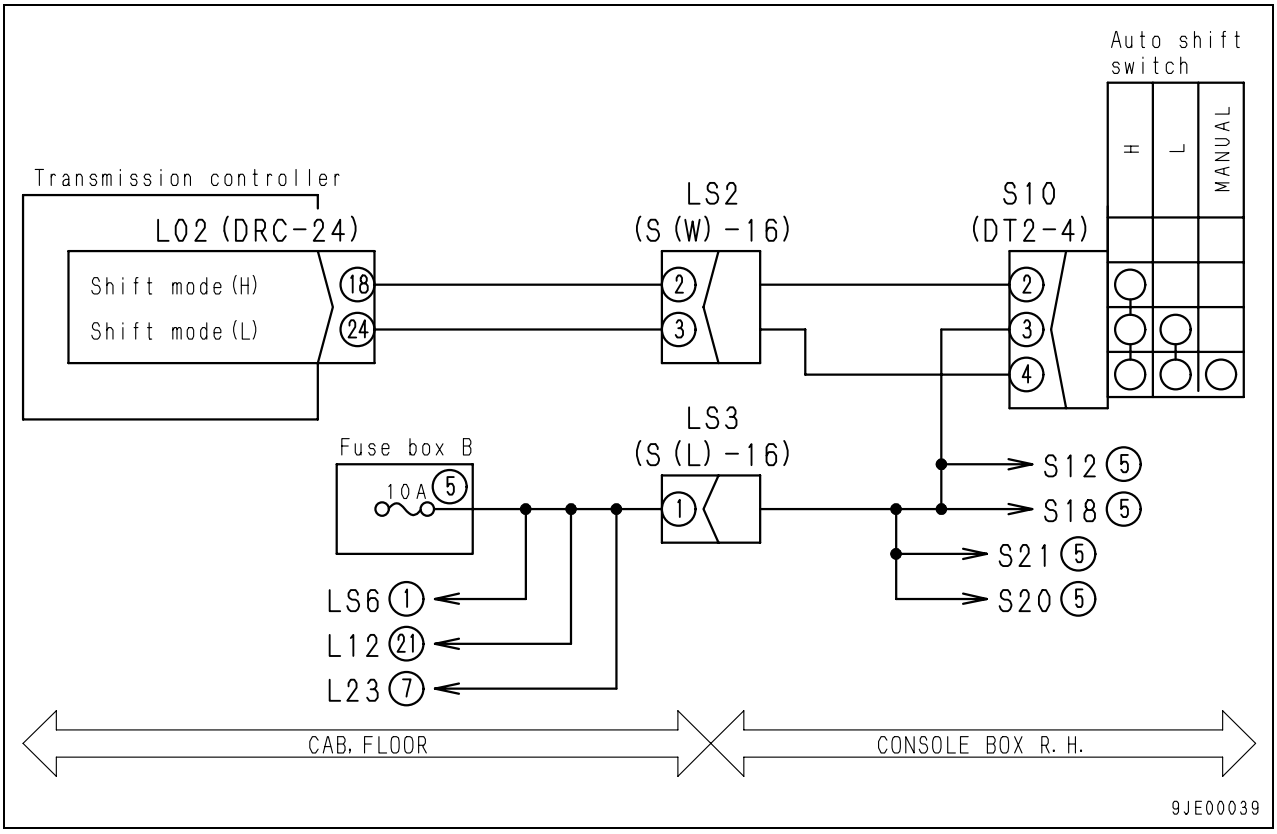
Failure code [DDT0L4] (Shift mode selector switch: ON/OFF signals disagree)

Action code	Failure code	Trouble	Shift mode selector switch: ON/OFF signals disagree (Transmission controller system)
E01	**DDT0L4**		
Contents of trouble	• The signals input from the transmission manual/auto shift selector switch are combined in an impossible manner.		
Action of controller	• Selects the manual shift mode. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The position of the transmission manual/auto shift selector switch does not match the shift mode during auto shift.		
Related information	• The input state (H/L) from the transmission manual/auto shift selector switch can be checked with the monitoring function (Code: 40905 D-IN-4, D-IN-5). • The operator can check the current shift mode with the automatic shift pilot lamp. • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission manual/auto-shift selector switch (Internal defect).	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S10 (male)	Shift mode	Resistance	
			Between (1) and (2), (3), (4)	Manual shift	Min. 1 MΩ	
				Auto shift (L)	Min. 1 MΩ	
				Auto shift (H)	Min. 1 MΩ	
			Between (2) and (3)	Manual shift	Min. 1 MΩ	
				Auto shift (L)	Min. 1 MΩ	
				Auto shift (H)	Max. 1 Ω	
			Between (3) and (4)	Manual shift	Min. 1 MΩ	
				Auto shift (L)	Max. 1 Ω	
				Auto shift (H)	Max. 1 Ω	
			Between (2) and (4)	Manual shift	Min. 1 MΩ	
				Auto shift (L)	Min. 1 MΩ	
				Auto shift (H)	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (18) – S10 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L02 (female) (24) – S10 (female) (4)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (18) – S10 (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between L02 (female) (24) – S10 (female) (4)		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L02 (female) (18) – S10 (female) (2)		Voltage	Max. 1 V
			Wiring harness between L02 (female) (24) – S10 (female) (4)		Voltage	Max. 1 V

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L02	Shift mode	Voltage
	5	Defective transmission controller	Between (18) and chassis ground	Manual shift	Max. 1 V
				Auto shift (L)	Max. 1 V
				Auto shift (H)	20 – 30 V
			Between (24) and chassis ground	Manual shift	Max. 1 V
				Auto shift (L)	20 – 30 V
				Auto shift (H)	20 – 30 V

Circuit diagram related to transmission manual/auto shift selector switch.

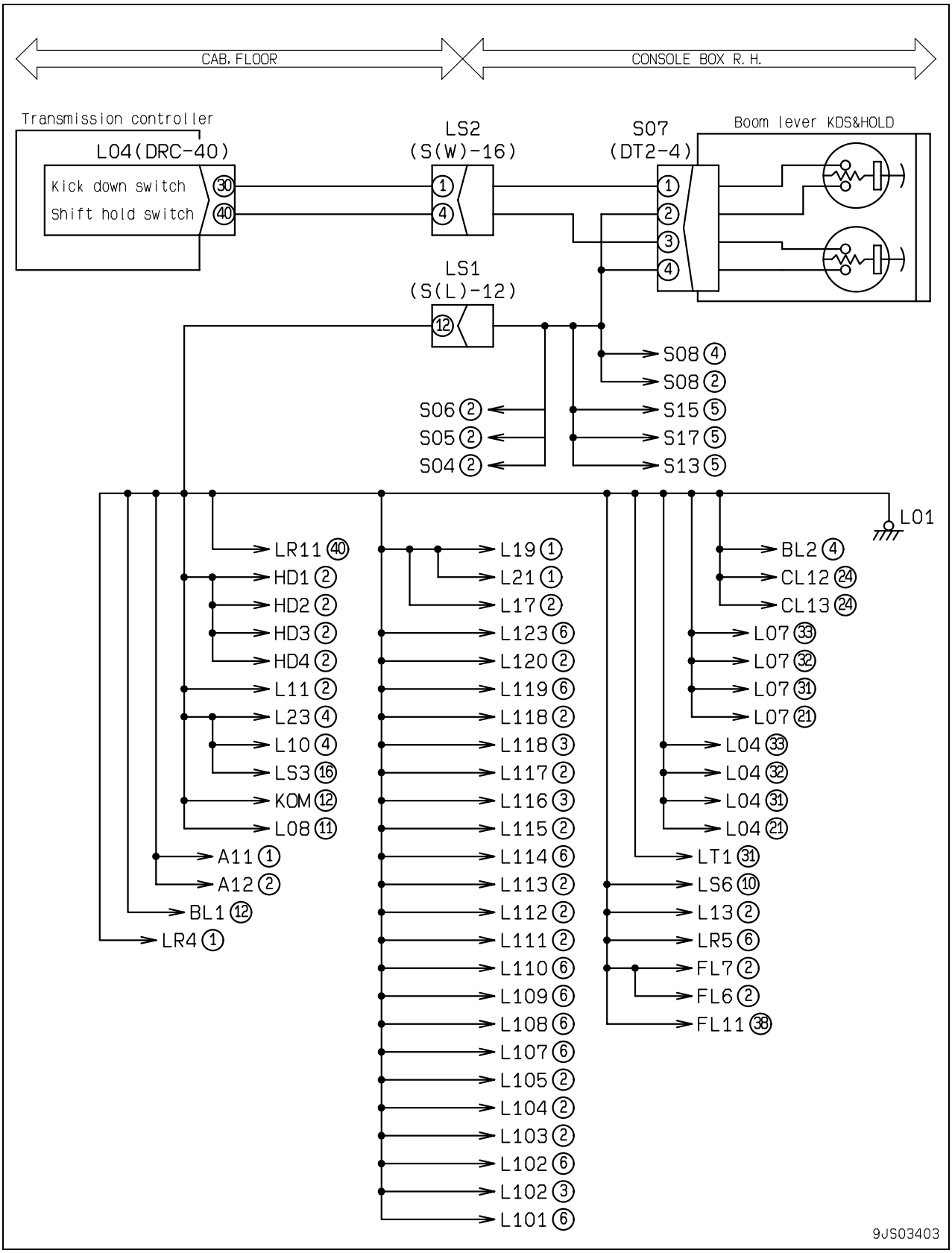


Failure code [DDW9LD] (Kick-down switch: Switch is kept pressed for long time)

Action code	Failure code	Trouble	Kick-down switch: Switch is kept pressed for long time (Transmission controller system)
E01	**DDW9LD**		
Contents of trouble	• Since the kick-down switch system is in ground fault, the kick-down is not turned OFF.		
Action of controller	• Turns the kick-down ON when a grounding fault is detected, then do not control the kick-down. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• When ground fault occurs, turn the kick-down ON once.		
Related information	• The input state (ON/OFF) from the kick-down switch can be checked with the monitoring function (Code: 40906 D-IN-10). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective kick-down switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S07 (male)	Kick-down switch	Resistance	
			Between (1) and (2)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (1), (2) and chassis ground	Normal	Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (30) – S07 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L04	Kick-down switch	Voltage	
			Between (30) and chassis ground	ON	Max. 1 V	
				OFF	8 – 10 V	

Circuit diagram related to kick-down switch and hold switch

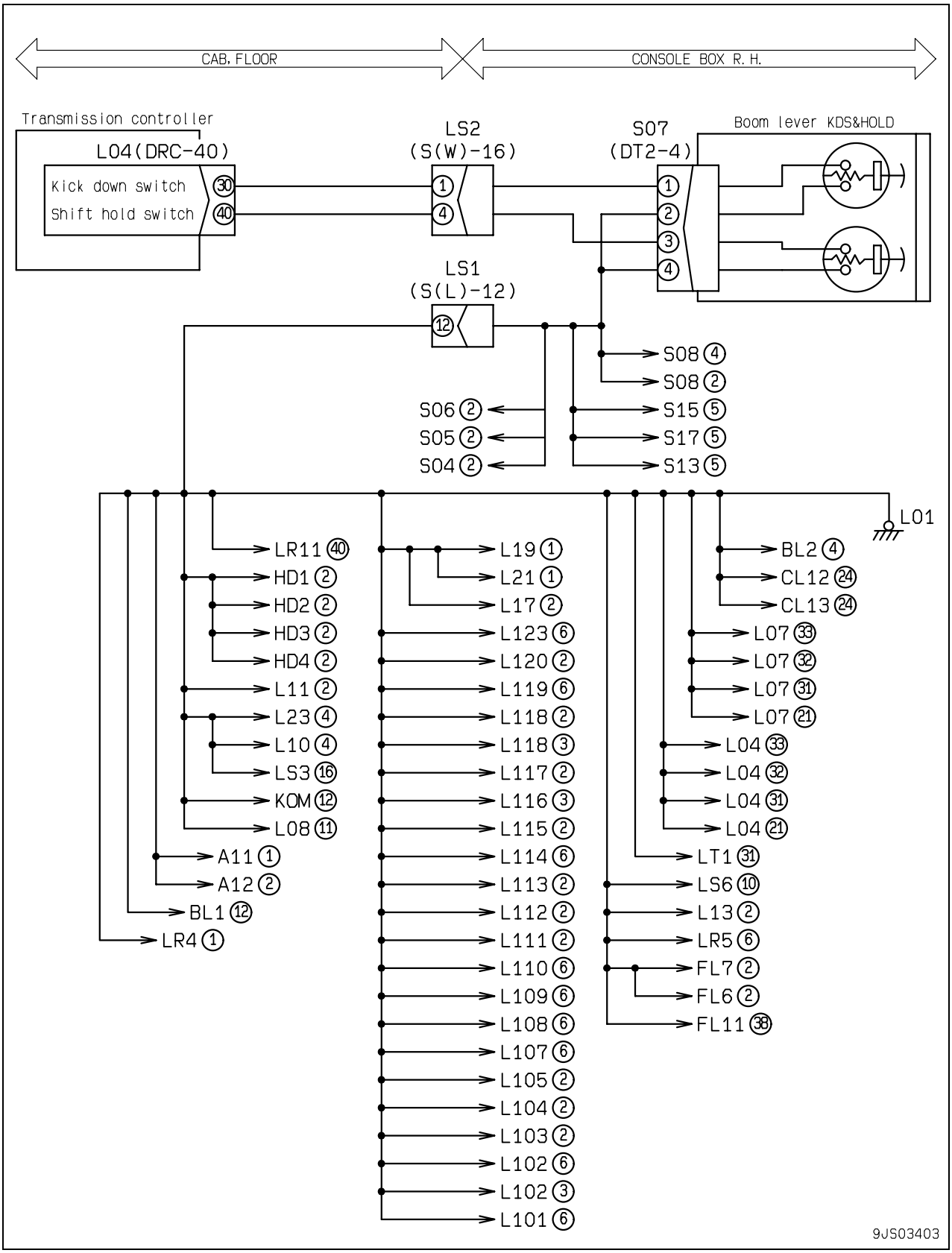


Failure code [DDWLLD] (Hold switch: Switch is kept pressed for long time)

Action code	Failure code	Trouble	Hold switch: Switch is kept pressed for long time (Transmission controller system)
E01	**DDWLLD**		
Contents of trouble	• Since the hold switch system is in ground fault, the hold switch cannot be selected.		
Action of controller	• Holds once when a grounding fault occurs, then do not control holding. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• When ground fault occurs, turn the hold switch once.		
Related information	• The input state (ON/OFF) from the hold switch can be checked with the monitoring function (Code: 40906 D-IN-11). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective hold switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S07 (male)	Hold switch	Resistance	
			Between (3) and (4)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (3), (4) and chassis ground	Normal	Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (40) – S07 (female) (3)		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L04	Hold switch	Voltage	
			Between (40) and chassis ground	ON	Max. 1 V	
				OFF	8 – 10 V	

Circuit diagram related to kick-down switch and hold switch

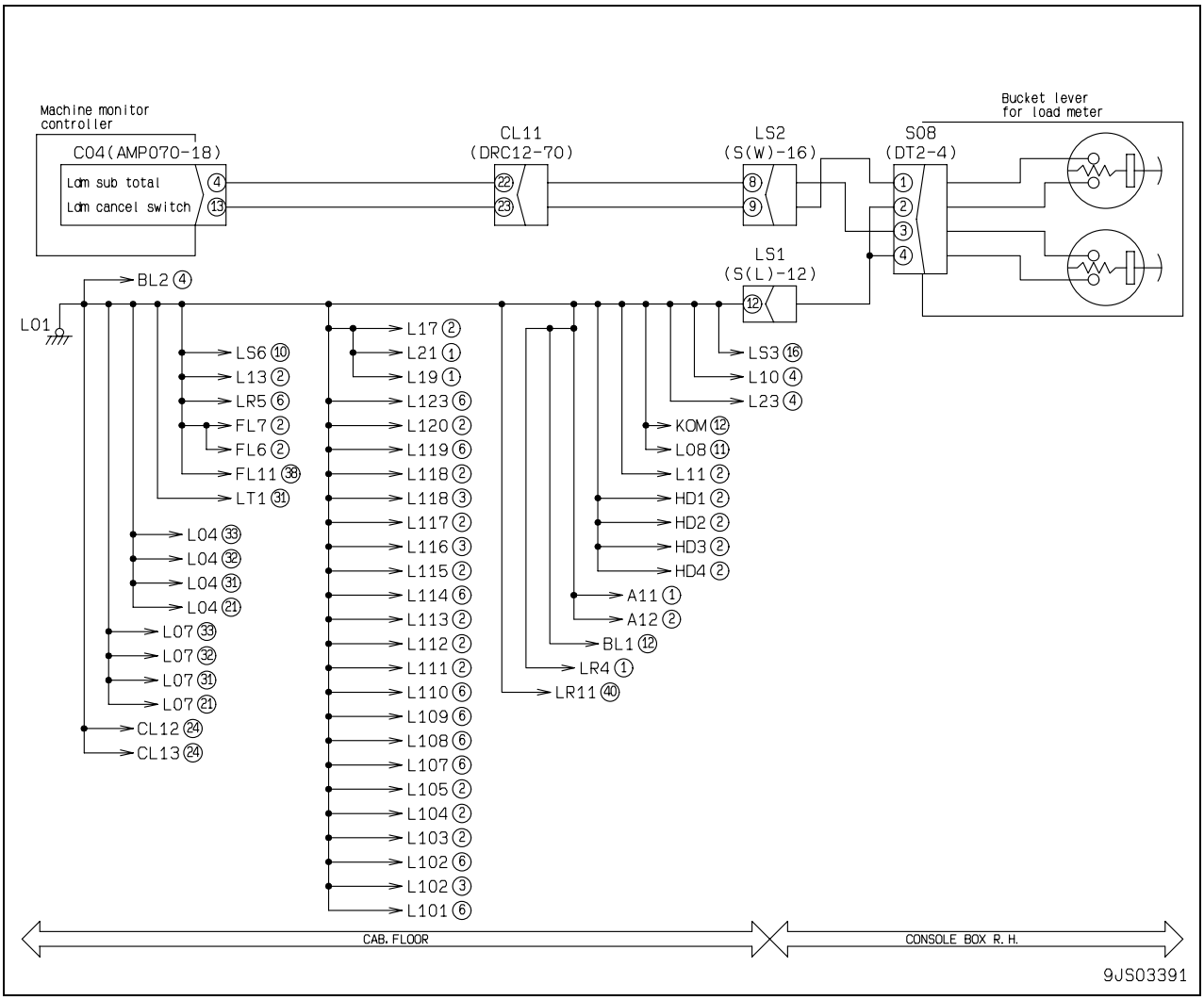


Failure code [DDY0LD] (Load meter cancel switch: Switch is kept pressed for long time)

Action code	Failure code	Trouble	Load meter cancel switch: Switch is kept pressed for long time (Machine monitor system)
E01	**DDY0LD**		
Contents of trouble	• The load meter cancel switch is in ground fault and load meter cancel switch does not function.		
Action of controller	• None in particular. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Unable to cancel cumulative data		
Related information	• The input state (ON/OFF) from the load meter cancel switch can be checked with the monitoring function (Code: 40904 D-IN-33). • Only for load meter specification (if equipped) • Method of reproducing failure code: Turn the starting switch ON		

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Defective load meter cancel switch (Internal short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>S08 (male)</td><td>Load meter cancel switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>ON</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>Between (1), (2) and chassis ground</td><td>Normal</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Grounding fault in wiring harness
(Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between C04 (female) (13) – S08 (female) (1)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective machine monitor</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td>C04 (male)</td><td>Load meter cancel switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (13) and chassis ground</td><td>ON</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>OFF</td><td colspan="2">20 – 30 V</td></tr>
</table>

Circuit diagram related to load meter cancel switch & subtotal switch



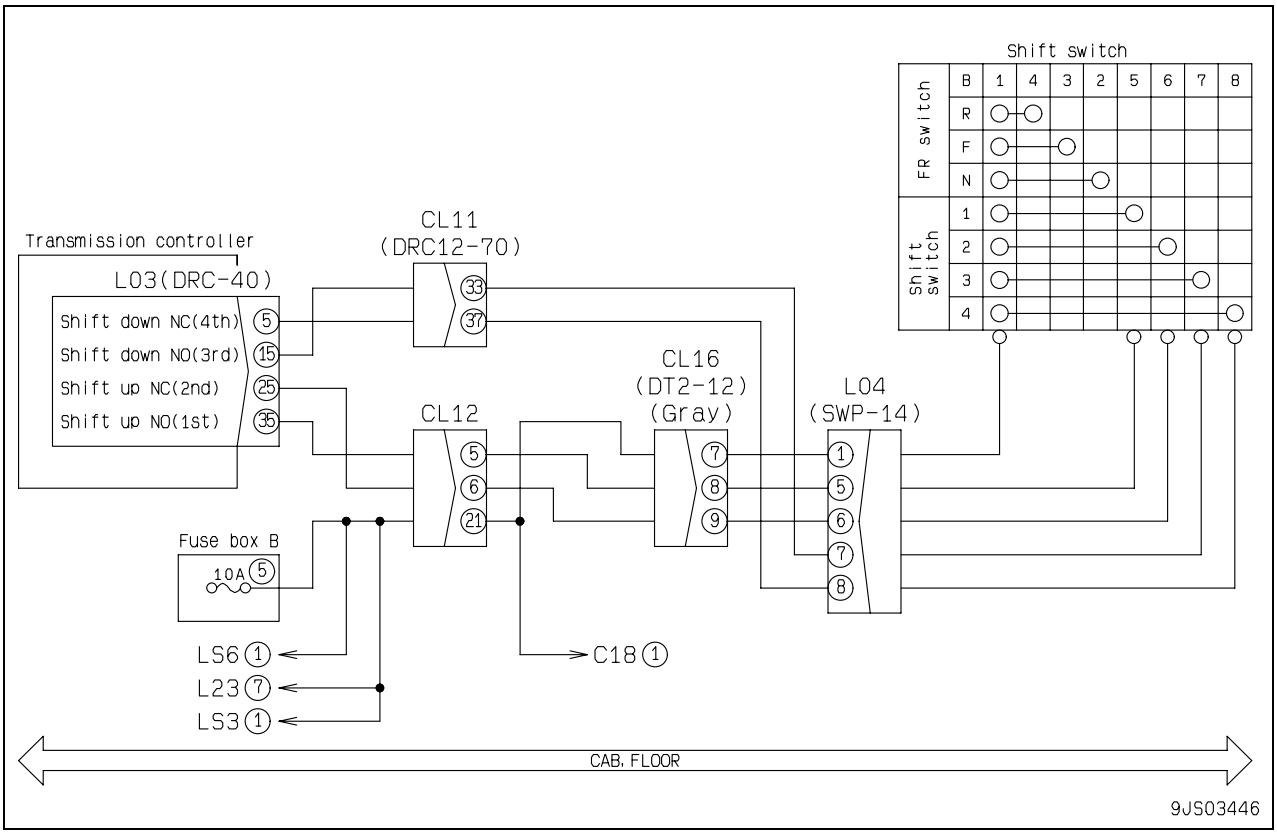
Failure code [DF10KA] (Transmission shift lever switch: Disconnection)

Action code	Failure code	Trouble	Transmission shift lever switch: Disconnection (Transmission controller system)
E01	**DF10KA**		
Contents of trouble	• Since the transmission shift lever switch input signal system is disconnected or in ground fault, the signal is not input.		
Action of controller	• Fixed to the shift range before the abnormality occurred • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The transmission is not set to the selected gear speed. • Shift indicator displays the shift range before the abnormality occurred		
Related information	• The input state (ON/OFF) from each shift switch can be checked with the monitoring function (Code: 40907 D-IN-16, D-IN-17, D-IN-18 or D-IN-19). • Only for steering wheel specification (STD) • Method of reproducing failure code: Turn the starting switch ON and operate shift lever		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission shift lever switch (Internal disconnection)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L04	Shift range	Voltage	
			Between (1) and chassis ground	Normal	20 – 30 V	
			Between (5) and chassis ground	1st (1st speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (6) and chassis ground	2nd (2nd speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (7) and chassis ground	3rd (3rd speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (8) and chassis ground	4th (4th speed)	20 – 30 V	
				Other than above	Max. 1 V	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 5 of fuse box B – L04 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L03 (female) (5) – L04 (female) (8)		Resistance	Max. 1 Ω
			Wiring harness between L03 (female) (15) – L04 (female) (7)		Resistance	Max. 1 Ω
			Wiring harness between L03 (female) (25) – L04 (female) (6)		Resistance	Max. 1 Ω
			Wiring harness between L03 (female) (35) – L04 (female) (5)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 5 of fuse box B – L04(female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between L03 (female) (5) – L04 (female) (8)		Resistance	Min. 1 MΩ
			Wiring harness between L03 (female) (15) – L04 (female) (7)		Resistance	Min. 1 MΩ
			Wiring harness between L03 (female) (25) – L04 (female) (6)		Resistance	Min. 1 MΩ
			Wiring harness between L03 (female) (35) – L04 (female) (5)		Resistance	Min. 1 MΩ

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	4	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L03	Shift range	Voltage
			Between (5) and chassis ground	1st (1st speed)	20 – 30 V
				Other than above	Max. 1 V
			Between (15) and chassis ground	2nd (2nd speed)	20 – 30 V
				Other than above	Max. 1 V
			Between (25) and chassis ground	3rd (3rd speed)	20 – 30 V
				Other than above	Max. 1 V
			Between (35) and chassis ground	4th (4th speed)	20 – 30 V
				Other than above	Max. 1 V

Circuit diagram related to transmission shift lever switch

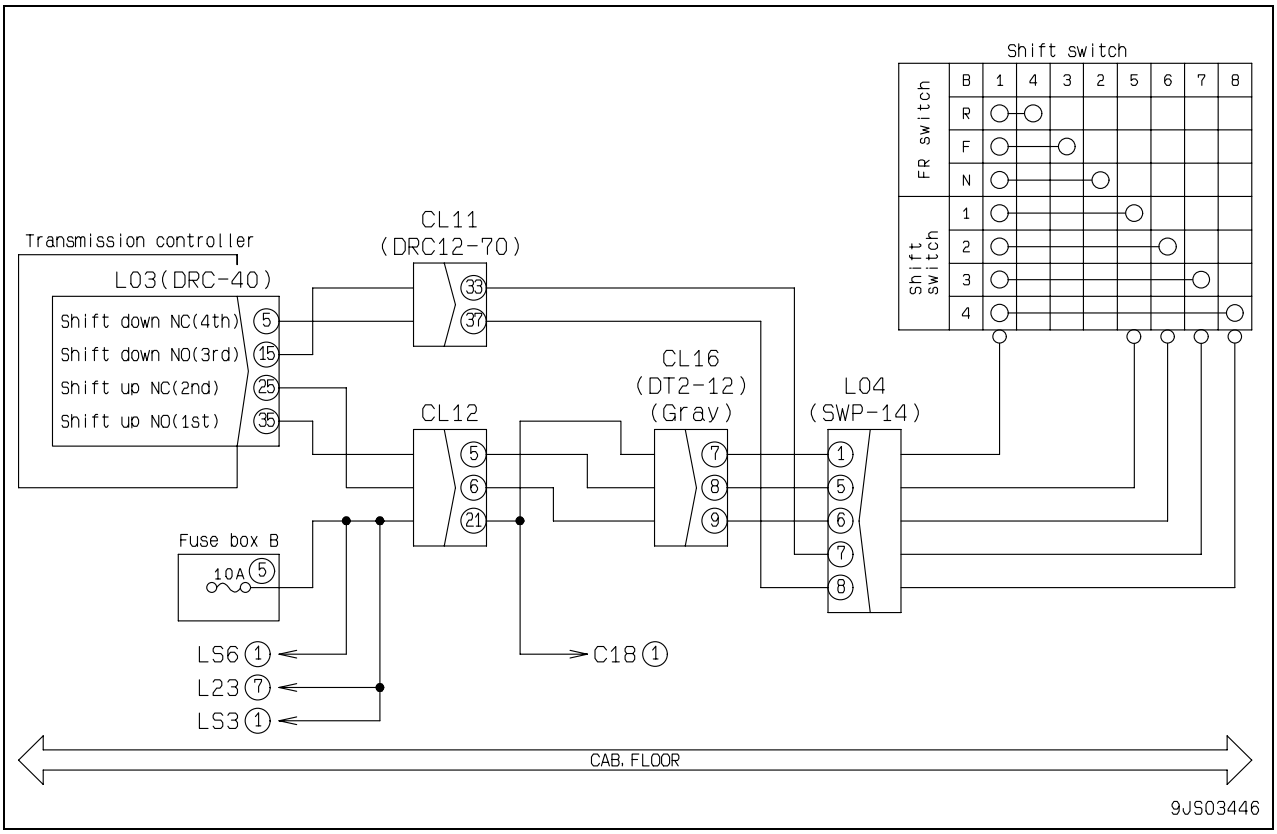


Failure code [DF10KB] (Transmission shift lever switch: Short circuit)

Action code	Failure code	Trouble	Transmission shift lever switch: Short circuit (Transmission controller system)
E01	**DF10KB**		
Contents of trouble	• Since the transmission shift lever switch input signal system is in hot short circuit, multiple transmission shift lever switch signals are input.		
Action of controller	• Uses the shift range input to the higher gear speed • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The transmission is not set to the selected gear speed. • Shift indicator indicates the shift range input to the higher gear speed.		
Related information	• The input state (ON/OFF) from each shift switch can be checked with the monitoring function (Code: 40907 D-IN-16, D-IN-17, D-IN-18 or D-IN-19). • Only for steering wheel specification (STD) • Method of reproducing failure code: Turn the starting switch ON and operate shift lever		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission shift lever switch (Internal short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L04	Shift range	Voltage	
			Between (5) and chassis ground	1st (1st speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (6) and chassis ground	2nd (2nd speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (7) and chassis ground	3rd (3rd speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (8) and chassis ground	4th (4th speed)	20 – 30 V	
				Other than above	Max. 1 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (5) – L04 (female) (8)		Voltage	Max. 1 V
			Wiring harness between L03 (female) (15) – L04 (female) (7)		Voltage	Max. 1 V
			Wiring harness between L03 (female) (25) – L04 (female) (6)		Voltage	Max. 1 V
			Wiring harness between L03 (female) (35) – L04 (female) (5)		Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L03	Shift range	Voltage	
			Between (5) and chassis ground	1st (1st speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (15) and chassis ground	2nd (2nd speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (25) and chassis ground	3rd (3rd speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (35) and chassis ground	4th (4th speed)	20 – 30 V	
				Other than above	Max. 1 V	

Circuit diagram related to transmission shift lever switch

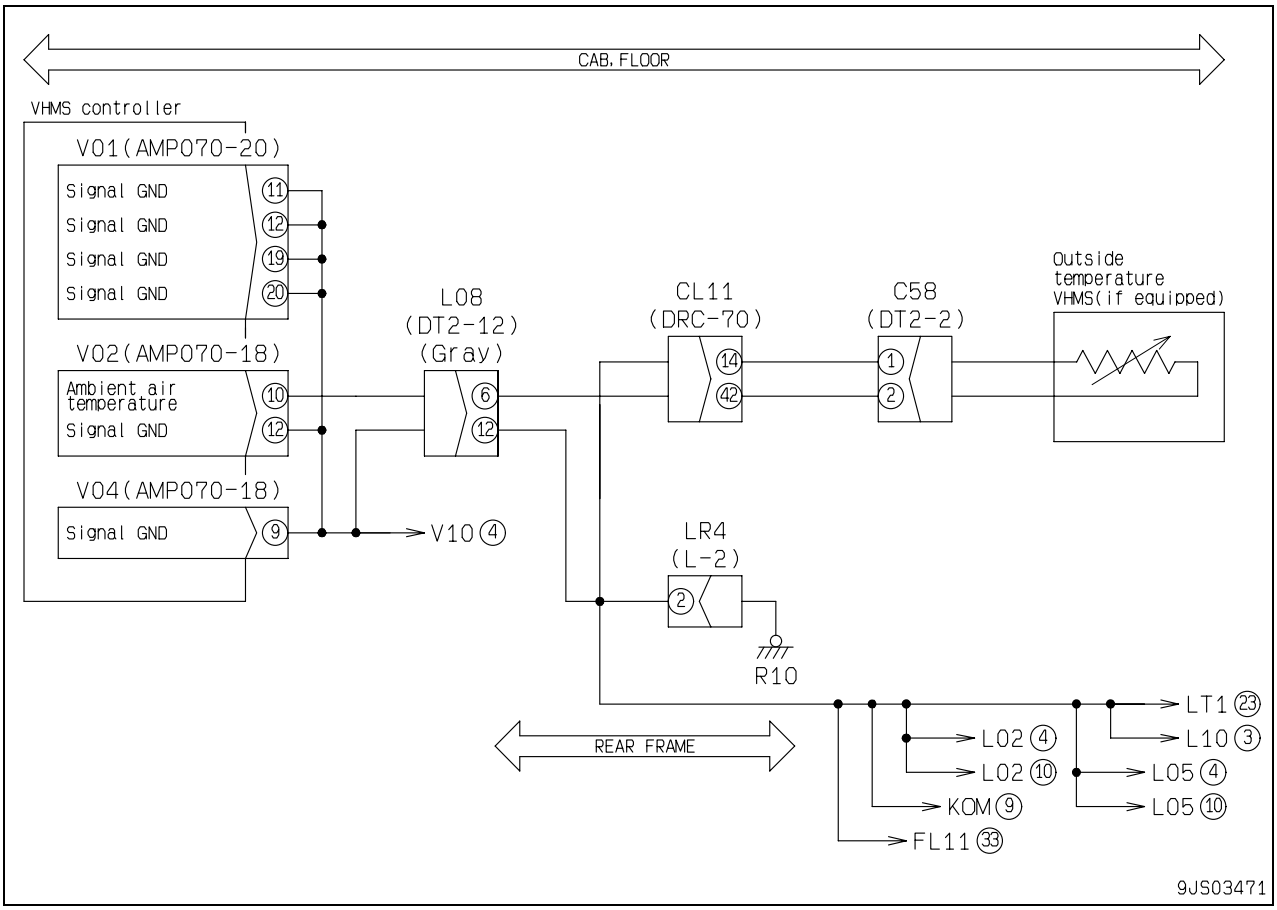


Failure code [DGE5KX] (or VHMS_LED display: “n4” → “01”) (Atmospheric temperature sensor: Out of input signal range)

Action code	Failure code	Trouble	Atmospheric temperature sensor: Out of input signal range (VHMS controller system)
—	**DGE5KX**		
Contents of trouble	• Input signal voltage from the atmospheric temperature sensor reads 4.9 V and above or 0.3 V or less.		
Action of controller	• None in particular.		
Problem that appears on machine	• Monitoring function fails to monitor the atmospheric temperature.		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n4” → “01”. • The input state (temperature) from the atmospheric temperature sensor can be checked with the monitoring function (Code: 37501 ATR TEMP). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective atmospheric temperature sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C58 (male)	Atmospheric temperature	Resistance	
			Between (1) and (2)	25°C (Normal temp)	3.6 – 4.7 kΩ	
				About 0°C	10.2 – 13.4 kΩ	
				About 40°C	2.1 – 2.6 kΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V02 (female) (10) – C58 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C58 (female) (2) – chassis ground		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V02 (female) (10) – C58 (female) (1)		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between V02 (female) (10) – C58 (female) (1)		Voltage	Max. 1 V
	5	Defective VHMS controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V02 (female)	Atmospheric temperature	Resistance	
			Between (10) and (12)	25°C (Normal temp)	3.6 – 4.7 kΩ	
				About 0°C	10.2 – 13.4 kΩ	
				About 40°C	2.1 – 2.6 kΩ	

Circuit diagram related to atmospheric temperature sensor

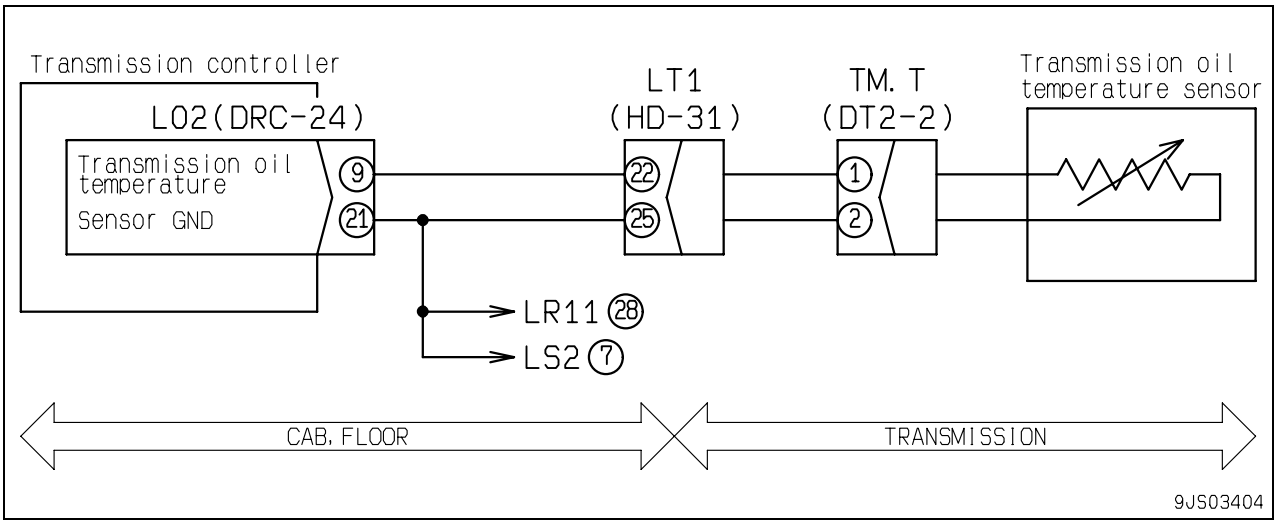


Failure code [DGF1KA] (Transmission oil temperature sensor: Disconnection)

Action code	Failure code	Trouble	Transmission oil temperature sensor: Disconnection (Transmission controller system)
E01	**DGF1KA**		
Contents of trouble	• Due to disconnection or hot short circuit in the transmission oil temperature sensor signal system, the transmission oil temperature reading is higher than normal range (Transmission oil temperature sensor signal voltage: Min. 4.56 V (Max. 15°C) and transmission oil temperature sensor signal voltage: Min. 3.7 V (55°C))		
Action of controller	• Judges that the transmission oil temperature is lower. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Gear shift shocks may be made.		
Related information	• The input state (oil temperature) from the transmission oil temperature sensor can be checked with the monitoring function (Code: 93600 T/M OIL TEMP). • The input state (voltage) from the transmission oil temperature sensor can be checked with the monitoring function (Code: 93601 T/M OIL TEMP). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission oil temperature sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			TM.T (male)	Transmission oil temperature	Resistance	
			Between (1) and (2)	25°C (Normal temp)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (9) – TM.T (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L02 (female)	Transmission oil temperature	Resistance	
			Between (9) and (21)	25°C (Normal temp)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	
			Wiring harness between TM.T (female) (2) and L02 (female) (21) – chassis ground		Resistance	Max. 1 Ω

Circuit diagram related to transmission oil temperature sensor

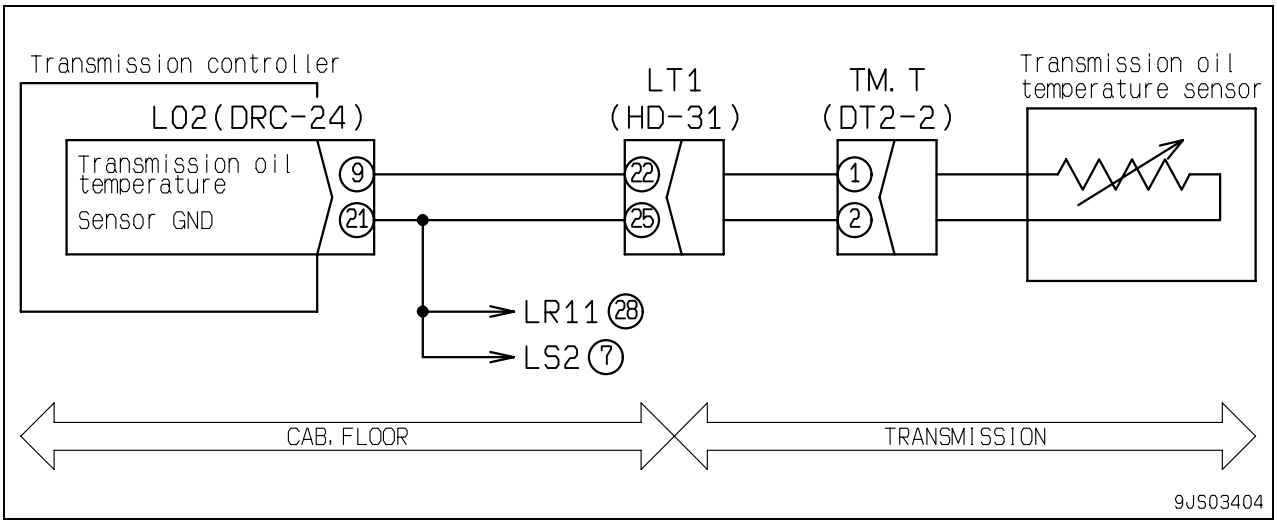


Failure code [DGF1KB] (Transmission oil temperature sensor: Short circuit)

Action code	Failure code	Trouble	Transmission oil temperature sensor: Short circuit (Transmission controller system)
E01	**DGF1KB**		
Contents of trouble	• Due to grounding fault in transmission oil temperature sensor signal system, the signal level is lower than normal range (Transmission oil temperature sensor signal voltage: Max. 0.97 V (Min. 150°C))		
Action of controller	• Judges that the transmission oil temperature is higher. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Gear shift shocks may be made.		
Related information	• The input state (oil temperature) from the transmission oil temperature sensor can be checked with the monitoring function (Code: 93600 T/M OIL TEMP). • The input state (voltage) from the transmission oil temperature sensor can be checked with the monitoring function (Code: 93601 T/M OIL TEMP). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission oil temperature sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			TM.T (male)	Transmission oil temperature	Resistance	
			Between (1) and (2)	25°C (Normal temp)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (9) – TM.T (female) (1)		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L02 (female)	Transmission oil temperature	Resistance	
			Between (9) and (21)	25°C (Normal temp)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	

Circuit diagram related to transmission oil temperature sensor



WA600-6 Wheel loader

Form No. SEN00569-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

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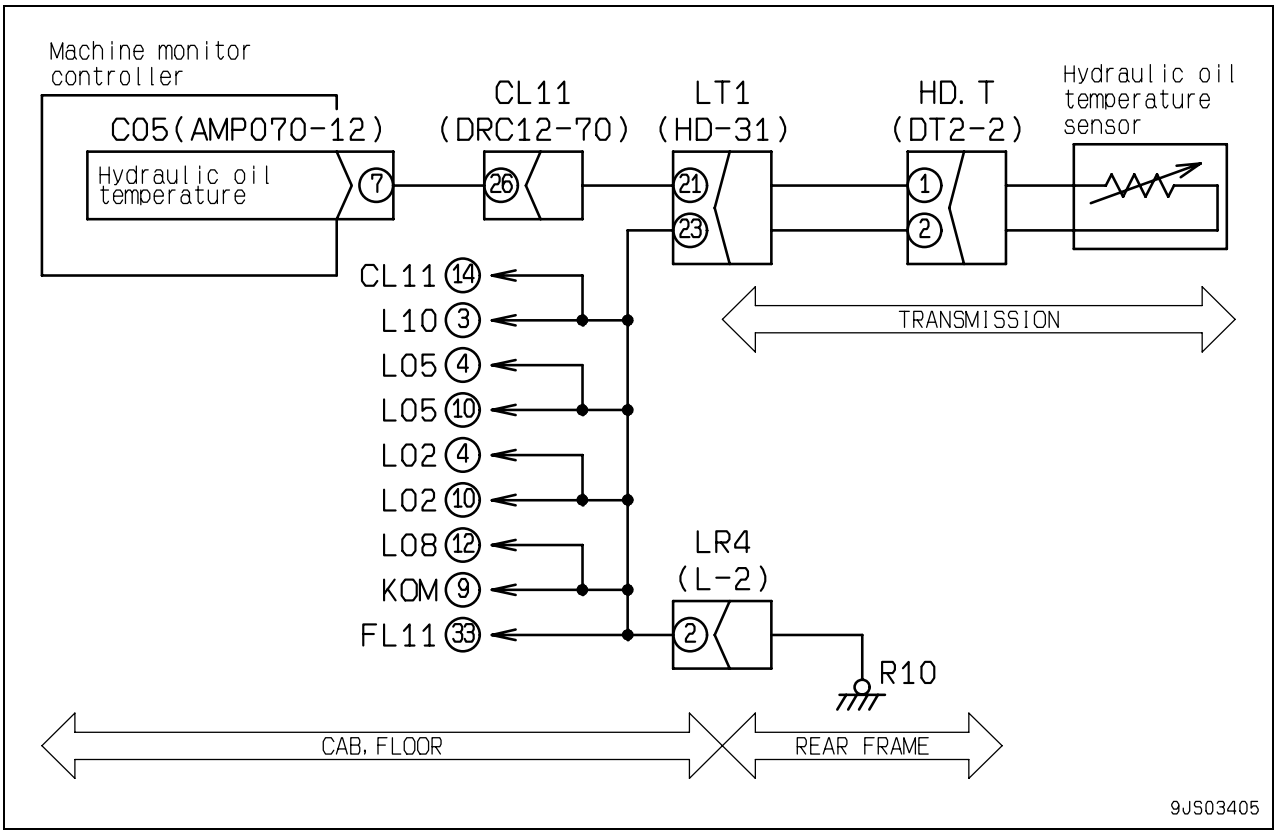
Troubleshooting by failure code (Display of code), Part 7

Failure code [DGH2KX] (Hydraulic oil temperature sensor: Out of input signal range)

Action code	Failure code	Trouble	Hydraulic oil temperature sensor: Out of input signal range (Machine monitor system)
E01	**DGH2KX**		
Contents of trouble	• Due to grounding fault in hydraulic oil temperature sensor signal system, the signal level is lower than normal range (Hydraulic oil temperature sensor signal voltage: Max. 0.97 V (Min. 150°C))		
Action of controller	• Judges that the hydraulic oil temperature is higher • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The hydraulic oil temperature gauge reads MAX position		
Related information	• The input state (oil temperature) from the hydraulic oil temperature sensor can be checked with the monitoring function (Code: 04401 HYD TEMP). • The input state (voltage) from the hydraulic oil temperature sensor can be checked with the monitoring function (Code: 04404 HYD TEMP). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission oil temperature sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			HD.T (male)	Hydraulic oil temperature	Resistance	
			Between (1) and (2)	25°C (Normal temp)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C05 (female) (7) – HD.T (female) (1)		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C05 (female)	Hydraulic oil temperature	Resistance	
			Between (7) and chassis ground	25°C (Normal temp)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	

Circuit diagram related to hydraulic oil temperature sensor

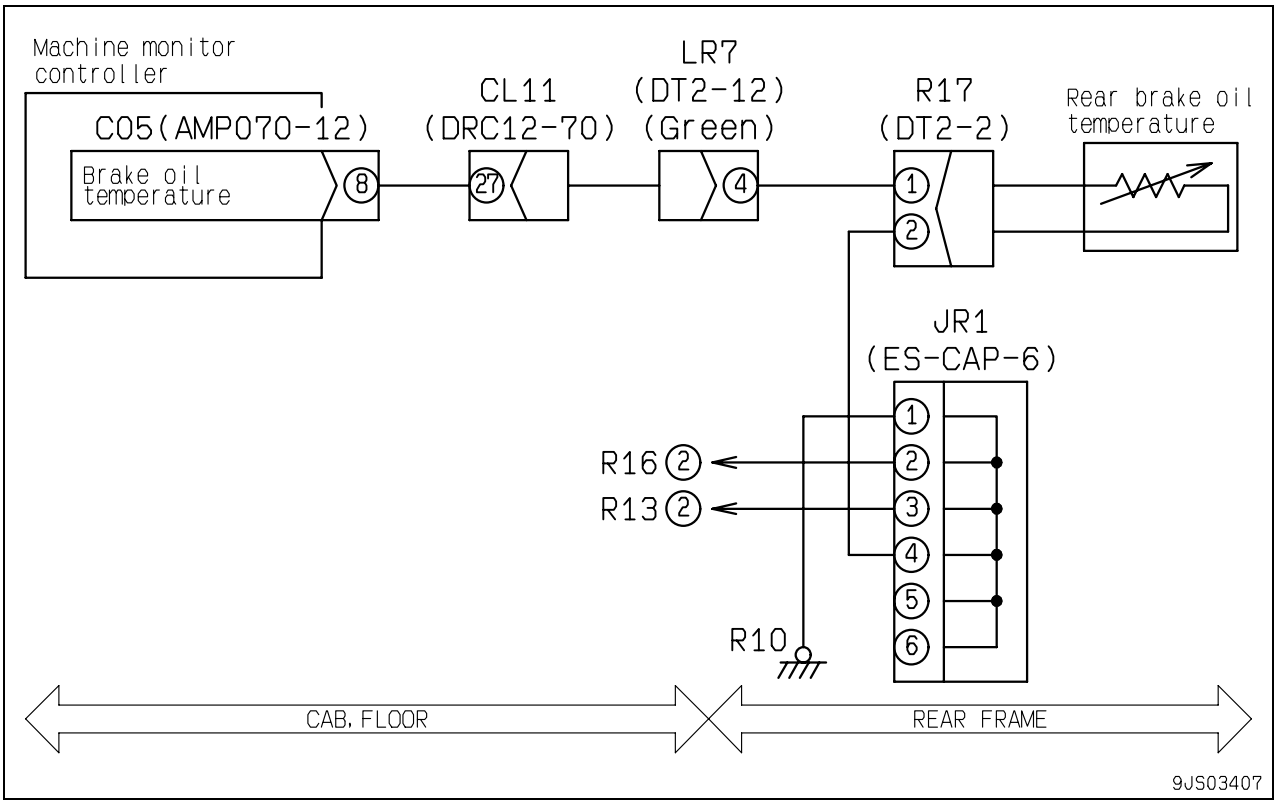


Failure code [DGR2KA] (Rear brake oil temperature sensor: Disconnection)

Action code	Failure code	Trouble	Rear brake oil temperature sensor: Disconnection (Machine monitor system)
E01	**DGR2KA**		
Contents of trouble	• Due to disconnection in rear brake oil temperature sensor signal system, the signal level is higher than normal range (Rear brake oil temperature sensor signal voltage: Max. 0.97 V (Min. 150°C))		
Action of controller	• Judges that the rear brake oil temperature is lower • If cause of failure disappears, system resets itself.		
Problem that appears on machine	—		
Related information	• The input state (oil temperature) from the rear brake oil temperature sensor can be checked with the monitoring function (Code: 30202 R BRAKE OIL). • The input state (voltage) from the rear brake oil temperature sensor can be checked with the monitoring function (Code: 30205 R BRAKE OIL). • Method of reproducing failure code: Turn the starting switch ON		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective rear brake oil temperature sensor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R17 (male)	Hydraulic oil temperature	Resistance	
			Between (1) and (2)	25°C (Normal temp)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C05 (female) (8) – R17 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between R17 (female) (2) – chassis ground		Resistance	Max. 1 Ω
	3	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C05 (female)	Oil temperature	Resistance	
			Between (8) and chassis ground	25°C (Normal temp)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	

Circuit diagram related to rear brake oil temperature sensor

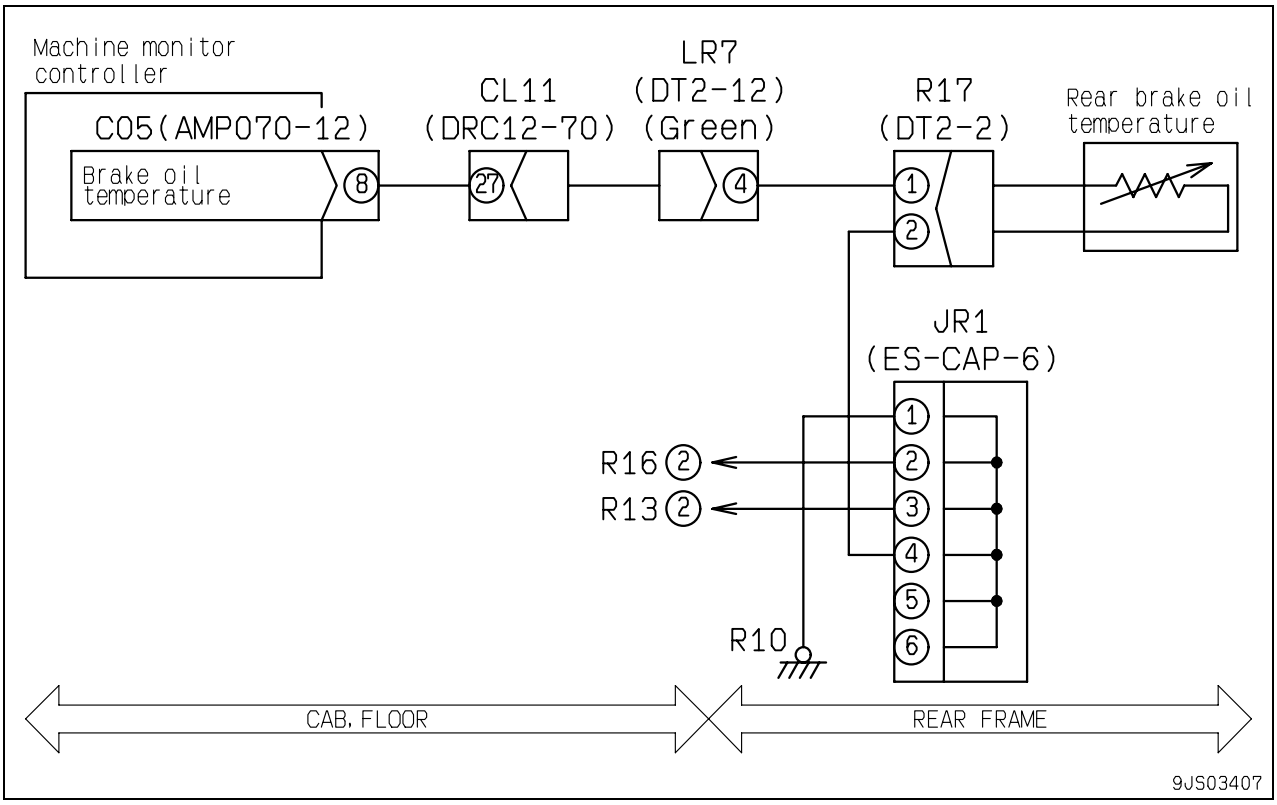


Failure code [DGR2KX] (Rear brake oil temperature sensor: Out of input signal range)

Action code	Failure code	Trouble	Rear brake oil temperature sensor: Out of input signal range (Machine monitor system)
E01	**DGR2KX**		
Contents of trouble	• Due to grounding fault in rear brake oil temperature sensor signal system, the signal level is lower than normal range (Rear brake oil temperature sensor signal voltage: Max. 0.97 V (Min. 150°C))		
Action of controller	• Judges that the rear brake oil temperature is higher • If cause of failure disappears, system resets itself.		
Problem that appears on machine	—		
Related information	• The input state (oil temperature) from the rear brake oil temperature sensor can be checked with the monitoring function (Code: 30202 R BRAKE OIL). • The input state (voltage) from the rear brake oil temperature sensor can be checked with the monitoring function (Code: 30205 R BRAKE OIL). • Method of reproducing failure code: Turn the starting switch ON		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective rear brake oil temperature sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R17 (male)	Hydraulic oil temperature	Resistance	
			Between (1) and chassis ground	25°C (Normal temp)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C05 (female) (8) – R17 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C05 (female)	Oil temperature	Resistance	
			Between (8) and chassis ground	25°C (Normal temp)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	

Circuit diagram related to rear brake oil temperature sensor



Failure code [DGT1KA] (Torque converter oil temperature sensor: Disconnection)

Action code	Failure code	Trouble	Torque converter oil temperature sensor: Disconnection (Transmission controller system)
E01	**DGT1KA**		
Contents of trouble	• Torque converter oil temperature sensor trouble is detected.		
Action of controller	• None in particular.		
Problem that appears on machine	—		
Related information	• Torque converter oil temperature sensor is not set in WA600-6.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	1	Option may be set defectively. Referring to Testing and adjusting, “Special functions of machine monitor (EMMS)”, “11. Optional device selecting function”, check that the very cold region specification (COLD SPEC) is set to “NO ADD”.

Failure code [DGT1KB] (Torque converter oil temperature sensor: Short circuit)

Action code	Failure code	Trouble	Torque converter oil temperature sensor: Short circuit (Transmission controller system)
E01	**DGT1KB**		
Contents of trouble	• Torque converter oil temperature sensor trouble is detected.		
Action of controller	• None in particular.		
Problem that appears on machine	—		
Related information	• Torque converter oil temperature sensor is not set in WA600-6.		

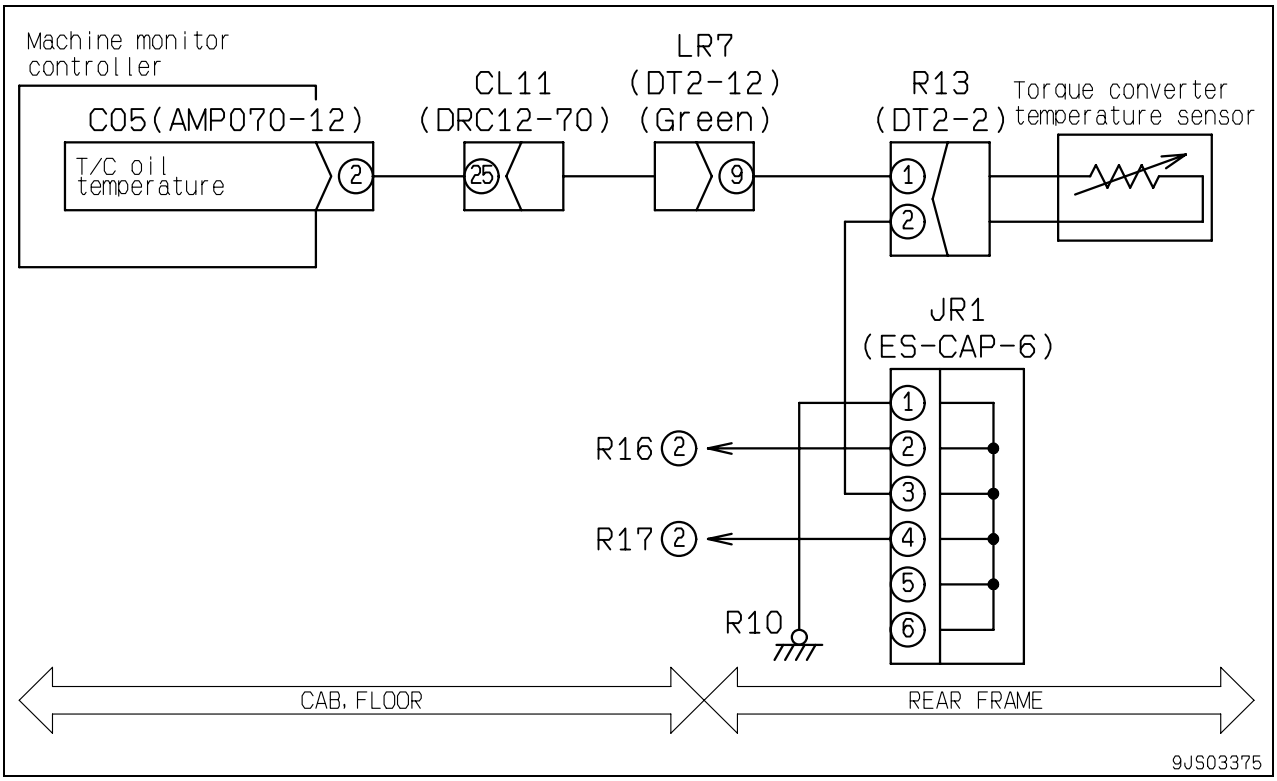
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	1	Option may be set defectively. Referring to Testing and adjusting, “Special functions of machine monitor (EMMS)”, “11. Optional device selecting function”, check that the very cold region specification (COLD SPEC) is set to “NO ADD”.

Failure code [DGT1KX] (Torque converter oil temperature sensor: Out of input signal range)

Action code	Failure code	Trouble	Torque converter oil temperature sensor: Out of input signal range (Machine monitor system)
E01	**DGT1KX**		
Contents of trouble	• Due to grounding fault in transmission oil temperature sensor signal system, the signal level is lower than normal range (Transmission oil temperature voltage: Max. 0.97 V (Min. 150°C))		
Action of controller	• Judges that the torque converter oil temperature is higher • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The torque converter oil temperature gauge reads MAX position		
Related information	• The input state (oil temperature) from the torque converter oil temperature sensor can be checked with the monitoring function (Code: 40100 TC OIL TEMP). • The input state (voltage) from the torque converter oil temperature sensor can be checked with the monitoring function (Code: 40101 TC OIL TEMP). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective torque converter oil temperature sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R13 (male)	Torque converter oil temperature	Resistance	
			Between (1) and (2)	25°C (Normal temp)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C05 (female) (2) – R13 (female) (1)		Resistance	Max. 1 Ω
	3	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C05 (female)	Torque converter oil temperature	Resistance	
			Between (2) and chassis ground	25°C (Normal temp)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	

Circuit diagram related to torque converter oil temperature sensor

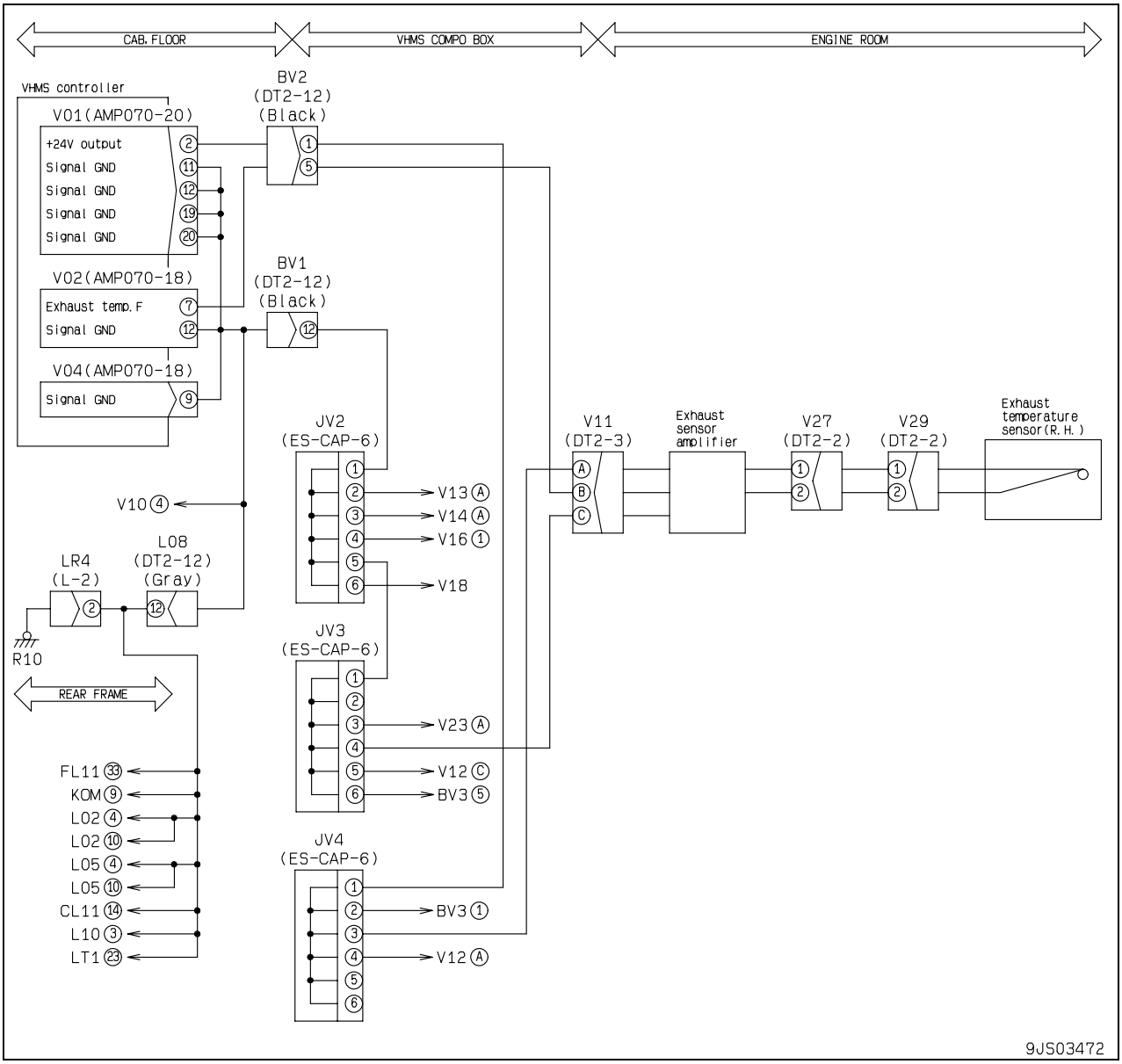


Failure code [DGT4KA] (or VHMS_LED display: “n3” → “12”) (Exhaust gas temperature sensor (F): Disconnection)

Action code	Failure code	Trouble	Exhaust gas temperature sensor (F): Disconnection
—	**DGT4KA**		
Contents of trouble	• Input signal voltage from the exhaust gas temperature sensor on the engine front side reads 4.9 V and above.		
Action of controller	• None in particular.		
Problem that appears on machine	• Monitoring function fails to monitor the exhaust gas temperature on the engine front side		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n3” → “12”. • The input state (temperature) from the exhaust gas temperature sensor (F) can be checked with the monitoring function (Code: 42610 EXHAUST TEMP F). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective exhaust gas temperature sensor on the engine front side (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V29	Exhaust gas temperature	Voltage	
			Between (1) and (2)	50 – 100°C	1.0 – 35 mV	
				300 – 400°C	11.2 – 15.6 mV	
				500 – 600°C	19.7 – 24.2 mV	
				700 – 800°C	28.1 – 32.6 mV	
	2	Defective exhaust gas temperature sensor amplifier on the engine front side (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V11	Exhaust gas temperature	Voltage	
			Between (A) and (C)	Normal	20 – 30 V	
			Between (B) and (C)	50 – 100°C	1.0 – 1.6 V	
				300 – 400°C	2.1 – 2.7 V	
				500 – 600°C	2.9 – 3.6 V	
				700 – 800°C	3.8 – 4.4 V	
	3	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between F11 (female) (B) – V02 (female) (7)		Voltage	Max. 1 V
			Wiring harness between V29 (female) (2) – V27 (female) (2)		Voltage	Max. 1 V
	4	Defective VHMS controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V02	Exhaust gas temperature	Voltage	
			Between (7) and (12)	50 – 100°C	1.0 – 1.6 V	
				300 – 400°C	2.1 – 2.7 V	
				500 – 600°C	2.9 – 3.6 V	
				700 – 800°C	3.8 – 4.4 V	

Circuit diagram related to exhaust gas temperature sensor (F)



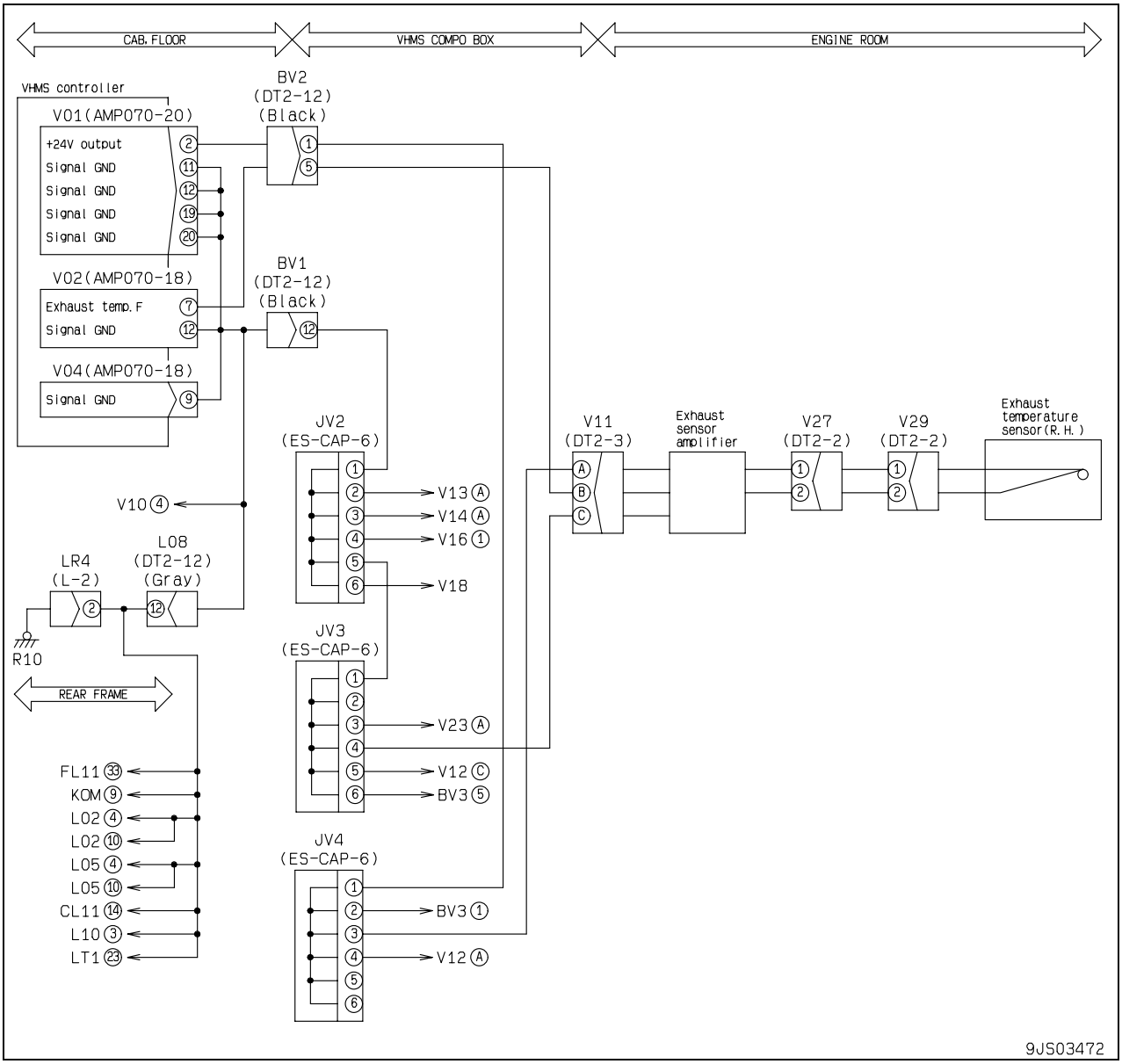
Failure code [DGT4KB] (or VHMS_LED display: “n3” → “11”) (Exhaust gas temperature sensor (F): Short circuit)

Action code	Failure code	Trouble	Exhaust gas temperature sensor (F): Short circuit (VHMS controller system)
—	**DGT4KB**		
Contents of trouble	• Input signal voltage from the exhaust gas temperature sensor on the engine front side reads 0.3 V or less.		
Action of controller	• None in particular.		
Problem that appears on machine	• Monitoring function fails to monitor the exhaust gas temperature on the engine front side		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n3” → “11”. • The input state (temperature) from the exhaust gas temperature sensor (F) can be checked with the monitoring function (Code: 42610 EXHAUST TEMP F). • If failure code [DBB6KP] (VHMS controller 24V power supply output: Low output voltage) is displayed, carry out troubleshooting for it first. • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective exhaust gas temperature sensor on the engine front side (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V29	Exhaust gas temperature	Voltage	
			Between (1) and (2)	50 – 100°C	1.0 – 3.5 mV	
				300 – 400°C	11.2 – 15.6 mV	
				500 – 600°C	19.7 – 24.2 mV	
				700 – 800°C	28.1 – 32.6 mV	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V29 (male)		Resistance	
			Between (1) and (2)		Min. 1 MΩ	
	2	Defective exhaust gas temperature sensor amplifier on the engine front side (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V11	Exhaust gas temperature	Voltage	
			Between (A) and (C)	Normal	20 – 30 V	
			Between (B) and (C)	50 – 100°C	1.0 – 1.6 V	
				300 – 400°C	2.1 – 2.7 V	
				500 – 600°C	2.9 – 3.6 V	
				700 – 800°C	3.8 – 4.4 V	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V11 (male)		Resistance	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V11 (female) (B) – V02 (female) (7)		Resistance	Max. 1 Ω
			Wiring harness between V29 (female) (2) – V27 (female) (2)		Resistance	Max. 1 Ω

<table>
<tr><td rowspan="6">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Grounding fault in wiring harness
(Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between F11 (female) (B) – V02 (female) (7)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between V29 (female) (2) – V27 (female) (2)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Defective VHMS controller</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.</td></tr>
<tr><td>V02</td><td>Exhaust gas temperature</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (7) and (12)</td><td>50 – 100°C</td><td colspan="2">1.0 – 1.6 V</td></tr>
<tr><td></td><td></td><td></td><td>300 – 400°C</td><td colspan="2">2.1 – 2.7 V</td></tr>
<tr><td></td><td></td><td></td><td>500 – 600°C</td><td colspan="2">2.9 – 3.6 V</td></tr>
<tr><td></td><td></td><td></td><td>700 – 800°C</td><td colspan="2">3.8 – 4.4 V</td></tr>
</table>

Circuit diagram related to exhaust gas temperature sensor (F)

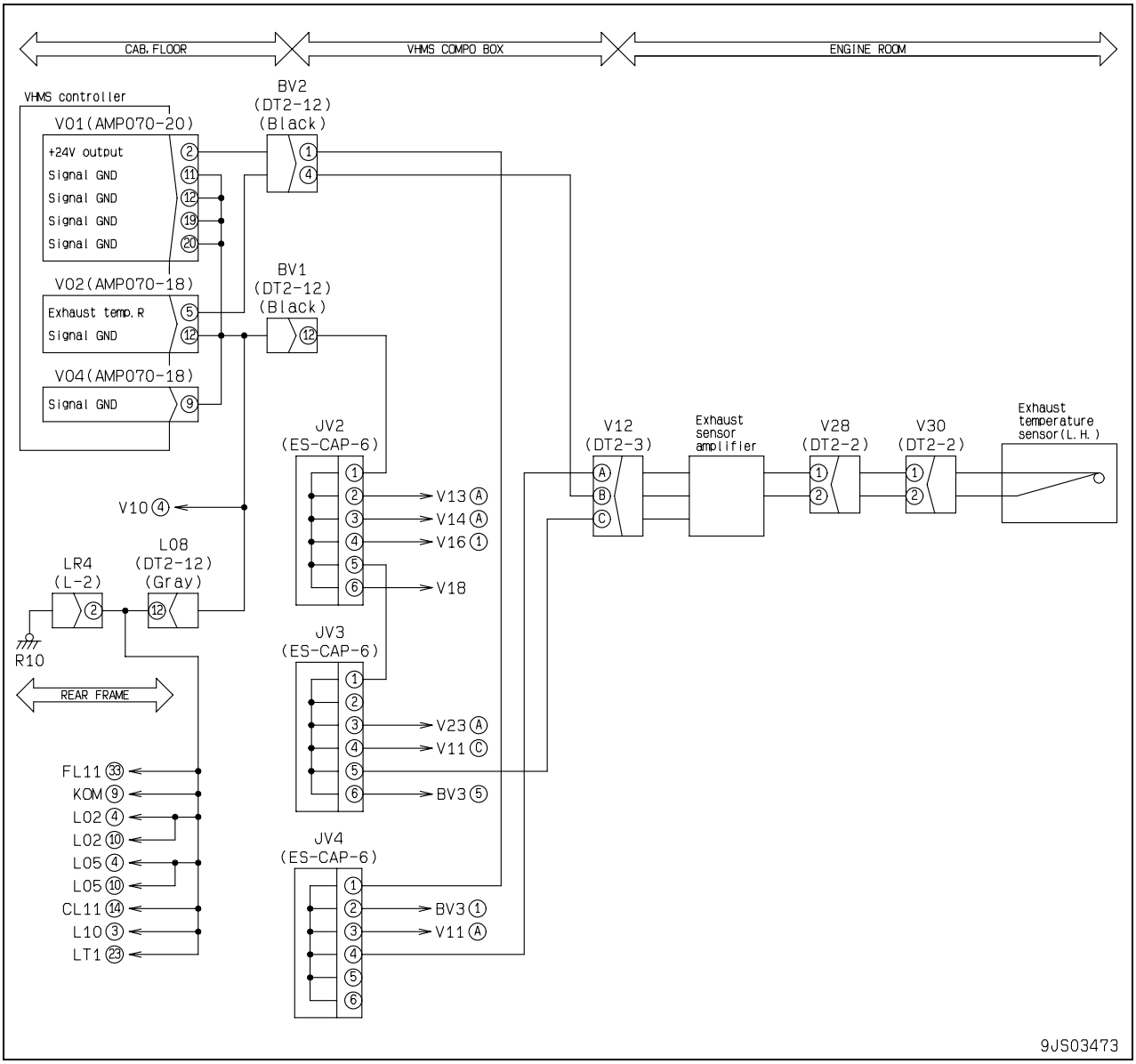


Failure code [DGT5KA] (or VHMS_LED display: “n3” → “22”) (Exhaust gas temperature sensor (R): Disconnection)

Action code	Failure code	Trouble	Exhaust gas temperature sensor (R): Disconnection (VHMS controller system)
—	**DGT5KA**		
Contents of trouble	• Input signal voltage from the exhaust gas temperature sensor on the engine rear side reads 4.9 V and above.		
Action of controller	• None in particular.		
Problem that appears on machine	• Monitoring function fails to monitor the exhaust gas temperature on the engine rear side		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n3” → “22”. • The input state (temperature) from the exhaust gas temperature sensor (R) can be checked with the monitoring function (Code: 42611 EXHAUST TEMP R). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective exhaust gas temperature sensor on the engine rear side (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V30	Exhaust gas temperature	Voltage	
			Between (1) and (2)	50 – 100°C	1.0 – 3.5 mV	
				300 – 400°C	11.2 – 15.6 mV	
				500 – 600°C	19.7 – 24.2 mV	
				700 – 800°C	28.1 – 32.6 mV	
	2	Defective exhaust gas temperature sensor amplifier on the engine rear side (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V12	Exhaust gas temperature	Voltage	
			Between (A) and (C)	Normal	20 – 30 V	
			Between (B) and (C)	50 – 100°C	1.0 – 1.6 V	
				300 – 400°C	2.1 – 2.7 V	
				500 – 600°C	2.9 – 3.6 V	
				700 – 800°C	3.8 – 4.4 V	
	3	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between V12 (female) (B) – V02 (female) (5)		Voltage	Max. 1 V
			Wiring harness between V30 (female) (2) – V28 (female) (2)		Voltage	Max. 1 V
	4	Defective VHMS controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V02	Exhaust gas temperature	Voltage	
			Between (5) and (12)	50 – 100°C	1.0 – 1.6 V	
				300 – 400°C	2.1 – 2.7 V	
				500 – 600°C	2.9 – 3.6 V	
				700 – 800°C	3.8 – 4.4 V	

Circuit diagram related to exhaust gas temperature sensor (R)



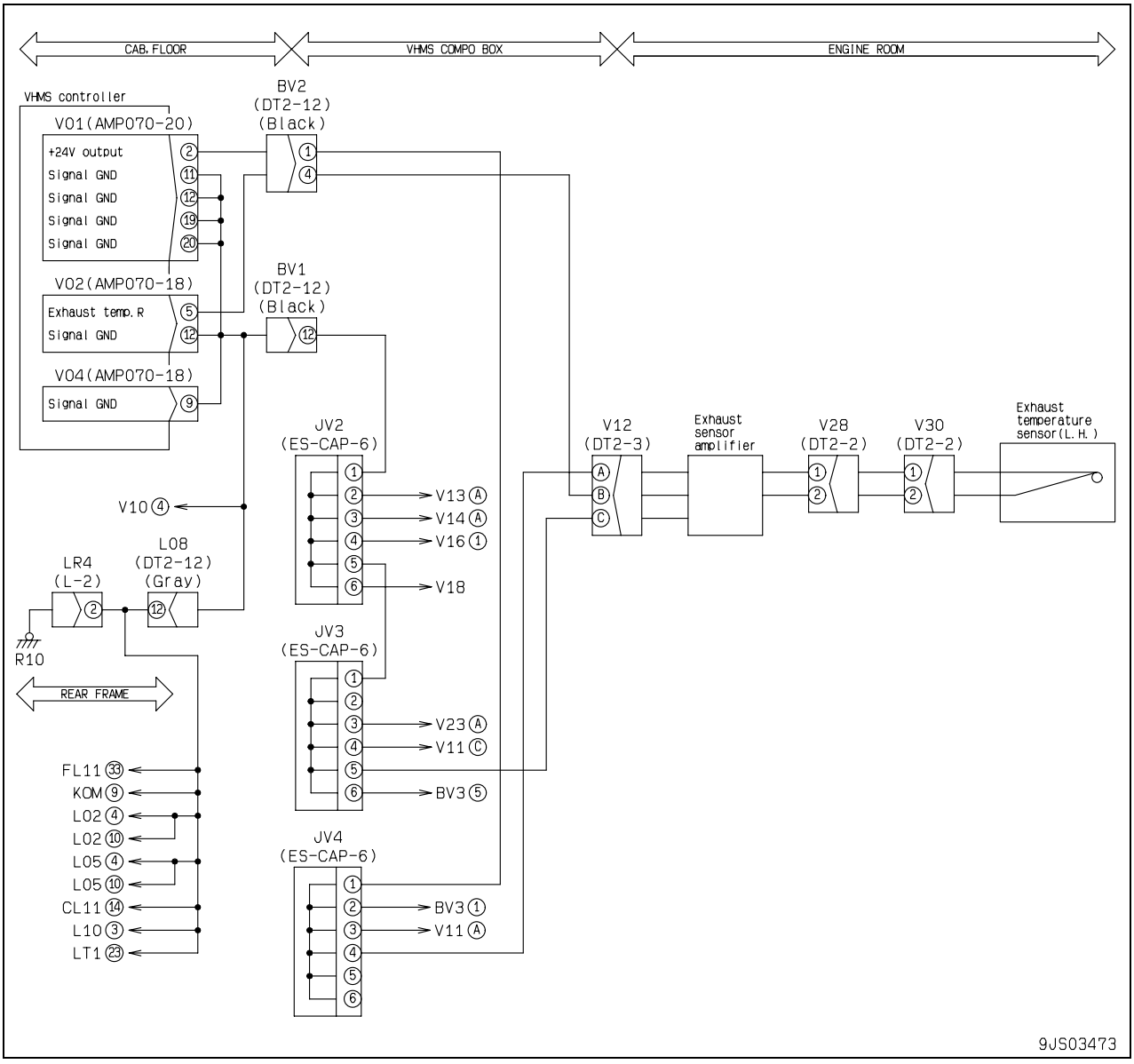
Failure code [DGT5KB] (or VHMS_LED display: “n3” → “21”) (Exhaust gas temperature sensor (R): Short circuit)

Action code	Failure code	Trouble	Exhaust gas temperature sensor (R): Short circuit (VHMS controller system)
—	**DGT5KB**		
Contents of trouble	• Input signal voltage from the exhaust gas temperature sensor on the engine rear side reads 0.3 V or less.		
Action of controller	• None in particular.		
Problem that appears on machine	• Monitoring function fails to monitor the exhaust gas temperature on the engine rear side		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n3” → “21”. • The input state (temperature) from the exhaust gas temperature sensor (R) can be checked with the monitoring function (Code: 42611 EXHAUST TEMP R). • If failure code [**DBB6KP**] (VHMS controller 24V power supply output: Low output voltage) is displayed, carry out troubleshooting for it first. • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective exhaust gas temperature sensor on the engine rear side (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V30	Exhaust gas temperature	Voltage	
			Between (1) and (2)	50 – 100°C	1.0 – 3.5 mV	
				300 – 400°C	11.2 – 15.6 mV	
				500 – 600°C	19.7 – 24.2 mV	
				700 – 800°C	28.1 – 32.6 mV	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V30 (male)		Resistance	
			Between (1) and (2)		Min. 1 MΩ	
	2	Defective exhaust gas temperature sensor amplifier on the engine rear side (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V12	Exhaust gas temperature	Voltage	
			Between (A) and (C)	Normal	20 – 30 V	
			Between (B) and (C)	50 – 100°C	1.0 – 1.6 V	
				300 – 400°C	2.1 – 2.7 V	
				500 – 600°C	2.9 – 3.6 V	
				700 – 800°C	3.8 – 4.4 V	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V12 (male)		Resistance	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V12 (female) (B) – V02 (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between V30 (female) (2) – V28 (female) (2)		Resistance	Max. 1 Ω

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between V12 (female) (B) – V02 (female) (5)	Resistance	Min. 1 MΩ
			Wiring harness between V30 (female) (2) – V28 (female) (2)	Resistance	Min. 1 MΩ
	5	Defective VHMS controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			V02	Exhaust gas temperature	Voltage
			Between (5) and (12)	50 – 100°C	1.0 – 1.6 V
				300 – 400°C	2.1 – 2.7 V
				500 – 600°C	2.9 – 3.6 V
				700 – 800°C	3.8 – 4.4 V

Circuit diagram related to exhaust gas temperature sensor (R)

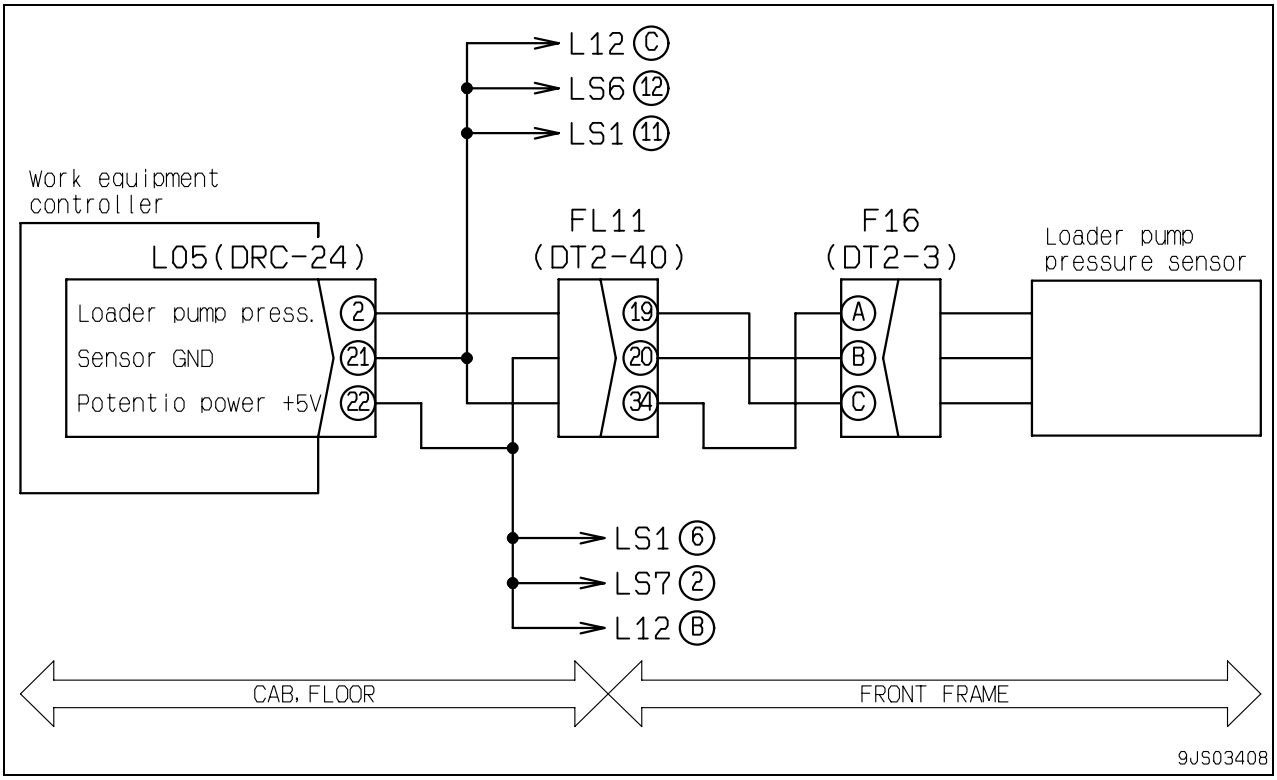


Failure code [DH21KA] (Work equipment pump oil pressure sensor: Disconnection)

Action code	Failure code	Trouble	Work equipment pump oil pressure sensor: Disconnection (Work equipment controller system)
E01	**DH21KA**		
Contents of trouble	• Due to disconnection or grounding fault in the work equipment oil pressure sensor system, the signal voltage is lower than normal range (Work equipment pump oil pressure sensor signal voltage: Max. 0.3 V)		
Action of controller	• Judges that work equipment pump oil pressure reads 0 • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Remote positioner inaccuracy of stopping • When work equipment is relieved, cut-off does not function		
Related information	• The input state (oil pressure) from the work equipment pump oil pressure sensor can be checked with the monitoring function (Code: 94700 PUMP PRESS). • The input state (voltage) from the work equipment pump oil pressure sensor can be checked with the monitoring function (Code: 94701 PUMP PRESS). • Method of reproducing failure code: Start engine and relieve bucket tilt		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective work equipment pump oil pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F16 (male)		Resistance	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then start engine, tilt the bucket and carry out troubleshooting.			
			F16	Work equipment	Voltage	
			Between (B) and (A)	Normal	4.85 – 5.15 V	
			Between (C) and (A)	Normal	0.50 – 4.50 V	
				Neutral	0.50 – 0.90 V	
				When bucket tilt relieved	3.02 – 3.42 V	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (2) – F16 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (21) – F16 (female) (A)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (22) – F16 (female) (B)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (2) – F16 (female) (C)		Resistance	Min. 1 MΩ
			Wiring harness between L05 (female) (22) – F16 (female) (B)		Resistance	Min. 1 MΩ
	4	Work equipment controller	★ Prepare with starting switch OFF, then start engine, tilt the bucket and carry out troubleshooting.			
			L05	Work equipment	Voltage	
			Between (22) and (21)	Normal	4.85 – 5.15 V	
			Between (2) and (21)	Normal	0.50 – 4.50 V	
				Neutral	0.50 – 0.90 V	
				When bucket tilt relieved	3.02 – 3.42 V	

Circuit diagram related to work equipment pump oil pressure sensor

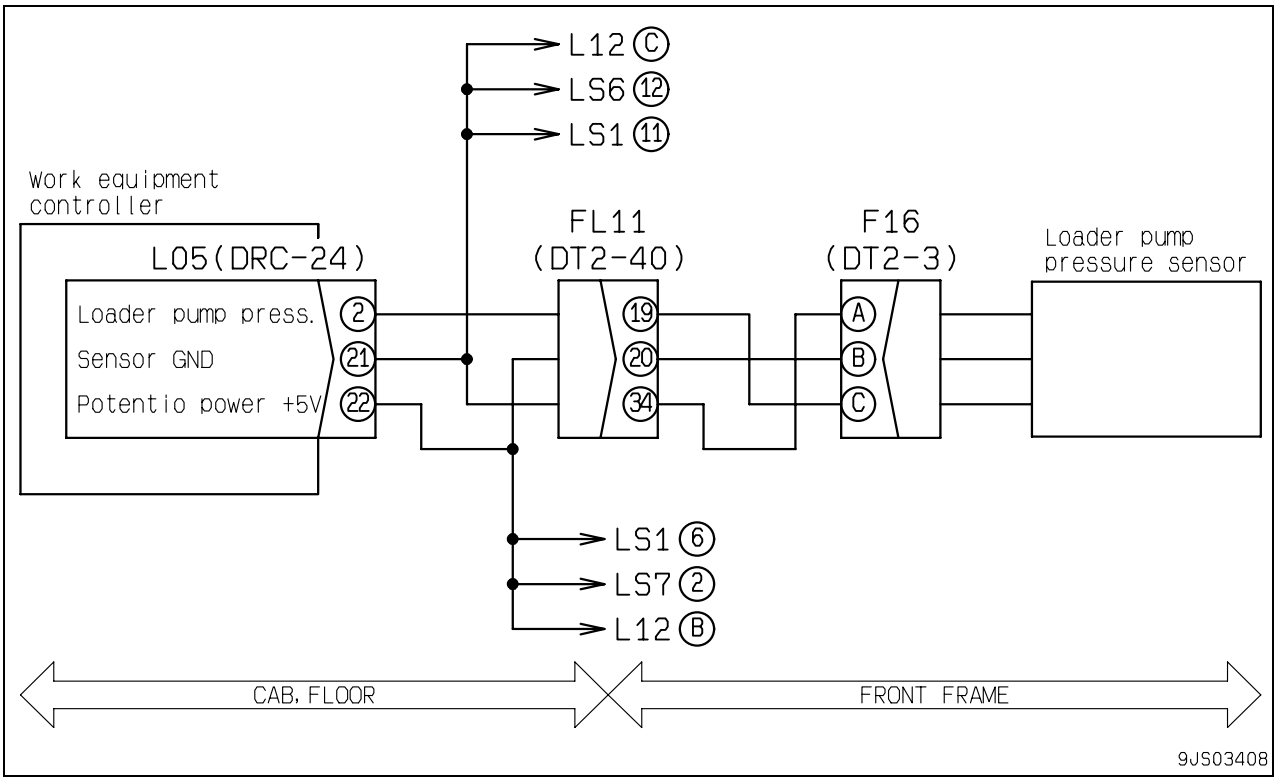


Failure code [DH21KB] (Work equipment pump oil pressure sensor: Short circuit)

Action code	Failure code	Trouble	Work equipment pump oil pressure sensor: Short circuit (Work equipment controller system)
E01	**DH21KB**		
Contents of trouble	• Due to hot short circuit in the work equipment pump oil pressure sensor signal system, the signal voltage is higher than normal range (Work equipment pump oil pressure sensor signal voltage: Min. 4.7 V)		
Action of controller	• Judges that work equipment pump oil pressure is higher • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Remote positioner inaccuracy of stopping • Cut-off function does not work when work equipment system is relieved.		
Related information	• The input state (oil pressure) from the work equipment pump oil pressure sensor can be checked with the monitoring function (Code: 94700 PUMP PRESS). • The input state (voltage) from the work equipment pump oil pressure sensor can be checked with the monitoring function (Code: 94701 PUMP PRESS). • Method of reproducing failure code: Start engine and relieve bucket tilt		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective work equipment pump oil pressure sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F16 (male)		Resistance	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then start engine, tilt the bucket and carry out troubleshooting.			
			F16	Bucket	Voltage	
			Between (B) and (A)	Normal	4.85 – 5.15 V	
			Between (C) and (A)	Normal	0.50 – 4.50 V	
				Neutral	0.50 – 0.90 V	
				When bucket tilt relieved	3.02 – 3.42 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L05 (female) (2) – F16 (female) (C)		Voltage	Max. 1 V
			Wiring harness between L05 (female) (22) – F16 (female) (B)		Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then start engine, tilt the bucket and carry out troubleshooting.			
			L05	Bucket	Voltage	
			Between (22) and (21)	Normal	4.85 – 5.15 V	
			Between (2) and (21)	Normal	0.50 – 4.50 V	
				Neutral	0.50 – 0.90 V	
				When bucket tilt relieved	3.02 – 3.42 V	

Circuit diagram related to work equipment pump oil pressure sensor

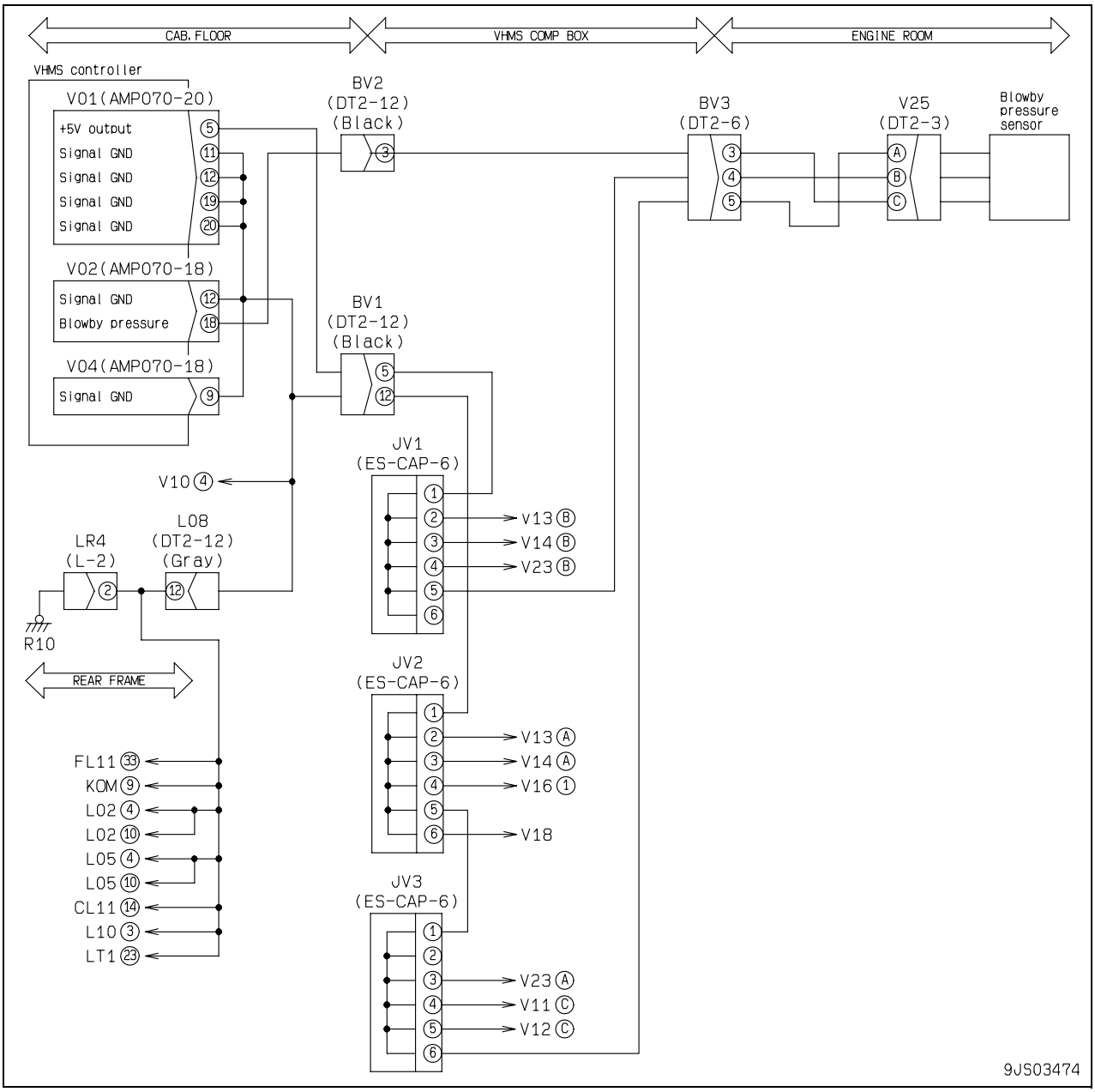


Failure code [DHE5KB] (or VHMS_LED display: “n3” → “32”) (Blow-by pressure sensor: Short circuit)

Action code	Failure code	Trouble	Blow-by pressure sensor: Short circuit (VHMS controller system)
—	**DHE5KB**		
Contents of trouble	• Input signal voltage from the blow-by pressure sensor reads 0.1 V or less.		
Action of controller	• None in particular.		
Problem that appears on machine	• Monitoring function fails to monitor the blow-by pressure		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n3” → “32”. • The input state (pressure) from the blow-by pressure sensor can be checked with the monitoring function (Code: 42801 BLOWBY PRESS). • If failure code [**DBB5KP**] (VHMS controller 5V power supply output: Low output voltage) is displayed, carry out troubleshooting for it first. • Method of reproducing failure code: Start engine and performs troubleshooting		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective blow-by pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V25	Engine speed	Voltage	
			Between (B) and (A)	Normal	4.85 – 5.15 V	
			Between (C) and (A)	Normal	0.50 – 4.50 V	
				High idle	0.50 – 0.90 V	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V25		Resistance	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V01 (female) (5) – V25 (female) (B)		Resistance	Max. 1 Ω
			Wiring harness between V25 (female) (C) – V02 (female) (18)		Resistance	Max. 1 Ω
			Wiring harness between V25 (female) (A) – chassis ground		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V01 (female) (5) – V25 (female) (B)		Resistance	Min. 1 MΩ
			Wiring harness between V25 (female) (C) – V02 (female) (18)		Resistance	Min. 1 MΩ
	4	Defective VHMS controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V02	Engine speed	Voltage	
			Between (18) and (12)	Normal	4.85 – 5.15 V	
				Normal	0.50 – 4.50 V	
				High idle	0.50 – 0.90 V	

Circuit diagram related to blow-by pressure sensor

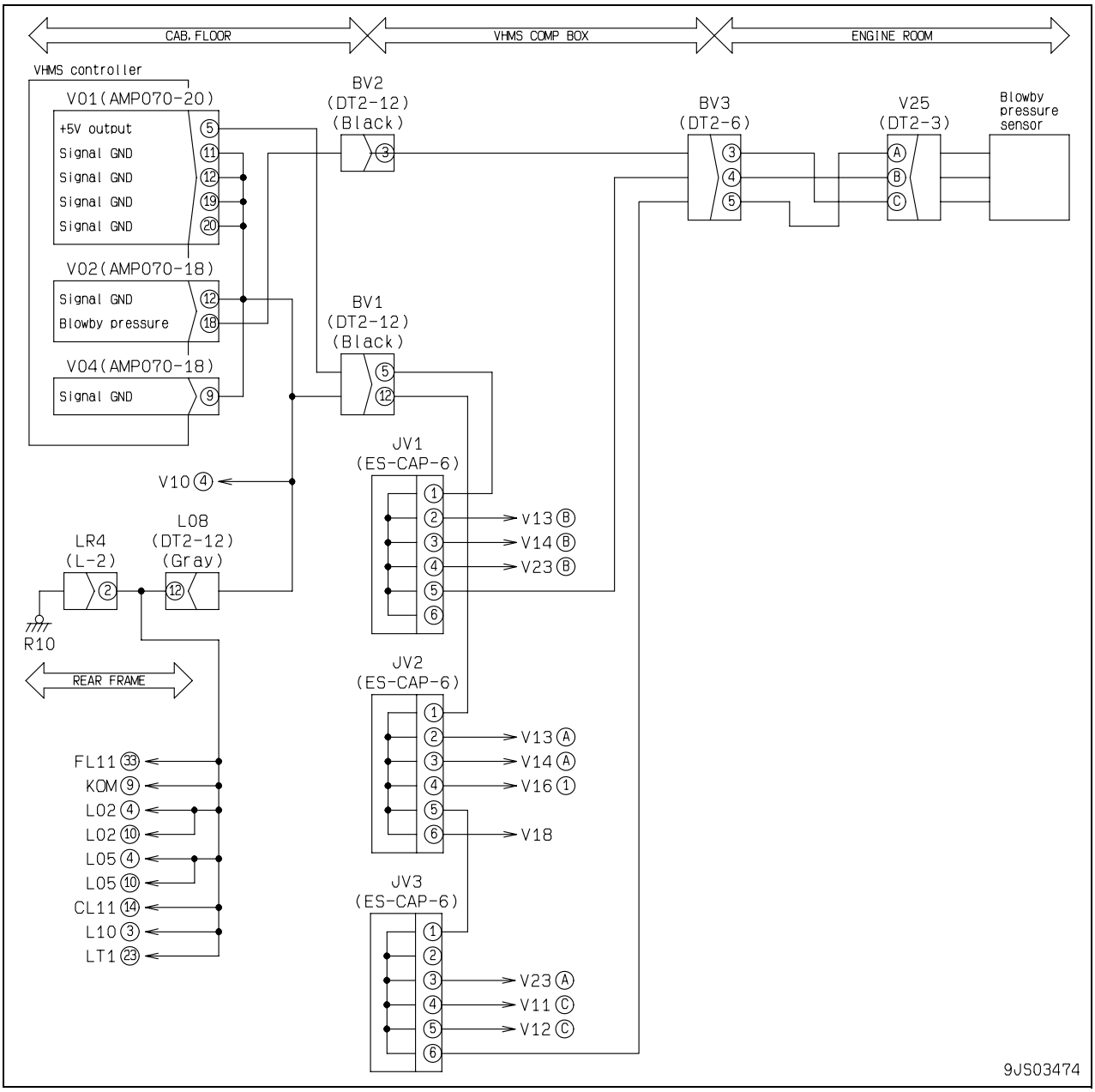


Failure code [DHE5KY] (or VHMS_LED display: “n3” → “31”) (Blow-by pressure sensor: Short circuit with power supply line)

Action code	Failure code	Trouble	Blow-by pressure sensor: Short circuit with power supply line (VHMS controller system)
—	**DHE5KY**		
Contents of trouble	• Input signal voltage from the blow-by pressure sensor reads 4.7 V and above.		
Action of controller	• None in particular.		
Problem that appears on machine	• Monitoring function fails to monitor the blow-by pressure		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n3” → “31”. • The input state (pressure) from the blow-by pressure sensor can be checked with the monitoring function (Code: 42801 BLOWBY PRESS). • Method of reproducing failure code: Start engine and performs troubleshooting		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective blow-by pressure sensor (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V25	Engine speed	Voltage	
			Between (B) and (A)	Normal	4.85 – 5.15 V	
			Between (C) and (A)	Normal	0.50 – 4.50 V	
				High idle	0.50 – 0.90 V	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V25		Resistance	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between V01 (female) (5) – V25 (female) (B)		Voltage	Max. 1 V
			Wiring harness between V25 (female) (C) – V02 (female) (18)		Voltage	Max. 1 V
	3	Defective VHMS controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			V02	Engine speed	Voltage	
			Between (18) and (12)	Normal	4.85 – 5.15 V	
				Normal	0.50 – 4.50 V	
				High idle	0.50 – 4.50 V	

Circuit diagram related to blow-by pressure sensor



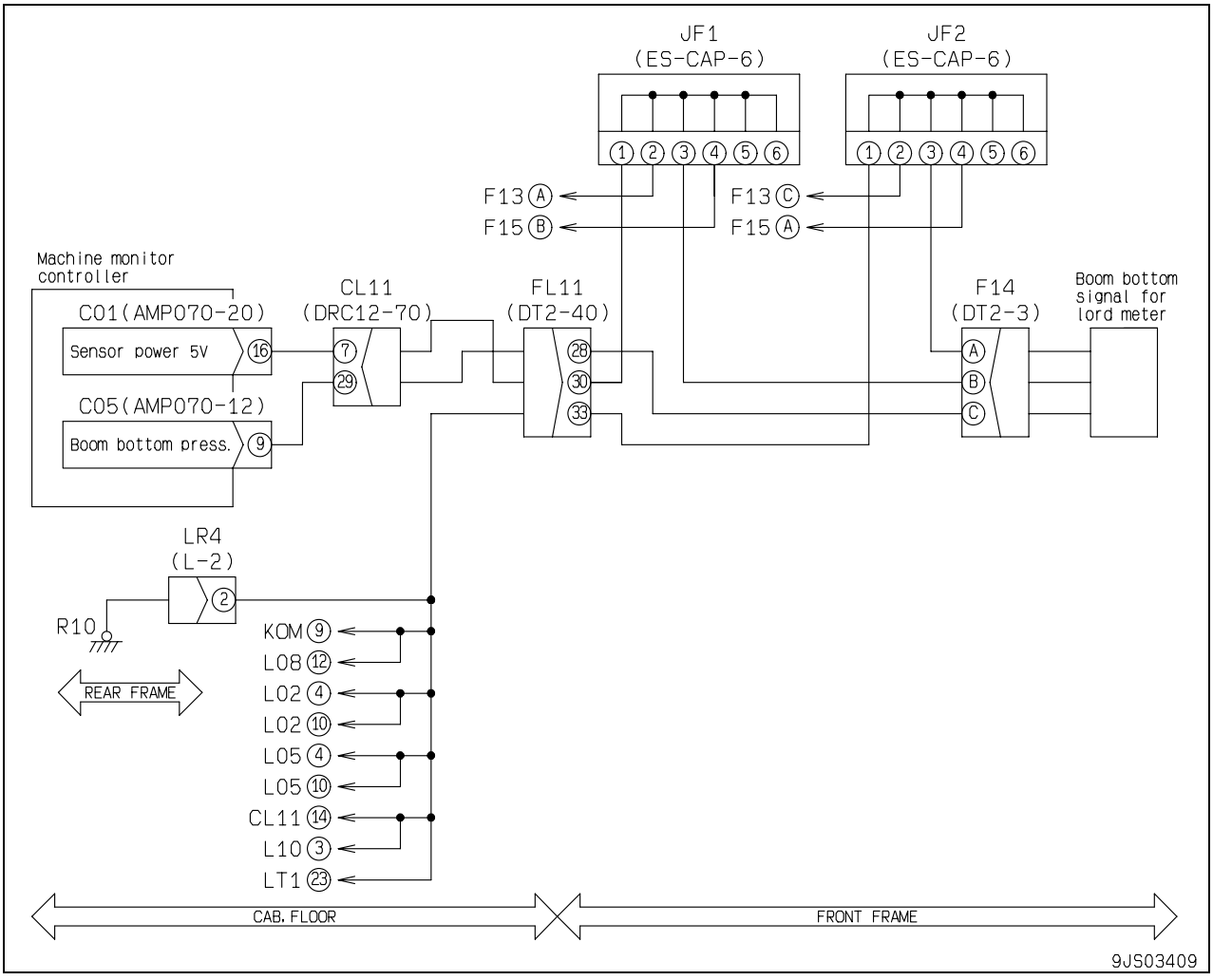
Failure code [DHPCKX] (Lift arm cylinder bottom pressure sensor: Out of input signal range)

Action code	Failure code	Trouble	Lift arm cylinder bottom pressure sensor: Out of input signal range (Machine monitor system)
E01	**DHPCKX**		
Contents of trouble	• Due to disconnection or grounding fault in the lift arm cylinder bottom pressure sensor signal, the lift arm cylinder bottom pressure sensor voltage is lower than normal range (Lift arm cylinder bottom pressure sensor signal voltage: Less than 0.3 V) • Due to hot short circuit in the lift arm cylinder bottom pressure sensor signal, the lift arm cylinder bottom pressure sensor voltage is lower than normal range (Lift arm cylinder bottom pressure sensor signal voltage: Min. 4.7 V)		
Action of controller	• If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Machine monitor does not display load.		
Related information	• The input state (oil pressure) from the lift arm cylinder bottom pressure sensor can be checked with the monitoring function (Code: 40400 BOOM BTM PRESS). • The input state (voltage) from the lift arm cylinder bottom pressure sensor can be checked with the monitoring function (Code: 40402 BOOM BTM PRESS). • Applicable only to machines equipped with load meter (if equipped) • Method of reproducing failure code: Start engine and perform lift arm lever operation		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm cylinder bottom pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F14 (male)		Resistance	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then start engine, raise the lift arm and carry out troubleshooting.			
			F14	Lift arm	Voltage	
			Between (B) and (A)	Normal	4.85 – 5.15 V	
			Between (C) and (A)	Normal	0.50 – 4.50 V	
				Neutral	0.50 – 0.90 V	
				Lift arm bottom relief	3.02 – 3.42 V	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (16) – F14 (female) (B)		Resistance	Max. 1 Ω
			Wiring harness between C05 (female) (9) – F14 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between F14 (female) (A) – chassis ground		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (16) – F14 (female) (B), – circuit branch end		Resistance	Min. 1 MΩ
			Wiring harness between C05 (female) (9) – F14 (female) (C), – circuit branch end		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between C01 (female) (16) – F14 (female) (B), – circuit branch end		Voltage	Max. 1 V
			Wiring harness between C05 (female) (9) – F14 (female) (C), – circuit branch end		Voltage	Max. 1 V

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	5	Defective machine monitor	★ Prepare with starting switch OFF, then start engine, raise the lift arm and carry out troubleshooting.		
			C01 and C05	Lift arm	Voltage
			Between C01 (16) and chassis ground	Normal	4.85 – 5.15 V
			Between C05 (9) and chassis ground	Normal	0.50 – 4.50 V
				Neutral	0.50 – 0.90 V
				Lift arm bottom relief	3.02 – 3.42 V

Circuit diagram related to lift arm cylinder bottom pressure sensor



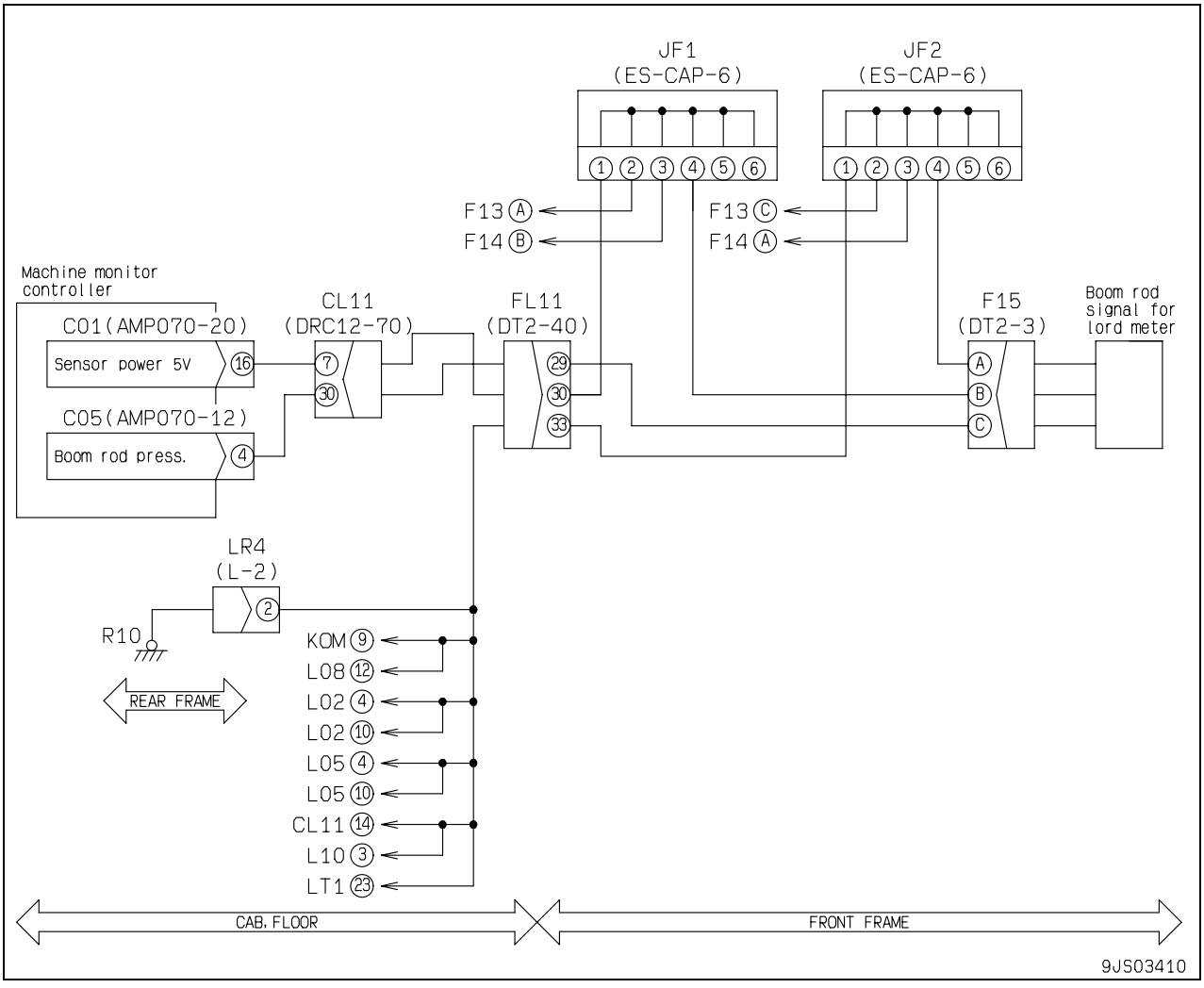
Failure code [DHPDKX] (Lift arm cylinder head pressure sensor: Out of input signal range)

Action code	Failure code	Trouble	Lift arm cylinder head pressure sensor: Out of input signal range (Machine monitor system)
E01	**DHPDKX**		
Contents of trouble	• Due to disconnection or grounding fault in the lift arm cylinder head pressure sensor signal, the lift arm cylinder head pressure sensor voltage is lower than normal range (Lift arm cylinder head pressure sensor signal voltage: Less than 0.3 V) • Due to hot short circuit in the lift arm cylinder head pressure sensor signal, the lift arm cylinder head pressure sensor voltage is higher than normal range (Lift arm cylinder head pressure sensor signal voltage: Min. 4.7 V)		
Action of controller	• If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Machine monitor does not display load.		
Related information	• The input state (oil pressure) from the lift arm cylinder head pressure sensor can be checked with the monitoring function (Code: 40500 BOOM HEAD PRESS). • The input state (oil pressure) from the lift arm cylinder head pressure sensor can be checked with the monitoring function (Code: 40501 BOOM HEAD PRESS). • Applicable only to machines equipped with load meter (if equipped) • Method of reproducing failure code: Start engine and perform lift arm lever operation		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm bottom pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F15 (male)		Resistance	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then start engine, raise the lift arm and carry out troubleshooting.			
			F15 (male)	Lift arm	Voltage	
			Between (B) and (A)	Normal	4.85 – 5.15 V	
			Between (C) and (A)	Normal	0.50 – 4.50 V	
				Neutral	0.50 – 0.90 V	
				Lift arm head relief	3.02 – 3.42 V	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (16) – F15 (female) (B)		Resistance	Max. 1 Ω
			Wiring harness between C05 (female) (4) – F15 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between F15 (female) (A) – chassis ground		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (16) – F15 (female) (B), – circuit branch end		Resistance	Min. 1 MΩ
			Wiring harness between C05 (female) (4) – F15 (female) (C), – circuit branch end		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between C01 (female) (16) – F15 (female) (B), – circuit branch end		Voltage	Max. 1 V
			Wiring harness between C05 (female) (4) – F15 (female) (C), – circuit branch end		Voltage	Max. 1 V

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	5	Defective machine monitor	★ Prepare with starting switch OFF, then start engine, raise the lift arm and carry out troubleshooting.		
			C01 and C05	Lift arm	Voltage
			Between C01 (16) and chassis ground	Normal	4.85 – 5.15 V
			Between C05 (4) and chassis ground	Normal	0.50 – 4.50 V
				Neutral	0.50 – 0.90 V
				Lift arm head relief	3.02 – 3.42 V

Circuit diagram related to lift arm cylinder bottom pressure sensor

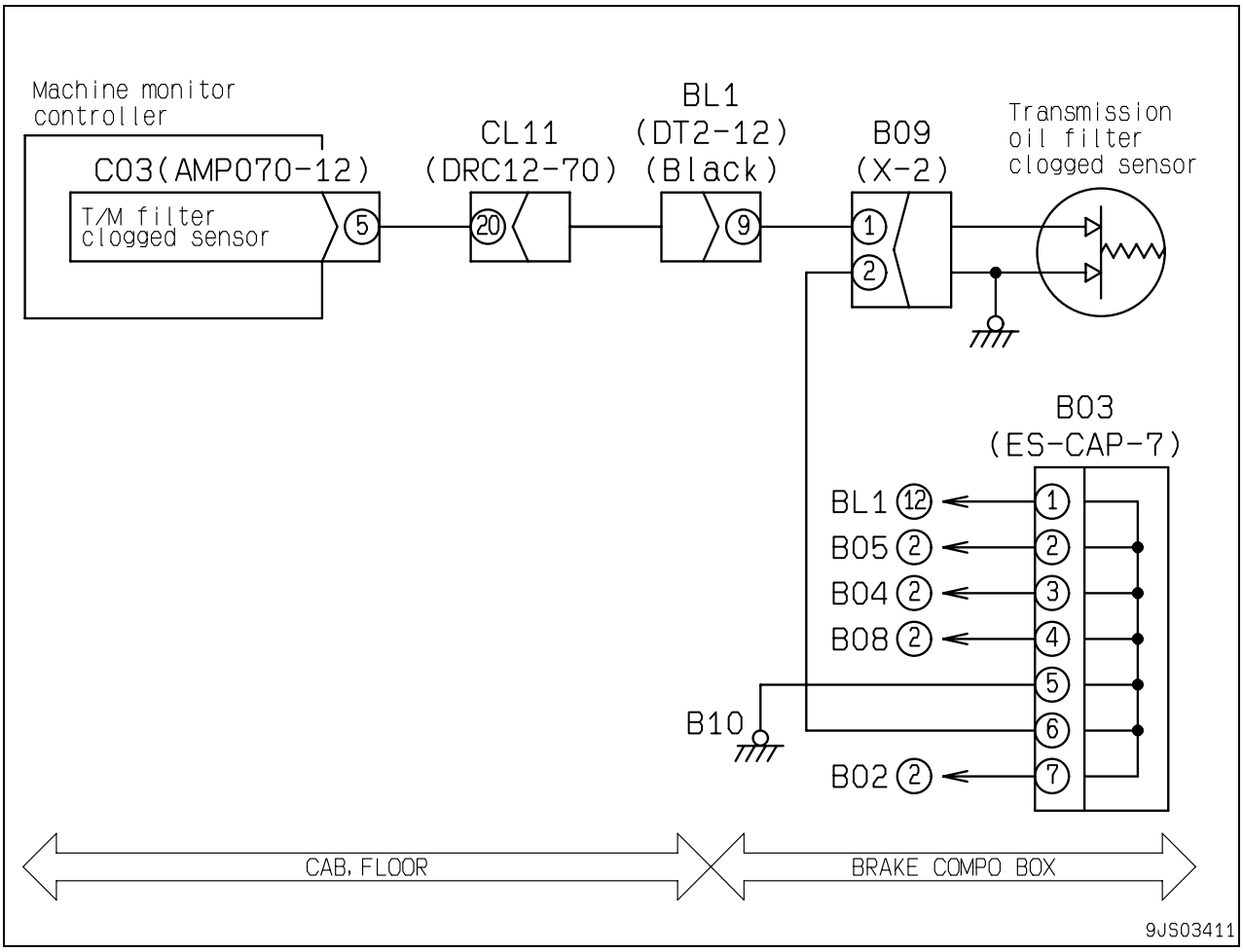


Failure code [DHT2L6] (Transmission filter clogging sensor: Signal disagrees with operating state of engine)

Action code	Failure code	Trouble	Transmission filter clogging sensor: Signal disagrees with operating state of engine (Machine monitor system)
E01	**DHT2L6**		
Contents of trouble	• Due to abnormal transmission clogging sensor signal, transmission clogging sensor signal voltage does not agree with the engine operation or stopping in normal condition.		
Action of controller	• If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The transmission filter clogging caution lamp does not light up.		
Related information	• The input state (ON/OFF) from the transmission filter clogging sensor can be checked with the monitoring function (Code: 40903 D-IN-24). • Method of reproducing failure code: Start engine and drive the machine in high idle		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission clogging sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			B09 (male)	Transmission filter	Resistance	
			Between (1) and (2)	Normal	Max. 1 Ω	
				Clogging	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C03 (female) (5) – B09 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between B09 (male) (2) – chassis ground		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C03 (female) (5) – B09 (female) (1)		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between C03 (female) (5) – B09 (female) (1)		Voltage	Max. 1 V
	5	Defective machine monitor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			C03 (female)	Transmission filter inlet pressure	Resistance	
			Between (5) and chassis ground	Normal	Max. 1 Ω	
				Clogging	Min. 1 MΩ	

Circuit diagram related to transmission clogging sensor

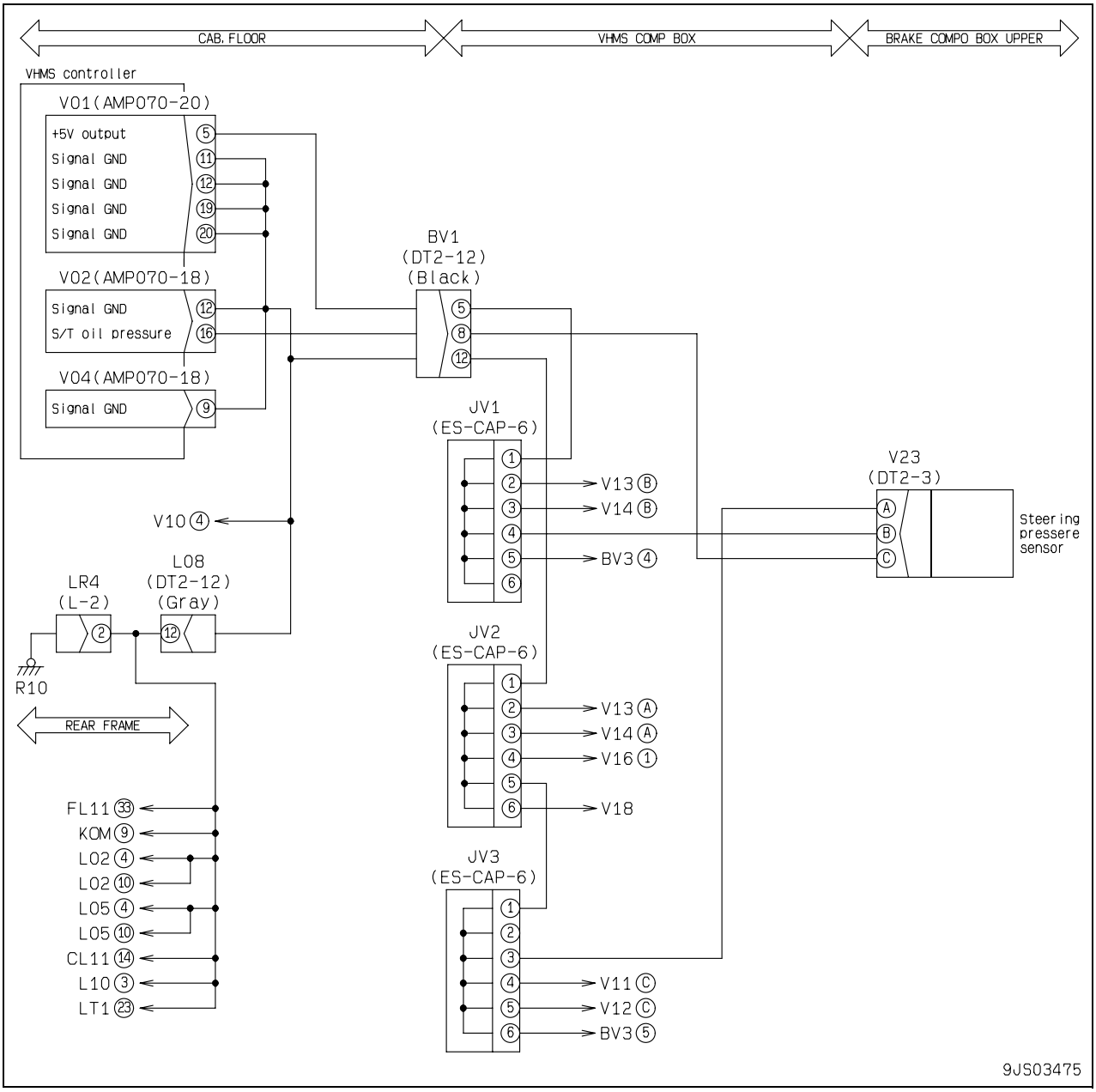


Failure code [DHT8KX] (or VHMS_LED display: “n5” → “33”) (Steering oil pressure sensor: Out of input signal range)

Action code	Failure code	Trouble	Steering oil pressure sensor: Out of input signal range (VHMS controller system)
—	**DHT8KX**		
Contents of trouble	• Input signal voltage from the steering oil pressure sensor reads 4.9 V and above or less than 0.3 V.		
Action of controller	• None in particular.		
Problem that appears on machine	• Monitoring function fails to monitor the steering oil pressure		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n5” → “33” • The input state (oil pressure) from the steering oil pressure sensor can be checked with the monitoring function (Code: 93000 S/T OIL PRESS). • If failure code [**DBB5KP**] (VHMS controller 5 V power supply output: Low output voltage) is displayed, carry out troubleshooting for it first. • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective steering oil pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V23 (male)	Steering operation	Voltage	
			Between (B) and (A)	Normal	4.85 – 5.15 V	
			Between (C) and (A)	Normal	0.50 – 4.50 V	
				Neutral	0.50 – 0.90 V	
				When relieved	3.2 – 3.4 V	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V23 (male)		Resistance	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V02 (female) (16) – V23 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between V23 (female) (A) – chassis ground		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V02 (female) (16) – V23 (female) (C)		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between V02 (female) (16) – V23 (female) (C)		Voltage	Max. 1 V
	5	Defective VHMS controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V02 (female)	Atmospheric temperature	Voltage	
			Between (16) and (12)	Normal	0.50 – 4.50 V	
				Neutral	0.50 – 0.90 V	
				When relieved	3.2 – 3.4 V	

Circuit diagram related to steering oil pressure sensor

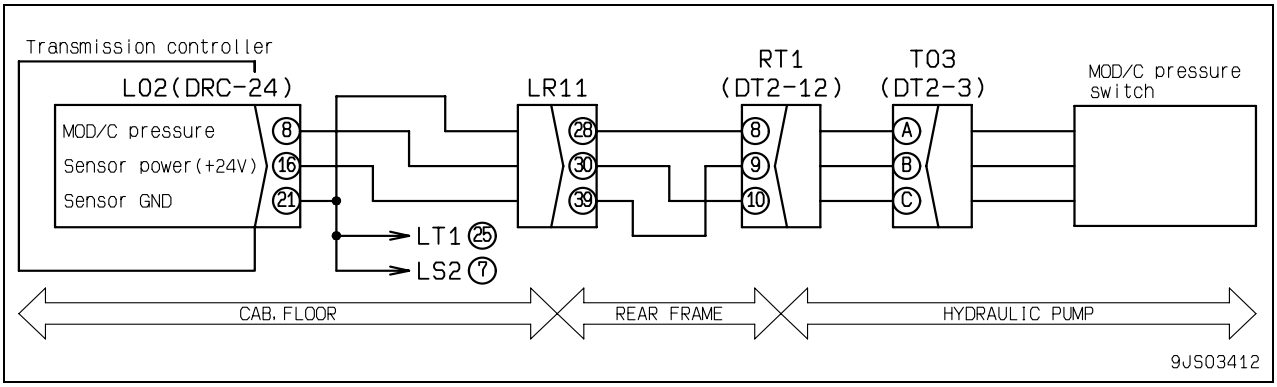


Failure code [DHTBKA] (Modulation clutch oil pressure sensor: Disconnection)

Action code	Failure code	Trouble	Modulation clutch oil pressure sensor: Disconnection (Transmission controller system)
E03	**DHTBKA**		
Contents of trouble	• Due to disconnection or ground fault in modulation clutch oil pressure sensor system, modulation clutch oil pressure signal voltage is lower than normal range (Modulation clutch oil pressure sensor signal voltage: Max. 0.3 V).		
Action of controller	• Uses modulation clutch oil pressure signal value output immediately before abnormality occurs. • Keeps the directional lever or directional selector switch in N (Neutral) to prevent cut off resetting. • Even if cause of failure disappears, system does not reset itself until directional selector switch is set to N (Neutral).		
Problem that appears on machine	• Keeps the directional lever or directional selector switch in N (Neutral) to prevent cut off resetting.		
Related information	• The input state (pressure) from the modulation clutch oil pressure sensor can be checked with the monitoring function (Code: 92400 MOD/C PRESS). • The input state (voltage) from the modulation clutch oil pressure sensor can be checked with the monitoring function (Code: 92401 MOD/C PRESS). • Method of reproducing failure code: Start engine and drive the machine		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective modulation clutch oil pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			T03 (male)	Resistance		
			Between (A), (B), (C) and chassis ground	Min. 1 MΩ		
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			T03	Voltage		
			Between (B) and (A)	0.9 – 1.2 V		
			Between (C) and (A)	20 – 30 V		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (8) – T03 (female) (C)	Resistance	Max. 1 Ω	
			Wiring harness between L02 (female) (16) – T03 (female) (B)	Resistance	Max. 1 Ω	
			Wiring harness between L02 (female) (21) – T03 (female) (A)	Resistance	Max. 1 Ω	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (8) – T03 (female) (C)	Resistance	Max. 1 Ω	
			Wiring harness between L02 (female) (16) – T03 (female) (B)	Resistance	Max. 1 Ω	
	4	Defective transmission controller	★ Prepare with starting switch OFF, then start engine, travel and carry out troubleshooting.			
			L02	Modulation clutch oil pressure	Voltage	
			Between (16) and (21)	Normal	4.75 – 5.25 V	
			Between (8) and (21)	0 MPa	1 V	
				50 MPa	5 V	

Circuit diagram related to modulation clutch oil pressure sensor

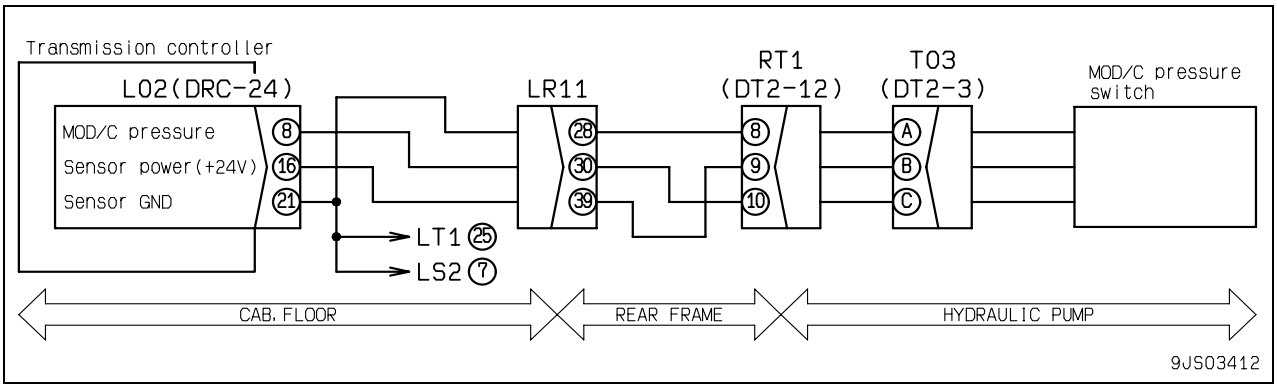


Failure code [DHTBKB] (Modulation clutch oil pressure sensor: Short circuit)

Action code	Failure code	Trouble	Modulation clutch oil pressure sensor: Short circuit (Transmission controller system)
E03	**DHTBKB**		
Contents of trouble	• Due to hot short circuit in the modulation clutch oil pressure sensor system, the modulation clutch oil pressure sensor detect pressure is higher than normal range (Modulation clutch oil pressure sensor detect pressure: Min. 4.5 MPa)		
Action of controller	• Uses modulation clutch oil pressure signal value output immediately before abnormality occurs. • Keeps the directional lever or directional selector switch in N (Neutral) to prevent cut off resetting. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until directional selector switch is set to N (Neutral).		
Problem that appears on machine	• Keeps the directional lever or directional selector switch in N (Neutral) to prevent cut off resetting.		
Related information	• The input state (pressure) from the modulation clutch oil pressure sensor can be checked with the monitoring function (Code: 92400 MOD/C PRESS). • The input state (voltage) from the modulation clutch oil pressure sensor can be checked with the monitoring function (Code: 40901 MOD/C PRESS). • Method of reproducing failure code: Start engine and drive the machine		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective modulation clutch oil pressure sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			T03 (male)	Resistance		
			Between (A), (B), (C) and chassis ground	Min. 1 MΩ		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			T03	Voltage		
			Between (B) and (A)	0.9 – 1.2 V		
			Between (C) and (A)	20 – 30 V		
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L02 (female) (8) – T03 (female) (C)	Voltage	Max. 1 V	
			Wiring harness between L02 (female) (16) – T03 (female) (B)	Voltage	Max. 1 V	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine, travel and carry out troubleshooting.			
			L02	Modulation clutch oil pressure	Voltage	
			Between (16) and (21)	Normal	4.75 – 5.25 V	
			Between (8) and (21)	0 MPa	1 V	
				50 MPa	5 V	

Circuit diagram related to modulation clutch oil pressure sensor

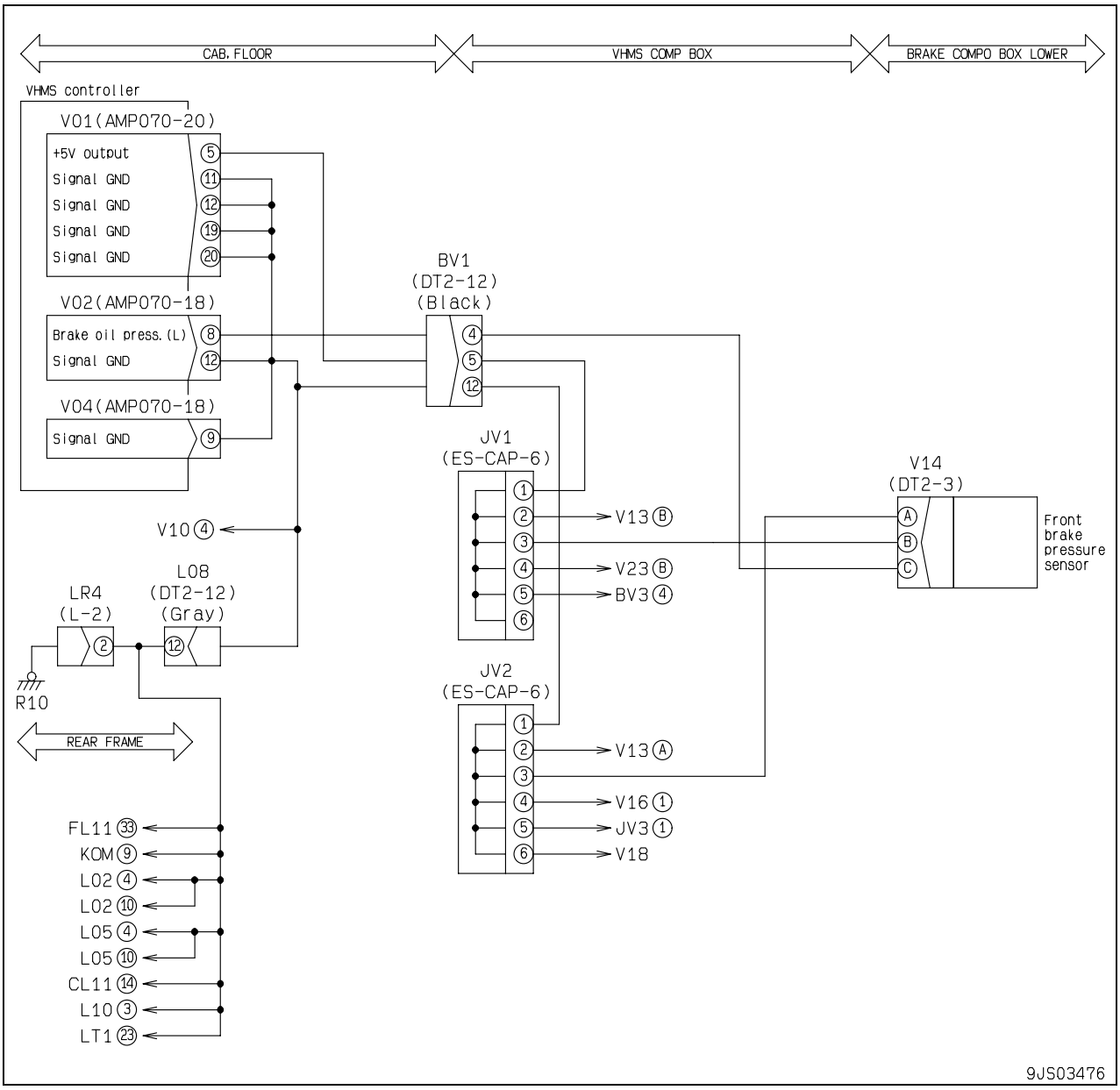


Failure code [DHU2KX] (or VHMS_LED display: “n7” → “11”) (Front brake oil pressure sensor (F): Out of input signal range)

Action code	Failure code	Trouble	Front brake oil pressure sensor: Out of input signal range (VHMS controller system)
—	**DHU2KX**		
Contents of trouble	• Input signal voltage from the front brake oil pressure sensor reads 4.9 V and above or less than 0.3 V.		
Action of controller	• None in particular.		
Problem that appears on machine	• Monitoring function fails to monitor the brake signal		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n7” → “11”. • The input state (ON/OFF) from the brake oil pressure sensor can be checked with the monitoring function (Code: 92900 BRAKE SIG). • If failure code [**DBB5KP**] (VHMS controller 5 V power supply output: Low output voltage) is displayed, carry out troubleshooting for it first. • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective front brake oil pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			V14 (male)	Wheel brake	Voltage	
			Between (B) and (A)	Normal	4.85 – 5.15 V	
			Between (C) and (A)	Normal	0.50 – 4.50 V	
				When front brake accumulator oil pressure reads 0	0.50 – 0.90 V	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V14 (male)		Resistance	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V02 (female) (8) – V14 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between V14 (female) (A) – chassis ground		Resistance	Min. 1 MΩ
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V02 (female) (8) – V14 (female) (C)		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between V02 (female) (8) – V14 (female) (C)		Voltage	Max. 1 V
	5	Defective VHMS controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			V02 (female)	Wheel brake	Voltage	
			Between (8) and (12)	Normal	4.85 – 5.15 V	
				Normal	0.50 – 4.50 V	
				When front brake accumulator pressure reads 0	0.50 – 0.90 V	

Circuit diagram related to the front brake oil pressure sensor

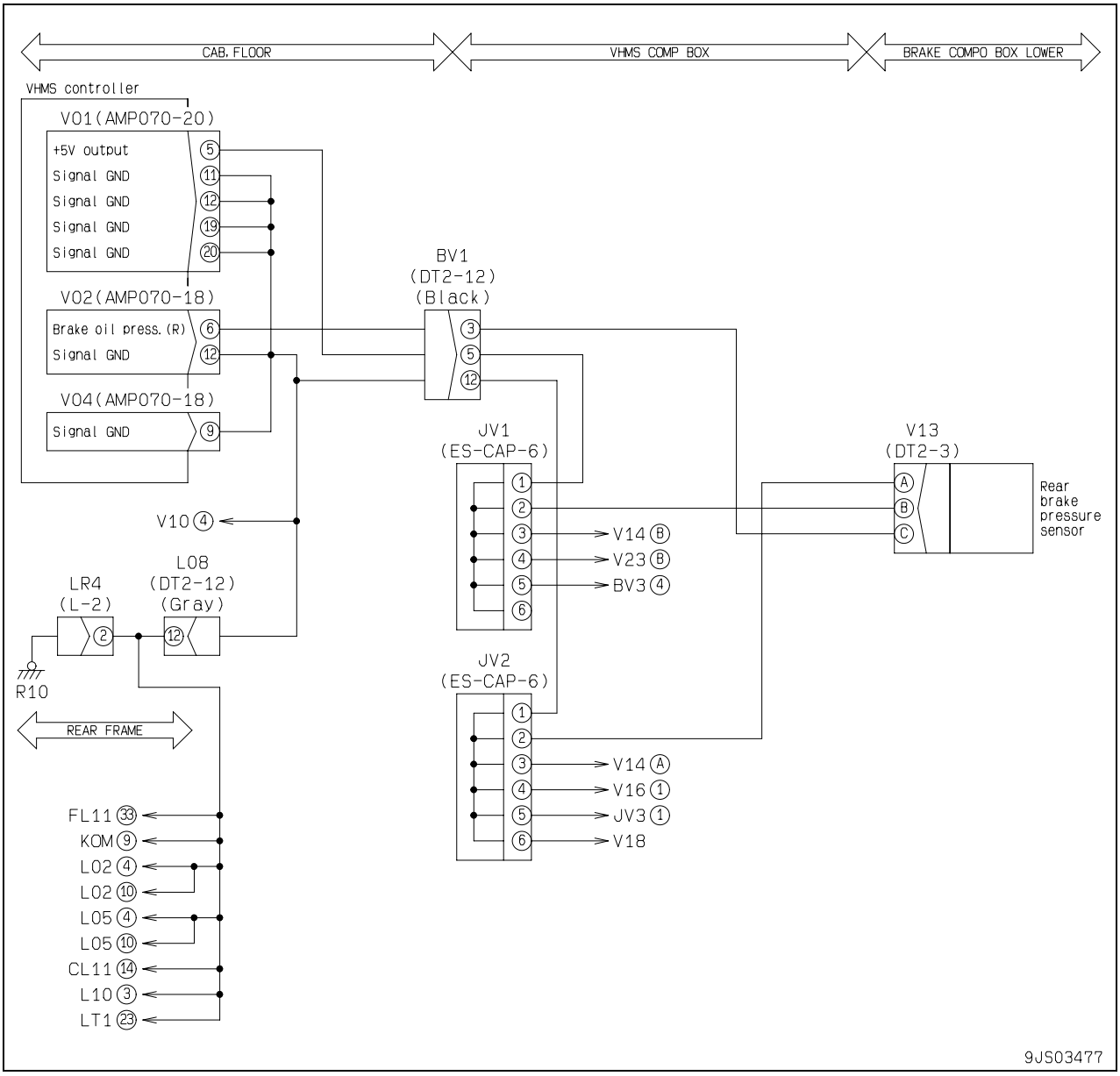


Failure code [DHU3KX] (or VHMS_LED display: “n7” → “12”) (Rear brake oil pressure sensor (R): Out of input signal range)

Action code	Failure code	Trouble	Rear brake oil pressure sensor: Out of input signal range (VHMS controller system)
—	**DHU3KX**		
Contents of trouble	• Input signal voltage from the rear brake oil pressure sensor reads 4.9 V and above or less than 0.3 V.		
Action of controller	• None in particular.		
Problem that appears on machine	• Monitoring function fails to monitor the brake signal		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n7” → “12”. • The input state (ON/OFF) from the brake oil pressure sensor can be checked with the monitoring function (Code: 92900 BRAKE SIG). • If failure code [**DBB5KP**] (VHMS controller 5V power supply output: Low output voltage) is displayed, carry out troubleshooting for it first. • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective rear brake oil pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			V13 (male)	Wheel brake	Voltage	
			Between (B) and (A)	Normal	4.85 – 5.15 V	
			Between (C) and (A)	Normal	0.50 – 4.50 V	
				When rear brake accumulator pressure reads 0	0.50 – 0.90 V	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V13 (male)		Resistance	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V02 (female) (6) – V13 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between V13 (female) (A) – chassis ground		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between V02 (female) (6) – V13 (female) (C)		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between V02 (female) (6) – V13 (female) (C)		Voltage	Max. 1 V
	5	Defective VHMS controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			V02 (female)	Wheel brake	Voltage	
			Between (6) and (12)	Normal	4.85 – 5.15 V	
				Normal	0.50 – 4.50 V	
				When rear brake accumulator pressure reads 0	0.50 – 0.90 V	

Circuit diagram related to the rear brake oil pressure sensor



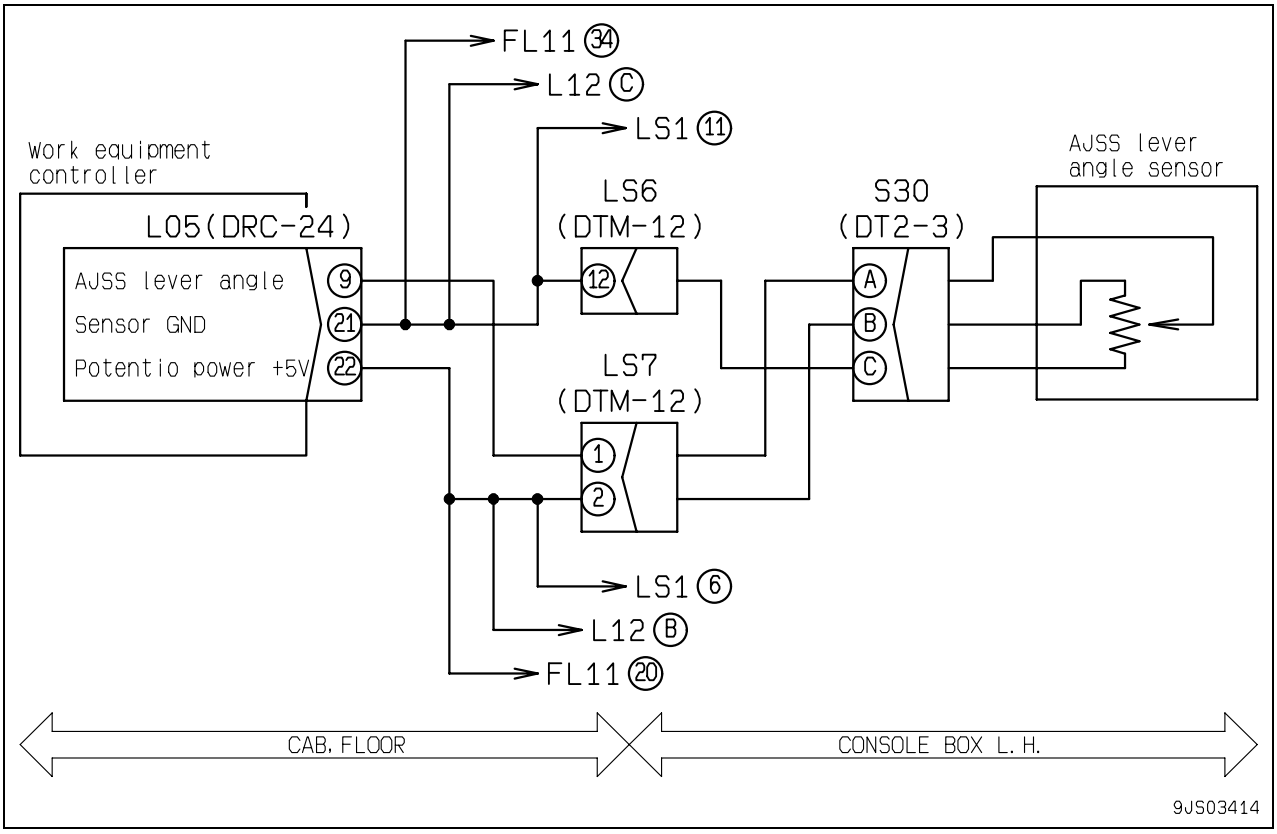
Failure code [DK30KA] (AJSS lever angle sensor: Disconnection)

Action code	Failure code	Trouble	AJSS lever angle sensor: Disconnection (Work equipment controller system)
E01	**DK30KA**		
Contents of trouble	• Due to disconnection or ground fault in AJSS lever angle sensor system, AJSS lever angle signal voltage is lower than normal range (AJSS angle sensor signal voltage: Max. 0.3 V).		
Action of controller	• Judges that AJSS is operated to the left • Stops the steering neutral safety function • Controls AJSS EPC output to the level corresponding to 1.47 MPa {15 kg/cm^2} • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The engine does not start. • Steering fine control is disabled (the machine jounces when performing steering operation). • Disabled to swing at full speed		
Related information	• The input state (voltage) from the AJSS lever angle sensor can be checked with the monitoring function (Code: 94300 AJSS LEVER, 94301 AJSS LEVER). • Method of reproducing failure code: Turn the starting switch ON and operate AJSS • This error is not displayed on a steering wheel specification machine. If it is displayed, select “NO ADD” AJSS option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective AJSS angle sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S30 (male)		Resistance	
			Between (B) and (C)		5 kΩ ± 20 %	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (steering lock).			
			S30	AJSS lever	Voltage	
			Between (B) and (C)	Normal	4.85 – 5.15 V	
			Between (A) and (C)	Normal	0.30 – 4.70 V	
				Lever in neutral	2.20 – 2.80 V	
				Full steering to right (straight travel state)	2.83 – 3.83 V	
				Full steering to left (straight travel state)	1.17 – 2.17 V	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (9) – S30 (female) (4)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (21) – S30 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (22) – S30 (female) (B)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (9) – S30 (female) (A)		Resistance	Min. 1 MΩ
			Wiring harness between L05 (female) (22) – S30 (female) (B), – circuit branch end		Resistance	Min. 1 MΩ

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	4	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L05	AJSS lever	Voltage
			Between (22) and (9)	Normal	4.85 – 5.15 V
			Between (21) and (9)	Normal	0.30 – 4.70 V
				Lever in neutral	2.20 – 2.80 V
				Full steering to right (straight travel state)	2.83 – 3.83 V
				Full steering to left (straight travel state)	1.17 – 2.17 V

Circuit diagram related to AJSS lever angle sensor



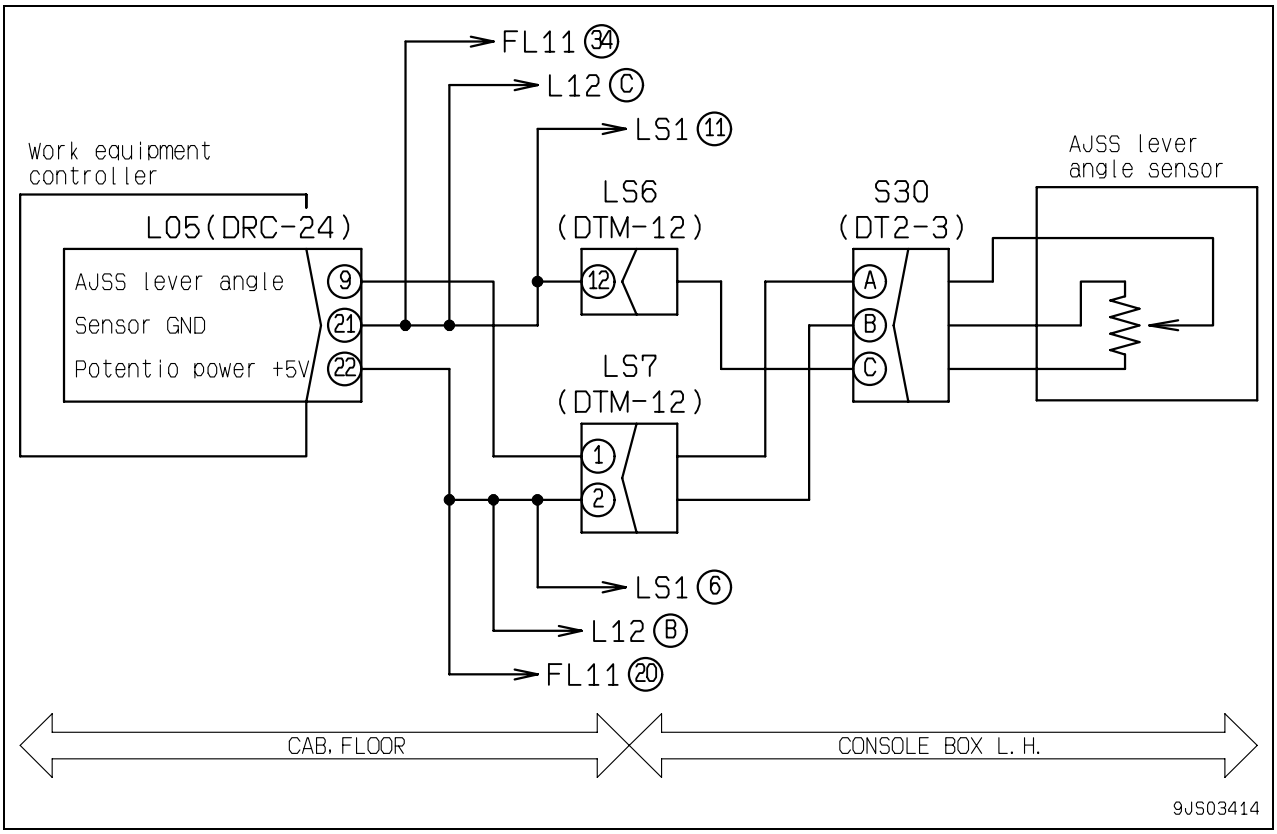
Failure code [DK30KY] (AJSS lever angle sensor: Short circuit with power supply line)

Action code	Failure code	Trouble	AJSS lever angle sensor: Short circuit with power supply line (Work equipment controller system)
E01	DK30KY		
Contents of trouble	• Due to hot short circuit in the AJSS lever angle sensor system, the AJSS lever angle signal voltage is higher than normal range (AJSS lever angle sensor signal voltage: Min. 4.7 V)		
Action of controller	• Judges that AJSS lever is operated to the right • Stops the AJSS neutral safety function • Controls AJSS EPC output to the level corresponding to 1.47 MPa {15 kg/cm^2} • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Once the engine stops, the engine does not start. • Steering fine control is disabled (the machine jounces when performing steering operation). • Disabled to swing at full speed		
Related information	• The input state (voltage) from the AJSS lever angle sensor can be checked with the monitoring function (Code: 94300 AJSS LEVER, 94301 AJSS LEVER). • Method of reproducing failure code: Turn the starting switch ON and operate AJSS lever • This error is not displayed on a steering wheel specification machine. If it is displayed, select "NO ADD" AJSS option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective AJSS angle sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S30 (male)		Resistance	
			Between (B) and (C)		5 kΩ ± 20 %	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (steering lock).			
			S30	AJSS lever	Voltage	
			Between (B) and (C)	Normal	4.85 – 5.15 V	
			Between (A) and (C)	Normal	0.30 – 4.70 V	
				Lever in neutral	2.20 – 2.80 V	
				Full steering to right (straight travel state)	2.83 – 3.83 V	
				Full steering to left (straight travel state)	1.17 – 2.17 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L05 (female) (9) – S30 (female) (4)		Voltage	Max. 1 V
			Wiring harness between L05 (female) (22) – S30 (female) (B), – circuit branch end		Voltage	Max. 1 V

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (steering lock).		
			L05	AJSS lever	Voltage
			Between (22) and (9)	Normal	4.85 – 5.15 V
			Between (21) and (9)	Normal	0.30 – 4.70 V
				Lever in neutral	2.20 – 2.80 V
				Full steering to right (straight travel state)	2.83 – 3.83 V
				Full steering to left (straight travel state)	1.17 – 2.17 V

Circuit diagram related to AJSS lever angle sensor



WA600-6 Wheel loader

Form No. SEN00570-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine Model	Serial number
WA600-6	60001 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 8

Troubleshooting by failure code (Display of code), Part 8 3
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Troubleshooting by failure code (Display of code), Part 8

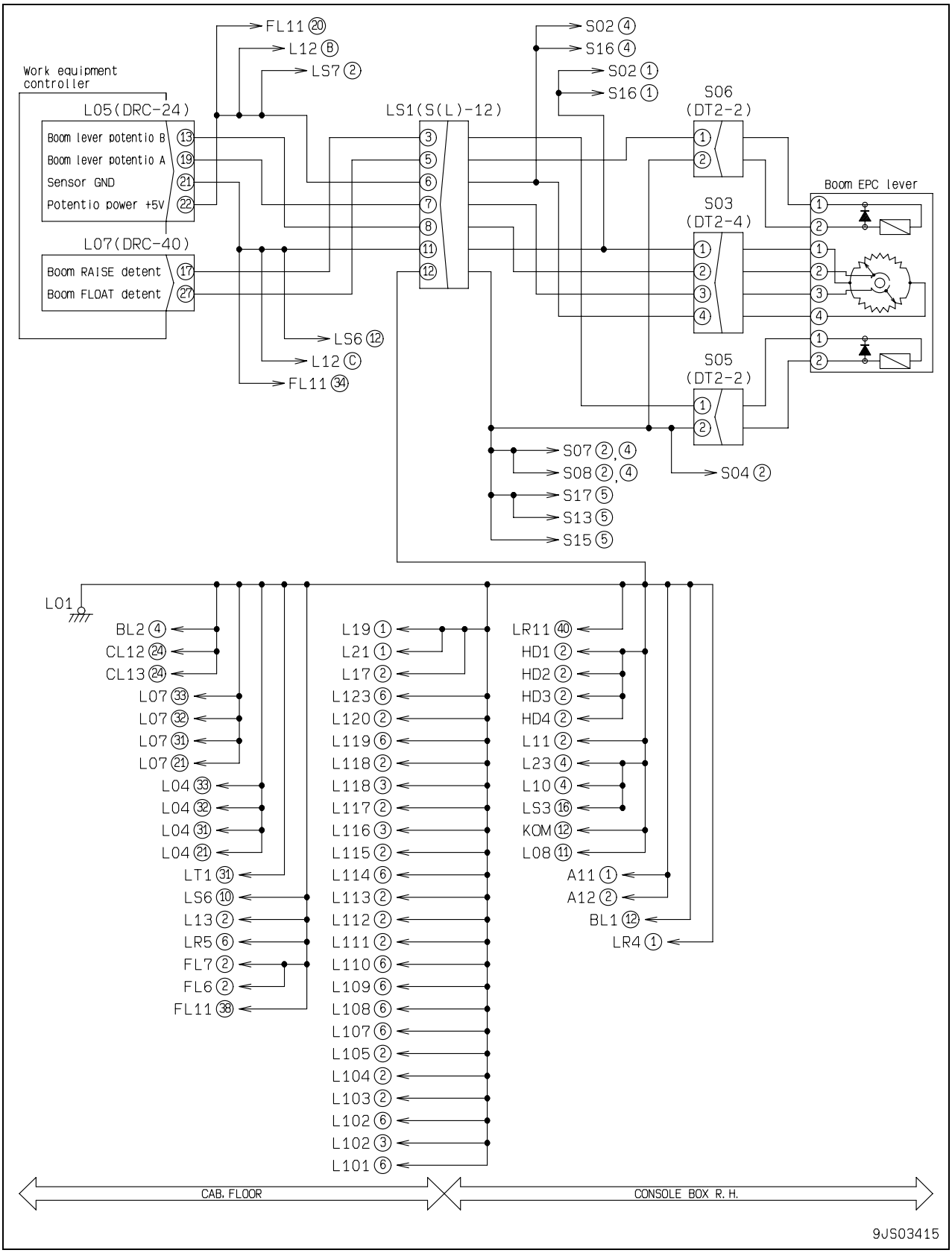
Failure code [DK59KA] (Lift arm EPC lever potentiometer (Main): Disconnection)

Action code	Failure code	Trouble	Lift arm EPC lever potentiometer (Main): Disconnection (Work equipment controller system)
E03	**DK59KA**		
Contents of trouble	• Due to disconnection or grounding fault in the lift arm EPC lever potentiometer system, the signal voltage is lower than normal range (Lift arm EPC lever potentiometer (Main) signal voltage: Max. 0.3 V).		
Action of controller	• If the lift arm EPC lever potentiometer (Sub) is normal, the Sub potentiometer is in control. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until lift arm EPC lever is set to N (Neutral).		
Problem that appears on machine	• Error is simply displayed.		
Related information	• The input state (voltage) from the lift arm EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42000 BOOM POT1). • The input state (voltage) from the lift arm EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42001 BOOM POT2). • Method of reproducing failure code: Turn the starting switch ON and operate lift arm lever		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm EPC lever potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S03 (male)		Resistance	
			Between (1) and (4)		3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			S03	Lift arm EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (3) and (1)	Lever in neutral	2.40 – 2.60 V	
				Raise operation (Before detent)	3.64 – 4.14 V	
				Raise operation (Detent position)	3.86 – 4.36 V	
				Lower operation (Before detent)	0.86 – 1.36 V	
				Float operation	0.64 – 1.14 V	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (19) – S03 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (21) – S03 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (22) – S03 (female) (4)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (19) – S03 (female) (3)		Resistance	Min. 1 MΩ
			Between L05 (female) (22) – S03 (female) (4), – circuit branch end		Resistance	Min. 1 MΩ

<table>
<tr><td rowspan="8">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="7">4</td><td rowspan="7">Defective work equipment controller</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)</td></tr>
<tr><td>L05</td><td>Lift arm EPC lever</td><td>Voltage</td></tr>
<tr><td>Between (22) and (21)</td><td>Normal</td><td>4.85 – 5.15 V</td></tr>
<tr><td rowspan="5">Between (19) and (21)</td><td>Lever in neutral</td><td>2.40 – 2.60 V</td></tr>
<tr><td>Raise operation (Before detent)</td><td>3.64 – 4.14 V</td></tr>
<tr><td>Raise operation (Detent position)</td><td>3.86 – 4.36 V</td></tr>
<tr><td>Lower operation (Before detent)</td><td>0.86 – 1.36 V</td></tr>
<tr><td>Float operation</td><td>0.64 – 1.14 V</td></tr>
</table>

Circuit diagram related to lift arm EPC lever potentiometer



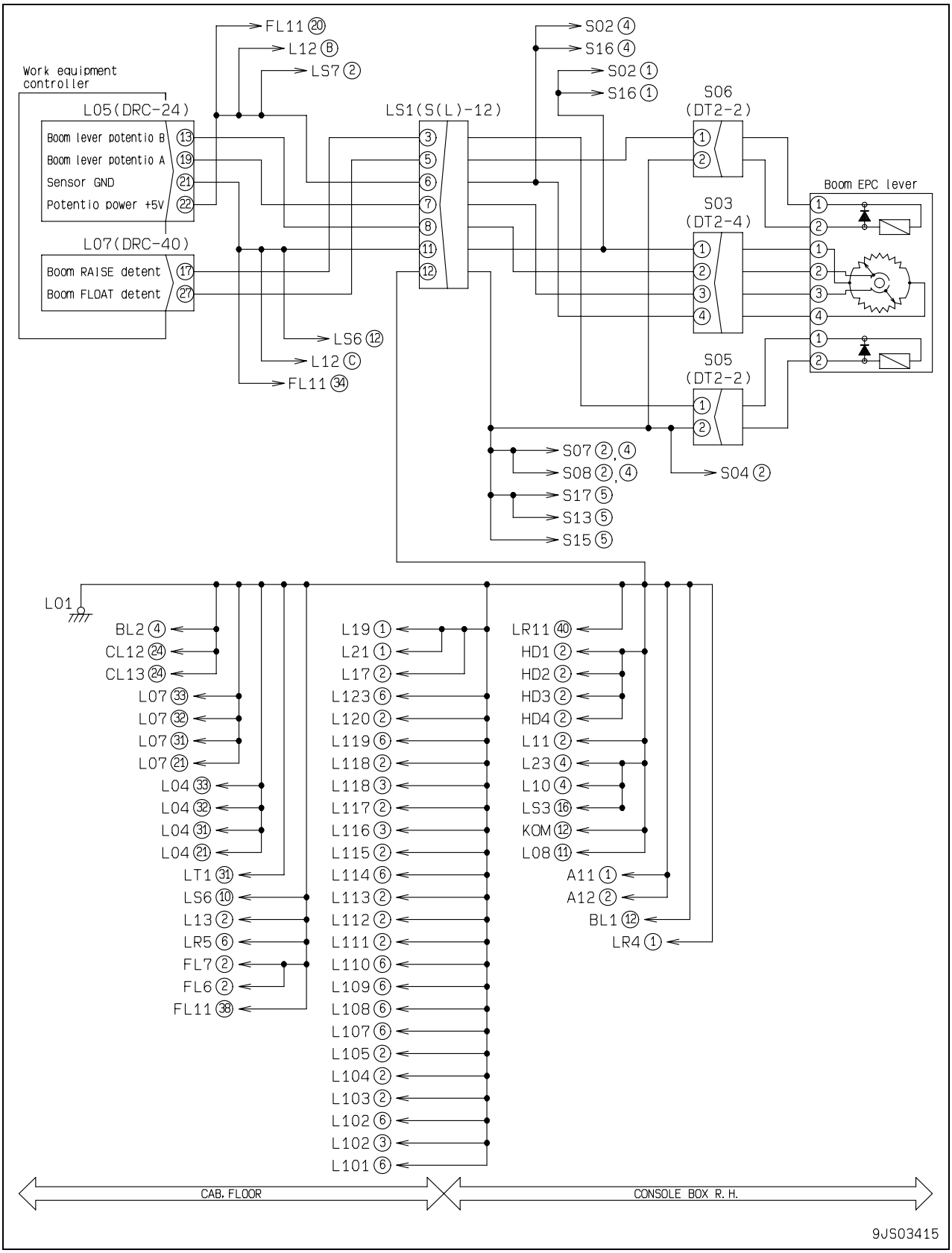
Failure code [DK59KY] (Lift arm EPC lever potentiometer (Main): Short circuit with power supply line)

Action code	Failure code	Trouble	Lift arm EPC lever potentiometer (Main): Short circuit with the power supply line (Work equipment controller system)
E03	**DK59KY**		
Contents of trouble	• Due to hot short circuit in the lift arm EPC lever potentiometer (Main) system, the signal voltage is higher than normal range (Lift arm EPC lever potentiometer (Main) signal voltage: Min. 4.7 V).		
Action of controller	• If the lift arm EPC lever potentiometer (Sub) is normal, the Sub potentiometer is in control. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until lift arm EPC lever is set to N (Neutral).		
Problem that appears on machine	• Error is simply displayed.		
Related information	• The input state (voltage) from the lift arm EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42000 BOOM POT1). • The input state (voltage) from the lift arm EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42001 BOOM POT2). • Method of reproducing failure code: Turn the starting switch ON and operate lift arm lever		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm EPC lever potentiometer (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S03		Resistance	
			Between (1) and (4)		3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			S03	Lift arm EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (3) and (1)	Lever in neutral	2.40 – 2.60 V	
				Raise operation (Before detent)	3.64 – 4.14 V	
				Raise operation (Detent position)	3.86 – 4.36 V	
				Lower operation (Before detent)	0.86 – 1.36 V	
				Float operation	0.64 – 1.14 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L05 (female) (19) – S03 (female) (3)		Voltage	Max. 1 V
			Between L05 (female) (22) – S03 (female) (4), – circuit branch end		Voltage	Max. 1 V

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)		
			L05	Lift arm EPC lever	Voltage
			Between (22) and (21)	Normal	4.85 – 5.15 V
			Between (19) and (21)	Lever in neutral	2.40 – 2.60 V
				Raise operation (Before detent)	3.64 – 4.14 V
				Raise operation (Detent position)	3.86 – 4.36 V
			Between (19) and (21)	Lower operation (Before detent)	0.86 – 1.36 V
				Float operation	0.64 – 1.14 V

Circuit diagram related to lift arm EPC lever potentiometer



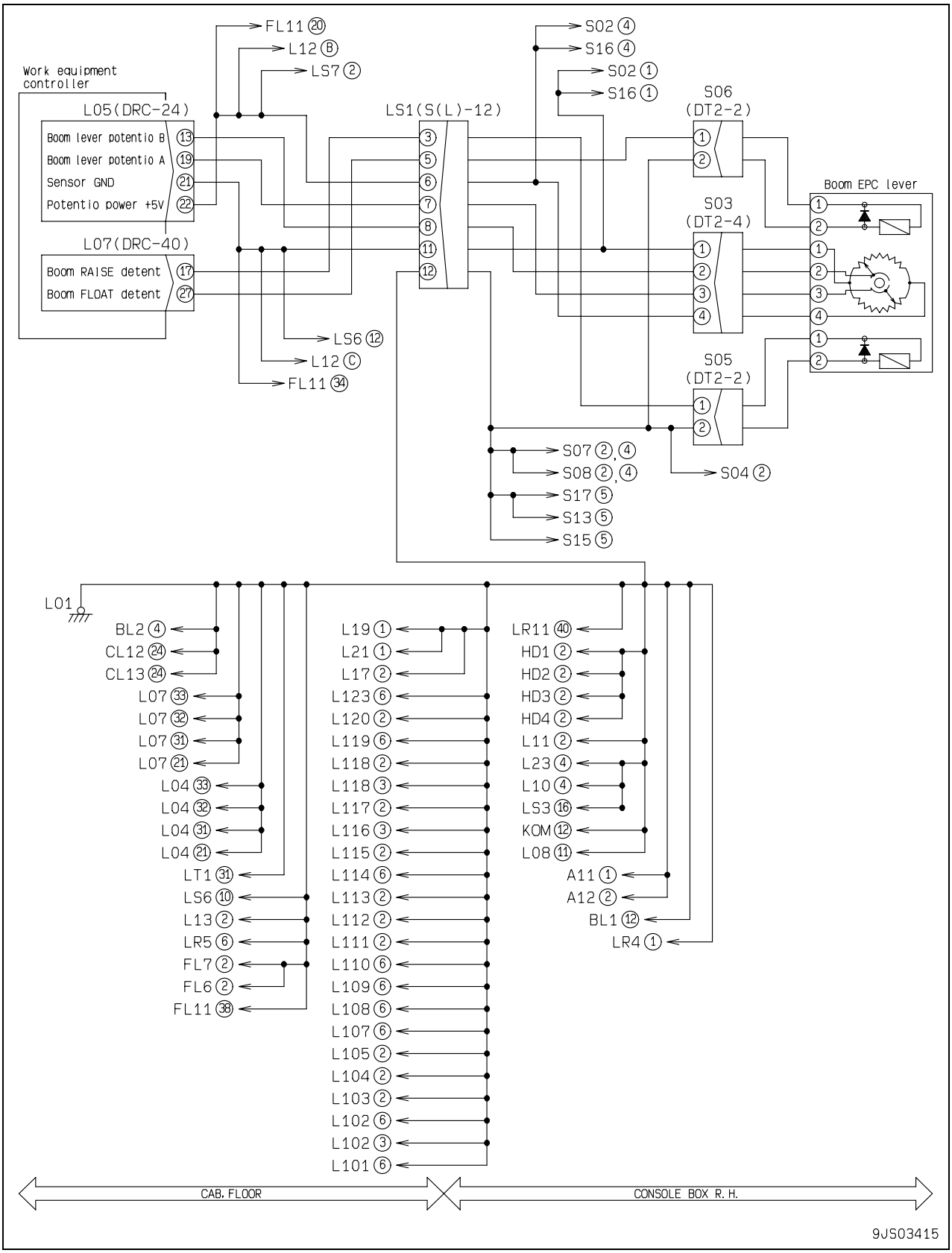
Failure code [DK59L8] (Lift arm EPC lever potentiometer (Main): Analog signals disagree)

Action code	Failure code	Trouble	Lift arm EPC lever potentiometer (Main): Analog signals disagree (Work equipment controller system)
E03	**DK59L8**		
Contents of trouble	• Lift arm EPC lever potentiometer (Main & Sub) input signals disagree with each other. (Lift arm EPC lever potentiometer signal voltage (sum of Main and Sub): Max. 4.7 V) or (Lift arm EPC lever potentiometer signal voltage (sum of Main and Sub): Min. 5.3 V)		
Action of controller	• Cannot recognize the lift arm EPC lever position correctly. • Operates with either Main or Sub potentiometer, whichever detecting a position within neutrality ±5 %, as the regular potentiometer. • Turns the output OFF if both Main and Sub potentiometers should fail to detect a position within neutrality ±5 %. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until lift arm EPC lever is set to N (Neutral).		
Problem that appears on machine	• Work equipment moves with the lever set to neutral. • If either Main or Sub potentiometer is abnormal, machine operates normally after the lever is set to neutral. • If both Main and Sub potentiometers are abnormal, lift arm does not move.		
Related information	• The input state (voltage) from the lift arm EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42000 BOOM POT1). • The input state (voltage) from the lift arm EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42001 BOOM POT2). • Method of reproducing failure code: Turn the starting switch ON and operate lift arm lever		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective lift arm EPC lever potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			S03 (male)	Resistance	
			Between (1) and (4)	3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground	Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)		
			S03	Lift arm EPC lever	Voltage
			Between (4) and (1)	Normal	4.85 – 5.15 V
			Between (3) and (1)	Lever in neutral	2.40 – 2.60 V
				Raise operation (Before detent)	3.64 – 4.14 V
				Raise operation (Detent position)	3.86 – 4.36 V
				Float operation	0.64 – 1.14 V
				Lower operation (Before detent)	0.86 – 1.36 V
			Between (2) and (1)	Lever in neutral	2.40 – 2.60 V
				Raise operation (Before detent)	0.86 – 1.36 V
				Raise operation (Detent position)	0.64 – 1.14 V
				Lower operation (Before detent)	3.64 – 4.14 V
				Float operation	3.86 – 4.36 V

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (13) – S03 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (19) – S03 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (21) – S03 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (22) – S03 (female) (4)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (13) – S03 (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between L05 (female) (19) – S03 (female) (3)		Resistance	Min. 1 MΩ
			Between L05 (female) (22) – S03 (female) (4), – circuit branch end		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L05 (female) (13) – S03 (female) (2)		Voltage	Max. 1 V
			Wiring harness between L05 (female) (19) – S03 (female) (3)		Voltage	Max. 1 V
			Between L05 (female) (22) – S03 (female) (4), – circuit branch end		Voltage	Max. 1 V
	5	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			L05	Lift arm EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (19) and (21)	Lever in neutral	2.40 – 2.60 V	
				Raise operation (Before detent)	3.64 – 4.14 V	
				Raise operation (Detent position)	3.86 – 4.36 V	
				Float operation	0.64 – 1.14 V	
				Lower operation (Before detent)	0.86 – 1.36 V	
			Between (13) and (21)	Lever in neutral	2.40 – 2.60 V	
				Raise operation (Before detent)	0.86 – 1.36 V	
				Raise operation (Detent position)	0.64 – 1.14 V	
				Lower operation (Before detent)	3.64 – 4.14 V	
				Float operation	3.86 – 4.36 V	

Circuit diagram related to lift arm EPC lever potentiometer



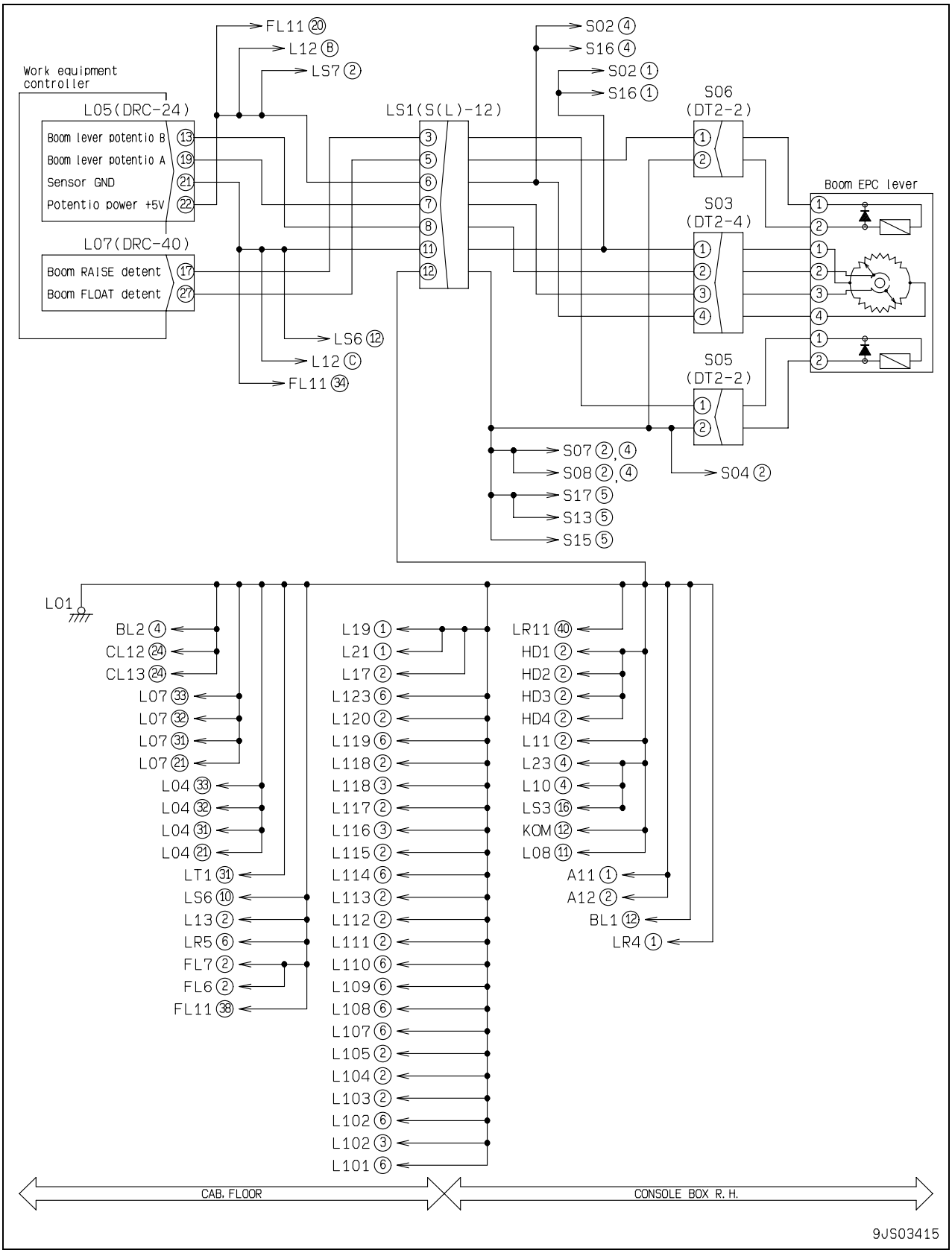
Failure code [DK5AKA] (Lift arm EPC lever potentiometer (Sub): Disconnection)

Action code	Failure code	Trouble	Lift arm EPC lever potentiometer (Sub): Disconnection (Work equipment controller system)
E03	**DK5AKA**		
Contents of trouble	• Due to disconnection or grounding fault in the lift arm EPC lever potentiometer (Sub) system, the signal voltage is lower than normal range (Lift arm EPC lever potentiometer (Sub) signal voltage: Max. 0.3 V).		
Action of controller	• If the lift arm EPC lever potentiometer (Main) is normal, the Main potentiometer is in control. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	—		
Related information	• The input state (voltage) from the lift arm EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42000 BOOM POT1). • The input state (voltage) from the lift arm EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42001 BOOM POT2). • Method of reproducing failure code: Turn the starting switch ON and operate lift arm lever		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm EPC lever potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S03 (male)		Resistance	
			Between (1) and (4)		3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			S03 (male)	Lift arm EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (2) and (1)	Lever in neutral	2.40 – 2.60 V	
				Raise operation (Before detent)	0.86 – 1.36 V	
				Raise operation (Detent position)	0.64 – 1.14 V	
				Lower operation (Before detent)	3.64 – 4.14 V	
				Float operation	3.86 – 4.36 V	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (13) – S03 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (21) – S03 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (22) – S03 (female) (4)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (13) – S03 (female) (2)		Resistance	Min. 1 MΩ
			Between L05 (female) (22) – S03 (female) (4), – circuit branch end		Resistance	Min. 1 MΩ

<table>
<tr><td rowspan="8">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="7">4</td><td rowspan="7">Defective work equipment controller</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)</td></tr>
<tr><td>L05</td><td>Lift arm EPC lever</td><td>Voltage</td></tr>
<tr><td>Between (22) and (21)</td><td>Normal</td><td>4.85 – 5.15 V</td></tr>
<tr><td rowspan="5">Between (13) and (21)</td><td>Lever in neutral</td><td>2.40 – 2.60 V</td></tr>
<tr><td>Raise operation (Before detent)</td><td>0.86 – 1.36 V</td></tr>
<tr><td>Raise operation (Detent position)</td><td>0.64 – 1.14 V</td></tr>
<tr><td>Lower operation (Before detent)</td><td>3.64 – 4.14 V</td></tr>
<tr><td>Float operation</td><td>3.86 – 4.36 V</td></tr>
</table>

Circuit diagram related to lift arm EPC lever potentiometer



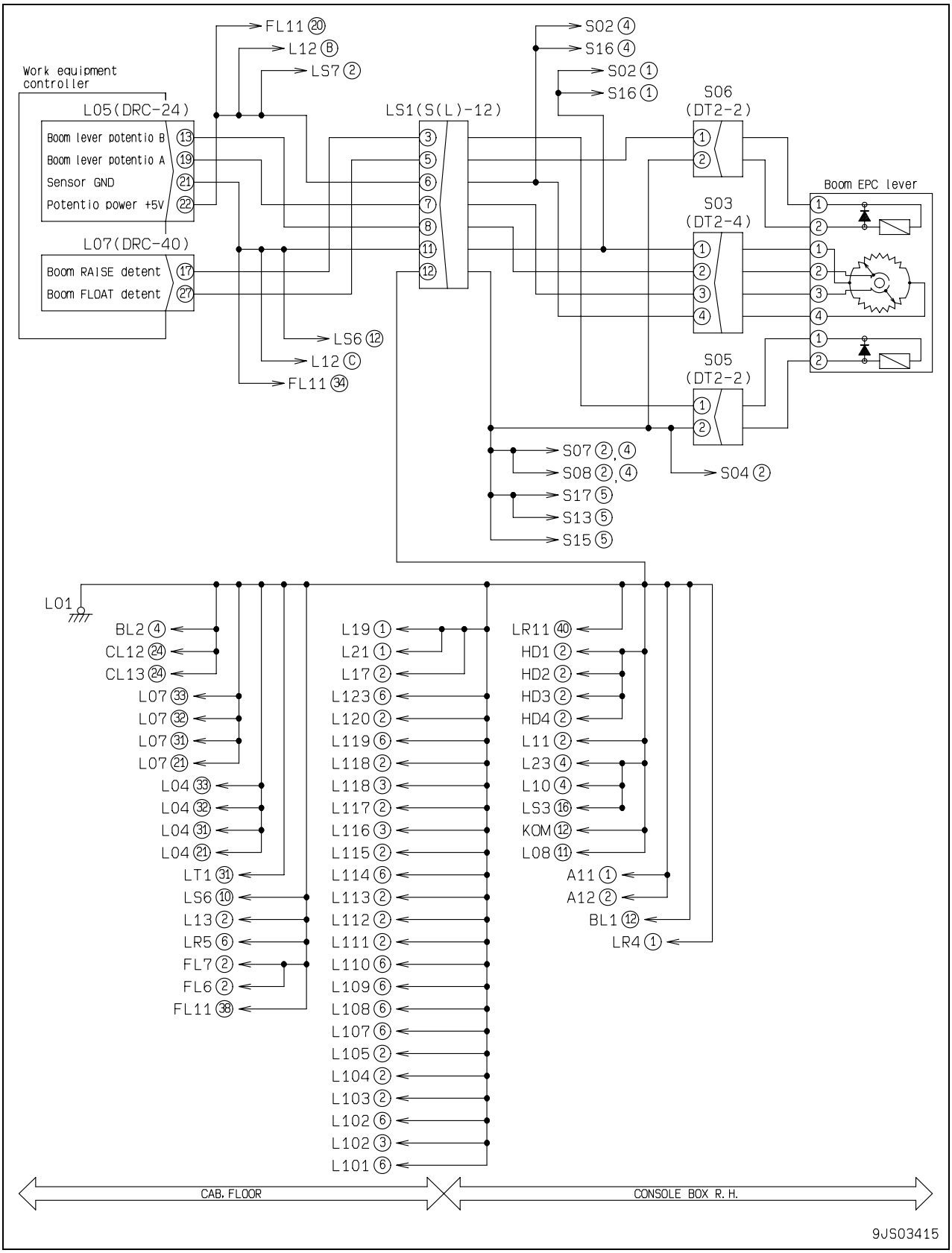
Failure code [DK5AKY] (Lift arm EPC lever potentiometer (Sub): Short circuit with power supply line)

Action code	Failure code	Trouble	Lift arm EPC lever potentiometer (Sub): Short circuit with the power supply line (Work equipment controller system)
E03	**DK5AKY**		
Contents of trouble	• Due to hot short circuit in the lift arm EPC lever potentiometer (Sub) system, the signal voltage is higher than normal range (Lift arm EPC lever potentiometer (Sub) signal voltage: Min. 4.7 V).		
Action of controller	• If the lift arm EPC lever potentiometer (Main) is normal, the Main potentiometer is in control. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until lift arm EPC lever is set to N (Neutral).		
Problem that appears on machine	—		
Related information	• The input state (voltage) from the lift arm EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42000 BOOM POT1). • The input state (voltage) from the lift arm EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42001 BOOM POT2). • Method of reproducing failure code: Turn the starting switch ON and operate lift arm lever		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm EPC lever potentiometer (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S03 (male)		Resistance	
			Between (1) and (4)		3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			S03 (male)	Lift arm EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (2) and (1)	Lever in neutral	2.40 – 2.60 V	
				Raise operation (Before detent)	0.86 – 1.36 V	
				Raise operation (Detent position)	0.64 – 1.14 V	
				Lower operation (Before detent)	3.64 – 4.14 V	
				Float operation	3.86 – 4.36 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L05 (female) (13) – S03 (female) (2)		Voltage	Max. 1 V
			Between L05 (female) (22) – S03 (female) (4), – circuit branch end		Voltage	Max. 1 V

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)		
			L05	Lift arm EPC lever	Voltage
			Between (22) and (21)	Normal	4.85 – 5.15 V
			Between (13) and (21)	Lever in neutral	2.40 – 2.60 V
				Raise operation (Before detent)	0.86 – 1.36 V
				Raise operation (Detent position)	0.64 – 1.14 V
			Between (13) and (21)	Lower operation (Before detent)	3.64 – 4.14 V
				Float operation	3.86 – 4.36 V

Circuit diagram related to lift arm EPC lever potentiometer



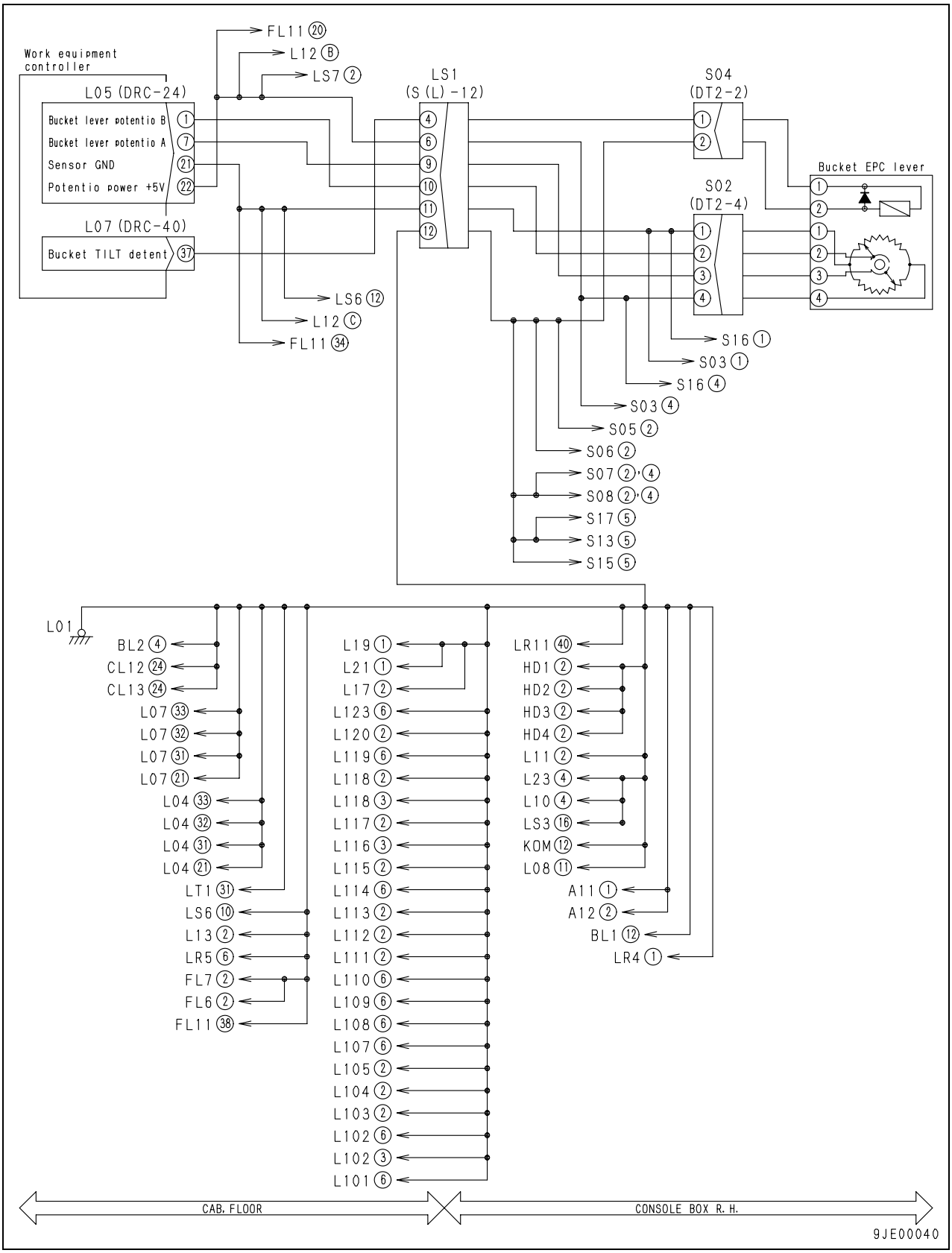
Failure code [DK5BKA] (Bucket EPC lever potentiometer (Main): Disconnection)

Action code	Failure code	Trouble	Bucket EPC lever potentiometer (Main): Disconnection (Work equipment controller system)
E03	**DK5BKA**		
Contents of trouble	• Due to disconnection or grounding fault in the bucket EPC lever potentiometer (Main) system, the signal voltage is lower than normal range (Bucket EPC lever potentiometer (Main) signal voltage: Max. 0.3 V).		
Action of controller	• Judges that the bucket EPC lever was fully operated in the dumping direction. • If the bucket EPC lever potentiometer (Sub) is normal, the Sub potentiometer is in control. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until bucket EPC lever is set to N (Neutral).		
Problem that appears on machine	• Error is simply displayed.		
Related information	• The input state (voltage) from the bucket EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42002 BUCKET POT1). • The input state (voltage) from the bucket EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42003 BUCKET POT2). • Method of reproducing failure code: Turn the starting switch ON and operate bucket lever		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective bucket EPC lever potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S02 (male)		Resistance	
			Between (1) and (4)		3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			S02	Bucket EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (3) and (1)	Lever in neutral	2.40 – 2.60 V	
				Tilt operation (Before detent)	3.64 – 4.14 V	
				Tilt operation (Detent position)	3.86 – 4.36 V	
				Full dump operation	0.69 – 1.14 V	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (7) – S02 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (21) – S02 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (22) – S02 (female) (4)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (7) – S02 (female) (3)		Resistance	Min. 1 MΩ
			Between L05 (female) (22) – S02 (female) (4), – circuit branch end		Resistance	Min. 1 MΩ

<table>
<tr><td rowspan="8">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="7">4</td><td rowspan="7">Defective work equipment controller</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)</td></tr>
<tr><td>L05</td><td>Bucket EPC lever</td><td>Voltage</td></tr>
<tr><td>Between (22) and (21)</td><td>Normal</td><td>4.85 – 5.15 V</td></tr>
<tr><td rowspan="2">Between (7) and (21)</td><td>Lever in neutral</td><td>2.40 – 2.60 V</td></tr>
<tr><td>Tilt operation (Before detent)</td><td>3.64 – 4.14 V</td></tr>
<tr><td rowspan="2">Between (7) and (21)</td><td>Tilt operation (Detent position)</td><td>3.86 – 4.36 V</td></tr>
<tr><td>Full dump operation</td><td>0.64 – 1.14 V</td></tr>
</table>

Circuit diagram related to bucket EPC lever potentiometer

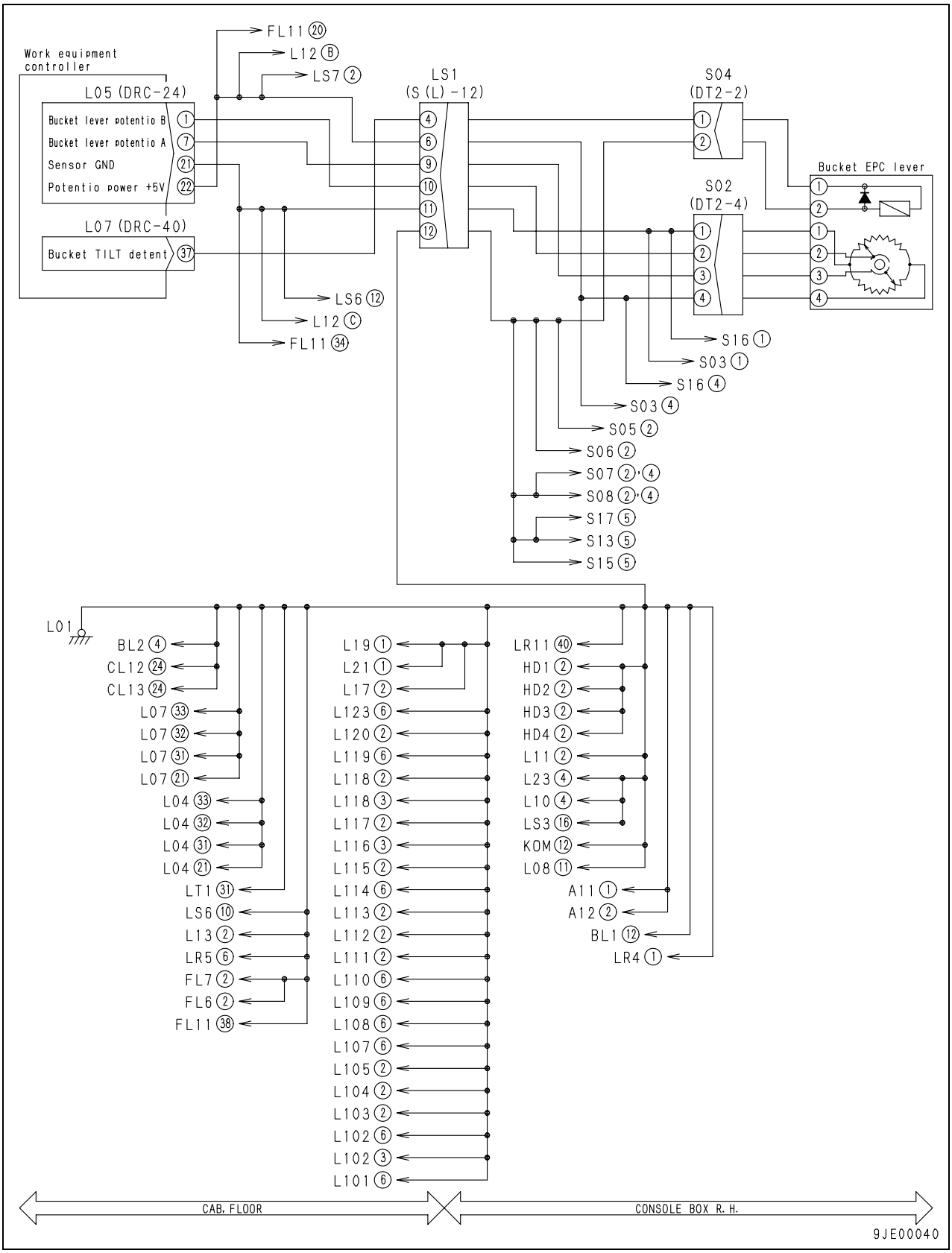


Failure code [DK5BKY] (Bucket EPC lever potentiometer (Main): Short circuit with power supply line)

Action code	Failure code	Trouble	Bucket EPC lever potentiometer (Main): Short circuit with the power supply line (Work equipment controller system)
E03	**DK5BKY**		
Contents of trouble	• Due to hot short circuit in the bucket EPC lever potentiometer (Main) system, the signal voltage is higher than normal range (Bucket EPC lever potentiometer (Main) signal voltage: Min. 4.7 V).		
Action of controller	• Judges that the bucket EPC lever was fully operated in the tilting direction. • If the bucket EPC lever potentiometer (Sub) is normal, the Sub potentiometer is in control. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until bucket EPC lever is set to N (Neutral).		
Problem that appears on machine	• Error is simply displayed.		
Related information	• The input state (voltage) from the bucket EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42002 BUCKET POT1). • The input state (voltage) from the bucket EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42003 BUCKET POT2). • Method of reproducing failure code: Turn the starting switch ON and operate bucket lever		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective bucket EPC lever potentiometer (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S02 (male)		Resistance	
			Between (1) and (4)		3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			S02	Bucket EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (3) and (1)	Lever in neutral	2.40 – 2.60 V	
				Tilt operation (Before detent)	3.64 – 4.14 V	
				Tilt operation (Detent position)	3.86 – 4.36 V	
				Full dump operation	0.64 – 1.14 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L05 (female) (7) – S02 (female) (3)		Voltage	Max. 1 V
			Between L05 (female) (22) – S02 (female) (4), – circuit branch end		Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			L05	Bucket EPC lever	Voltage	
			Between (22) and (21)	Normal	4.85 – 5.15 V	
			Between (7) and (21)	Lever in neutral	2.40 – 2.60 V	
				Tilt operation (Before detent)	3.64 – 4.14 V	
				Tilt operation (Detent position)	3.86 – 4.36 V	
				Full dump operation	0.64 – 1.14 V	

Circuit diagram related to bucket EPC lever potentiometer



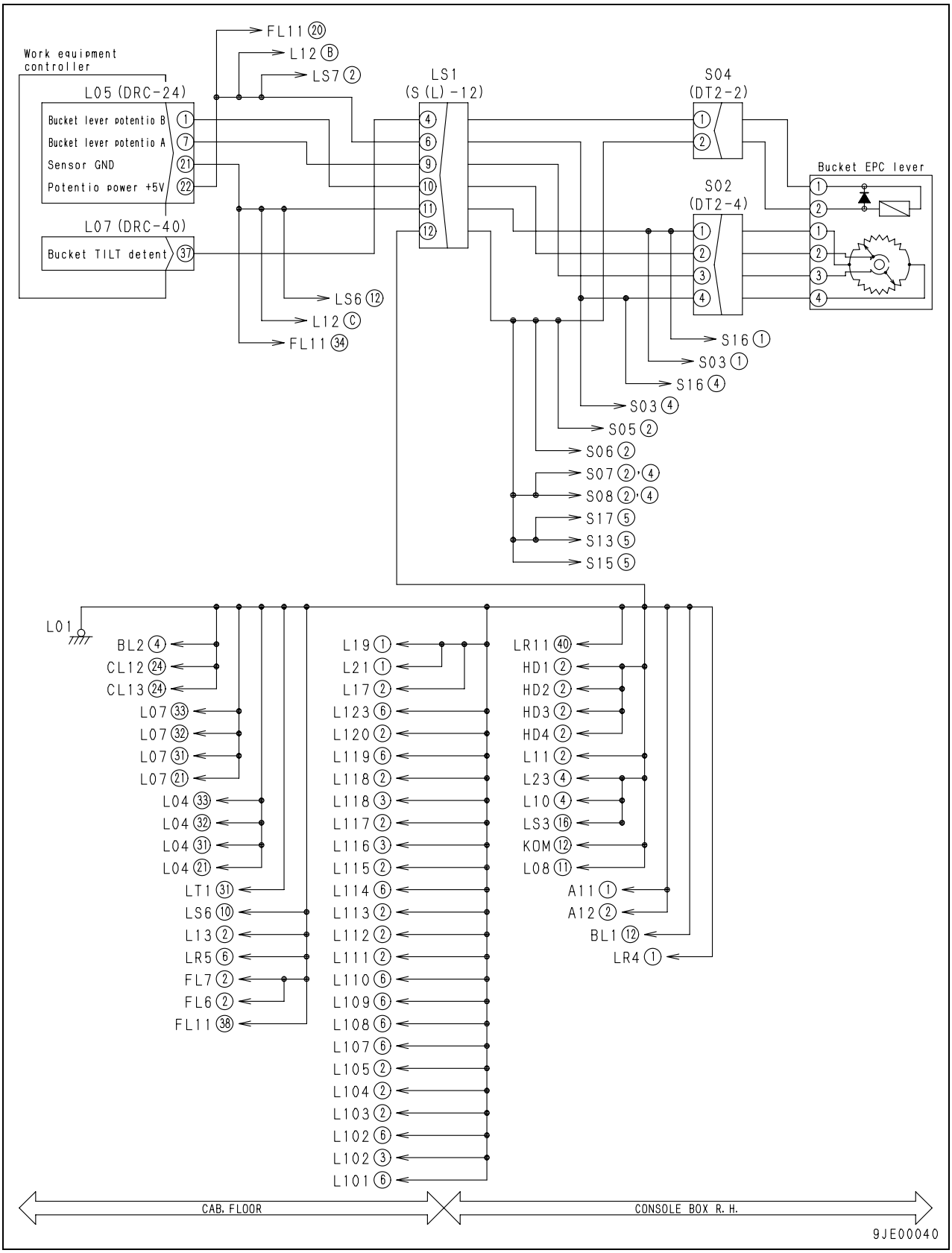
Failure code [DK5BL8] (Bucket EPC lever potentiometer (Main): Analog signals disagree)

Action code	Failure code	Trouble	Bucket EPC lever potentiometer (Main): Analog signals disagree (Work equipment controller system)
E03	**DK5BL8**		
Contents of trouble	• Bucket EPC lever potentiometer (Main & Sub) input signals disagree with each other. (Bucket EPC lever potentiometer signal voltage (sum of Main and Sub): Max. 4.7 V) or (Bucket EPC lever potentiometer signal voltage (sum of Main and Sub): Min. 5.3 V)		
Action of controller	• Cannot recognize the bucket EPC lever position correctly. • Operates with either Main or Sub potentiometer, whichever detecting a position within neutrality ±5 %, as the regular potentiometer. • Turns the output OFF if both Main and Sub potentiometers should fail to detect a position within neutrality ±5 %. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until bucket EPC lever is set to N (Neutral).		
Problem that appears on machine	• Work equipment moves with the lever set to neutral. • If either Main or Sub potentiometer is abnormal, machine operates normally after the lever is set to neutral. • If both Main and Sub potentiometers are abnormal, bucket does not move.		
Related information	• The input state (voltage) from the bucket EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42002 BUCKET POT1). • The input state (voltage) from the bucket EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42003 BUCKET POT2). • Method of reproducing failure code: Turn the starting switch ON and operate bucket lever		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective bucket EPC lever potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			S02 (male)	Resistance	
			Between (1) and (4)	3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground	Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)		
			S02	Bucket EPC lever	Voltage
			Between (4) and (1)	Normal	4.85 – 5.15 V
			Between (3) and (1)	Lever in neutral	2.40 – 2.60 V
				Tilt operation (Before detent)	3.64 – 4.14 V
				Tilt operation (Detent position)	3.86 – 4.36 V
				Full dump operation	0.64 – 1.14 V
			Between (2) and (1)	Lever in neutral	2.40 – 2.60 V
				Tilt operation (Before detent)	0.86 – 1.36 V
				Tilt operation (Detent position)	0.64 – 1.14 V
				Full dump operation	3.86 – 4.36 V

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (1) – S02 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (7) – S02 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (21) – S02 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (22) – S02 (female) (4)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (1) – S02 (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between L05 (female) (7) – S02 (female) (3)		Resistance	Min. 1 MΩ
			Between L05 (female) (22) – S02 (female) (4), – circuit branch end		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L05 (female) (1) – S02 (female) (2)		Voltage	Max. 1 V
			Wiring harness between L05 (female) (7) – S02 (female) (3)		Voltage	Max. 1 V
			Between L05 (female) (22) – S02 (female) (4), – circuit branch end		Voltage	Max. 1 V
	5	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			L05	Bucket EPC lever	Voltage	
			Between (22) and (21)	Normal	4.85 – 5.15 V	
			Between (7) and (21)	Lever in neutral	2.40 – 2.60 V	
				Tilt operation (Before detent)	3.64 – 4.14 V	
				Tilt operation (Detent position)	3.86 – 4.36 V	
				Full dump operation	0.64 – 1.14 V	
			Between (1) and (21)	Lever in neutral	2.40 – 2.60 V	
				Tilt operation (Before detent)	0.86 – 1.36 V	
				Tilt operation (Detent position)	0.61 – 1.14 V	
				Full dump operation	3.96 – 4.36 V	

Circuit diagram related to bucket EPC lever potentiometer



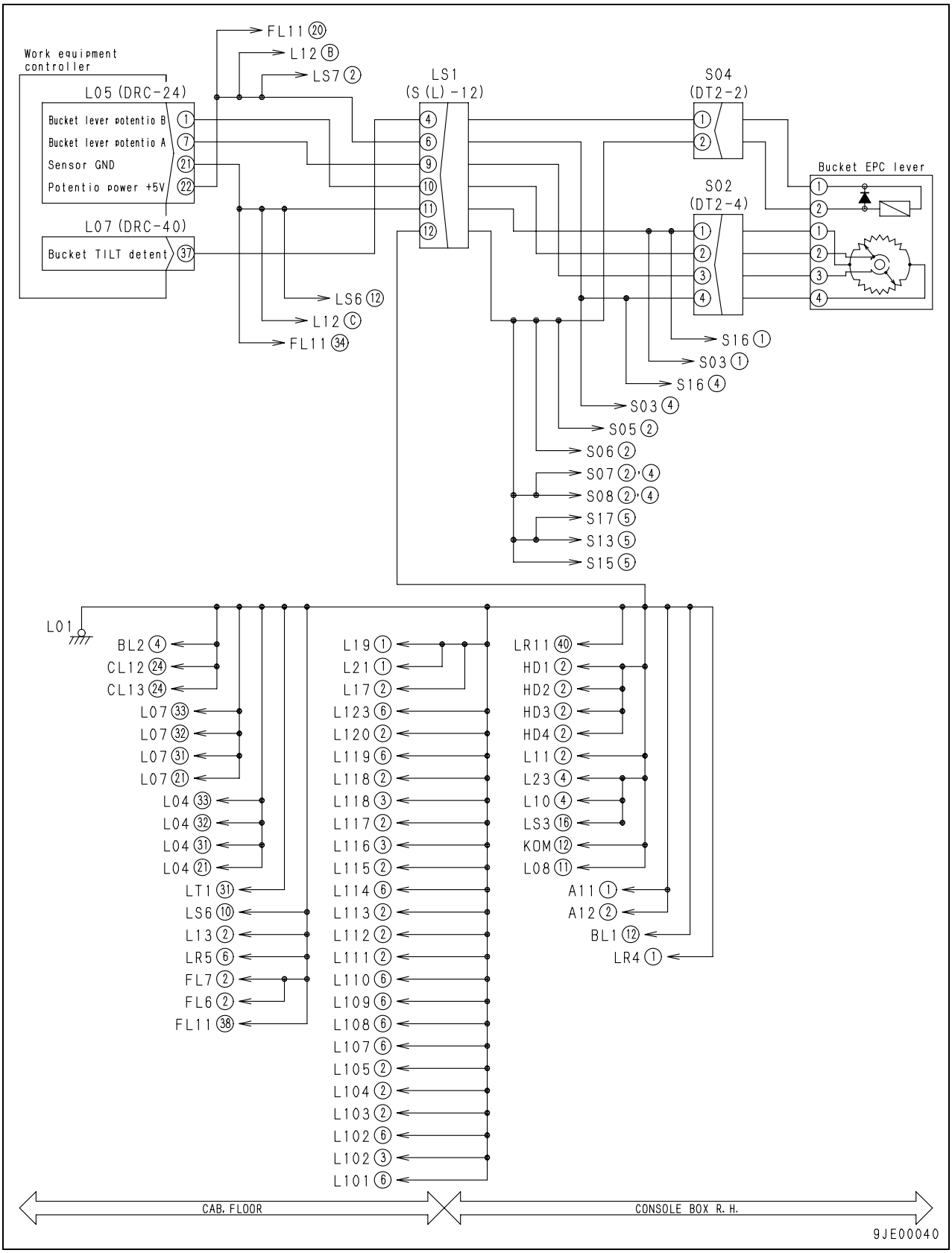
Failure code [DK5CKA] (Bucket EPC lever potentiometer (Sub): Disconnection)

Action code	Failure code	Trouble	Bucket EPC lever potentiometer (Sub): Disconnection (Work equipment controller system)
E03	**DK5CKA**		
Contents of trouble	• Due to disconnection or grounding fault in the bucket EPC lever potentiometer (Sub) system, (Sub) signal voltage is lower than normal range (Bucket EPC lever potentiometer (Sub) signal voltage: Max. 0.3 V).		
Action of controller	• If the bucket EPC lever potentiometer (Main) is normal, the Main potentiometer is in control. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	—		
Related information	• The input state (voltage) from the bucket EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42002 BUCKET POT1). • The input state (voltage) from the bucket EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42003 BUCKET POT2). • Method of reproducing failure code: Turn the starting switch ON and operate bucket lever		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective bucket EPC lever potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S02 (male)		Resistance	
			Between (1) and (4)		3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			S02	Bucket EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (2) and (1)	Lever in neutral	2.40 – 2.60 V	
				Tilt operation (Before detent)	0.86 – 1.36 V	
				Tilt operation (Detent position)	0.64 – 1.14 V	
				Full dump operation	3.96 – 4.36 V	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (1) – S02 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (21) – S02 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (22) – S02 (female) (4)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (1) – S02 (female) (2)		Resistance	Min. 1 MΩ
			Between L05 (female) (22) – S02 (female) (4), – circuit branch end		Resistance	Min. 1 MΩ

<table>
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<tr><td rowspan="7">4</td><td rowspan="7">Defective work equipment controller</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)</td></tr>
<tr><td>L05</td><td>Bucket EPC lever</td><td>Voltage</td></tr>
<tr><td>Between (22) and (21)</td><td>Normal</td><td>4.85 – 5.15 V</td></tr>
<tr><td rowspan="2">Between (1) and (21)</td><td>Lever in neutral</td><td>2.40 – 2.60 V</td></tr>
<tr><td>Tilt operation (Before detent)</td><td>0.86 – 1.36 V</td></tr>
<tr><td rowspan="2">Between (1) and (21)</td><td>Tilt operation (Detent position)</td><td>0.64 – 1.14 V</td></tr>
<tr><td>Full dump operation</td><td>3.86 – 4.36 V</td></tr>
</table>

Circuit diagram related to bucket EPC lever potentiometer

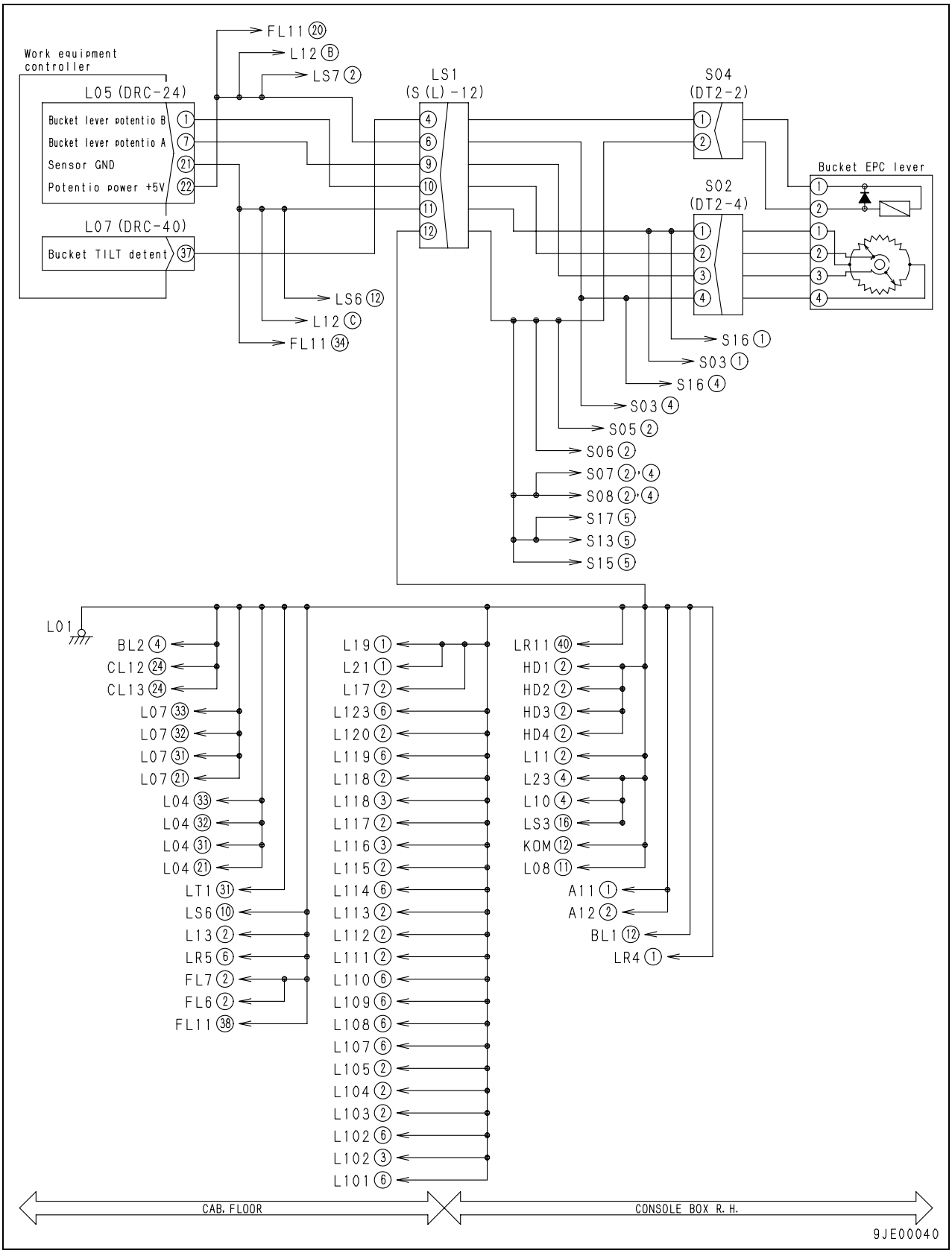


Failure code [DK5CKY] (Bucket EPC lever potentiometer (Sub): Short circuit with power supply line)

Action code	Failure code	Trouble	Bucket EPC lever potentiometer (Sub): Short circuit with the power supply line (Work equipment controller system)
E03	**DK5CKY**		
Contents of trouble	• Due to disconnection or grounding fault in the bucket EPC lever potentiometer (Sub) system, (Sub) signal voltage is lower than normal range (Bucket EPC lever potentiometer (Sub) signal voltage: Min. 4.7 V).		
Action of controller	• If the bucket EPC lever potentiometer (Main) is normal, the Main potentiometer is in control. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until bucket EPC lever is set to N (Neutral).		
Problem that appears on machine	—		
Related information	• The input state (voltage) from the bucket EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42002 BUCKET POT1). • The input state (voltage) from the bucket EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42003 BUCKET POT2). • Method of reproducing failure code: Turn the starting switch ON and operate bucket lever		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective bucket EPC lever potentiometer (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S02 (male)		Resistance	
			Between (1) and (4)		3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			S02	Bucket EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (2) and (1)	Lever in neutral	2.40 – 2.60 V	
				Tilt operation (Before detent)	0.86 – 1.36 V	
				Tilt operation (Detent position)	0.64 – 1.14 V	
				Full dump operation	3.86 – 4.36 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L05 (female) (1) – S02 (female) (2)		Voltage	Max. 1 V
			Between L05 (female) (22) – S02 (female) (4), – circuit branch end		Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			L05	Bucket EPC lever	Voltage	
			Between (22) and (21)	Normal	4.85 – 5.15 V	
			Between (1) and (21)	Lever in neutral	2.40 – 2.60 V	
				Tilt operation (Before detent)	0.86 – 1.36 V	
				Tilt operation (Detent position)	0.64 – 1.14 V	
				Full dump operation	3.86 – 4.36 V	

Circuit diagram related to bucket EPC lever potentiometer



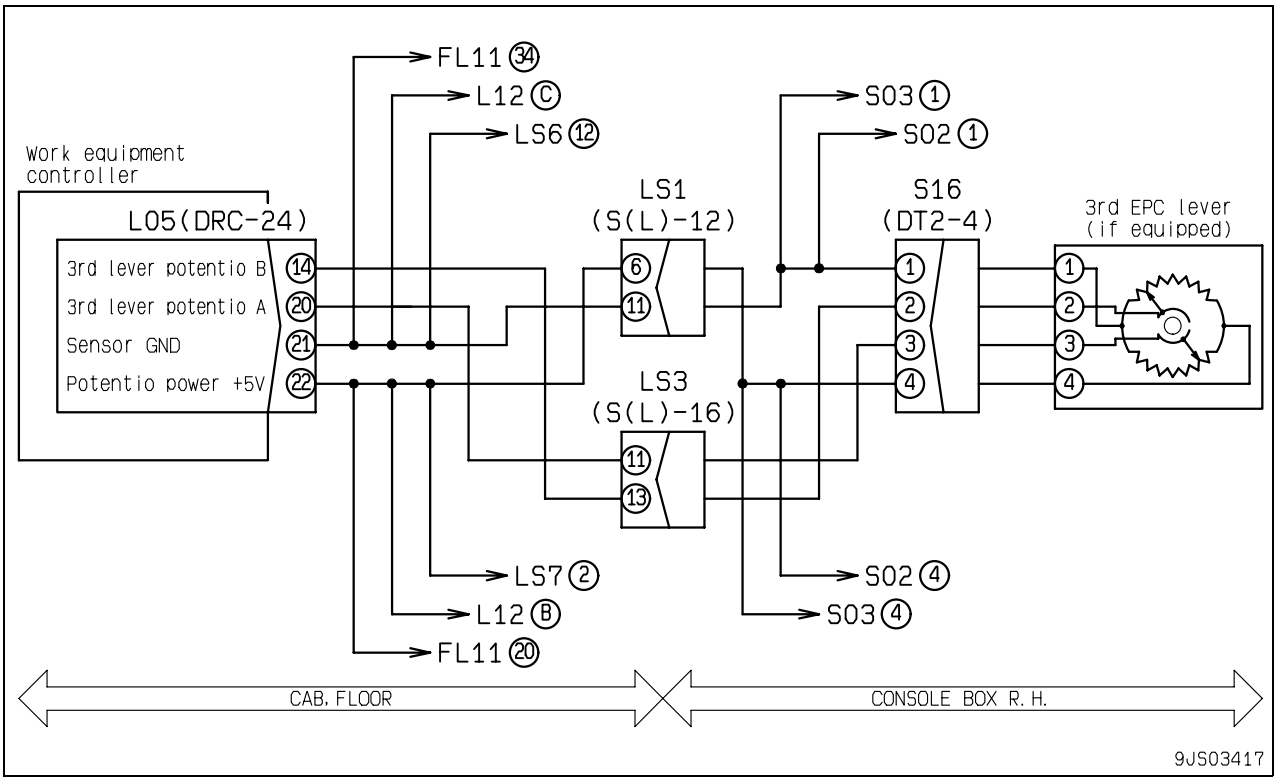
Failure code [DK5DKA] (3-spool valve (attachment) EPC lever potentiometer (Main): Disconnection)

Action code	Failure code	Trouble	3-spool valve (attachment) EPC lever potentiometer (Main): Disconnection (Work equipment controller system)
E03	**DK5DKA**		
Contents of trouble	• Due to disconnection or grounding fault in the 3-spool (attachment) EPC lever potentiometer (Main), the signal voltage is lower than normal range (3-spool valve (attachment) EPC lever potentiometer (Main) signal voltage: Max. 0.3 V).		
Action of controller	• Judges that the 3-spool valve (attachment) EPC lever was fully operated in the retracting direction. • If the 3-spool valve (attachment) EPC lever potentiometer (Sub) is normal, the Sub potentiometer is in control. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until 3-spool valve (attachment) EPC lever is set to N (Neutral).		
Problem that appears on machine	• Error is simply displayed.		
Related information	• The input state (voltage) from the 3-spool valve (attachment) EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42006 3-spool POT1). • The input state (voltage) from the 3-spool valve (attachment) EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42007 3-spool POT2). • Method of reproducing failure code: Turn the starting switch ON and operate 3-spool valve (attachment) lever • This error is not displayed on a machine which is not equipped with 3-spool valve (attachment). If it is displayed, select “NO ADD” 3-spool valve option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 3-spool valve (attachment) EPC lever potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S16 (male)		Resistance	
			Between (1) and (4)		3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			S16 (male)	3-spool valve (attachment) EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (3) and (1)	Lever in neutral	2.40 – 2.60 V	
				Full extension operation	3.86 – 4.36 V	
				Full retraction operation	0.64 – 1.14 V	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (20) – S16 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (21) – S16 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (22) – S16 (female) (4)		Resistance	Max. 1 Ω

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (20) – S16 (female) (3)		Resistance	Min. 1 MΩ
			Between L05 (female) (22) – S16 (female) (4), – circuit branch end		Resistance	Min. 1 MΩ
	4	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			L05	3-spool valve (attachment) EPC lever	Voltage	
			Between (22) and (21)	Normal	4.85 – 5.15 V	
			Between (20) and (21)	Lever in neutral	2.40 – 2.60 V	
				Full extension operation	3.86 – 4.36 V	
				Full retraction operation	0.64 – 1.14 V	

Circuit diagram related to 3-spool valve (attachment) EPC lever potentiometer



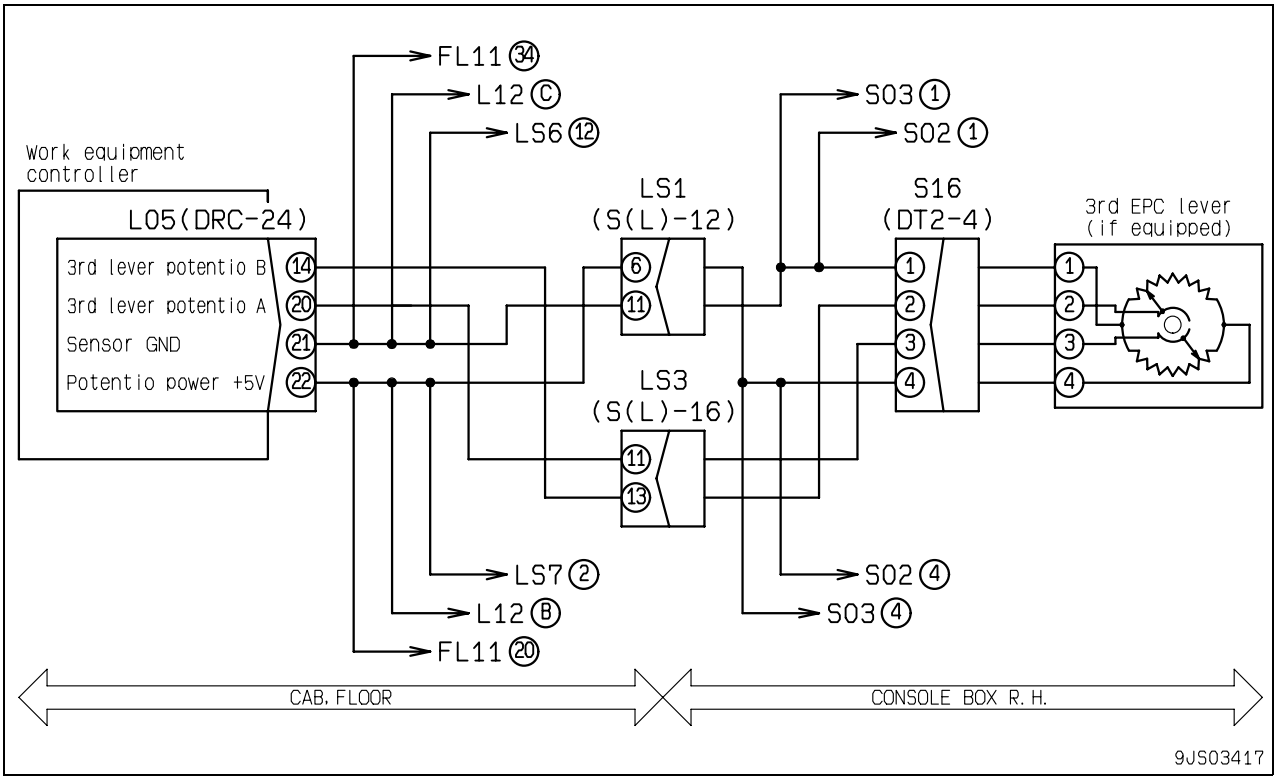
Failure code [DK5DKY] (3-spool valve (attachment) EPC lever potentiometer (Main): Short circuit with power supply line)

Action code	Failure code	Trouble	3-spool valve (attachment) EPC lever potentiometer (Main): Short circuit with power supply line (Work equipment controller system)
E03	**DK5DKY**		
Contents of trouble	• Due to hot short circuit in the 3-spool (attachment) EPC lever potentiometer (Main) system, the signal voltage is higher than normal range (3-spool valve (attachment) EPC lever potentiometer (Main) signal voltage: Max. 4.7 V).		
Action of controller	• Judges that the 3-spool valve (attachment) EPC lever was fully operated in the extending direction. • If the 3-spool valve (attachment) EPC lever potentiometer (Sub) is normal, the Sub potentiometer is in control. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until 3-spool valve (attachment) EPC lever is set to N (Neutral).		
Problem that appears on machine	• Error is simply displayed.		
Related information	• The input state (voltage) from the 3-spool valve (attachment) EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42006 3-spool POT1). • The input state (voltage) from the 3-spool valve (attachment) EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42007 3-spool POT2). • Method of reproducing failure code: Turn the starting switch ON and operate 3-spool valve (attachment) lever • This error is not displayed on a machine which is not equipped with 3-spool valve (attachment). If it is displayed, select “NO ADD” 3-spool valve option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 3-spool valve (attachment) EPC lever potentiometer (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S16 (male)		Resistance	
			Between (1) and (4)		3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			S16 (male)	3-spool valve (attachment) EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (3) and (1)	Lever in neutral	2.40 – 2.60 V	
				Full extension operation	3.86 – 4.36 V	
				Full retraction operation	0.64 – 1.14 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (20) – S16 (female) (3)		Voltage	Max. 1 V
			Between L05 (female) (22) – S16 (female) (4), – circuit branch end		Voltage	Max. 1 V

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)		
			L05	3-spool valve (attachment) EPC lever	Voltage
			Between (22) and (21)	Normal	4.85 – 5.15 V
			Between (20) and (21)	Lever in neutral	2.40 – 2.60 V
				Full extension operation	3.86 – 4.36 V
				Full retraction operation	0.64 – 1.14 V

Circuit diagram related to 3-spool valve (attachment) EPC lever potentiometer



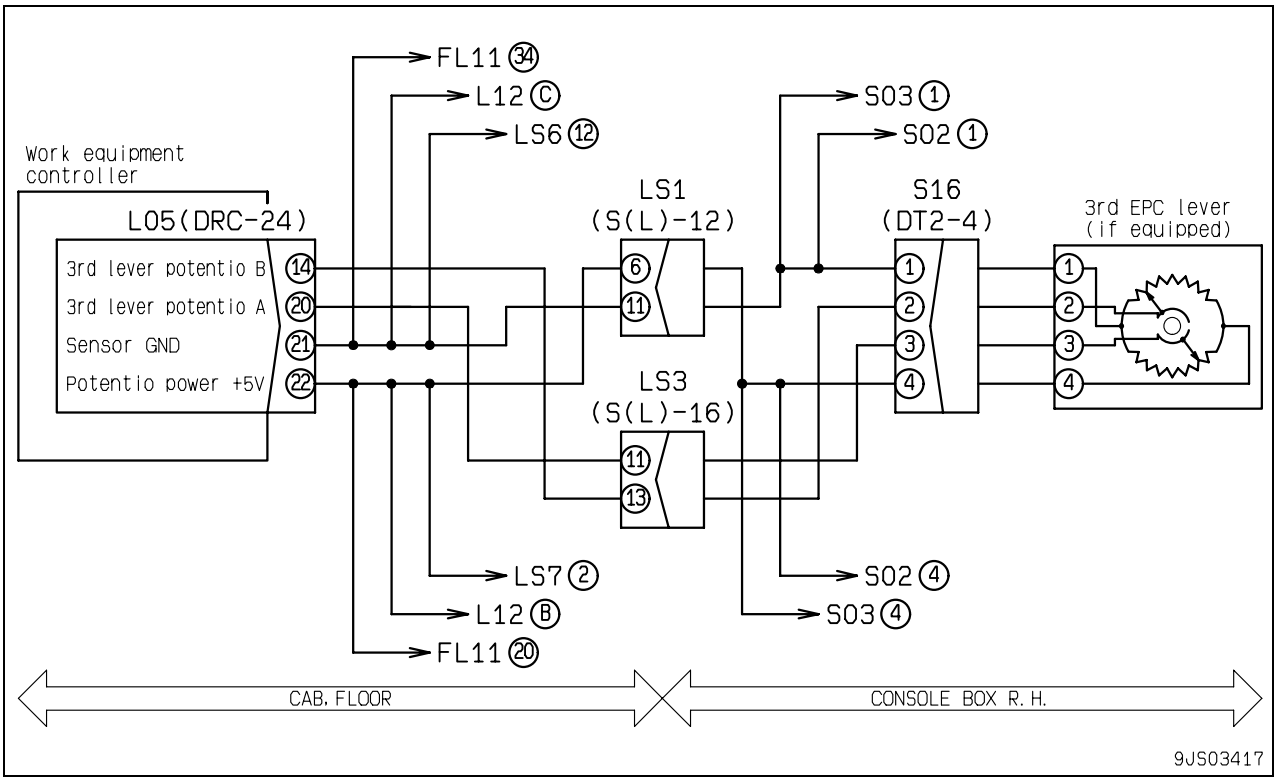
Failure code [DK5DL8] (3-spool valve (attachment) EPC lever potentiometer (Main): Analog signals disagree)

Action code	Failure code	Trouble	3-spool valve (attachment) EPC lever potentiometer (Main): Analog signals disagree (Work equipment controller system)
E03	**DK5DL8**		
Contents of trouble	• The 3-spool valve (attachment) EPC lever potentiometer (Main & Sub) input signals disagree with each other. (3-spool valve (attachment) EPC lever potentiometer signal voltage (both Main and Sub): Max. 4.7 V) or (3-spool valve (attachment) EPC lever potentiometer signal voltage (both Main and Sub): Min. 5.3 V)		
Action of controller	• Cannot recognize the 3-spool valve (attachment) EPC lever position correctly. • Operates with either Main or Sub potentiometer, whichever detecting a position within neutrality ± 5 %, as the regular potentiometer. • Turns the output OFF if both Main and Sub potentiometers should fail to detect a position within neutrality ± 5 %. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until 3-spool valve (attachment) EPC lever is set to N (Neutral).		
Problem that appears on machine	• Work equipment moves with the lever set to neutral. • If either Main or Sub potentiometer is abnormal, machine operates normally after the lever is set to neutral. • If both Main and Sub potentiometers are abnormal, 3-spool valve (attachment) cylinder does not move.		
Related information	• The input state (voltage) from the 3-spool valve (attachment) EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42006 3-spool POT1). • The input state (voltage) from the 3-spool valve (attachment) EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42007 3-spool POT2). • Method of reproducing failure code: Turn the starting switch ON and operate 3-spool valve (attachment) lever • This error is not displayed on a machine which is not equipped with 3-spool valve (attachment). If it is displayed, select “NO ADD” 3-spool valve option in option setting.		

<table>
<tr><td rowspan="16">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="15">1</td><td rowspan="15">Defective 3-spool valve (attachment) EPC lever potentiometer (Internal disconnection or short circuit)</td><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">S16 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (1) and (4)</td><td>3.2 ± 0.64 kΩ</td></tr>
<tr><td colspan="2">Between (1), (2), (3), (4) and chassis ground</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)</td></tr>
<tr><td>S16 (male)</td><td>3-spool valve (attachment) EPC lever</td><td>Voltage</td></tr>
<tr><td>Between (4) and (1)</td><td>Normal</td><td>4.85 – 5.15 V</td></tr>
<tr><td rowspan="3">Between (3) and (1)</td><td>Lever in neutral</td><td>2.40 – 2.60 V</td></tr>
<tr><td>Full extension operation</td><td>3.86 – 4.36 V</td></tr>
<tr><td>Full retraction operation</td><td>0.64 – 1.14 V</td></tr>
<tr><td rowspan="3">Between (2) and (1)</td><td>Lever in neutral</td><td>2.40 – 2.60 V</td></tr>
<tr><td>Full extension operation</td><td>0.64 – 1.14 V</td></tr>
<tr><td>Full retraction operation</td><td>3.86 – 4.36 V</td></tr>
</table>

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (14) – S16 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (20) – S16 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (21) – S16 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (22) – S16 (female) (4)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (14) – S16 (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between L05 (female) (20) – S16 (female) (3)		Resistance	Min. 1 MΩ
			Between L05 (female) (22) – S16 (female) (4), – circuit branch end		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L05 (female) (14) – S16 (female) (2)		Voltage	Max. 1 V
			Wiring harness between L05 (female) (20) – S16 (female) (3)		Voltage	Max. 1 V
			Between L05 (female) (22) – S16 (female) (4), – circuit branch end		Voltage	Max. 1 V
	5	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			L05	3-spool valve (attachment) EPC lever	Voltage	
			Between (22) and (21)	Normal	4.85 – 5.15 V	
			Between (20) and (21)	Lever in neutral	2.40 – 2.60 V	
				Full extension operation	3.86 – 4.36 V	
				Full retraction operation	0.64 – 1.14 V	
			Between (14) and (21)	Lever in neutral	2.40 – 2.60 V	
				Full extension operation	0.64 – 1.14 V	
				Full retraction operation	3.86 – 4.36 V	

Circuit diagram related to 3-spool valve (attachment) EPC lever potentiometer



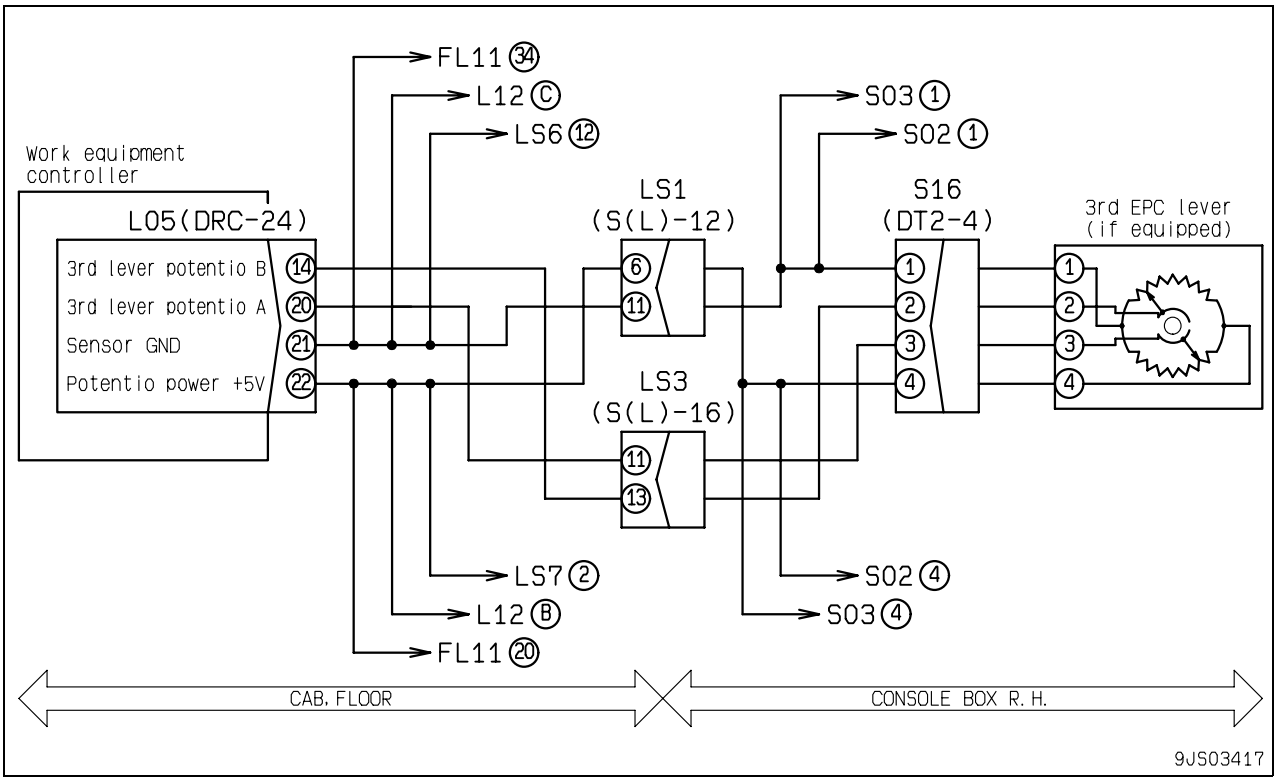
Failure code [DK5EKA] (3-spool valve (attachment) EPC lever potentiometer (Sub): Disconnection)

Action code	Failure code	Trouble	3-spool valve (attachment) EPC lever potentiometer (Sub): Disconnection (Work equipment controller system)
E03	**DK5EKA**		
Contents of trouble	• Due to disconnection or grounding fault in the 3-spool valve (attachment) EPC lever potentiometer (Sub), the signal voltage is lower than normal range (3-spool valve (attachment) EPC lever potentiometer (Sub) signal voltage: Max. 0.3 V).		
Action of controller	• If the 3-spool valve (attachment) EPC lever potentiometer (Main) is normal, the Main potentiometer is in control. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	—		
Related information	• The input state (voltage) from the 3-spool valve (attachment) EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42006 3-spool POT1). • The input state (voltage) from the 3-spool valve (attachment) EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42007 3-spool POT2). • Method of reproducing failure code: Turn the starting switch ON and operate 3-spool valve (attachment) lever • This error is not displayed on a machine which is not equipped with 3-spool valve (attachment). If it is displayed, select “NO ADD” 3-spool valve option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 3-spool valve (attachment) EPC lever potentiometer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S16 (male)		Resistance	
			Between (1) and (4)		3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			S16	3-spool valve (attachment) EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (2) and (1)	Lever in neutral	2.40 – 2.60 V	
				Full extension operation	0.64 – 1.14 V	
				Full retraction operation	3.86 – 4.36 V	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (14) – S16 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (21) – S16 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L05 (female) (22) – S16 (female) (4)		Resistance	Max. 1 Ω

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (female) (14) – S16 (female) (2)		Resistance	Min. 1 MΩ
			Between L05 (female) (22) – S16 (female) (4), – circuit branch end		Resistance	Min. 1 MΩ
	4	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			L05	3-spool valve (attachment) EPC lever	Voltage	
			Between (22) and (21)	Normal	4.85 – 5.15 V	
			Between (14) and (21)	Lever in neutral	2.40 – 2.60 V	
			Between (14) and (21)	Full extension operation	0.64 – 1.14 V	
				Full retraction operation	3.86 – 4.36 V	

Circuit diagram related to 3-spool valve (attachment) EPC lever potentiometer



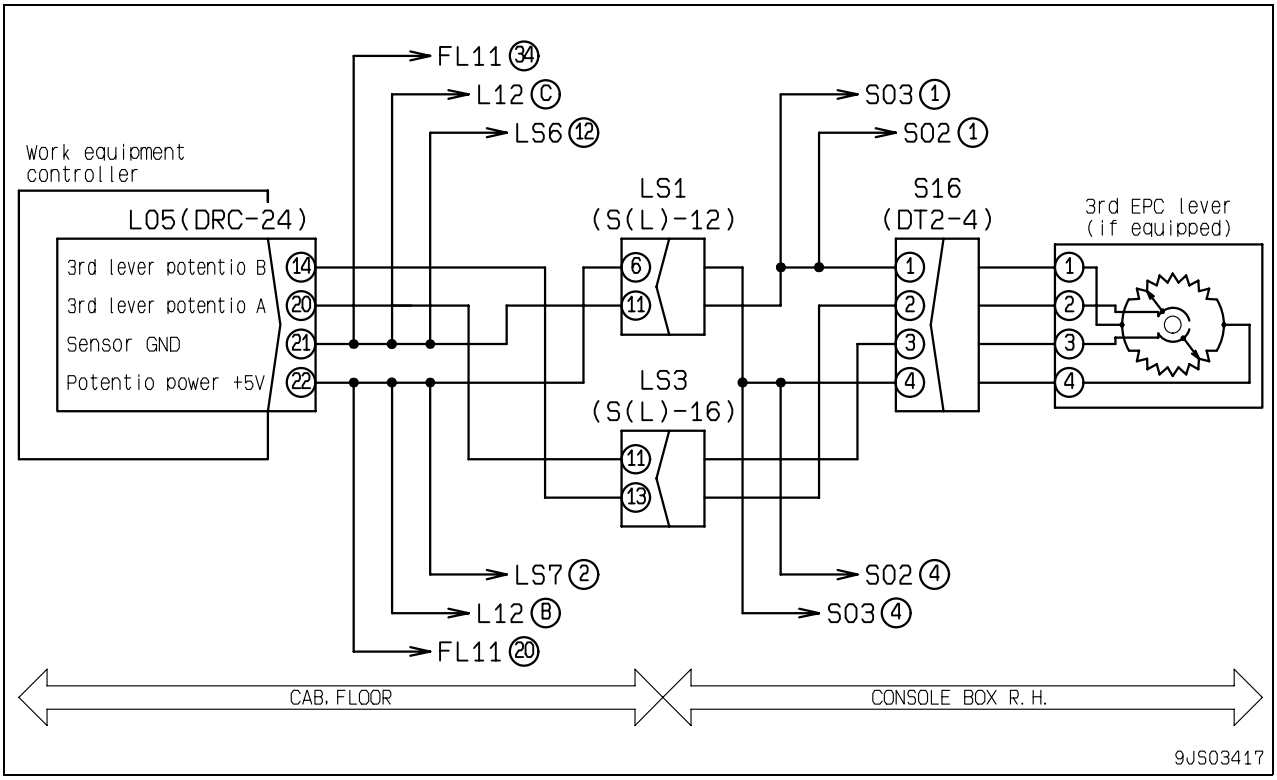
Failure code [DK5EKY] (3-spool valve EPC lever potentiometer (Sub): Short circuit with power supply line)

Action code	Failure code	Trouble	3-spool valve (attachment) EPC lever potentiometer (Sub): Short circuit with power supply line (Work equipment controller system)
E03	**DK5EKY**		
Contents of trouble	• Due to hot short circuit in the 3-spool (attachment) EPC lever potentiometer (Sub) system, the signal voltage is higher than normal range (3-spool valve (attachment) EPC lever potentiometer (Sub) signal voltage: Min. 4.7 V).		
Action of controller	• If the 3-spool valve (attachment) EPC lever potentiometer (Main) is normal, the Main potentiometer is in control. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until 3-spool valve (attachment) EPC lever is set to N (Neutral).		
Problem that appears on machine	—		
Related information	• The input state (voltage) from the 3-spool valve (attachment) EPC lever potentiometer (Main) can be checked with the monitoring function (Code: 42006 3RD POT1). • The input state (voltage) from the 3-spool valve (attachment) EPC lever potentiometer (Sub) can be checked with the monitoring function (Code: 42007 3RD POT2). • Method of reproducing failure code: Turn the starting switch ON and operate 3-spool valve (attachment) lever • This error is not displayed on a machine which is not equipped with 3-spool valve (attachment). If it is displayed, select “NO” 3-spool valve option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 3-spool valve (attachment) EPC lever potentiometer (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S16 (male)		Resistance	
			Between (1) and (4)		3.2 ± 0.64 kΩ	
			Between (1), (2), (3), (4) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)			
			S16	3-spool valve (attachment) EPC lever	Voltage	
			Between (4) and (1)	Normal	4.85 – 5.15 V	
			Between (2) and (1)	Lever in neutral	2.40 – 2.60 V	
				Full extension operation	0.64 – 1.14 V	
				Full retraction operation	3.86 – 4.36 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L05 (female) (14) – S16 (female) (2)		Voltage	Max. 1 V
			Between L05 (female) (22) – S16 (female) (4), – circuit branch end		Voltage	Max. 1 V

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (work equipment lock)		
			L05	3-spool valve (attachment) EPC lever	Voltage
			Between (22) and (21)	Normal	4.85 – 5.15 V
			Between (14) and (21)	Lever in neutral	2.40 – 2.60 V
				Full extension operation	0.64 – 1.14 V
				Full retraction operation	3.86 – 4.36 V

Circuit diagram related to 3-spool valve (attachment) EPC lever potentiometer



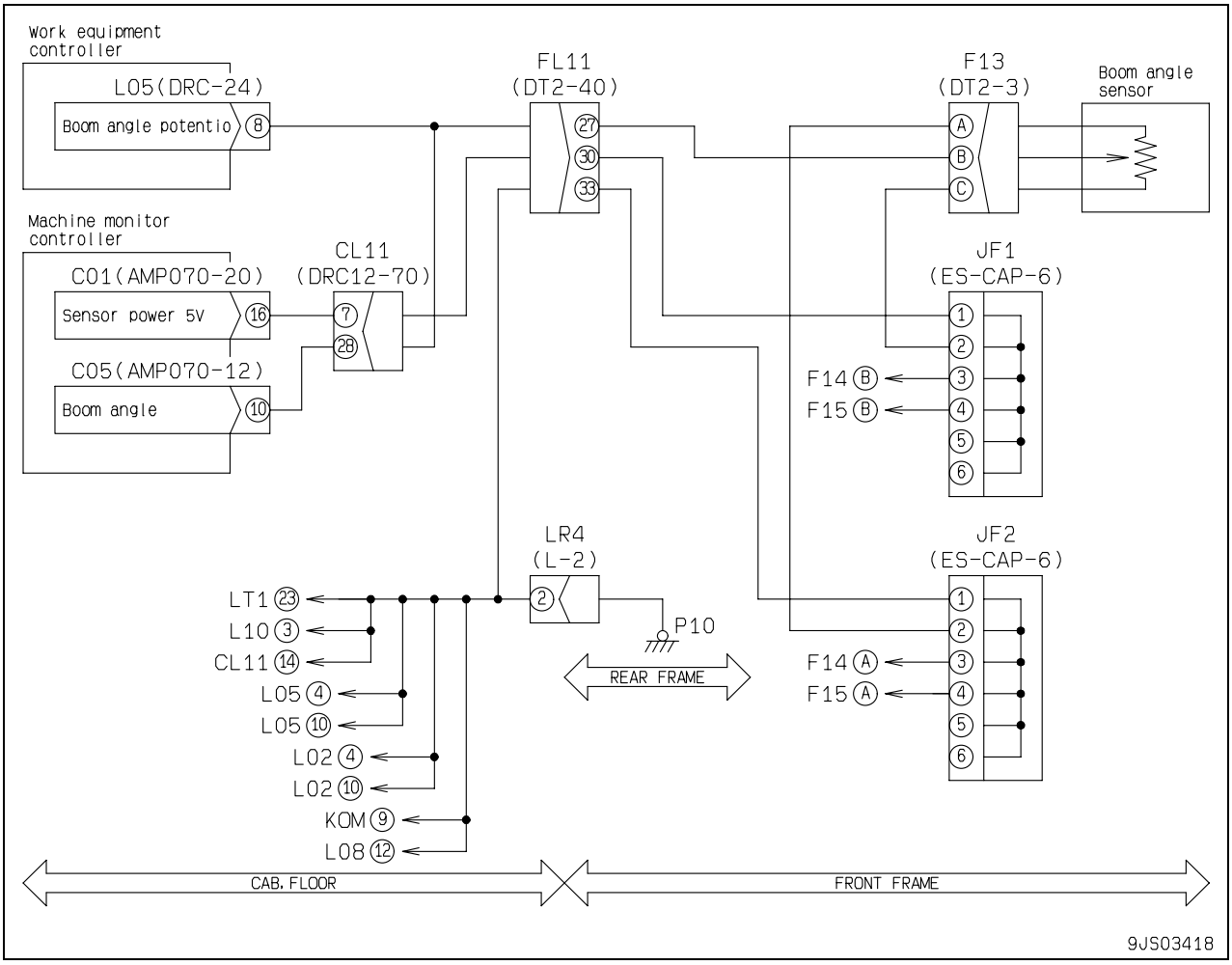
Failure code [DKA0KA] (Lift arm angle sensor: Disconnection)

Action code	Failure code	Trouble	Lift arm angle sensor: Disconnection (Work equipment controller system)
E01	**DKA0KA**		
Contents of trouble	• Due to disconnection or ground fault in lift arm angle sensor system, the signal voltage is lower than normal range (Lift arm angle sensor signal: Max. 0.3 V).		
Action of controller	• Judges that lift arm is at the lowest position. • Resets the remote positioner function. • Resets semi auto digging function. • No PC control while the lift arm is rising. • When the remote positioner lower setting is ON, turns OFF the lift arm float detent, and when the remote positioner lower setting is OFF, usually operates the lift arm float detent. • Turns the lift arm raise detent OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Remote positioner malfunction (operation does not stop) • Faulty semi-auto digging operation (operation does not start) • No PC control while the lift arm is rising		
Related information	• The input state (angle) from the lift arm angle sensor can be checked with the monitoring function (Code: 06002 BOOM ANG). • The input state (voltage) from the lift arm angle sensor can be checked with the monitoring function (Code: 06005 BOOM ANG). • If failure code [**DAF5KP**] (Machine monitor: Low output voltage) is displayed, carry out troubleshooting for it first. • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm angle sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F13 (male)		Resistance	
			Between (A) and (C)		5 kΩ ± 20 %	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			F13	Lift arm position	Voltage	
			Between (C) and (A)	Normal	4.85 – 5.15 V	
			Between (B) and (A)	Normal	1.00 – 4.00 V	
				Raise stroke end	3.50 – 4.00 V	
				Lower stroke end	1.00 – 1.88 V	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F13 (female) (A) – chassis ground		Resistance	Max. 1 Ω
			Wiring harness between F13 (female) (B) – L05 (female) (8)		Resistance	Max. 1 Ω
			Wiring harness between F13 (female) (C) – C01 (female) (16)		Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F13 (female) (B) – L05 (female) (8) or C05 (female) (10)		Resistance	Min. 1 MΩ
			Wiring harness between F13 (female) (C) – C01 (female) (16), – circuit branch end		Resistance	Min. 1 MΩ

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	4	Defective work equipment controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			L05	Lift arm position	Voltage
			Between (8) and chassis ground	Normal	0.83 – 4.17 V
			Between (8) and chassis ground	Raise stroke end	3.50 – 4.00 V
				Lower stroke end	1.00 – 1.88 V

Circuit diagram related to lift arm angle sensor



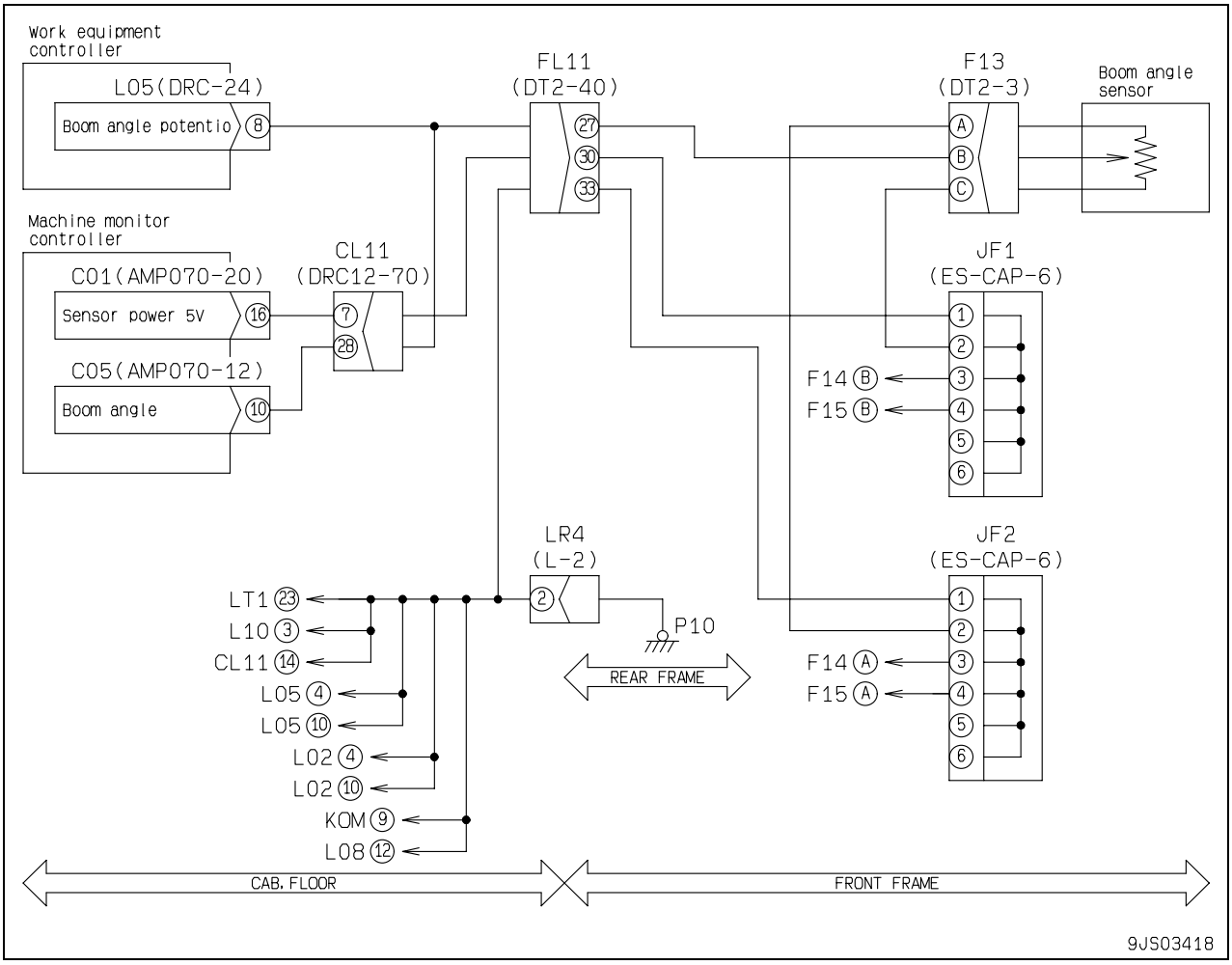
Failure code [DKA0KX] (Lift arm angle sensor: Out of input signal range)

Action code	Failure code	Trouble	Lift arm angle sensor: Out of input signal range (Machine monitor system)
E01	**DKA0KX**		
Contents of trouble	• Due to disconnection or ground fault in lift arm angle sensor system, the signal voltage is not input (Lift arm angle sensor signal voltage: Max. 1 V). • Due to hot short circuit in lift arm angle sensor system, the signal voltage is higher than normal level (Lift arm angle sensor signal voltage: Min. 4 V).		
Action of controller	• If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Machine monitor does not display load.		
Related information	• The input state (angle) from the lift arm angle sensor can be checked with the monitoring function (Code: 06002 BOOM ANG). • The input state (voltage) from the lift arm angle sensor can be checked with the monitoring function (Code: 06005 BOOM ANG). • If failure code [**DAF5KP**] (Machine monitor: Low output voltage) is displayed, carry out troubleshooting for it first. • Method of reproducing failure code: Turn the starting switch ON		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective lift arm angle sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F13 (male)	Resistance		
			Between (A) and (C)	5 kΩ ± 20 %		
			Between (A), (B), (C) and chassis ground	Min. 1 MΩ		
			★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			F13	Lift arm position	Voltage	
			Between (C) and (A)	Normal	4.85 – 5.15 V	
			Between (B) and (A)	Normal	1.00 – 4.00 V	
				Raise stroke end	3.50 – 4.00 V	
				Lower stroke end	1.00 – 1.88 V	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F13 (female) (A) – chassis ground	Resistance	Max. 1 Ω	
			Wiring harness between F13 (female) (B) – L05 (female) (8) or C05 (female) (10)	Resistance	Max. 1 Ω	
			Wiring harness between F13 (female) (C) – C01 (female) (16)	Resistance	Max. 1 Ω	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F13 (female) (B) – L05 (female) (8) or C05 (female) (10)	Resistance	Min. 1 MΩ	
			Wiring harness between F13 (female) (C) – C01 (female) (16), – circuit branch end	Resistance	Min. 1 MΩ	

<table>
<tr><td rowspan="6">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Hot short in wiring harness (Contact with 24 V circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td colspan="2">Wiring harness between F13 (female) (B) – L05 (female) (8) or C05 (female) (10)</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td colspan="2">Wiring harness between F13 (female) (C) – C01 (female) (16), – circuit branch end</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Defective machine monitor</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.</td></tr>
<tr><td>L05</td><td>Lift arm position</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="3">Between (8) and chassis ground</td><td>Normal</td><td colspan="2">0.83 – 4.17 V</td></tr>
<tr><td>Raise stroke end</td><td colspan="2">3.50 – 4.00 V</td></tr>
<tr><td>Lower stroke end</td><td colspan="2">1.00 – 1.88 V</td></tr>
</table>

Circuit diagram related to lift arm angle sensor

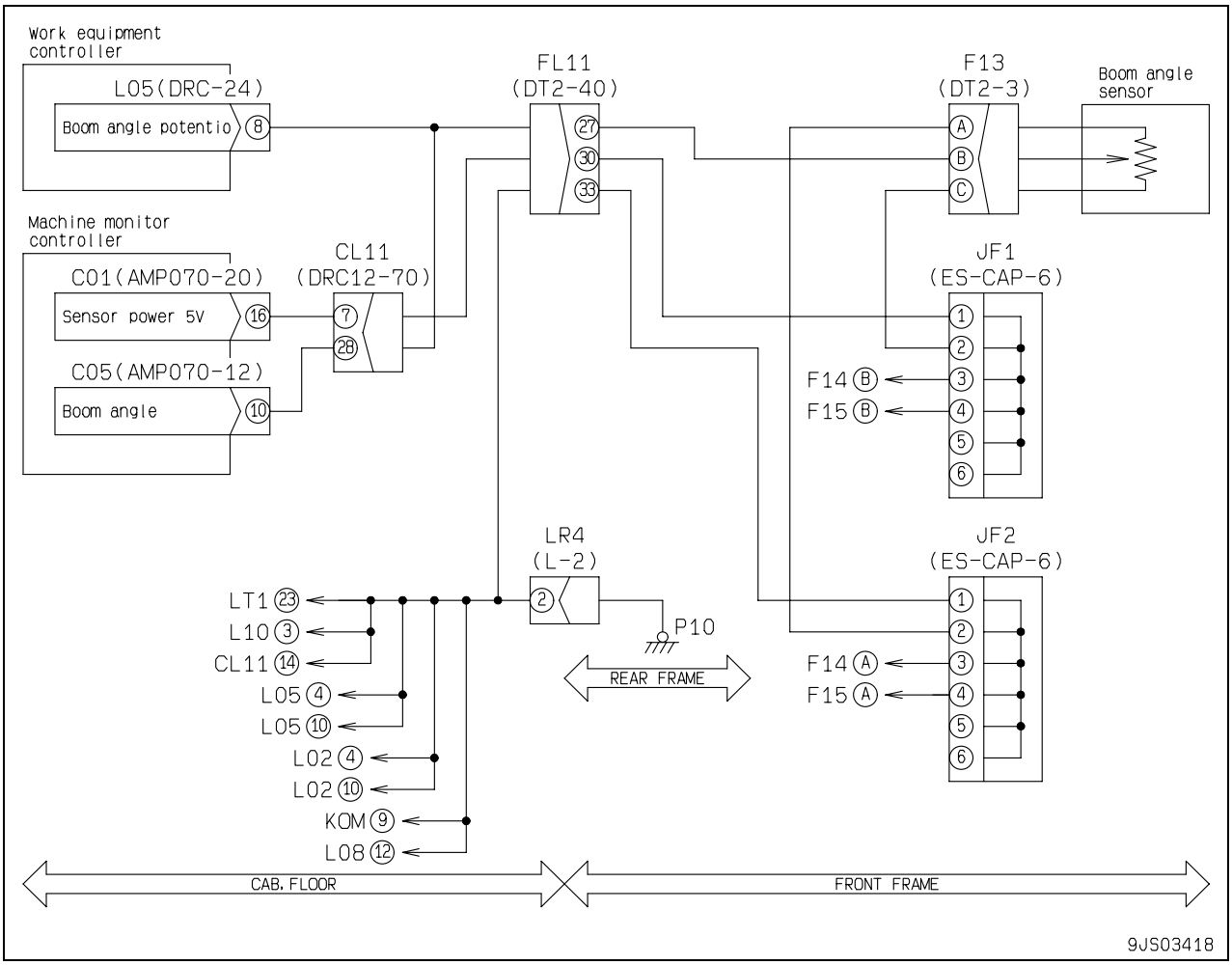


Failure code [DKA0KY] (Lift arm angle sensor: Short circuit with power supply line)

Action code	Failure code	Trouble	Lift arm angle sensor: Short circuit with power supply line (Work equipment controller system)
E01	**DKA0KY**		
Contents of trouble	• Due to disconnection or hot short in lift arm angle sensor system, the signal voltage is higher than normal range (Lift arm angle sensor signal: Min. 4.7 V).		
Action of controller	• Judges that lift arm is at the highest position. • Resets the remote positioner function. • Resets semi auto digging function. • No PC control while the lift arm is rising. • When the remote positioner lower setting is ON, turns OFF the lift arm float detent, and when the remote positioner lower setting is OFF, usually operates the lift arm float detent. • Turns the lift arm raise detent OFF. • Even if cause of failure disappears, system does not reset itself until lift arm lever is set to N (Neutral).		
Problem that appears on machine	• Remote positioner malfunction • Faulty semi-auto digging operation • No PC control while the lift arm is rising		
Related information	• The input state (angle) from the boom angle sensor can be checked with the monitoring function (Code: 06002 BOOM ANG). • The input state (voltage) from the boom angle sensor can be checked with the monitoring function (Code: 06005 BOOM ANG). • Method of reproducing failure code: Turn the starting switch ON		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm angle sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F13 (male)		Resistance	
			Between (A) and (C)		5 kΩ ± 20 %	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			F13	Lift arm position	Voltage	
			Between (C) and (A)	Normal	4.85 – 5.15 V	
			Between (B) and (A)	Normal	1.00 – 4.00 V	
				Raise stroke end	3.50 – 4.00 V	
				Lower stroke end	1.00 – 1.88 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between F13 (female) (B) – L05 (female) (8) or C05 (female) (10)		Voltage	Max. 1 V
			Wiring harness between F13 (female) (C) – C01 (female) (16), – circuit branch end		Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L05	Lift arm position	Voltage	
			Between (8) and chassis ground	Normal	0.83 – 4.17 V	
				Raise stroke end	3.50 – 4.00 V	
				Lower stroke end	1.00 – 1.88 V	

Circuit diagram related to lift arm angle sensor

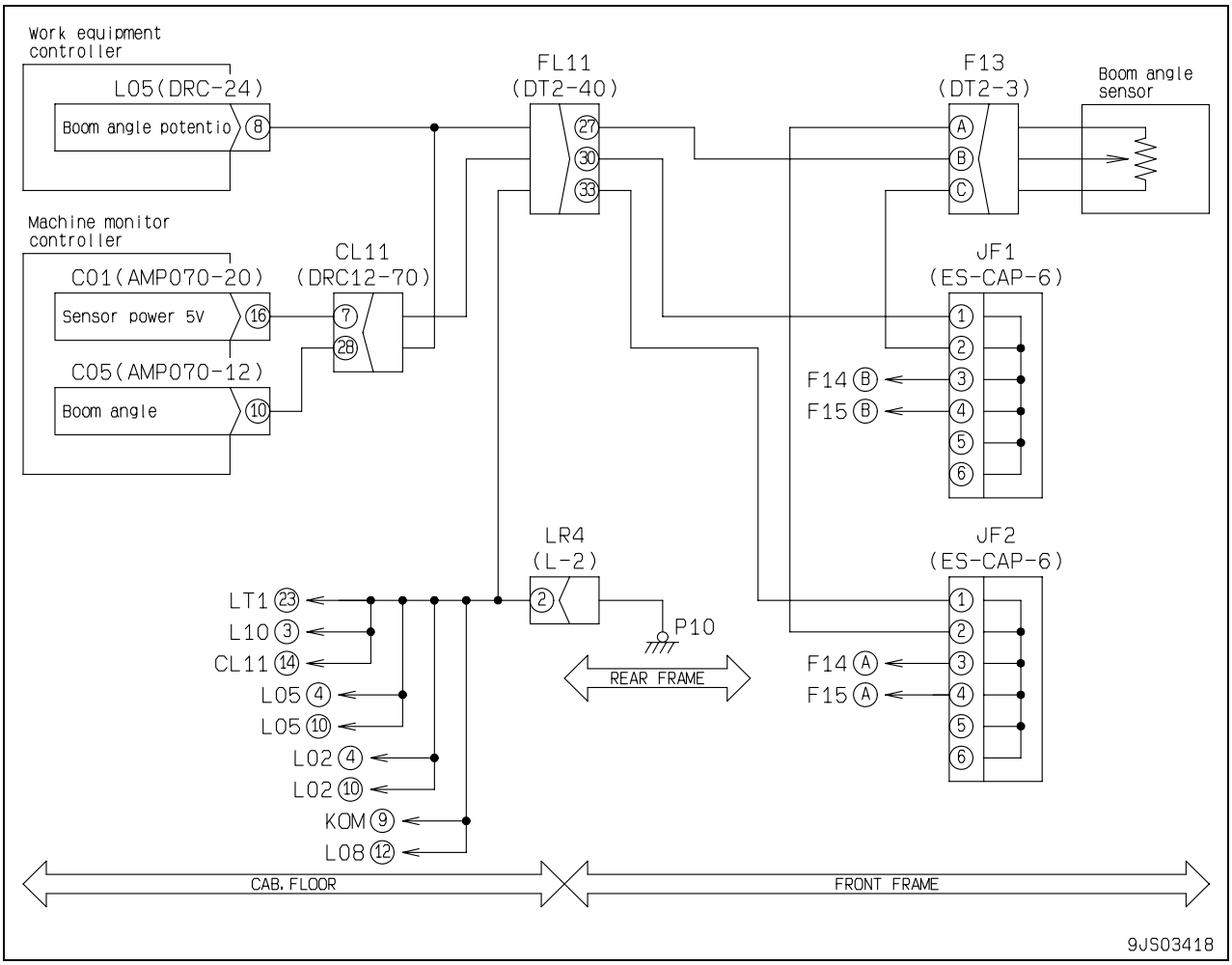


Failure code [DKA0L0] (Lift arm angle sensor: Improper position)

Action code	Failure code	Trouble	Lift arm angle sensor: Improper position (Work equipment controller system)
E01	**DKA0L0**		
Contents of trouble	• Due to lift arm angle sensor dislocation, lift arm angle is not detectable correctly. (Lift arm angle upper limit +5° and above or lift arm angle lower limit +5° or above)		
Action of controller	• Resets the remote positioner function. • Resets semi auto digging function. • No PC control while the lift arm is rising. • When the remote positioner lower setting is ON, turns OFF the lift arm float detent, and when the remote positioner lower setting is OFF, usually operates the lift arm float detent. • Turns the lift arm raise detent OFF • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Remote positioner malfunction (operation does not stop) • Faulty semi-auto digging operation (operation does not start) • Faulty PC control operation when boom rises		
Related information	• The input state (angle) from the lift arm angle sensor can be checked with the monitoring function (Code: 06002 BOOM ANG). • The input state (voltage) from the lift arm angle sensor can be checked with the monitoring function (Code: 06005 BOOM ANG). • Method of reproducing failure code: Start engine and set the lift arm to raise or lower stroke end • This error may be displayed when boom angle sensor is initialized wrongly.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective lift arm angle sensor adjustment	★ Adjustment of lift arm angle sensor may be defective. Check it directly (see “Testing and adjusting“).		
	2	Defective lift arm angle sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F13 (male)		Resistance
			Between (A) and (C)		5 kΩ ± 20 %
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ
			★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			F13	Lift arm position	Voltage
			Between (C) and (A)	Normal	4.85 – 5.15 V
			Between (B) and (A)	Normal	1.00 – 4.00 V
				Raise stroke end	3.50 – 4.00 V
				Lower stroke end	1.00 – 1.88 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			L05	Lift arm position	Voltage
			Between (8) and chassis ground	Normal	0.83 – 4.17 V
				Raise stroke end	3.50 – 4.00 V
				Lower stroke end	1.00 – 1.88 V

Circuit diagram related to lift arm angle sensor



WA600-6 Wheel loader

Form No. SEN00571-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

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Troubleshooting by failure code (Display of code), Part 9

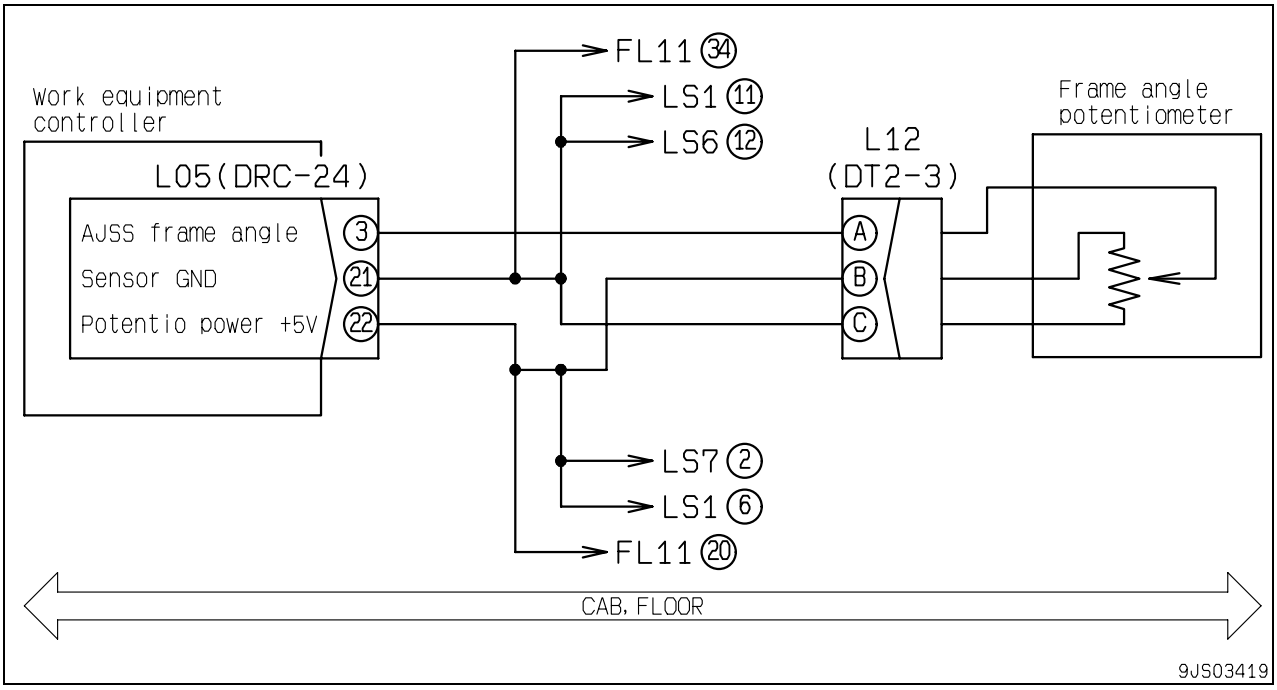
Failure code [DKD0KA] (Frame angle sensor: Disconnection)

Action code	Failure code	Trouble	Frame angle sensor: Disconnection (Work equipment controller system)
E01	**DKD0KA**		
Contents of trouble	• Due to disconnection or ground fault in frame angle sensor system, the frame angle sensor signal voltage is outside the lower limit (frame angle sensor signal: Max. 0.3 V).		
Action of controller	• Stops the AJSS neutral safety function. • Controls AJSS EPC output to the level corresponding to 1.47 MPa {15 kg/cm^2}. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The engine can be started while AJSS lever is operated (The machine turns just after engine is started). • Steering fine control is not possible (the machine jounces when performing steering operation). • The winker cannot be automatically reset.		
Related information	• The input state (angle) from the frame angle sensor can be checked with the monitoring function (Code: 94400 FRAME ANGLE). • AJSS (if equipped) specification only • Method of reproducing failure code: Turn the starting switch ON. • This error is not displayed on a steering wheel specification machine. If it is displayed, select “NO ADD” AJSS option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective frame angle sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L12 (male)	Resistance		
			Between (B) and (C)	5 kΩ ± 20 %		
			Between (A), (B), (C) and chassis ground	Min. 1 MΩ		
			★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L12	Frame	Voltage	
			Between (B) and (C)	Normal	4.85 – 5.15 V	
			Between (A) and (C)	Normal	0.46 – 4.54 V	
				While machine is traveling straight	2.20 – 2.80 V	
				Full steering to right	0.46 – 1.46 V	
				Full steering to left	3.54 – 4.54 V	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (3) – L12 (female) (A)	Resistance	Max. 1 Ω	
			Wiring harness between L05 (21) – L12 (female) (C)	Resistance	Max. 1 Ω	
			Wiring harness between L05 (22) – F12 (female) (B)	Resistance	Max. 1 Ω	
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L05 (3) – L12 (female) (A)	Resistance	Min. 1 MΩ	
			Wiring harness between L05 (22) – L12 (female) (B), – circuit branch	Resistance	Min. 1 MΩ	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	4	Defective work equipment controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			L05	Frame position	Voltage
			Between (22) and (21)	Normal	4.85 – 5.15 V
			Between (3) and (21)	Normal	0.46 – 4.54 V
				While machine is traveling straight	2.20 – 2.80 V
				Full steering to right	0.46 – 1.46 V
				Full steering to left	3.54 – 4.54 V

Circuit diagram related to frame angle sensor

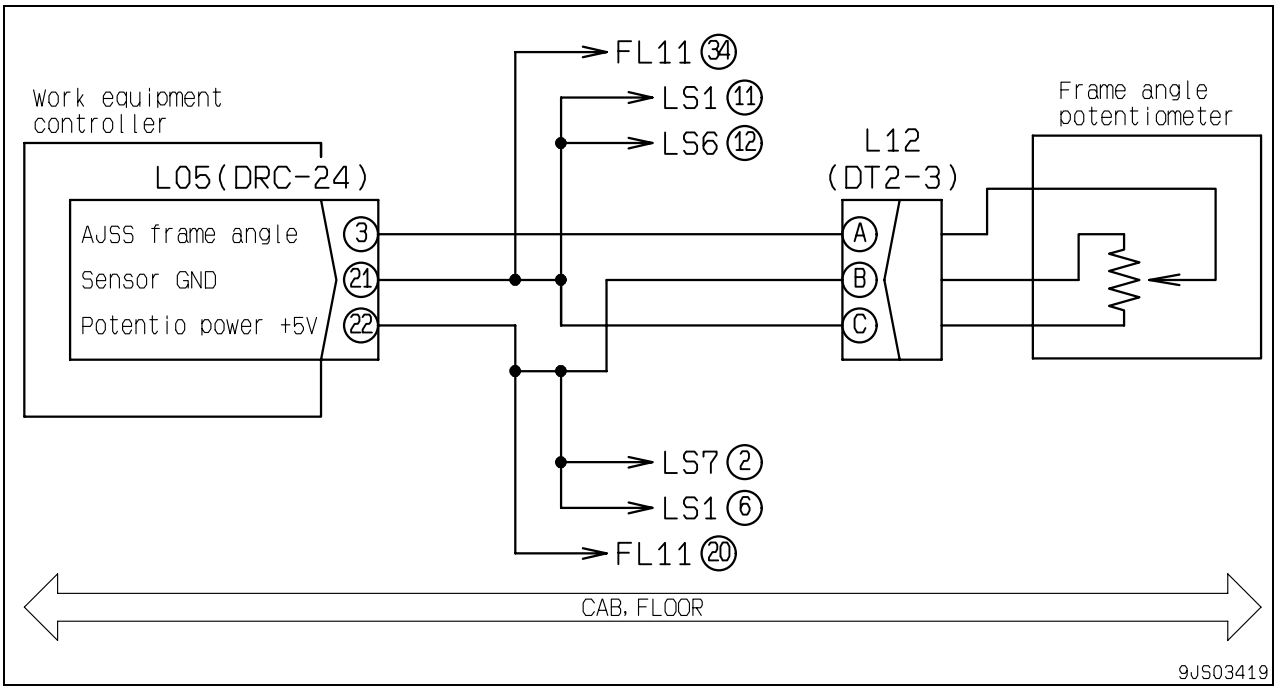


Failure code [DKD0KY] (Frame angle sensor: Short circuit with power supply line)

Action code	Failure code	Trouble	Frame angle sensor: Short circuit with power supply line (Work equipment controller system)
E01	**DKD0KY**		
Contents of trouble	• Due to hot short circuit in frame angle sensor system, the frame angle sensor signal voltage is outside the higher limit (frame angle sensor signal: Max. 4.7 V).		
Action of controller	• Stops the AJSS neutral safety function. • Controls AJSS EPC output to the level corresponding to 1.47 MPa {15 kg/cm^2}. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The engine can be started while AJSS lever is operated (The machine turns just after engine is started). • Steering fine control is not possible (the machine jounces when performing steering operation). • The winker cannot be automatically reset.		
Related information	• The input state (angle) from the frame angle sensor can be checked with the monitoring function (Code: 94400 FRAME ANGLE). • AJSS (if equipped) specification only • Method of reproducing failure code: Turn the starting switch ON. • This error is not displayed on a steering wheel specification machine. If it is displayed, select “NO ADD” AJSS option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective frame angle sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L12 (male)		Resistance	
			Between (B) and (C)		5 kΩ ± 20 %	
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ	
			★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L12	Frame	Voltage	
			Between (B) and (C)	Normal	4.85 – 5.15 V	
			Between (A) and (C)	Normal	0.46 – 4.54 V	
				While machine is traveling straight	2.20 – 2.80 V	
				Full steering to right	0.46 – 1.46 V	
				Full steering to left	3.54 – 4.54 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L05 (3) – L12 (female) (A)		Voltage	Max. 1 V
			Wiring harness between L05 (22) – L12 (female) (B), – circuit branch		Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L05	Frame position	Voltage	
			Between (22) and (21)	Normal	4.85 – 5.15 V	
			Between (3) and (21)	Normal	0.46 – 4.54 V	
				While machine is traveling straight	2.20 – 2.80 V	
				Full steering to right	0.46 – 1.46 V	
				Full steering to left	3.54 – 4.54 V	

Circuit diagram related to frame angle sensor



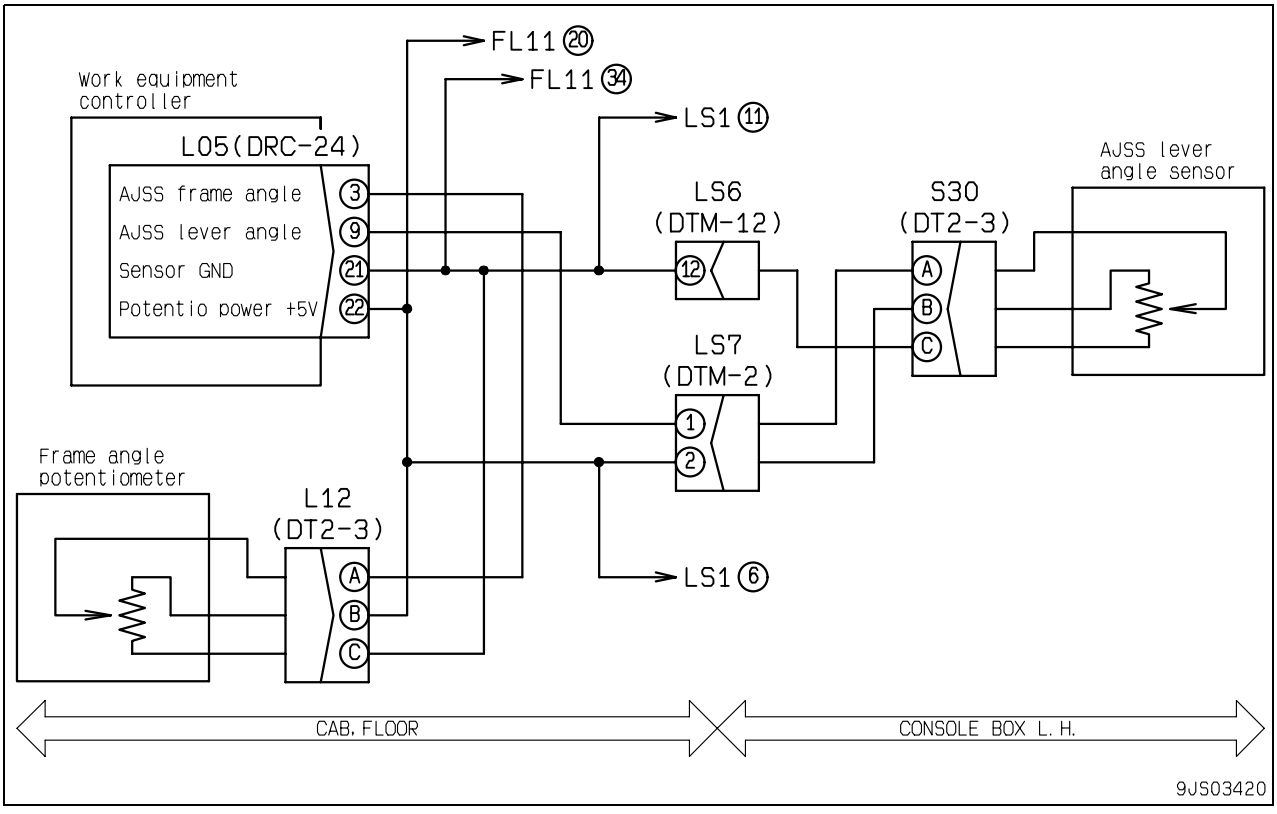
Failure code [DKD0KZ] (AJSS lever and frame angle sensor: Disconnection or short circuit)

Action code	Failure code	Trouble	AJSS angle sensor & frame angle sensor: Disconnection or short circuit) (Work equipment controller system)
E01	DKD0KZ		
Contents of trouble	• Due to displacement of the AJSS lever angle sensor and frame angle sensor, the AJSS lever position cannot be detected normally (steering deviation angle: Min. +25°).		
Action of controller	• Cannot recognize the ADJSS lever position correctly. • Stops the AJSS neutral safety function. • Controls AJSS EPC output to the level corresponding to 1.47 MPa {15 kg/cm^2}. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The engine can start even when the AJSS lever is not in neutral (the machine turns immediately after the engine starts). • The engine cannot start when the AJSS lever is in neutral. • Steering speed is different according to the steering direction, to the right or to the left. • The winker cannot be automatically reset.		
Related information	• The input state (angle) from the AJSS lever angle sensor can be checked with the monitoring function (Code: 94300 AJSS LEVER, Code: 74301 AJSS LEVER). • The input state (angle) from the frame angle sensor can be checked with the monitoring function (Code: 94400 FRAME ANGLE, Code: 94401 FRAME ANGLE). • The steering deviation angle can be checked with the monitoring function (Code: 94800 STEERING DEFLECTION). • AJSS (if equipped) specification only • Method of reproducing failure code: Turn the starting switch ON. • This error is not displayed on a steering wheel specification machine. If it is displayed, select “NO ADD” AJSS option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective frame angle sensor adjustment	★ The frame angle sensor adjustment may be defective. Check it directly. (See Testing and adjusting.)		
	2	Defective frame angle sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L12 (male)		Resistance
			Between (B) and (C)		5 kΩ ± 20 %
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ
			★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			L12	Frame	Voltage
			Between (B) and (C)	Normal	4.85 – 5.15 V
			Between (A) and (C)	Normal	0.46 – 4.54 V
				Lever in neutral	0.46 – 4.54 V
				Full steering to right	0.46 – 1.46 V
				Full steering to left	3.54 – 4.54 V
	3	Defective AJSS angle sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			S30 (male)		Resistance
			Between (B) and (C)		5 kΩ ± 20 %
			Between (A), (B), (C) and chassis ground		Min. 1 MΩ
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (steering lock)		
			S30	AJSS lever	Voltage
			Between (B) and (C)	Normal	4.85 – 5.15 V
			Between (A) and (C)	Normal	0.30 – 4.70 V
				Lever in neutral	2.20 – 2.80 V
				Full steering to right (straight travel)	2.83 – 3.83 V
				Full steering to left (straight travel)	1.17 – 2.17 V

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	4	Defective work equipment controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			L05	Frame	Voltage
			Between (22) and (21)	Normal	4.85 – 5.15 V
			Between (3) and (21)	Normal	0.46 – 4.54 V
				When lever is in neutral	2.20 – 2.80 V
				Full steering to right	0.46 – 1.46 V
				Full steering to left	3.54 – 4.54 V
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (steering lock)		
			L05	AJSS lever	Voltage
			Between (22) and (21)	Normal	4.85 – 5.15 V
			Between (9) and (21)	Normal	0.30 – 4.70 V
				When lever is in neutral	2.20 – 2.80 V
				Full steering to right (straight travel)	2.83 – 3.83 V
				Full steering to left (straight travel)	1.17 – 2.17 V

Circuit diagram related to AJSS lever angle sensor and frame angle sensor

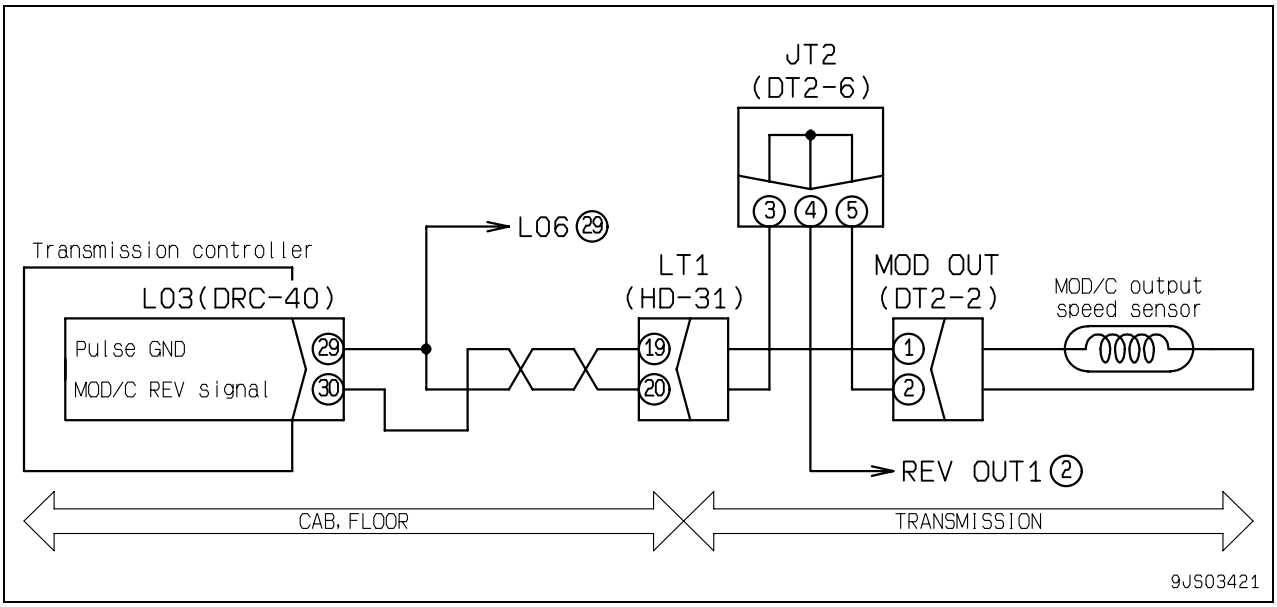


Failure code [DLFAKA] (Modulation clutch output shaft speed sensor: Disconnection)

Action code	Failure code	Trouble	Modulation clutch output shaft speed sensor: Disconnection (Transmission controller system)
E03	**DLFAKA**		
Contents of trouble	• Due to disconnection or hot short circuit in the modulation clutch output shaft speed sensor system, the modulation clutch output shaft speed sensor signal voltage is outside the higher limit. (Modulation clutch output shaft speed sensor signal voltage: Min. 1.5 V) • Signal from the modulation clutch output shaft speed sensor is 0 rpm.		
Action of controller	• Uses modulation clutch output immediately before abnormality occurs. • Stops modulation clutch control with the directional lever or directional selector switch in N (Neutral), and directly connect the modulation clutch. • If cause of failure disappears, system resets itself. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• The modulation clutch is directly connected once the directional lever or directional selector switch is placed in N (Neutral).		
Related information	• Method of reproducing failure code: Engine started + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective modulation clutch output shaft speed sensor adjustment	★ The modulation clutch output shaft speed sensor adjustment may be defective. Check it directly (see Testing and adjusting).			
	2	Defective modulation clutch output shaft speed sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			MOD OUT (male)	Resistance		
			Between (1) and (2)	500 – 1,000 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	3	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (29) – MOD OUT (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L03 (female) (30) – MOD OUT (female) (1)	Resistance	Max. 1 Ω	
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L03 (female) (30) – MOD OUT (female) (1)	Voltage	Max. 1 V	
	5	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L03 (female)	Resistance		
			Between (29) and (30)	500 – 1,000 Ω		
			Between (29), (30) and chassis ground	Min. 1 MΩ		

Circuit diagram related to modulation clutch output shaft speed sensor

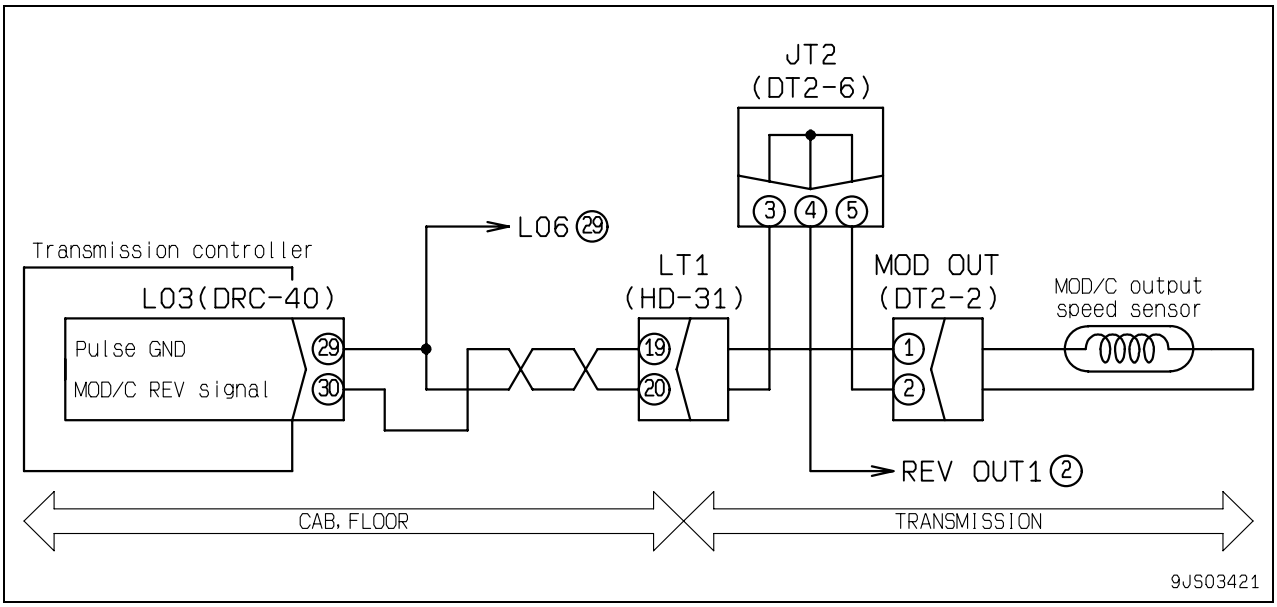


Failure code [DLFALC] (Modulation clutch output shaft speed sensor: Speed signals disagree)

Action code	Failure code	Trouble	Modulation clutch output shaft speed sensor: Speed signals disagree (Transmission controller system)
E03	**DLFALC**		
Contents of trouble	• Due to ground fault in the modulation clutch output shaft speed sensor, the modulation clutch output shaft speed sensor signal voltage is outside the lower limit. • This failure code appears under the following conditions. 1) Engine speed: Min. 700 rpm 2) Modulation clutch pressure: Min. 2 MPa {19.6 kg/cm^2} 3) Modulation clutch speed: 0 rpm 4) Modulation clutch speed sensor signal line: Disconnection is not detected		
Action of controller	• Uses modulation clutch output immediately before abnormality occurs. • Stops modulation clutch control with the directional lever or directional selector switch in N (Neutral), and directly connect the modulation clutch. • If cause of failure disappears, system resets itself. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• The modulation clutch is directly connected once the directional lever or directional selector switch is placed in N (Neutral).		
Related information	• Method of reproducing failure code: Engine started + Travel		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective modulation clutch output shaft speed sensor adjustment	★ The modulation clutch output shaft speed sensor adjustment may be defective. Check it directly (see Testing and adjusting).			
	2	Defective modulation clutch output shaft speed sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			MOD OUT (male)	Resistance		
			Between (1) and (2)	500 – 1,000 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (30) – MOD OUT (female) (1)	Resistance	Min. 1 MΩ	
	4	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L03 (female)	Resistance		
			Between (29) and (30)	500 – 1,000 Ω		
			Between (29), (30) and chassis ground	Min. 1 MΩ		

Circuit diagram related to modulation clutch output shaft speed sensor

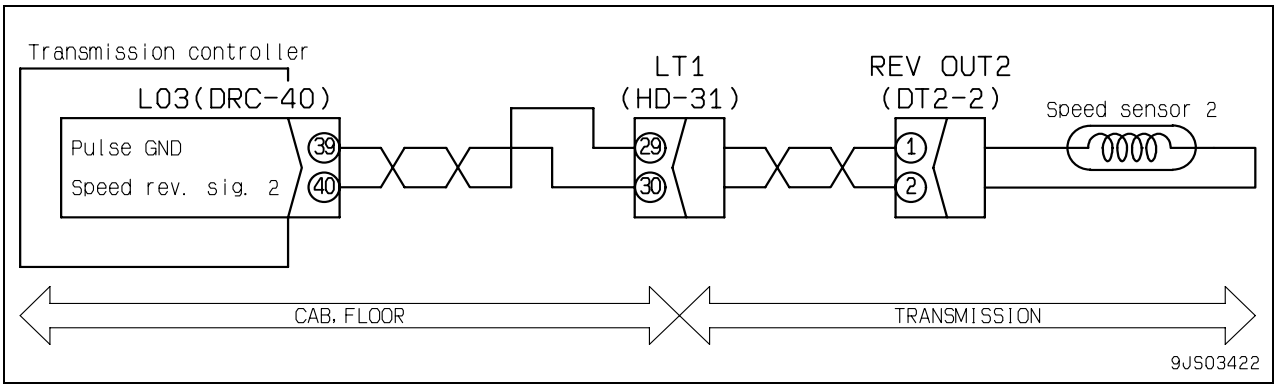


Failure code [DLT3KA] (Transmission output shaft speed sensor (2): Disconnection)

Action code	Failure code	Trouble	Transmission output shaft speed sensor (2): Disconnection (Transmission controller system)
E03	**DLT3KA**		
Contents of trouble	• Due to disconnection or hot short circuit in the transmission output shaft speed sensor (2), the transmission output shaft speed sensor (2) signal voltage is outside the higher limit. (Transmission output shaft speed sensor (2) signal: Min. 1.5 V) • Signal from the transmission output shaft speed sensor is 0 rpm.		
Action of controller	• When the transmission output shaft speed sensor (1) is normal: Performs control by the transmission output shaft speed sensor (1). • When abnormality (DLT4KB, DLT4KX) detection conditions excluding the detection time of the transmission output shaft speed sensor (1) are detected: 1) In the auto-shift mode, change the shift mode to the manual mode. 2) In the auto-shift mode, change the mode for transmitting signal to the machine monitor to the manual mode. • If cause of failure disappears, system resets itself. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	—		
Related information	• The input state (speed) from the transmission output shaft speed sensor (1) can be checked with the monitoring function (Code: 31400 T/M SPEED OUT). • The input state (speed) from the transmission output shaft speed sensor (2) can be checked with the monitoring function (Code: 31404 T/M SPEED OUT2). • Method of reproducing failure code: Engine started + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission output shaft speed sensor (2) adjustment	★ The transmission output shaft speed sensor (2) adjustment may be defective. Check it directly (see Testing and adjusting).			
	2	Defective transmission output shaft speed sensor (2) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			REV OUT2 (male)	Resistance		
			Between (1) and (2)	500 – 1,000 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	3	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (39) – REV OUT2 (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L03 (female) (40) – REV OUT2 (female) (1)	Resistance	Max. 1 Ω	
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L03 (female) (40) – REV OUT2 (female) (1)	Voltage	Max. 1 V	
	5	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L03	Resistance		
			Between (39) and (40)	500 – 1,000 Ω		
			Between (39), (40) and chassis ground	Min. 1 MΩ		

Circuit diagram related to transmission output shaft speed sensor (2)

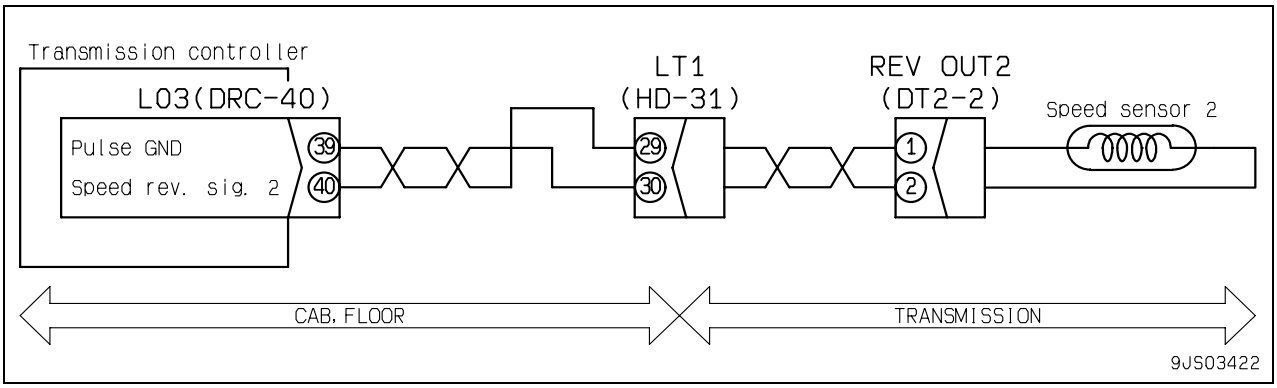


Failure code [DLT3LC] (Transmission output shaft speed sensor (2): Speed signals disagree)

Action code	Failure code	Trouble	Transmission output shaft speed sensor (2): Speed signals disagree (Transmission controller system)
E03	**DLT3LC**		
Contents of trouble	• Due to ground fault in the transmission output shaft speed sensor (2), the transmission output shaft speed sensor (2) signal voltage is outside the lower limit. • This failure code appears under the following conditions. 1) Transmission output shaft speed sensor (1): Min. 200 rpm 2) Transmission output shaft speed sensor (2): 0 rpm 3) Transmission clutch speed sensor (2) signal line: Disconnection is not detected.		
Action of controller	• When the transmission output shaft speed sensor (1) is normal: Performs control by the transmission output shaft speed sensor (1). • When abnormality (DLT4KB, DLT4KX) detection conditions excluding the detection time of the transmission output shaft speed sensor (1) are detected: 1) In the auto-shift mode, change the shift mode to the manual mode. 2) In the auto-shift mode, change the mode for transmitting signal to the machine monitor to the manual mode. • If cause of failure disappears, system resets itself. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	—		
Related information	• The input state (speed) from the transmission output shaft speed sensor (1) can be checked with the monitoring function (Code: 31400 T/M SPEED OUT). • The input state (speed) from the transmission output shaft speed sensor (2) can be checked with the monitoring function (Code: 31404 T/M SPEED OUT2). • Method of reproducing failure code: Engine started + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission output shaft speed sensor (2) adjustment	★ The transmission output shaft speed sensor (2) adjustment may be defective. Check it directly (see Testing and adjusting).			
	2	Defective transmission output shaft speed sensor (2) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			REV OUT2 (male)	Resistance		
			Between (1) and (2)	500 – 1,000 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (40) – REV OUT2 (female) (1)	Resistance	Min. 1 MΩ	
	4	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L03	Resistance		
			Between (39) and (40)	500 – 1,000 Ω		
			Between (39), (40) and chassis ground	Min. 1 MΩ		

Circuit diagram related to transmission output shaft speed sensor (2)

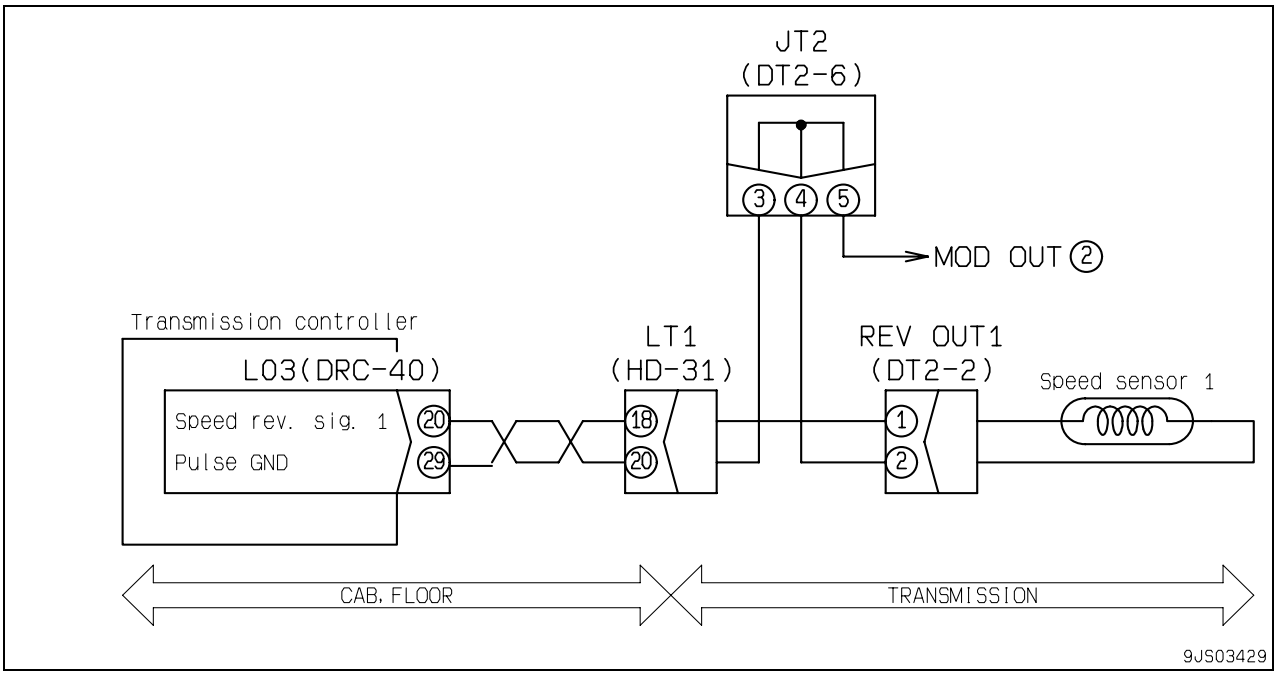


Failure code [DLT4KB] (Transmission output shaft speed sensor (1): Short circuit)

Action code	Failure code	Trouble	Transmission output shaft speed sensor (1): Short circuit (Transmission controller system)
E03	**DLT4KB**		
Contents of trouble	• Due to ground fault in the transmission output shaft speed sensor (1), the transmission output shaft speed sensor (1) signal voltage is outside the lower limit. • This failure code appears under the following conditions. 1) Transmission output shaft speed sensor (1): Min. 200 rpm 2) Transmission output shaft speed sensor (2): 0 rpm 3) Transmission clutch speed sensor (2) signal line: Disconnection is not detected.		
Action of controller	• When the transmission output shaft speed sensor (2) is normal: Performs control by the transmission output shaft speed sensor (2). • When abnormality (DLT3KA, DLT3LC) detection conditions excluding the detection time of the transmission output shaft speed sensor (2) are detected: 1) In the auto-shift mode, change the shift mode to the manual mode. 2) In the auto-shift mode, change the mode for transmitting signal to the machine monitor to the manual mode. • If cause of failure disappears, system resets itself. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	—		
Related information	• The input state (speed) from the transmission output shaft speed sensor (1) can be checked with the monitoring function (Code: 31400 T/M SPEED OUT). • The input state (speed) from the transmission output shaft speed sensor (2) can be checked with the monitoring function (Code: 31404 T/M SPEED OUT2). • Method of reproducing failure code: Engine started + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission output shaft speed sensor (1) adjustment	★ The transmission output shaft speed sensor (1) adjustment may be defective. Check it directly (see Testing and adjusting).			
	2	Defective transmission output shaft speed sensor (1) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			REV OUT1 (male)	Resistance		
			Between (1) and (2)	500 – 1,000 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	3	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (20) – REV OUT1 (female) (1)	Resistance	Min. 1 MΩ	
	4	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L03	Resistance		
			Between (20) and (29)	500 – 1,000 Ω		
			Between (20), (29) and chassis ground	Min. 1 MΩ		

Circuit diagram related to transmission output shaft speed sensor (1)

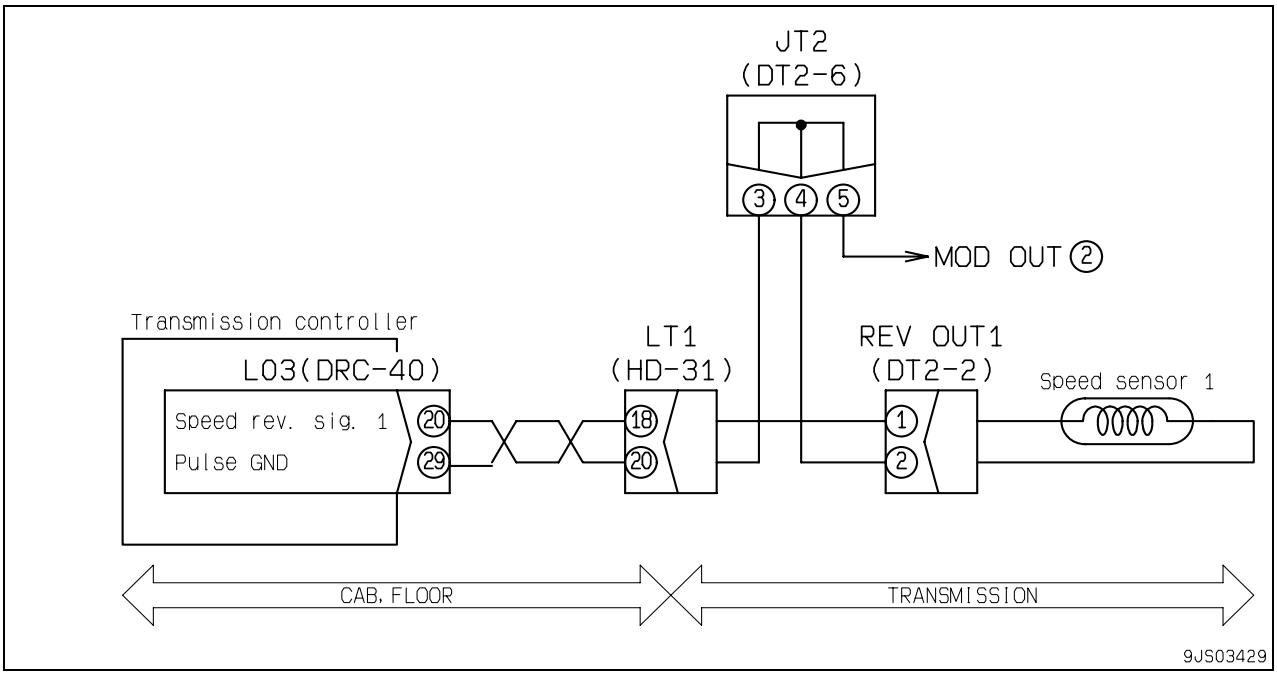


Failure code [DLT4KX] (Transmission output shaft speed sensor (1): Out of input signal range)

Action code	Failure code	Trouble	Transmission output shaft speed sensor (1): Out of input signal range (Transmission controller system)
E03	**DLT4KX**		
Contents of trouble	• Due to disconnection or hot short circuit in the transmission output shaft speed sensor (1), the transmission output shaft speed sensor (1) signal voltage is outside the higher limit. (Transmission output shaft speed sensor (1) signal: Min. 1.5 V) • Signal from the transmission output shaft speed sensor is 0 rpm.		
Action of controller	• When the transmission output shaft speed sensor (2) is normal: Performs control by the transmission output shaft speed sensor (2). • When abnormality (DLT3KA, DLT3LC) detection conditions excluding the detection time of the transmission output shaft speed sensor (2) are detected: 1) In the auto-shift mode, change the shift mode to the manual mode. 2) In the auto-shift mode, change the mode for transmitting signal to the machine monitor to the manual mode. • If cause of failure disappears, system resets itself. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	—		
Related information	• The input state (speed) from the transmission output shaft speed sensor (1) can be checked with the monitoring function (Code: 31400 T/M SPEED OUT). • The input state (speed) from the transmission output shaft speed sensor (2) can be checked with the monitoring function (Code: 31404 T/M SPEED OUT2). • Method of reproducing failure code: Engine started + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission output shaft speed sensor (1) adjustment	★ The transmission output shaft speed sensor (2) adjustment may be defective. Check it directly (see Testing and adjusting).			
	2	Defective transmission output shaft speed sensor (1) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			REV OUT1 (male)	Resistance		
			Between (1) and (2)	500 – 1,000 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	3	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L03 (female) (20) – REV OUT1 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between L03 (female) (29) – REV OUT1 (female) (2)	Resistance	Max. 1 Ω	
	4	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L03 (female) (20) – REV OUT1 (female) (1)	Voltage	Max. 1 V	
	5	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L03	Resistance		
			Between (20) and (29)	500 – 1,000 Ω		
			Between (20), (29) and chassis ground	Min. 1 MΩ		

Circuit diagram related to transmission output shaft speed sensor (1)

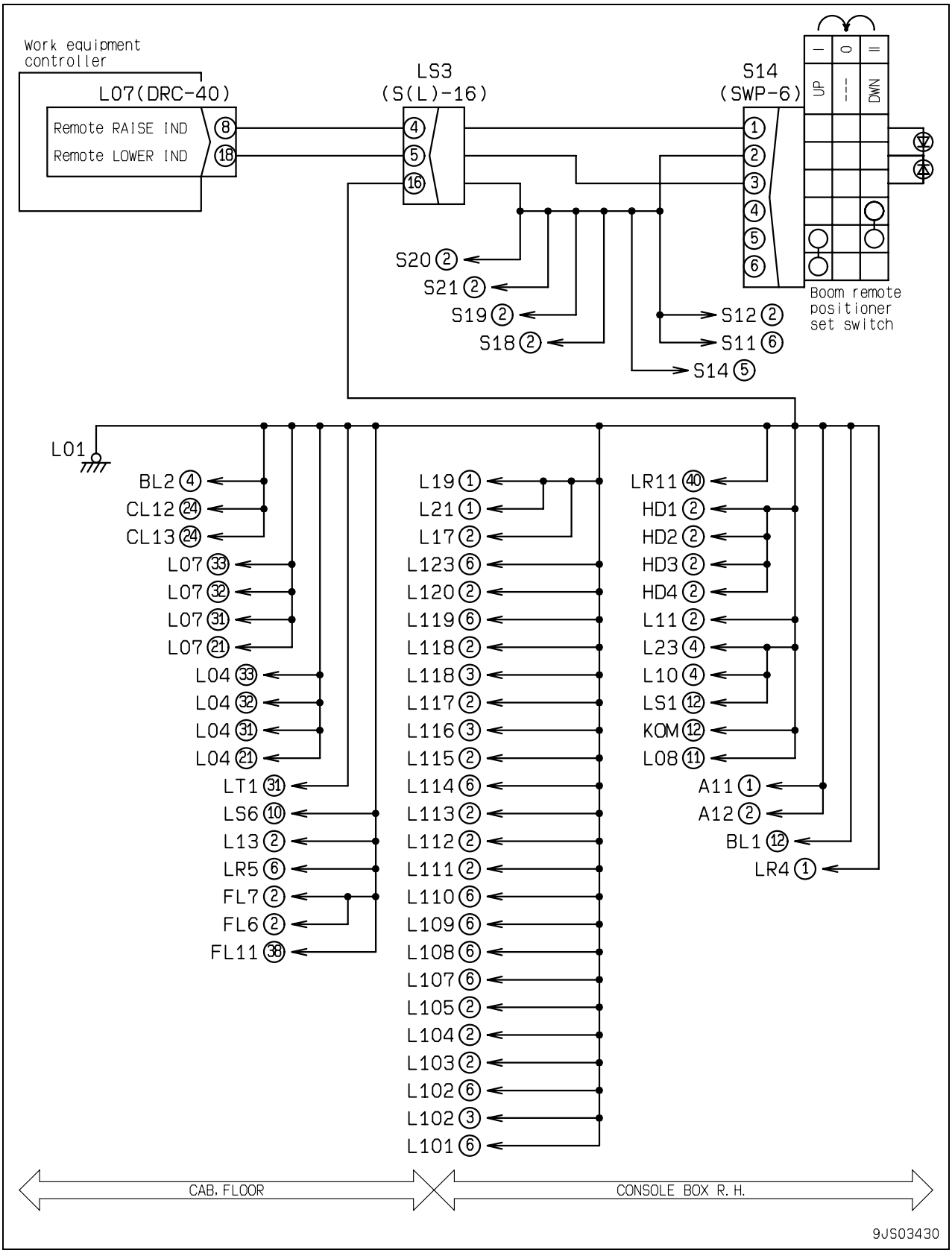


Failure code [DUM1KB] (Remote positioner raise indicator lamp: Short circuit)

Action code	Failure code	Trouble	Remote positioner raise indicator lamp: Short circuit (Work equipment controller system)
—	**DUM1KB**		
Contents of trouble	• Since the remote positioner raise indicator lamp system is shorted with the chassis ground, the signal is not output to the indicator lamp.		
Action of controller	• Turns off the remote positioner raise indicator output. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The remote positioner raise indicator lamp does not light up.		
Related information	• The output state (ON/OFF) to the remote positioner raise lamp can be checked with the monitoring function (Code: 40954 D-OUT-18). • Method of reproducing failure code: Engine started		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective remote positioner raise indicator lamp (light-emitting diode) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. (See inspection procedure for diode)			
			S14 (male)		Resistance	
			Between (2) and (1)		Min. 1 MΩ (No continuity)	
			Between (1), (2) and chassis ground		Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (8) – S14 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	Remote positioner raise		Voltage
			Between (8) and chassis ground	When used		20 – 30 V
				When not used		Max. 1 V

Circuit diagram related to remote positioner raise/lower indicator lamp

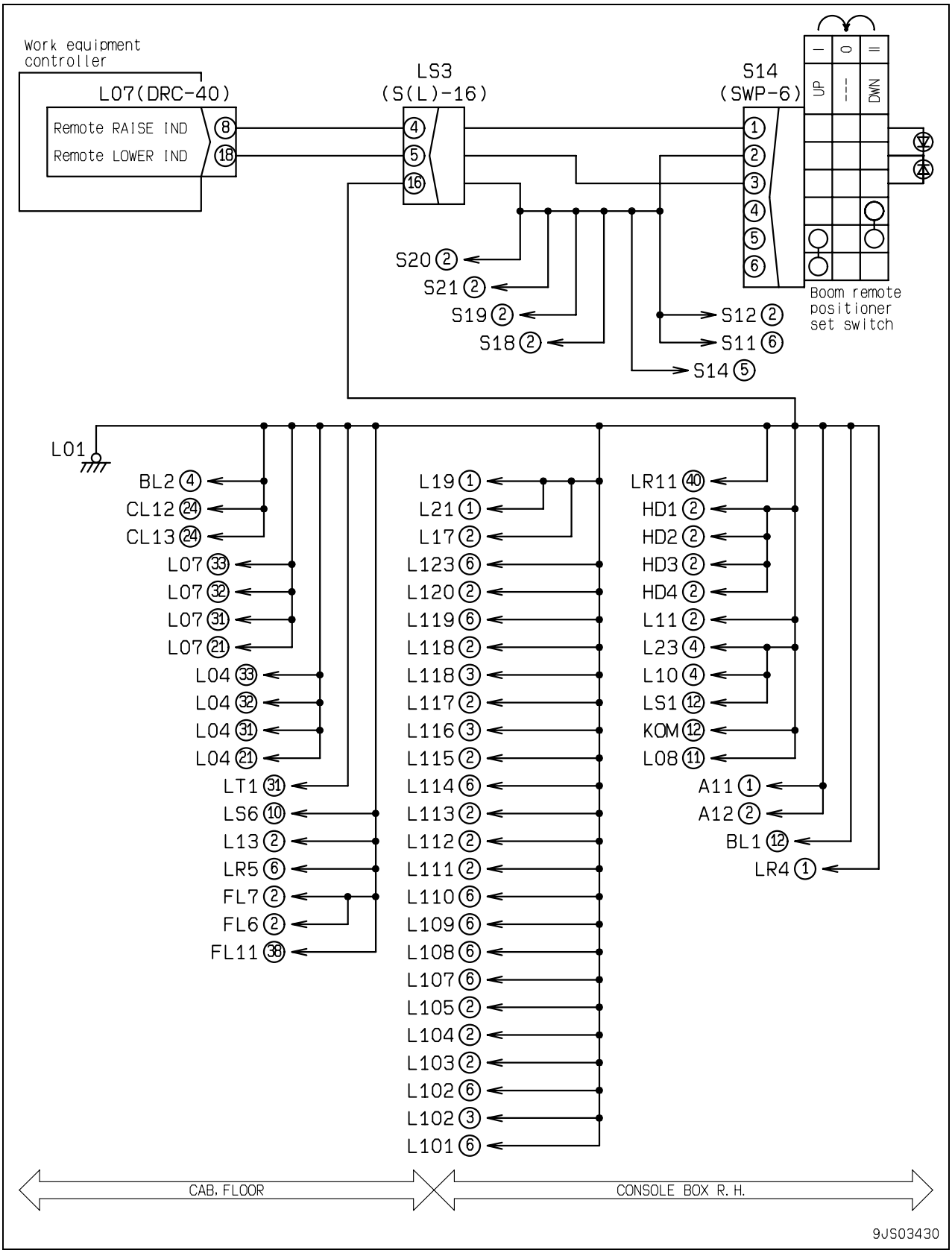


Failure code [DUM2KB] (Remote positioner lower indicator lamp: Short circuit)

Action code	Failure code	Trouble	Remote positioner lower indicator lamp: Short circuit (Work equipment controller system)
—	**DUM2KB**		
Contents of trouble	• Since the remote positioner lower indicator lamp system is shorted with the chassis ground, the signal is not output to the indicator lamp.		
Action of controller	• Turns off the remote positioner lower indicator output. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The remote positioner lower indicator lamp does not light up.		
Related information	• The output state (ON/OFF) to the remote positioner lower lamp can be checked with the monitoring function (Code: 40954 D-OUT-19). • Method of reproducing failure code: Engine started + lift arm lower		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective remote positioner lower indicator lamp (light-emitting diode) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. (See inspection procedure for diode)			
			S14 (male)		Resistance	
			Between (2) and (3)		Min. 1 MΩ (No continuity)	
			Between (2), (3) and chassis ground		Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (18) – S14 (female) (3)		Resistance	Min. 1 MΩ
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	Remote positioner raise		Voltage
			Between (18) and chassis ground	When used		20 – 30 V
				When not used		Max. 1 V

Circuit diagram related to remote positioner raise/lower indicator lamp

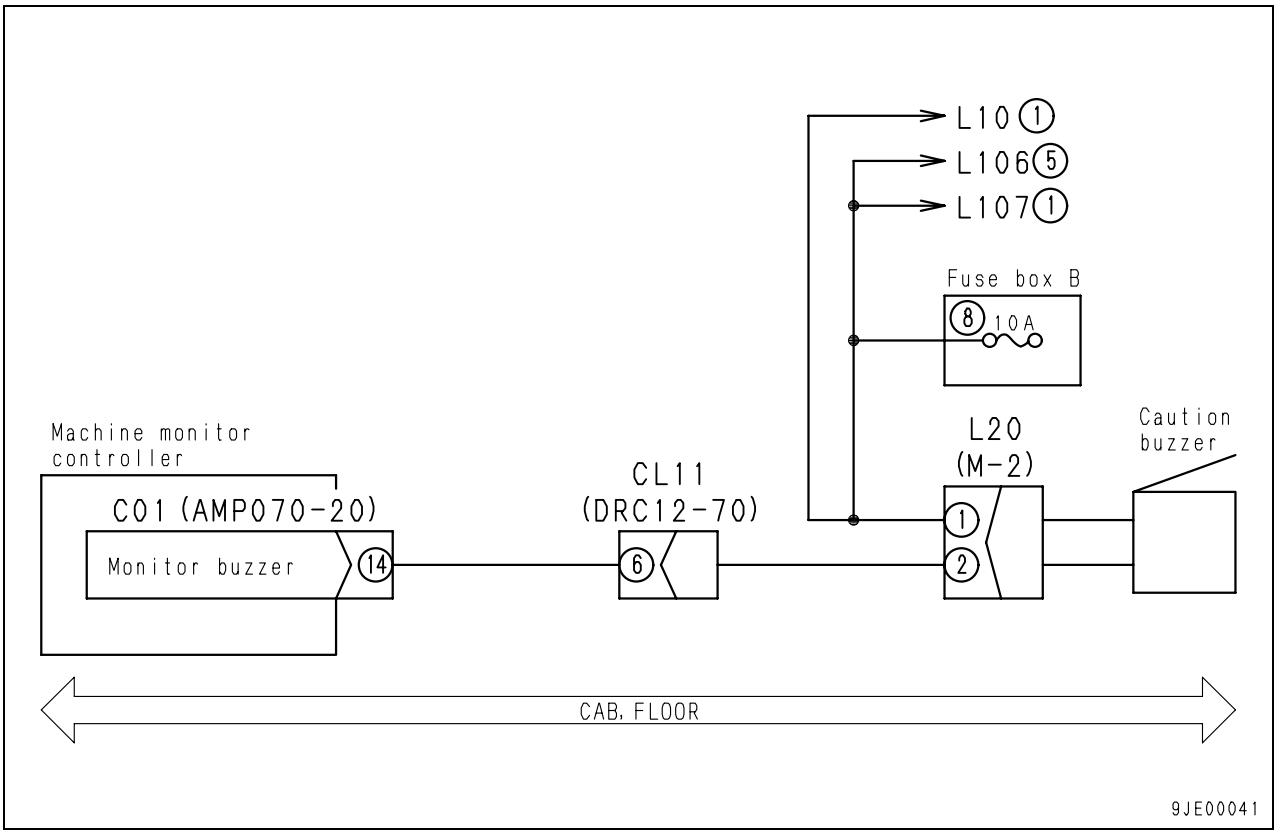


Failure code [DV00KB] (Alarm buzzer: Short circuit)

Action code	Failure code	Trouble	Alarm buzzer: Short circuit (Machine monitor system)
E01	**DV00KB**		
Contents of trouble	• The alarm buzzer output circuit is shorted with the power supply line.		
Action of controller	• Stops alarm buzzer output. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Alarm buzzer does not sound.		
Related information	• The output state (ON/OFF) to the alarm buzzer can be checked with the monitoring function (Code: 40952, D-OUT-0). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective alarm buzzer (Internal short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L20 (female)	Starting switch	Voltage	
			Between (1) and chassis ground	ON	20 – 30 V	
			Between (1) and (2)	For 2 sec after ON (Alarm buzzer sounds)	20 – 30 V	
				For 3 sec from 2 sec after ON (Alarm buzzer does not sound)	Max. 1 V	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between C01 (female) (14) – L20 (female) (2)		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C01	Starting switch	Voltage	
			Between (14) and chassis ground	ON	20 – 30 V	
				For 2 sec after ON (Alarm buzzer sounds)	Max. 1 V	
				For 3 sec from 2 sec after ON (Alarm buzzer does not sound)	20 – 30 V	

Circuit diagram related to alarm buzzer

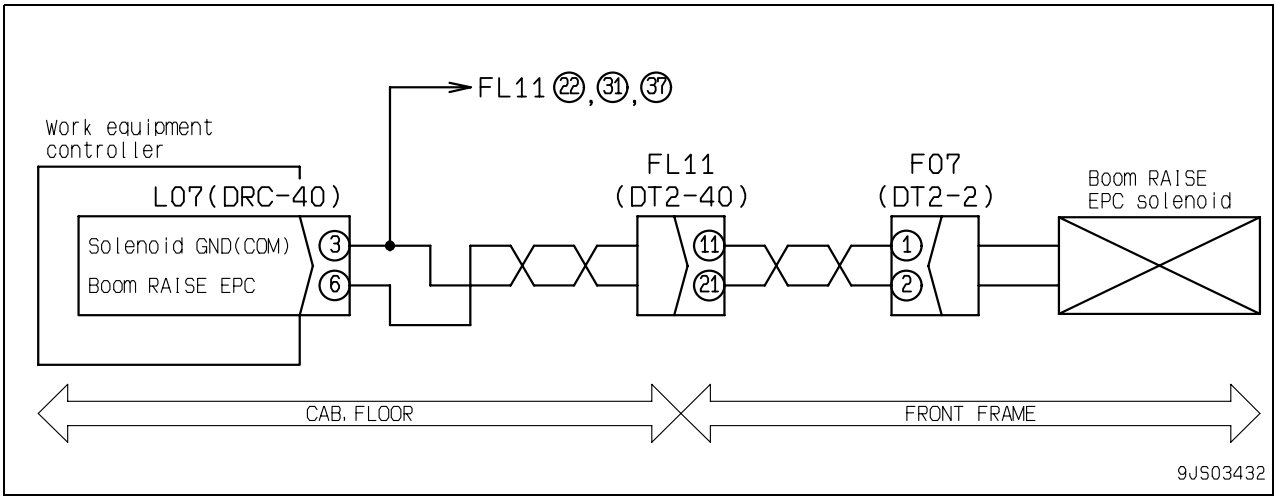


Failure code [DW4PKA] (Lift arm raise EPC solenoid: Disconnection)

Action code	Failure code	Trouble	Lift arm raise EPC solenoid: Disconnection (Work equipment controller system)
E03	**DW4PKA**		
Contents of trouble	• Since the lift arm raise EPC solenoid output signal system is disconnected, no current flows when the lift arm raise EPC solenoid output is ON.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Lift arm does not rise		
Related information	• The output state (current) to the lift arm raise EPC solenoid can be checked with the monitoring function (Code: 41900 RAISE EPC DIR). • Method of reproducing failure code: Engine started + lift arm raise		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective lift arm raise EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F07 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L07 (female) (6) – F07 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between L07 (female) (3) – F07 (female) (2)	Resistance	Max. 1 Ω
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (6) and (3)	5 – 15 Ω	

Circuit diagram related to lift arm raise EPC solenoid

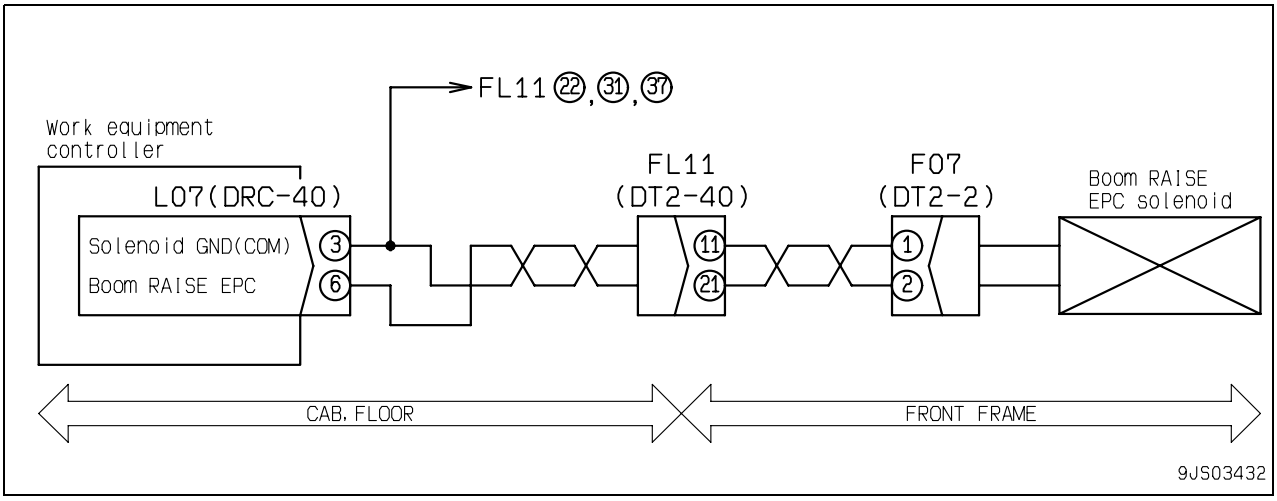


Failure code [DW4PKB] (Lift arm raise EPC solenoid: Short circuit)

Action code	Failure code	Trouble	Lift arm raise EPC solenoid: Short circuit (Work equipment controller system)
E03	**DW4PKB**		
Contents of trouble	• Since the lift arm raise EPC solenoid signal system was shorted with the chassis ground, abnormal current flowed when the lift arm raise EPC solenoid output was ON.		
Action of controller	• Stops outputting the signal to the lift arm raise EPC solenoid. • Stops outputting the signal to the lift arm raise detent. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Lift arm does not rise		
Related information	• The output state (current) to the lift arm raise EPC solenoid can be checked with the monitoring function (Code: 41900 RAISE EPC DIR). • Method of reproducing failure code: Engine started + lift arm raise		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm raise EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F07 (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (6) – F07 (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L07 (female)	Resistance		
			Between (6) and (3)	5 – 15 Ω		
			Between (6), (3) and chassis ground	Min. 1 MΩ		

Circuit diagram related to lift arm raise EPC solenoid

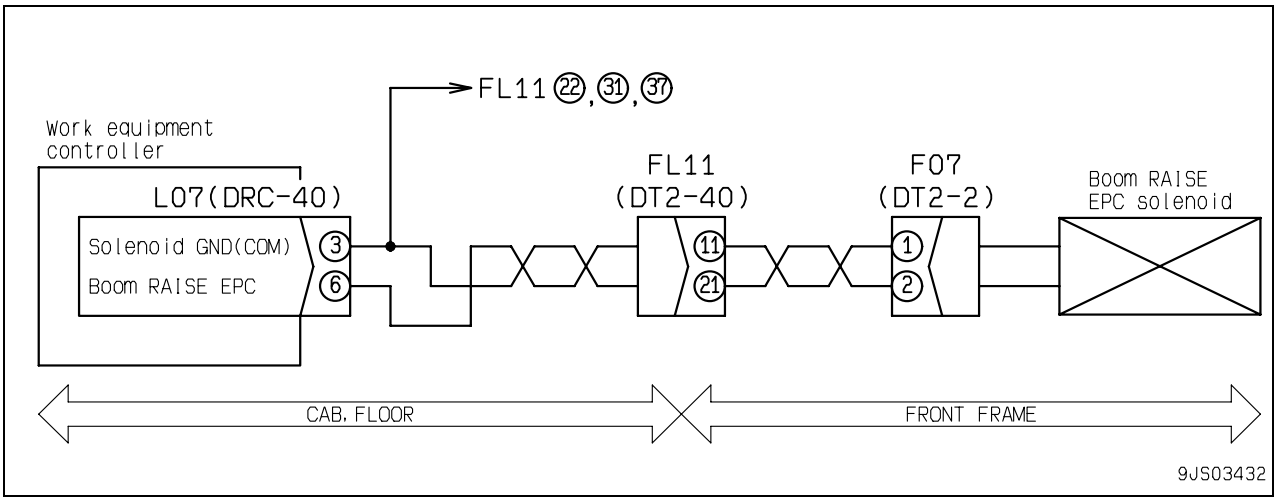


Failure code [DW4PKY] (Lift arm raise EPC solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	Lift arm raise EPC solenoid: Short circuit with power supply line (Work equipment controller system)
E03	**DW4PKY**		
Contents of trouble	• Since the lift arm raise EPC solenoid signal system was shorted with the power source, abnormal voltage was applied when the lift arm raise EPC solenoid output was OFF.		
Action of controller	• Turns the output to the work equipment neutral lock solenoid ON. • Stops outputting the signal to the lift arm raise/lower, bucket tilt/dump, 3-spool valve (attachment) extract/retract EPC solenoid. • Stops outputting the signal to all work equipment detent. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• When work equipment neutral lock solenoid is turned ON, all the work equipment do not work. • The lift arm raise EPC solenoid may be burnt out.		
Related information	• The output state (current) to the lift arm raise EPC solenoid can be checked with the monitoring function (Code: 41900 RAISE EPC DIR). • The output state (current) to the lift arm lower EPC solenoid can be checked with the monitoring function (Code: 41901 LOWER EPC DIR). • The output state (current) to the bucket tilt EPC solenoid can be checked with the monitoring function (Code: 41902 TILT EPC DIR). • The output state (current) to the bucket dump EPC solenoid can be checked with the monitoring function (Code: 41903 DUMP EPC DIR). • The output state (current) to the 3-spool valve (attachment) extract EPC solenoid can be checked with the monitoring function (Code: 41906, 3RD EPC1 DIR). • The output state (current) to the 3-spool valve (attachment) retract EPC solenoid can be checked with the monitoring function (Code: 41907, 3RD EPC2 DIR). • Method of reproducing failure code: Engine started		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective lift arm raise EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F07 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L07 (female) (6) – F07 (female) (1)	Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (6) and (3)	5 – 15 Ω	
			Between (6), (3) and chassis ground	Min. 1 MΩ	

Circuit diagram related to lift arm raise EPC solenoid

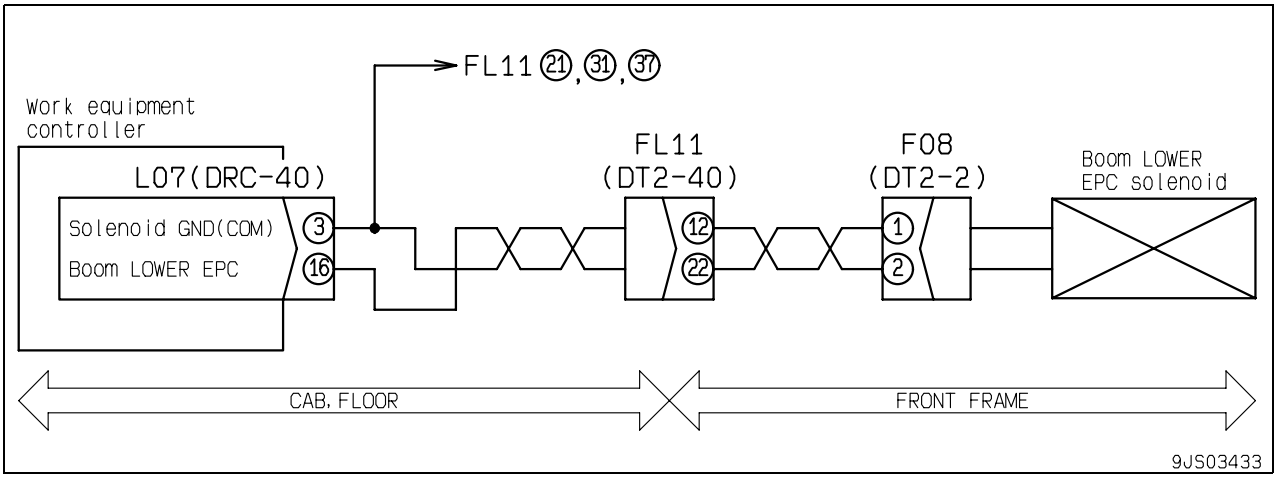


Failure code [DW4QKA] (Lift arm lower EPC solenoid: Disconnection)

Action code	Failure code	Trouble	Lift arm lower EPC solenoid: Disconnection (Work equipment controller system)
E03	**DW4QKA**		
Contents of trouble	• Since the lift arm lower EPC solenoid output signal system is disconnected, no current flows when the lift arm lower EPC solenoid output is ON.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Lift arm does not lower.		
Related information	• The output state (current) to the lift arm lower EPC solenoid can be checked with the monitoring function (Code: 41901 LOWER EPC DIR). • Method of reproducing failure code: Start engine and lower the lift arm.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective lift arm lower EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F08 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L07 (female) (16) – F08 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between L07 (female) (3) – F08 (female) (2)	Resistance	Max. 1 Ω
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (16) and (3)	5 – 15 Ω	

Circuit diagram related to lift arm lower EPC solenoid

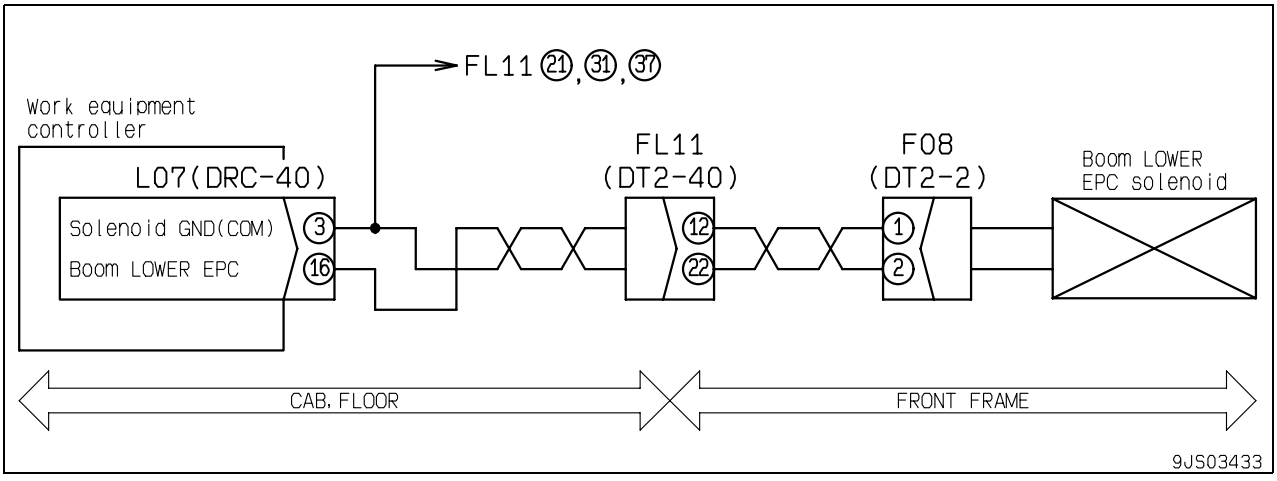


Failure code [DW4QKB] (Lift arm lower EPC solenoid: Short circuit)

Action code	Failure code	Trouble	Lift arm lower EPC solenoid: Short circuit (Work equipment controller system)
E03	**DW4QKB**		
Contents of trouble	• Since the lift arm lower EPC solenoid signal system was shorted with the chassis ground, abnormal current flowed when the lift arm lower EPC solenoid output was ON.		
Action of controller	• Stops outputting the signal to the lift arm lower EPC solenoid. • Stops outputting the signal to the lift arm float magnet detent. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Lift arm does not lower.		
Related information	• The output state (current) to the lift arm lower EPC solenoid can be checked with the monitoring function (Code: 41901 LOWER EPC DIR). • Method of reproducing failure code: Engine started + lift arm lower		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm lower EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F08 (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (16) – F08 (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L07 (female)	Resistance		
			Between (16) and (3)	5 – 15 Ω		
			Between (16), (3) and chassis ground	Min. 1 MΩ		

Circuit diagram related to lift arm lower EPC solenoid

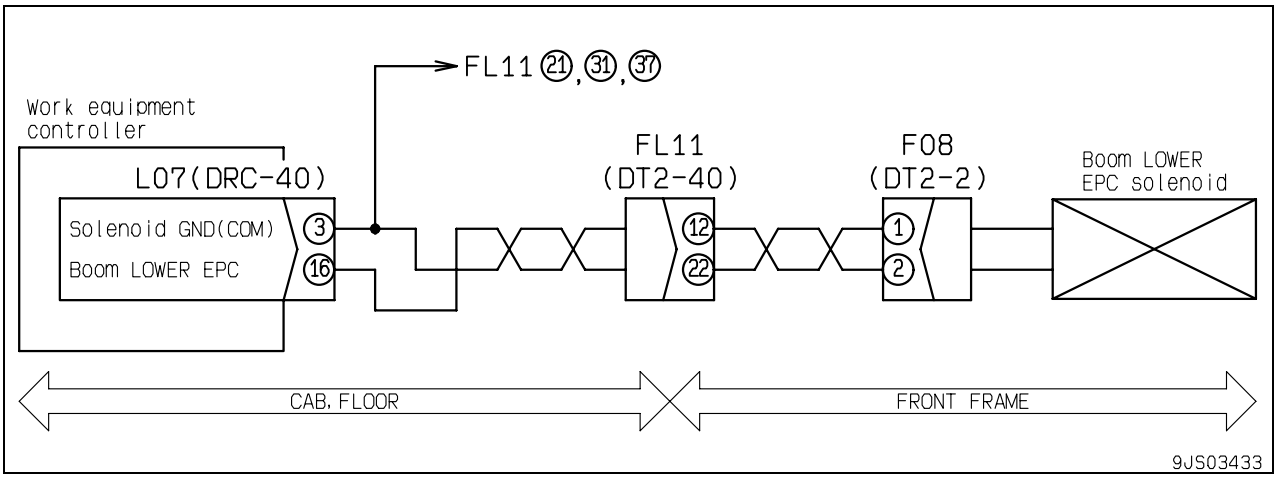


Failure code [DW4QKY] (Lift arm lower EPC solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	Lift arm lower EPC solenoid: Short circuit with power supply line (Work equipment controller system)
E03	**DW4QKY**		
Contents of trouble	• Since the lift arm lower EPC solenoid signal system was shorted with the power source, abnormal voltage was applied when the lift arm lower EPC solenoid output was OFF.		
Action of controller	• Turns the output to the work equipment neutral lock solenoid ON. • Stops outputting the signal to the lift arm raise/lower, bucket tilt/dump, 3-spool valve (attachment) extract/retract EPC solenoid. • Stops outputting the signal to all work equipment detent. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• When work equipment neutral lock solenoid is turned ON, all the work equipment do not work. • The lift arm lower EPC solenoid may be burnt out.		
Related information	• The output state (current) to the lift arm raise EPC solenoid can be checked with the monitoring function (Code: 41900 RAISE EPC DIR). • The output state (current) to the lift arm lower EPC solenoid can be checked with the monitoring function (Code: 41901 LOWER EPC DIR). • The output state (current) to the bucket tilt EPC solenoid can be checked with the monitoring function (Code: 41902 TILT EPC DIR). • The output state (current) to the bucket dump EPC solenoid can be checked with the monitoring function (Code: 41903 DUMP EPC DIR). • The output state (current) to the 3-spool valve (attachment) extract EPC solenoid can be checked with the monitoring function (Code: 41906, 3RD EPC1 DIR). • The output state (current) to the 3-spool valve (attachment) retract EPC solenoid can be checked with the monitoring function (Code: 41907, 3RD EPC2 DIR). • Method of reproducing failure code: Engine started		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective lift arm lower EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F08 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L07 (female) (16) – F08 (female) (1)	Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (16) and (3)	5 – 15 Ω	
			Between (16), (3) and chassis ground	Min. 1 MΩ	

Circuit diagram related to lift arm lower EPC solenoid

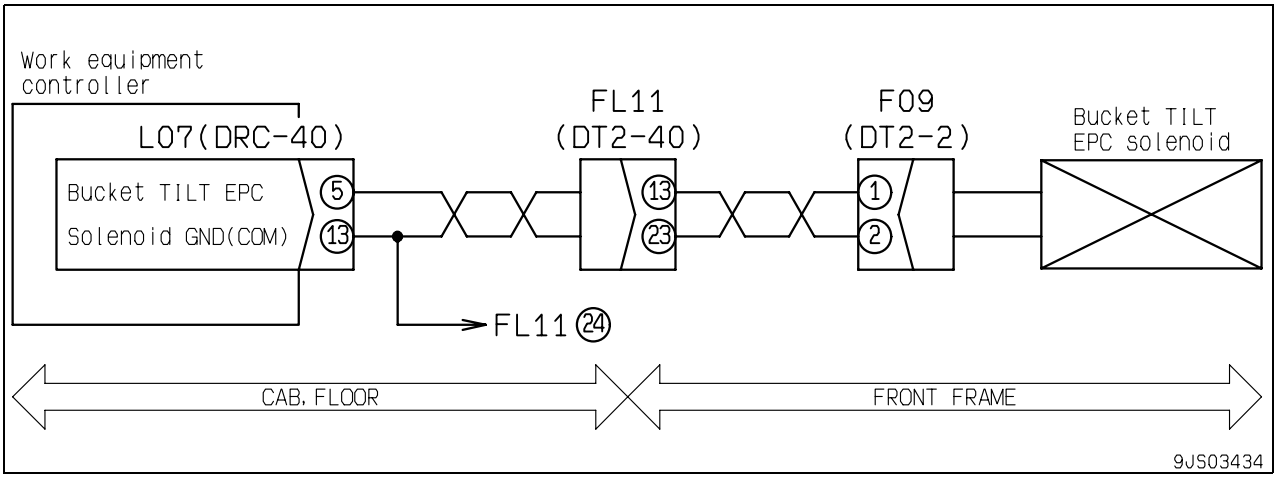


Failure code [DW4RKA] (Bucket tilt EPC solenoid: Disconnection)

Action code	Failure code	Trouble	Bucket tilt EPC solenoid: Disconnection (Work equipment controller system)
E03	**DW4RKA**		
Contents of trouble	• Since the bucket tilt EPC solenoid output signal output signal system is disconnected, no current flows when the bucket tilt EPC solenoid output is ON.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Bucket does not tilt.		
Related information	• The output state (current) to the bucket tilt EPC solenoid can be checked with the monitoring function (Code: 41902 TILT EPC DIR). • Method of reproducing failure code: Engine started + bucket tilt		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective bucket tilt EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F09 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L07 (female) (5) – F09 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between L07 (female) (13) – F09 (female) (2)	Resistance	Max. 1 Ω
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (5) and (13)	5 – 15 Ω	

Circuit diagram related to bucket tilt EPC solenoid

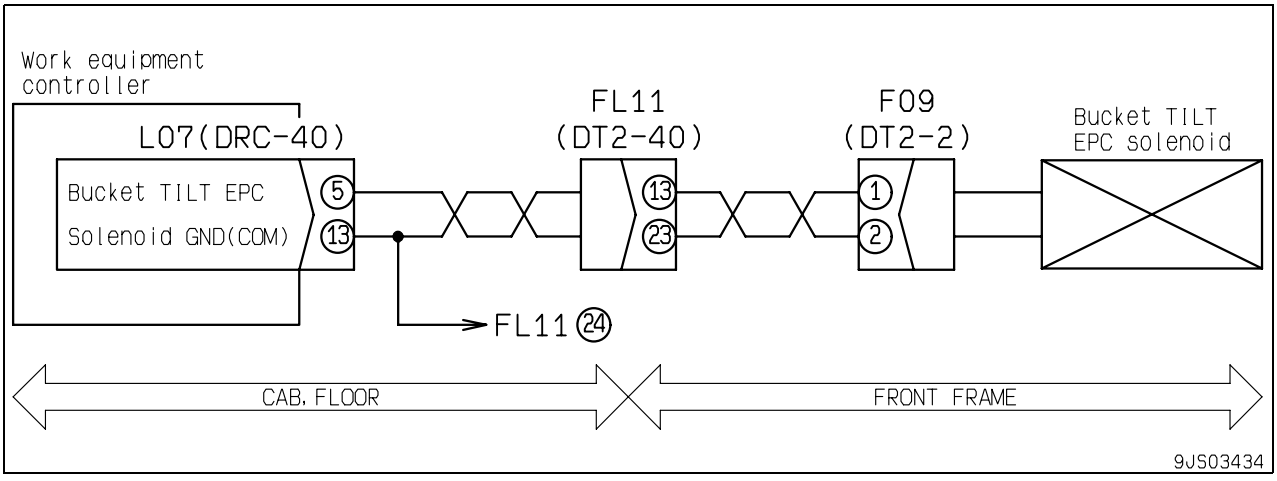


Failure code [DW4RKB] (Bucket tilt EPC solenoid: Short circuit)

Action code	Failure code	Trouble	Bucket tilt EPC solenoid: Short circuit (Work equipment controller system)
E03	**DW4RKB**		
Contents of trouble	• Since the bucket tilt EPC solenoid signal system was shorted with the chassis ground, abnormal current flowed when the bucket tilt EPC solenoid output was ON.		
Action of controller	• Stops outputting the signal to the bucket tilt EPC solenoid. • Stops outputting the signal to the bucket tilt detent. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Bucket does not tilt. • The wiring harness or controller may be burnt out.		
Related information	• The output state (current) to the bucket tilt EPC solenoid can be checked with the monitoring function (Code: 41902 TILT EPC DIR). • Method of reproducing failure code: Start engine and tilt the bucket.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective bucket tilt EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F09 (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (5) – F09 (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L07 (female)	Resistance		
			Between (5) and (13)	5 – 15 Ω		
			Between (5), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to bucket tilt EPC solenoid

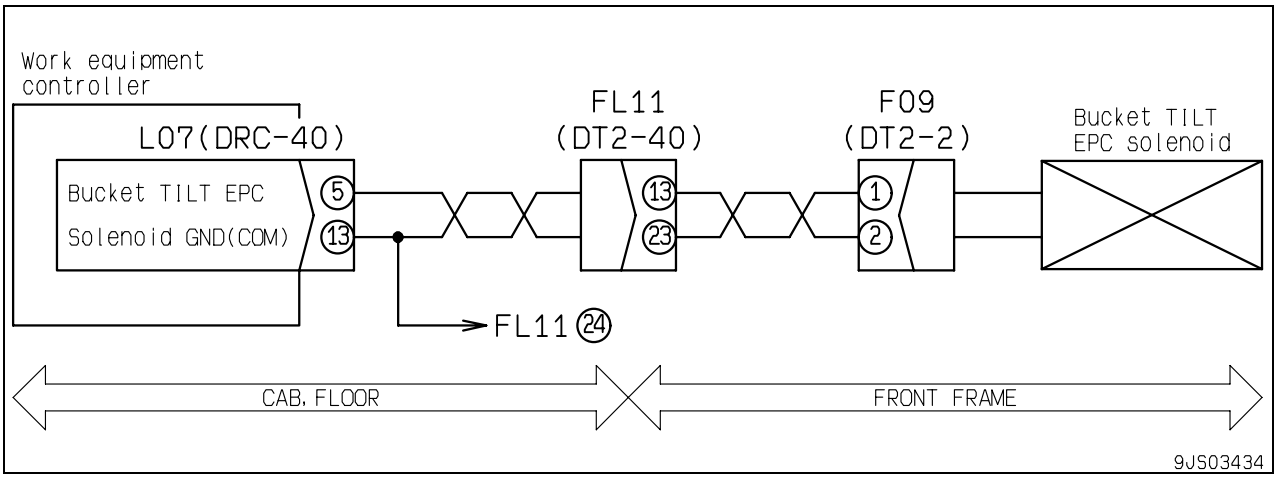


Failure code [DW4RKY] (Bucket tilt EPC solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	Bucket tilt EPC solenoid: Short circuit with power supply line (Work equipment controller system)
E03	**DW4RKY**		
Contents of trouble	• Since the bucket tilt EPC solenoid signal system was shorted with the power source, abnormal voltage was applied when the bucket tilt EPC solenoid output was OFF.		
Action of controller	• Turns the output to the work equipment neutral lock solenoid ON. • Stops outputting the signal to the lift arm raise/lower, bucket tilt/dump, 3-spool valve (attachment) extract/retract EPC solenoid. • Stops outputting the signal to all work equipment detent. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• When the work equipment neutral lock solenoid is turned ON, all the work equipment do not work. • The bucket tilt EPC solenoid may be burnt out.		
Related information	• The output state (current) to the lift arm raise EPC solenoid can be checked with the monitoring function (Code: 41900 RAISE EPC DIR). • The output state (current) to the lift arm lower EPC solenoid can be checked with the monitoring function (Code: 41901 LOWER EPC DIR). • The output state (current) to the bucket tilt EPC solenoid can be checked with the monitoring function (Code: 41902 TILT EPC DIR). • The output state (current) to the bucket dump EPC solenoid can be checked with the monitoring function (Code: 41903 DUMP EPC DIR). • The output state (current) to the 3-spool valve (attachment) extract EPC solenoid can be checked with the monitoring function (Code: 41906, 3RD EPC1 DIR). • The output state (current) to the 3-spool valve (attachment) retract EPC solenoid can be checked with the monitoring function (Code: 41907, 3RD EPC2 DIR). • Method of reproducing failure code: Start engine		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective bucket tilt EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F09 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L07 (female) (5) – F09 (female) (1)	Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (5) and (13)	5 – 15 Ω	
			Between (5), (13) and chassis ground	Min. 1 MΩ	

Circuit diagram related to bucket tilt EPC solenoid

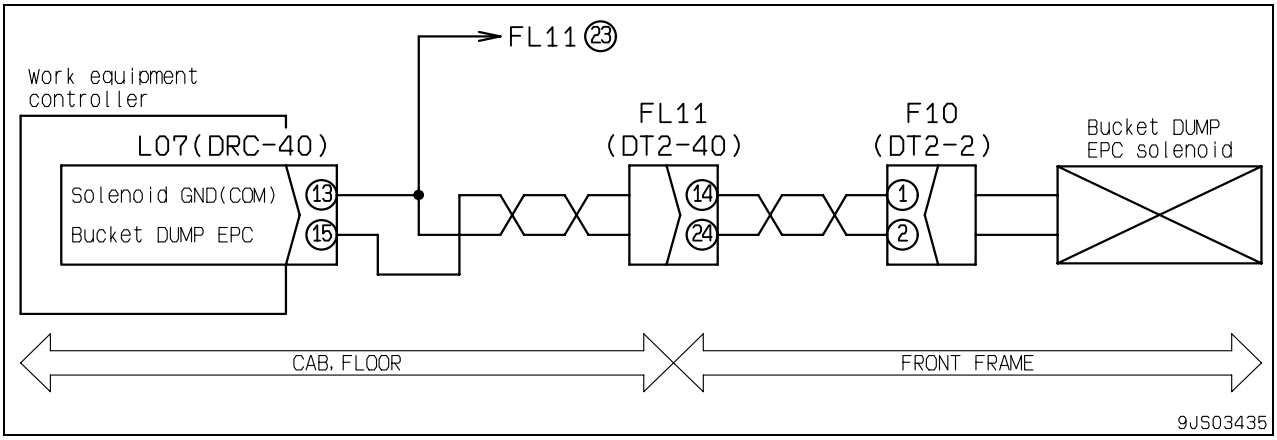


Failure code [DW4SKA] (Bucket dump EPC solenoid: Disconnection)

Action code	Failure code	Trouble	Bucket dump EPC solenoid: Disconnection (Work equipment controller system)
E03	**DW4SKA**		
Contents of trouble	• Since the bucket dump EPC solenoid output signal system is disconnected, no current flows when the bucket dump EPC solenoid output is ON.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Bucket does not dump.		
Related information	• The output state (current) to the bucket dump EPC solenoid can be checked with the monitoring function (Code: 41903 DUMP EPC DIR). • Method of reproducing failure code: Engine started + bucket dump		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective bucket dump EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F10 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L07 (female) (15) – F10 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between L07 (female) (13) – F10 (female) (2)	Resistance	Max. 1 Ω
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (15) and (13)	5 – 15 Ω	

Circuit diagram related to bucket dump EPC solenoid

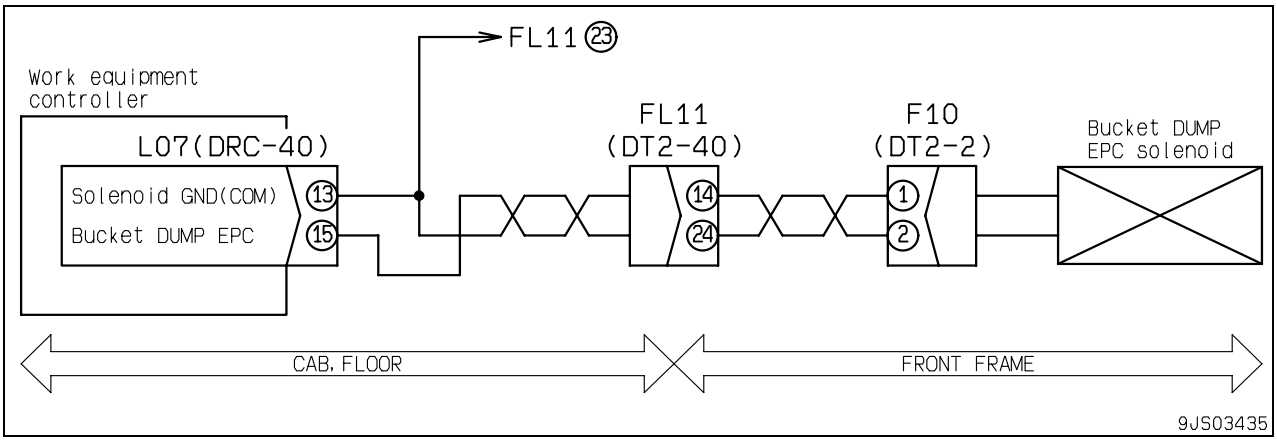


Failure code [DW4SKB] (Bucket dump EPC solenoid: Short circuit)

Action code	Failure code	Trouble	Bucket dump EPC solenoid: Short circuit (Work equipment controller system)
E03	**DW4SKB**		
Contents of trouble	• Since the bucket dump EPC solenoid signal system was shorted with the chassis ground, abnormal current flowed when the bucket dump EPC solenoid output was ON.		
Action of controller	• Stops outputting the signal to the bucket dump EPC solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Bucket does not dump. • The wiring harness or controller may be burnt out.		
Related information	• The output state (current) to the bucket dump EPC solenoid can be checked with the monitoring function (Code: 41903 DUMP EPC DIR). • Method of reproducing failure code: Start engine and dump the bucket.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective bucket dump EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F10 (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (15) – F10 (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L07 (female)	Resistance		
			Between (15) and (13)	5 – 15 Ω		
			Between (15), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to bucket dump EPC solenoid

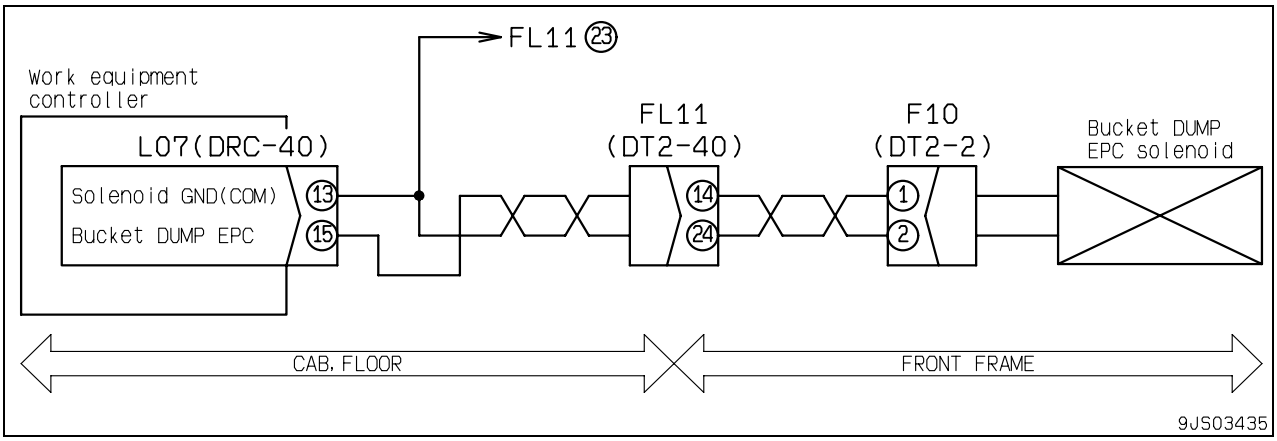


Failure code [DW4SKY] (Bucket dump EPC solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	Bucket dump EPC solenoid: Short circuit with power supply line (Work equipment controller system)
E03	**DW4SKY**		
Contents of trouble	• Since the bucket dump EPC solenoid signal system was shorted with the power source, abnormal voltage was applied when the bucket dump EPC solenoid output was OFF.		
Action of controller	• Turns the output to the work equipment neutral lock solenoid ON. • Stops outputting the signal to the lift arm raise/lower, bucket dump/tilt, 3-spool valve (attachment) extract/retract EPC solenoid. • Stops outputting the signal to all work equipment detent. • Turns the centralized warning lamp and alarm buzzer ON. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• When work equipment neutral lock solenoid is turned ON, all the work equipment do not work. • The bucket dump EPC solenoid may be burnt out.		
Related information	• The output state (current) to the lift arm raise EPC solenoid can be checked with the monitoring function (Code: 41900 RAISE EPC DIR). • The output state (current) to the lift arm lower EPC solenoid can be checked with the monitoring function (Code: 41901 LOWER EPC DIR). • The output state (current) to the bucket tilt EPC solenoid can be checked with the monitoring function (Code: 41902 TILT EPC DIR). • The output state (current) to the bucket dump EPC solenoid can be checked with the monitoring function (Code: 41903 DUMP EPC DIR). • The output state (current) to the 3-spool valve (attachment) extract EPC solenoid can be checked with the monitoring function (Code: 41906, 3RD EPC1 DIR). • The output state (current) to the 3-spool valve (attachment) retract EPC solenoid can be checked with the monitoring function (Code: 41907, 3RD EPC2 DIR). • Method of reproducing failure code: Engine started		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective bucket dump EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F10 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L07 (female) (15) – F10 (female) (1)	Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (15) and (13)	5 – 15 Ω	
			Between (15), (13) and chassis ground	Min. 1 MΩ	

Circuit diagram related to bucket dump EPC solenoid

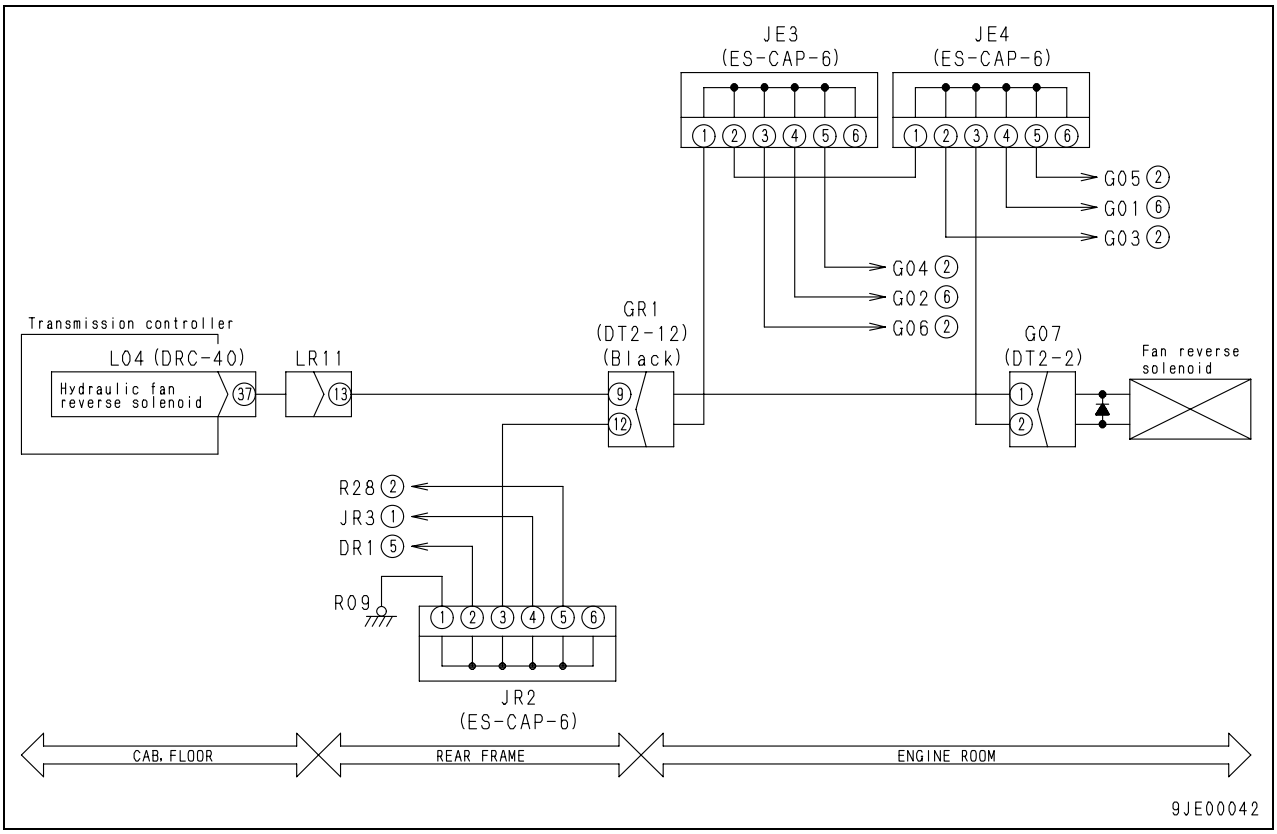


Failure code [DW7BKA] (Fan reverse solenoid: Disconnection)

Action code	Failure code	Trouble	Fan reverse solenoid: Disconnection (Transmission controller system)
E01	**DW7BKA**		
Contents of trouble	• Since the fan reverse solenoid system is disconnected, no current flows when the fan reverse solenoid output is ON.		
Action of controller	• Disables the automatic fan reverse function (if equipped). • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The automatic fan reverse function is disabled in the case of automatic fan reverse function (if equipped) specification.		
Related information	• The output state (ON/OFF) to the fan reverse solenoid can be checked with the monitoring function (Code: 40949, D-OUT-3). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fan reverse solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			G07 (male)	Resistance	
			Between (1) and (2)	35 – 45 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L04 (female) (37) – G07 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between G07 (female) (2) and chassis ground	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (37) and chassis ground	35 – 45 Ω	

Circuit diagram related to fan reverse solenoid

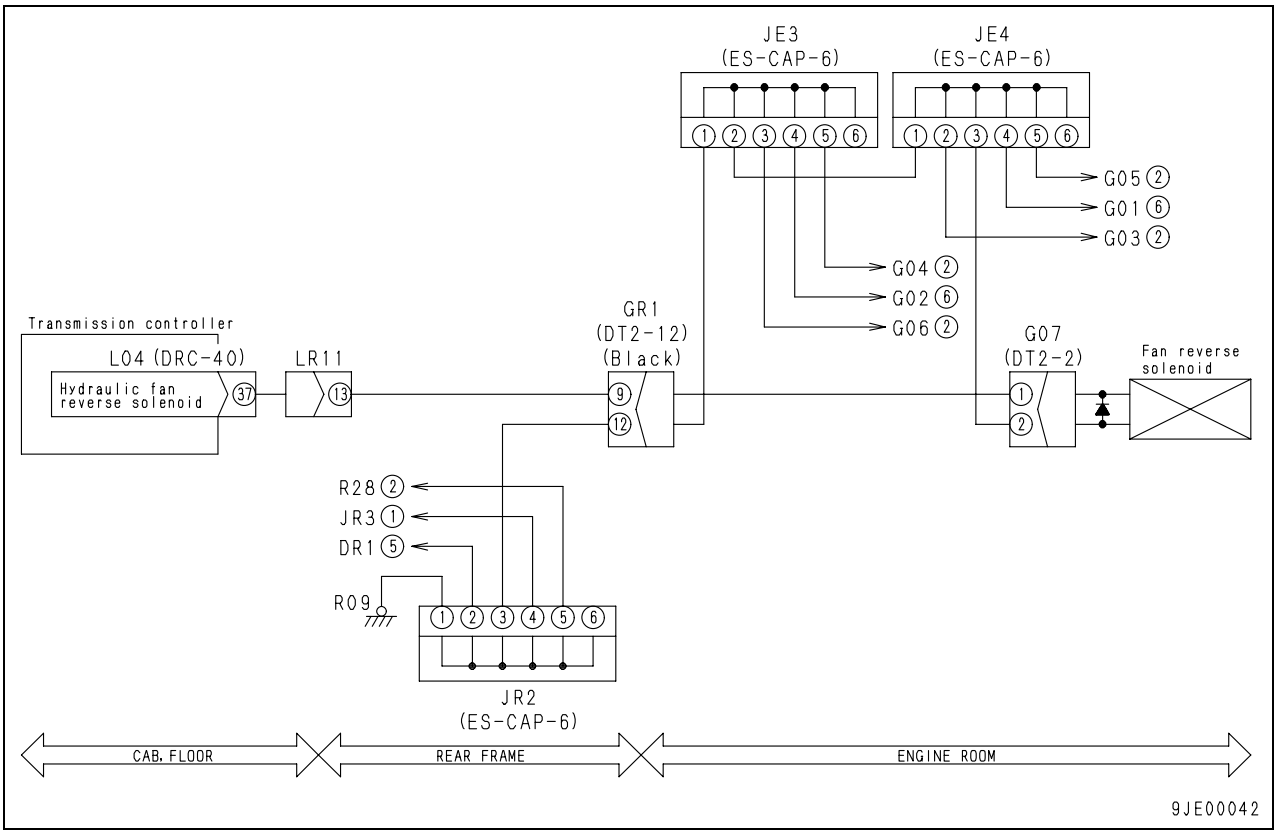


Failure code [DW7BKB] (Fan reverse solenoid: Short circuit)

Action code	Failure code	Trouble	Fan reverse solenoid: Short circuit (Transmission controller system)
E01	**DW7BKB**		
Contents of trouble	• Since the fan reverse solenoid system was short circuited, abnormal current flowed when the fan reverse solenoid output was ON.		
Action of controller	• Turns the output to the fan reverse solenoid OFF. • Disables the automatic fan reverse function (if equipped). • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The fan cannot turn in reverse by operating the fan reverse switch. • The automatic fan reverse function is disabled in the case of automatic fan reverse function (if equipped) specification.		
Related information	• The output state (ON/OFF) to the fan reverse solenoid can be checked with the monitoring function (Code: 40949, D-OUT-3). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fan reverse solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			G07 (male)	Resistance		
			Between (1) and (2)	35 – 45 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (37) – G07 (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (37) and chassis ground	35 – 45 Ω		

Circuit diagram related to fan reverse solenoid

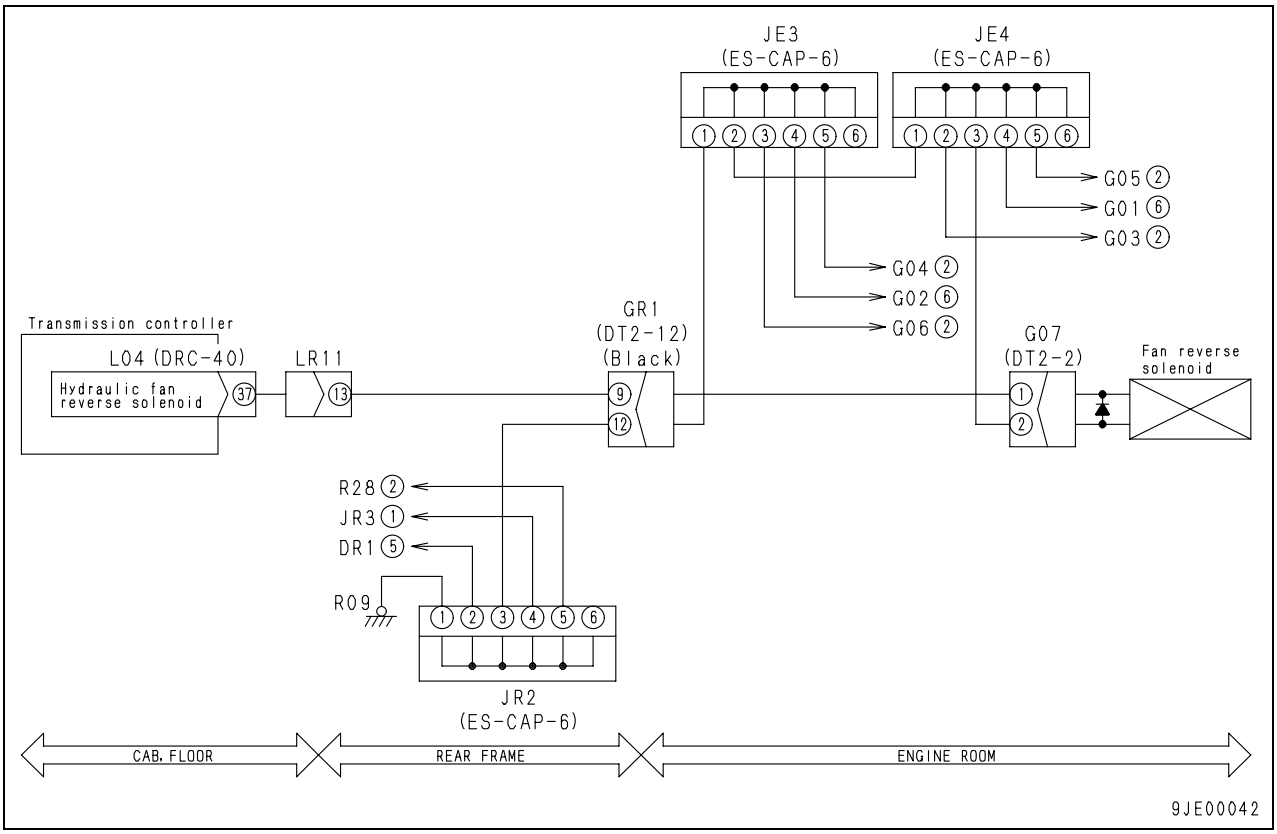


Failure code [DW7BKY] (Fan reverse solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	Fan reverse solenoid: Short circuit with power supply line (Transmission controller system)
E01	**DW7BKY**		
Contents of trouble	• Since the fan reverse solenoid system was shorted with the power source, abnormal voltage was applied when the fan reverse switch output was OFF.		
Action of controller	• Disables the automatic fan reverse function (if equipped). • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The automatic fan reverse function is disabled in the case of automatic fan reverse function (if equipped) specification.		
Related information	• The output state (ON/OFF) to the fan reverse solenoid can be checked with the monitoring function (Code: 40949, D-OUT-3). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fan reverse solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			G07 (male)	Resistance	
			Between (1) and (2)	35 – 45 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L04 (female) (37) – G07 (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (37) and chassis ground	35 – 45 Ω	

Circuit diagram related to fan reverse solenoid



Failure code [DW7DKA] (Hydraulic drive fan neutral solenoid: Disconnection)

Action code	Failure code	Trouble	Hydraulic drive fan neutral solenoid: Disconnection (Transmission controller system)
E01	**DW7DKA**		
Contents of trouble	• A hydraulic drive fan neutral solenoid error was detected.		
Action of controller	• None in particular.		
Problem that appears on machine	—		
Related information	• The hydraulic drive fan neutral solenoid is not set in WA600-6.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Optional setting may be improper. Referring to “11. Optional device selecting function” in “Special functions of machine monitor (EMMS)” in “Testing and adjusting”, check that AUTO RE FAN is set to “NO ADD”.	

Failure code [DW7DKB] (Hydraulic drive fan neutral solenoid: Short circuit)

Action code	Failure code	Trouble	Hydraulic drive fan neutral solenoid: Short circuit (Transmission controller system)
E01	**DW7DKB**		
Contents of trouble	• A hydraulic drive fan neutral solenoid error was detected.		
Action of controller	• None in particular.		
Problem that appears on machine	—		
Related information	• The hydraulic drive fan neutral solenoid is not set in WA600-6.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Optional setting may be improper. Referring to “11. Optional device selecting function” in “Special functions of machine monitor (EMMS)” in “Testing and adjusting”, check that AUTO RE FAN is set to “NO ADD”.	

Failure code [DW7DKY] (Hydraulic drive fan neutral solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	Hydraulic drive fan neutral solenoid: Short circuit with power supply line (Transmission controller system)
E01	**DW7DKY**		
Contents of trouble	• A hydraulic drive fan neutral solenoid error was detected.		
Action of controller	• None in particular.		
Problem that appears on machine	—		
Related information	• The hydraulic drive fan neutral solenoid is not set in WA600-6.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Optional setting may be improper.	Referring to “11. Optional device selecting function” in “Special functions of machine monitor (EMMS)” in “Testing and adjusting”, check that AUTO RE FAN is set to “NO ADD”.

WA600-6 Wheel loader

Form No. SEN00572-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

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Failure code [DWN6KB] (Lift arm raise magnet detent solenoid: Short circuit) 12
Failure code [DWN6KY] (Lift arm raise magnet detent solenoid: Short circuit with power supply line) 14
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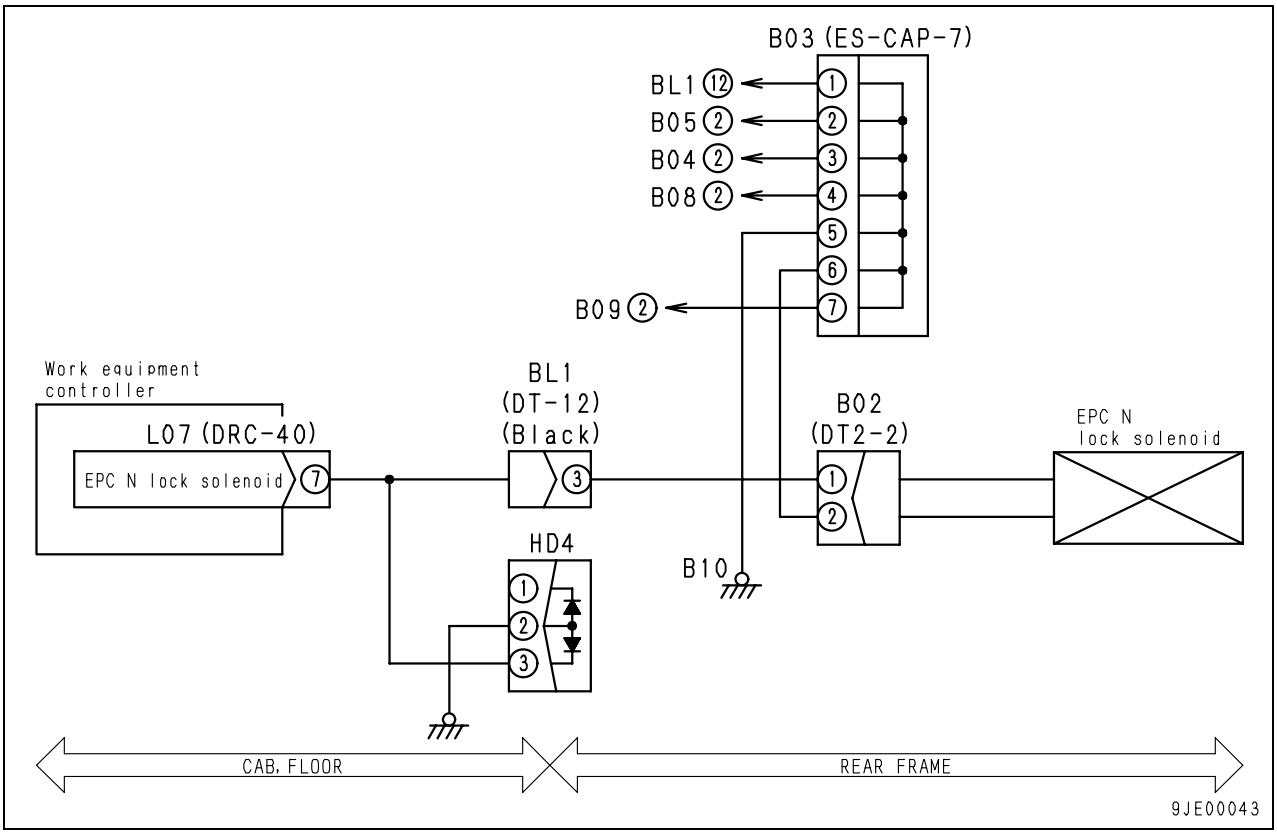
Troubleshooting by failure code (Display of code), Part 10

Failure code [DWM1KA] (Work equipment neutral lock solenoid: Disconnection)

Action code	Failure code	Trouble	Work equipment neutral lock solenoid: Disconnection (Work equipment controller system)
E01	**DWM1KA**		
Contents of trouble	• Since the work equipment neutral lock solenoid system is disconnected, no current flows when the work equipment neutral lock solenoid output is ON.		
Action of controller	• Stops outputting the signal to the work equipment EPC solenoid according to an input signal from the work equipment lock lever. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Each work equipment EPC solenoid lock normally works according to an input signal from the work equipment lock lever.		
Related information	• The output state (ON/OFF) to the work equipment neutral lock solenoid can be checked with the monitoring function (Code: 40952, D-OUT-0). • Method of reproducing failure code: Turn the starting switch ON and move the work equipment lock lever to the LOCK position.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective work equipment neutral lock solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			B02 (male)	Resistance		
			Between (1) and (2)	35 – 45 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (7) – B02 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between B02 (female) (2) – chassis ground	Resistance	Max. 1 Ω	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L07 (female)	Resistance		
			Between (7) and chassis ground	35 – 45 Ω		

Circuit diagram related to work equipment neutral lock solenoid

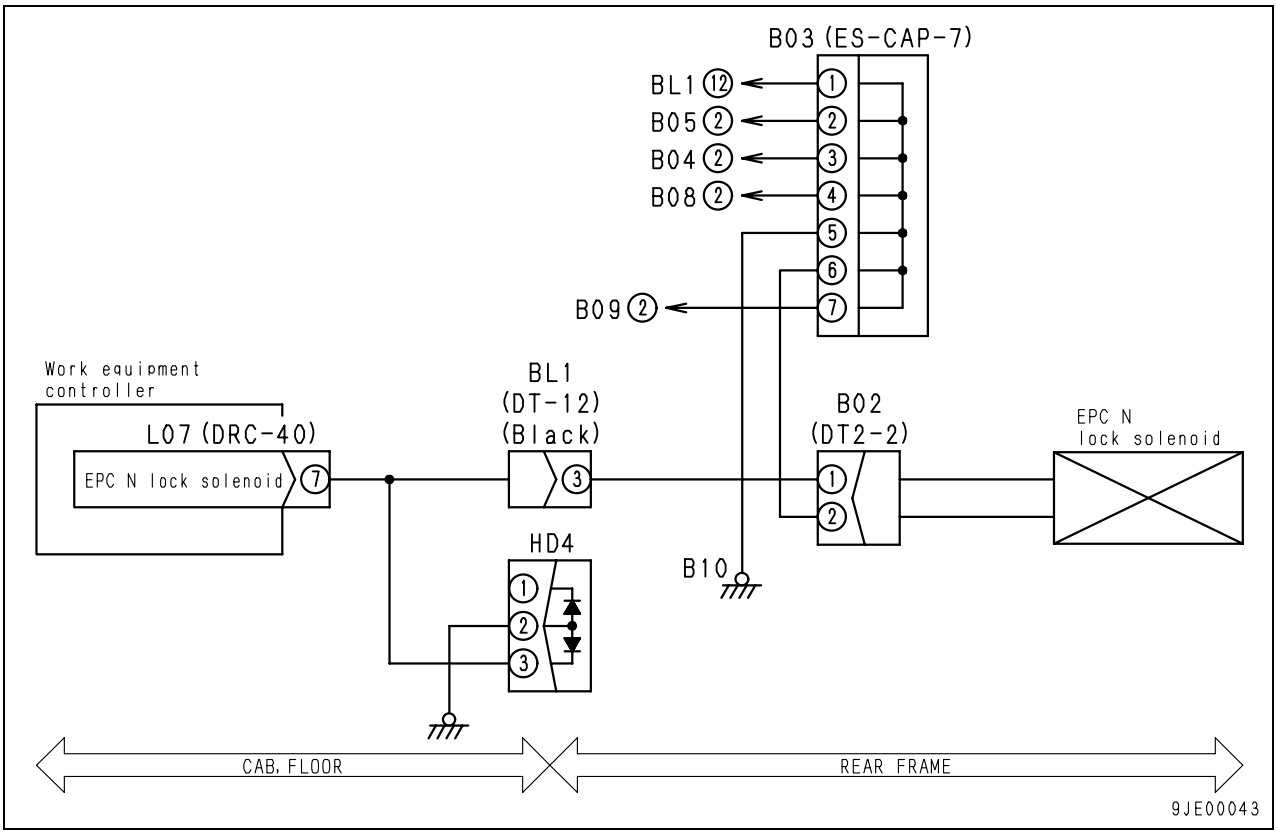


Failure code [DWM1KB] (Work equipment neutral lock solenoid: Short circuit)

Action code	Failure code	Trouble	Work equipment neutral lock solenoid: Short circuit (Work equipment controller system)
E01	**DWM1KB**		
Contents of trouble	• Since the work equipment neutral lock solenoid system was shorted with the chassis ground, abnormal current flowed when the work equipment neutral lock solenoid output was ON.		
Action of controller	• Stops outputting the signal to the work equipment neutral lock solenoid. • Stops outputting the signal to the work equipment solenoid according to an input signal from the work equipment lock lever. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Each work equipment solenoid EPC lock normally works according to an input signal from the work equipment lock lever. • The wiring harness or controller may be burnt out.		
Related information	• The output state (ON/OFF) to the work equipment neutral lock solenoid can be checked with the monitoring function (Code: 40952, D-OUT-0). • Method of reproducing failure code: Turn the starting switch ON and move the work equipment lock lever to the LOCK position		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective work equipment neutral lock solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			B02 (male)	Resistance		
			Between (1) and (2)	35 – 45 Ω		
			Between (1), (2) – chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (7) – B02 (female) (1)	Resistance	Max. 1 Ω	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L07 (female)	Resistance		
			Between (7) and chassis ground	35 – 45 Ω		

Circuit diagram related to work equipment neutral lock solenoid

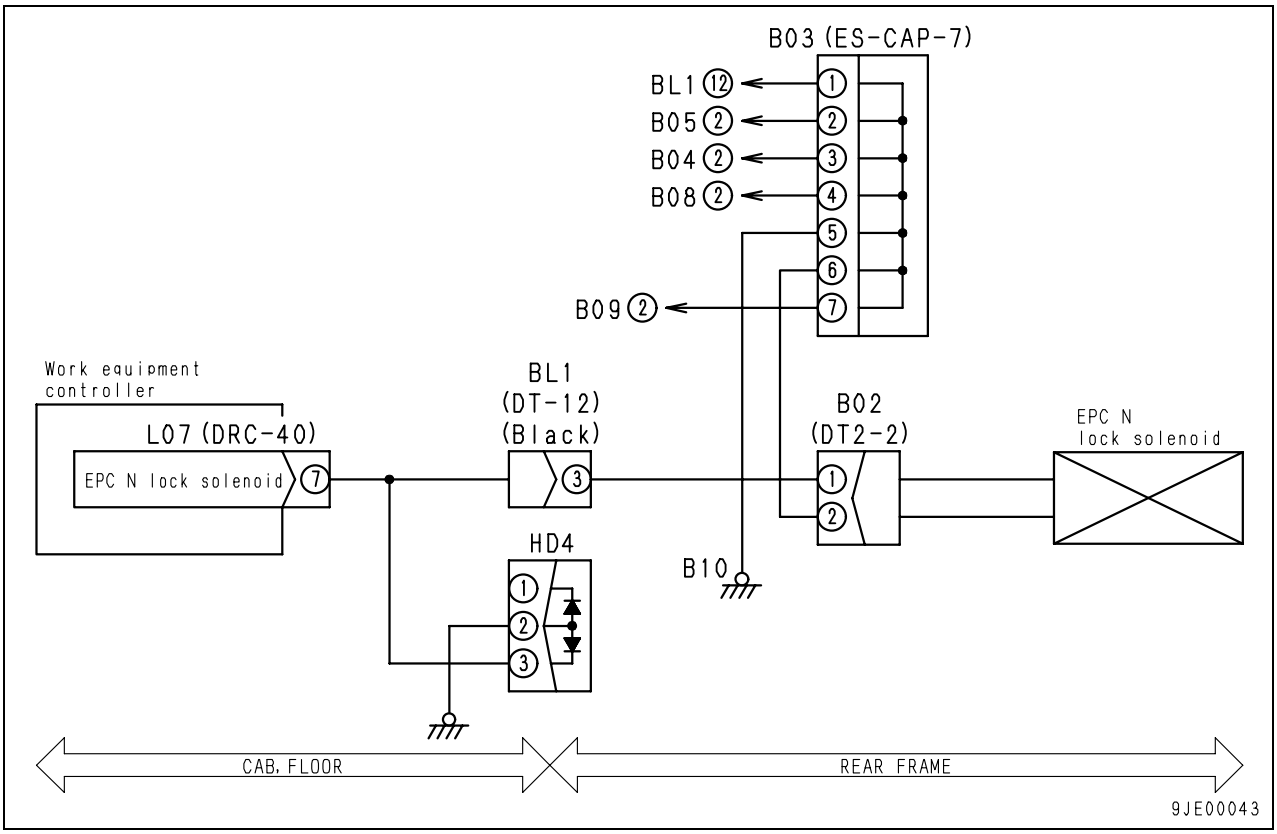


Failure code [DWM1KY] (Work equipment neutral lock solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	Work equipment neutral lock solenoid: Short circuit with power supply line (Work equipment controller system)
E01	**DWM1KY**		
Contents of trouble	• Since the work equipment neutral lock solenoid system was shorted with the power source, abnormal voltage was applied when the work equipment neutral lock solenoid output was OFF.		
Action of controller	• Do not stop output to the work equipment neutral lock solenoid. • Stops outputting the signal to the work equipment EPC solenoid according to an input signal from the work equipment lock lever. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• All work equipment do not move.		
Related information	• The output state (ON/OFF) to the work equipment neutral lock EPC solenoid can be checked with the monitoring function (Code: 40952, D-OUT-0). • Method of reproducing failure code: Turn the starting switch ON and move the work equipment lock lever to the LOCK position • The work equipment can be operated by disconnecting the work equipment neutral lock solenoid connector (Disconnection in wiring harness).		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective work equipment neutral lock solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			B02 (male)	Resistance	
			Between (1) and (2)	35 – 45 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L07 (female) (7) – B02 (female) (1)	Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (7) and chassis ground	35 – 45 Ω	

Circuit diagram related to work equipment neutral lock solenoid

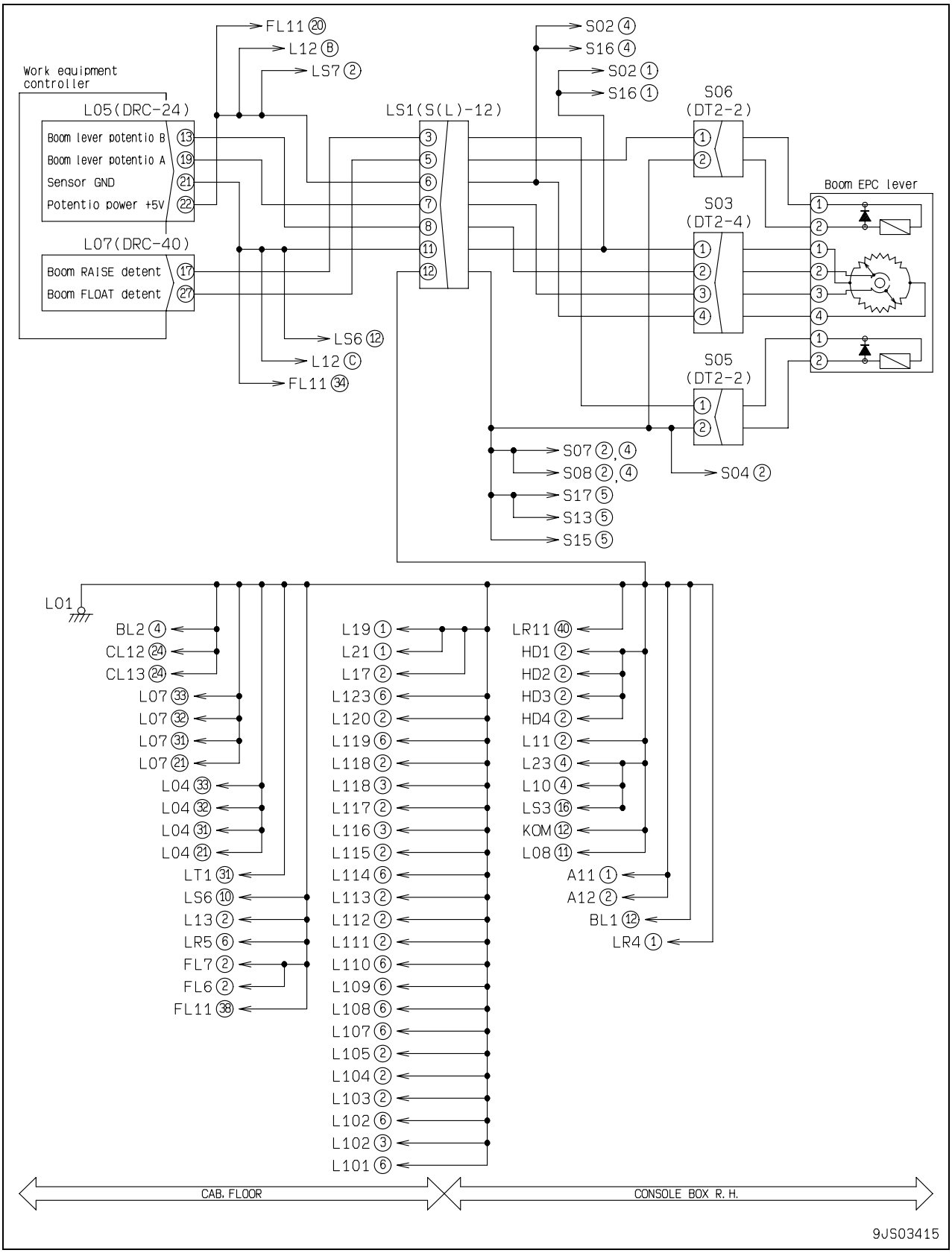


Failure code [DWN6KA] (Lift arm raise magnet detent solenoid: Disconnection)

Action code	Failure code	Trouble	Lift arm raise magnet detent solenoid: Disconnection (Work equipment controller system)
E01	**DWN6KA**		
Contents of trouble	• Since the lift arm raise magnet detent solenoid power supply system is disconnected, no current flows when the lift arm raise magnet detent solenoid output is ON.		
Action of controller	• Keeps normal output condition to the lift arm raise magnet detent solenoid. • Stops outputting the signal to the remote positioner raise stop lamp. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The lift arm remote positioner raise does not function. • The lift arm is not held at raise detent position.		
Related information	• The output state (ON/OFF) to the lift arm raise magnet detent solenoid can be checked with the monitoring function (Code: 40952 D-OUT-1). • Method of reproducing failure code: Engine start + lift arm raise detent		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm raise magnet detent solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S05 (male)		Resistance	
			Between (1) and (2)		35 – 45 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (17) – S05 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between S05 (female) (2) – chassis ground		Resistance	Max. 1 Ω
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	Lift arm lever	Voltage	
			Between (17) and chassis ground	Neutral	Max. 1 V	
				Raise detent operation	20 – 30 V	

Circuit diagram related to lift arm magnet detent solenoid

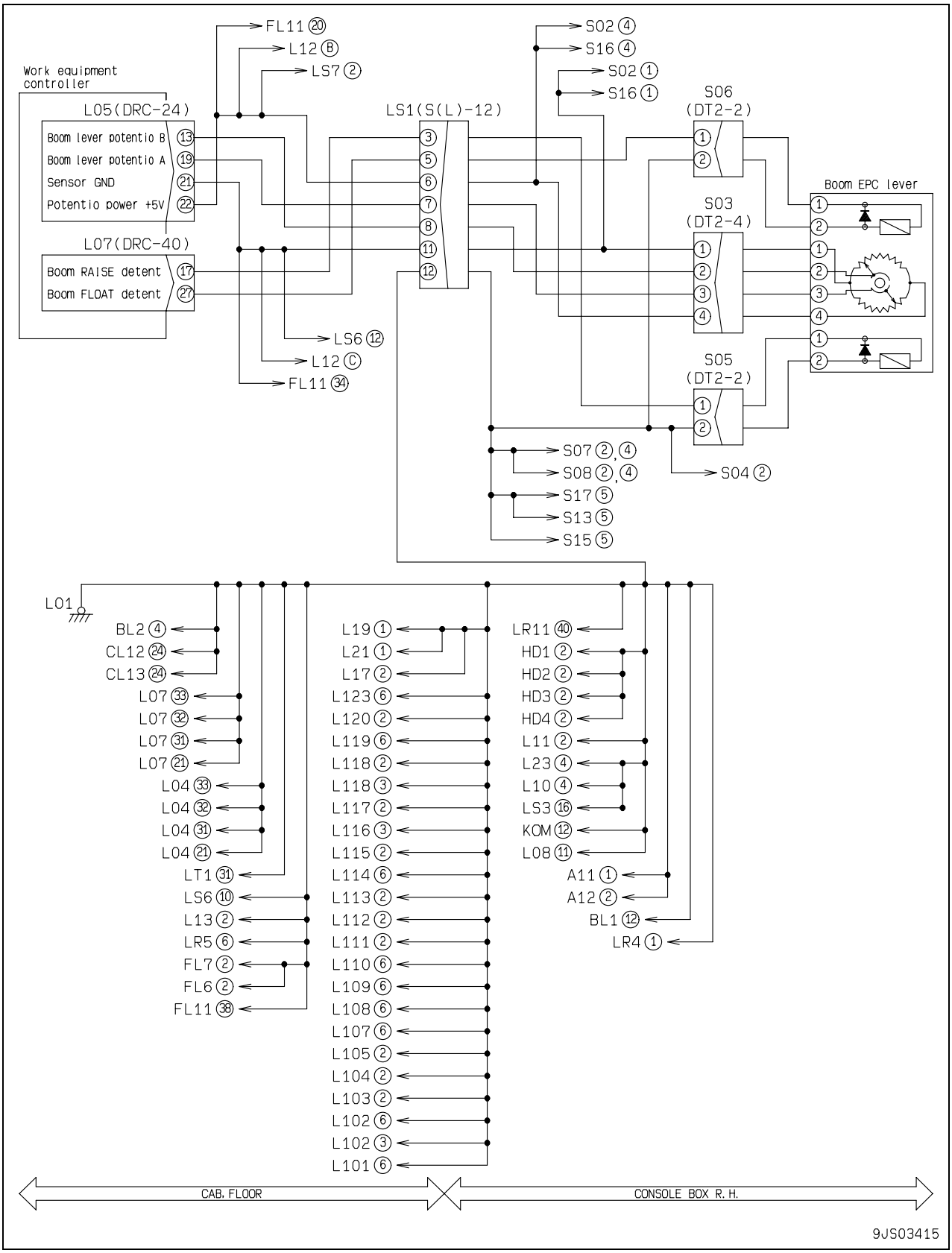


Failure code [DWN6KB] (Lift arm raise magnet detent solenoid: Short circuit)

Action code	Failure code	Trouble	Lift arm raise magnet detent solenoid: Short circuit (Work equipment controller system)
E01	**DWN6KB**		
Contents of trouble	• Since the lift arm raise magnet detent solenoid power supply system was shorted with the chassis ground, abnormal current flowed when the lift arm raise magnet detent solenoid output was ON.		
Action of controller	• Stops outputting the signal to the lift arm raise magnet detent solenoid. • Stops outputting the signal to the remote positioner raise stop lamp to stop raise stop control. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The lift arm remote positioner raise does not function. • The lift arm is not held at raise detent position.		
Related information	• The output state (ON/OFF) to the lift arm raise magnet detent solenoid can be checked with the monitoring function (Code: 40952 D-OUT-1). • Method of reproducing failure code: Engine started + lift arm raise detent		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm raise magnet detent solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S05 (male)		Resistance	
			Between (1) and (2)		35 – 45 Ω	
			Between (1), (2) and chassis ground		Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (17) – S05 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	Lift arm lever	Voltage	
			Between (17) and chassis ground	Neutral	Max. 1 V	
				Raise detent operation	20 – 30 V	

Circuit diagram related to lift arm magnet detent solenoid

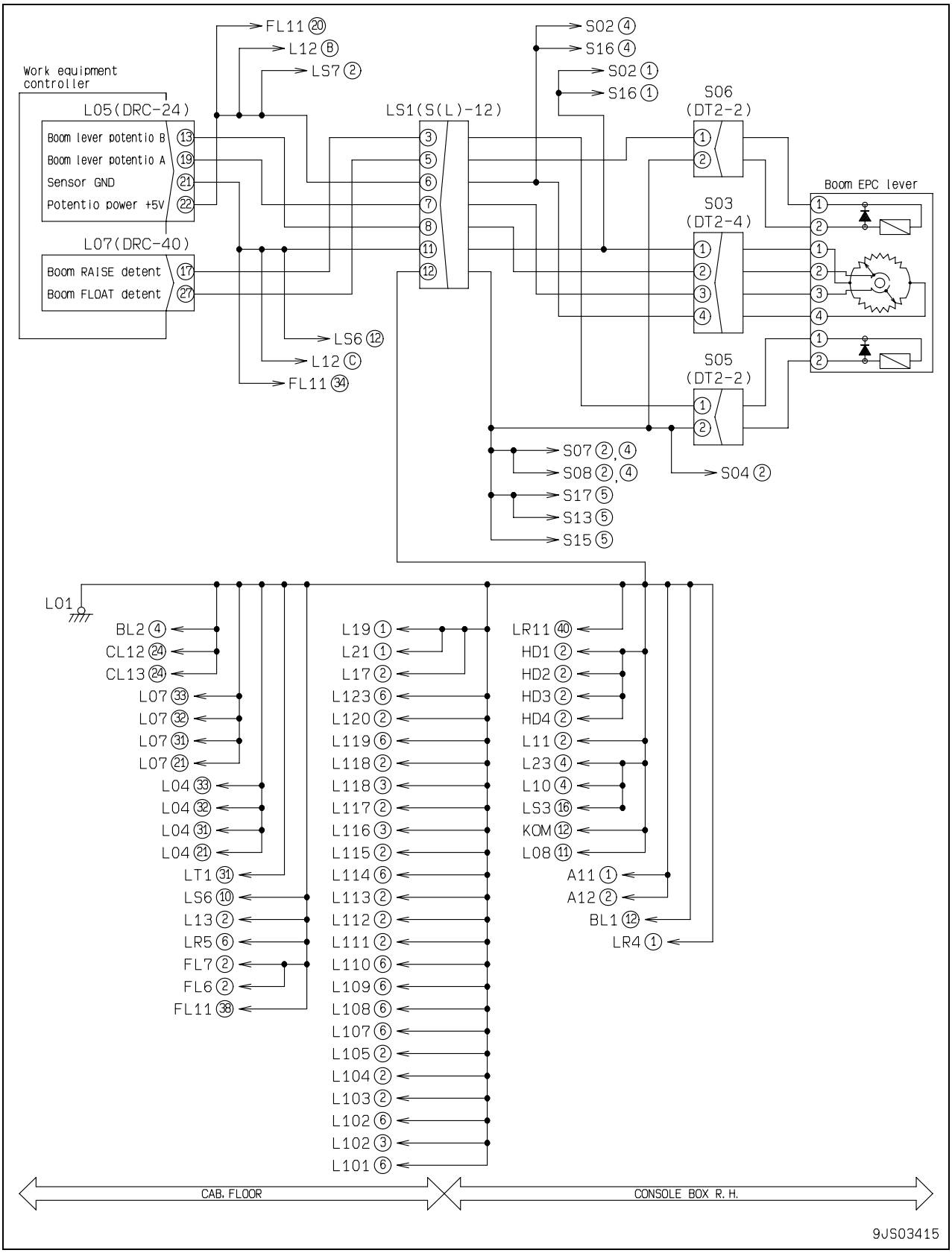


Failure code [DWN6KY] (Lift arm raise magnet detent solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	Lift arm raise magnet detent solenoid: Short circuit with power supply line (Work equipment controller system)
E01	**DWN6KY**		
Contents of trouble	• Since the lift arm raise magnet detent solenoid power supply system was shorted with the power source, abnormal voltage was applied when the lift arm raise magnet detent solenoid output was ON.		
Action of controller	• Stops outputting the signal to the lift arm raise magnet detent solenoid. • Stops outputting the signal to the remote positioner raise stop lamp to stop raise stop control. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If you perform lift arm raise detent operation, detent condition is not automatically released (can be manually released). • If you do not perform lift arm detent operation, return of the left arm lever to neutral is affected by the suction power of the magnet (lever control is deteriorated).		
Related information	• The output state (ON/OFF) to the lift arm raise magnet detent solenoid can be checked with the monitoring function (Code: 40952 D-OUT-1). • Method of reproducing failure code: Engine started		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm raise magnet detent solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S05 (male)		Resistance	
			Between (1) and (2)		35 – 45 Ω	
			Between (1), (2) and chassis ground		Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L07 (female) (17) – S05 (female) (1)		Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	Lift arm lever	Voltage	
			Between (17) and chassis ground	Neutral	Max. 1 V	
				Raise detent operation	20 – 30 V	

Circuit diagram related to lift arm magnet detent solenoid

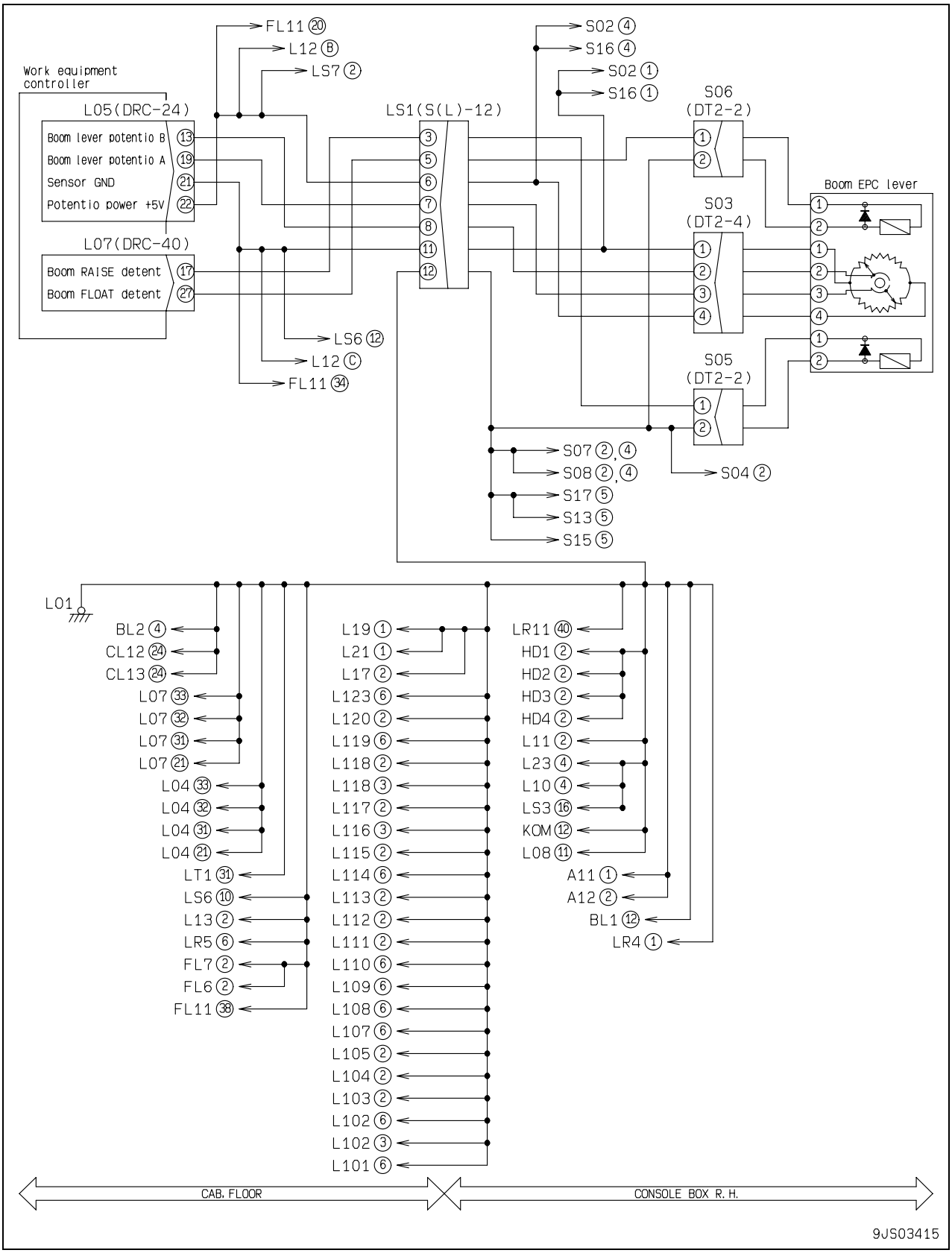


Failure code [DWN7KA] (Lift arm float magnet detent solenoid: Disconnection)

Action code	Failure code	Trouble	Lift arm float magnet detent solenoid: Disconnection (Work equipment controller system)
E01	**DWN7KA**		
Contents of trouble	• Since the lift arm float magnet detent solenoid power supply system is disconnected, no current flows when the lift arm float magnet detent solenoid output is ON.		
Action of controller	• Keeps normal output condition to the lift arm float magnet detent solenoid. • Stops outputting the signal to the remote positioner lower stop lamp. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The lift arm remote positioner lower does not function. • The lift arm is not held at float detent position.		
Related information	• The output state (ON/OFF) to the lift arm float magnet detent solenoid can be checked with the monitoring function (Code: 40952 D-OUT-2). • Method of reproducing failure code: Engine started + lift arm float detent		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm float magnet detent solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S06 (male)		Resistance	
			Between (1) and (2)		35 – 45 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (27) – S06 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between S06 (female) (2) – chassis ground		Resistance	Max. 1 Ω
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	Lift arm lever	Voltage	
			Between (27) and chassis ground	Neutral	Max. 1 V	
				Float detent operation	20 – 30 V	

Circuit diagram related to lift arm magnet detent solenoid

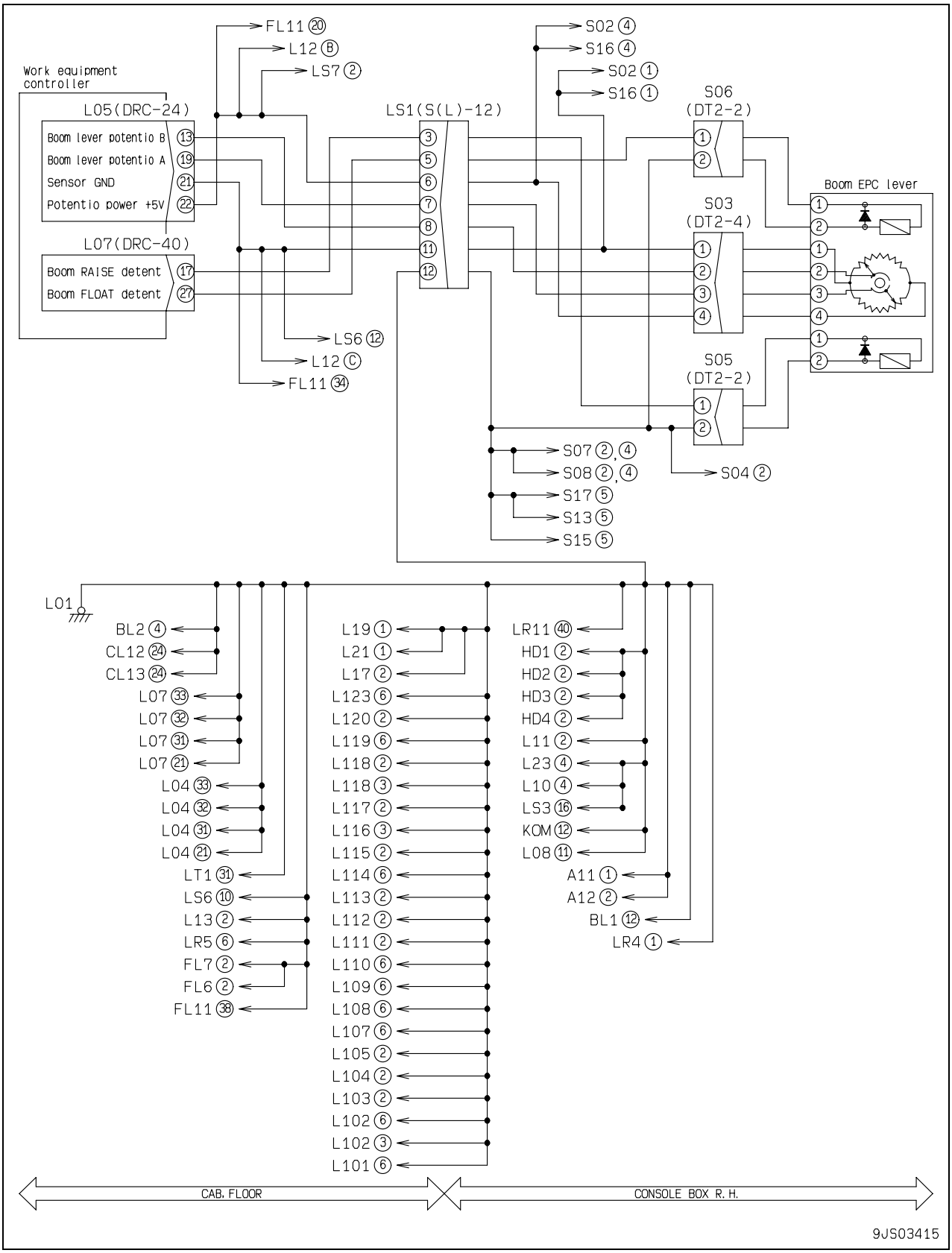


Failure code [DWN7KB] (Lift arm float magnet detent solenoid: Short circuit)

Action code	Failure code	Trouble	Lift arm float magnet detent solenoid: Short circuit (Work equipment controller system)
E01	**DWN7KB**		
Contents of trouble	• Since the lift arm float magnet detent solenoid power supply system was shorted with the chassis ground, abnormal current flowed when the lift arm float magnet detent solenoid output was ON.		
Action of controller	• Stops outputting the signal to the lift arm float magnet detent solenoid. • Stops outputting the signal to the remote positioner lower stop lamp. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The lift arm remote positioner lower does not function. • The lift arm is not held at float detent position.		
Related information	• The output state (ON/OFF) to the lift arm float magnet detent solenoid can be checked with the monitoring function (Code: 40952 D-OUT-2). • Method of reproducing failure code: Engine started + lift arm float detent		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective lift arm float magnet detent solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S06 (male)	Resistance		
			Between (1) and (2)	35 – 45 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (27) – S06 (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	Lift arm lever	Voltage	
			Between (27) and chassis ground	Neutral	Max. 1 V	
				Float detent operation	20 – 30 V	

Circuit diagram related to lift arm magnet detent solenoid

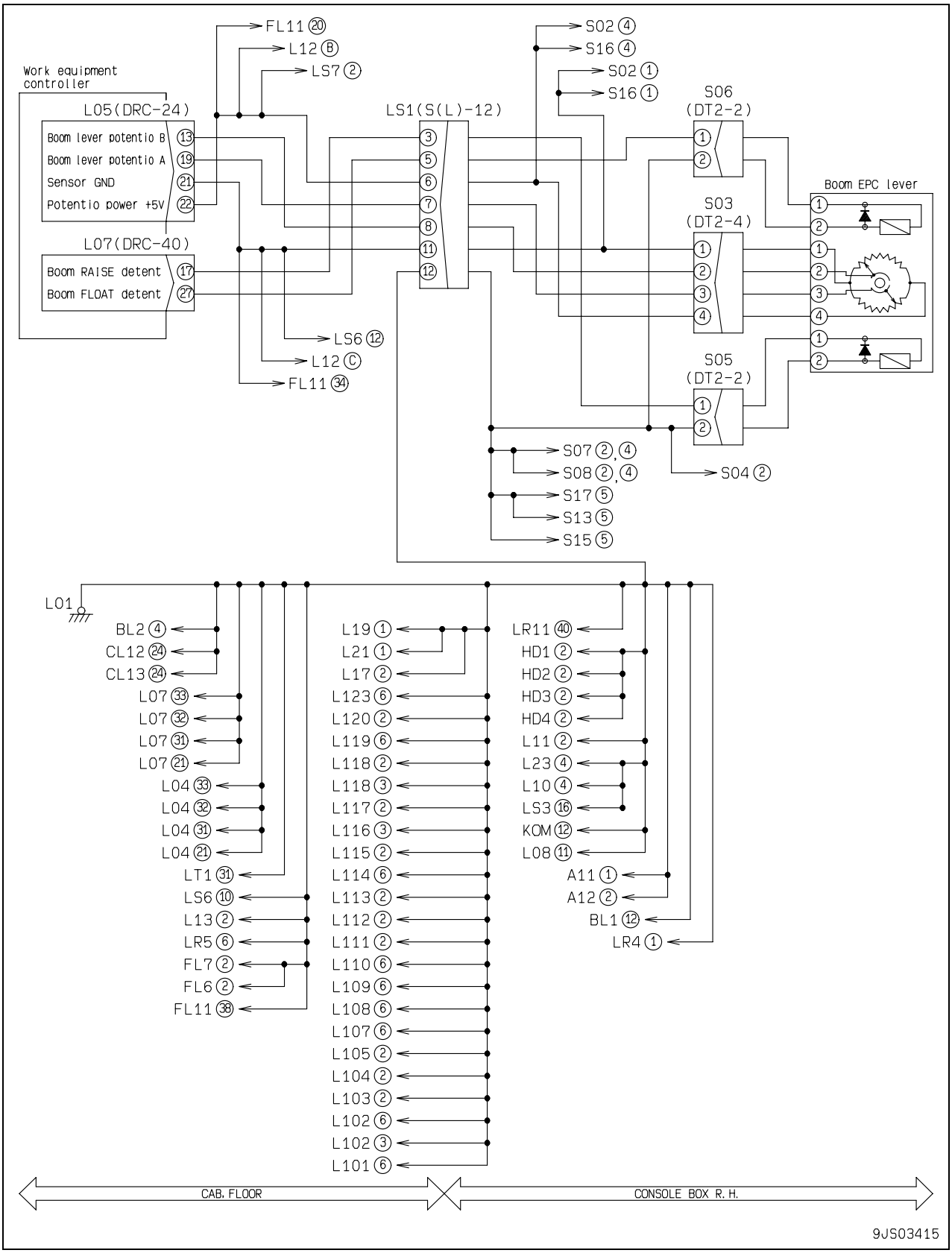


Failure code [DWN7KY] (Lift arm float magnet detent solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	Lift arm float magnet detent solenoid: Short circuit with power supply line (Work equipment controller system)
E01	**DWN7KY**		
Contents of trouble	• Since the lift arm float magnet detent solenoid power supply system was shorted with the power source, abnormal voltage was applied when the lift arm float magnet detent solenoid output was ON.		
Action of controller	• Stops outputting the signal to the lift arm float magnet detent solenoid. • Stops outputting the signal to the remote positioner lower stop lamp to stop lower stop control. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If you perform lift arm float detent operation, detent condition is not automatically released (can be manually released). • If you do not perform lift arm detent operation, return of the left arm lever to neutral is affected by the suction power of the magnet (lever control is deteriorated).		
Related information	• The output state (ON/OFF) to the lift arm float magnet detent solenoid can be checked with the monitoring function (Code: 40952 D-OUT-2). • Method of reproducing failure code: Start engine		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective lift arm float magnet detent solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S06 (male)		Resistance	
			Between (1) and (2)		35 – 45 Ω	
			Between (1), (2) and chassis ground		Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L07 (female) (27) – S06 (female) (1)		Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	Lift arm lever	Voltage	
			Between (27) and chassis ground	Neutral	Max. 1 V	
				Float detent operation	20 – 30 V	

Circuit diagram related to lift arm magnet detent solenoid

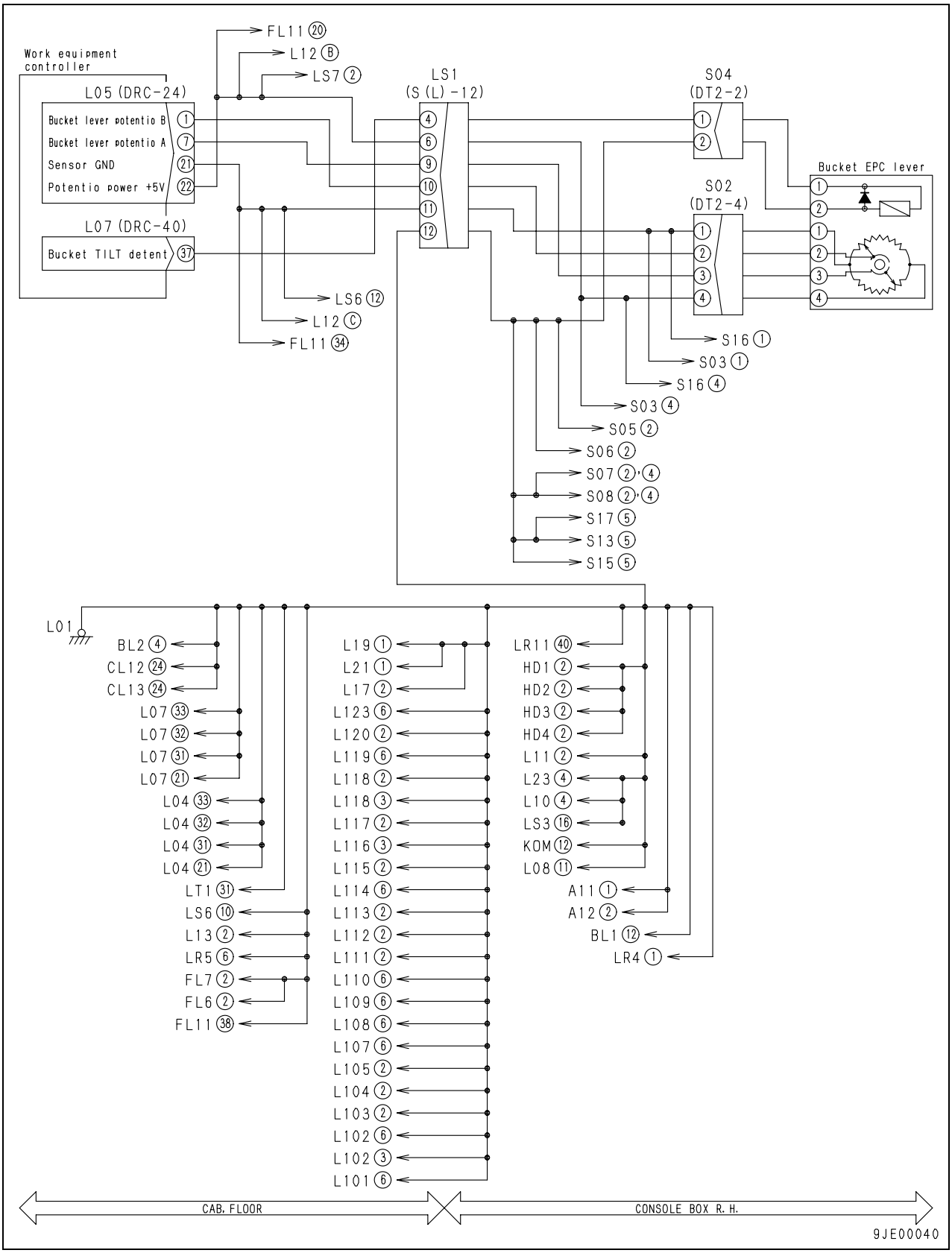


Failure code [DWN8KA] (Bucket tilt magnet detent solenoid: Disconnection)

Action code	Failure code	Trouble	Bucket tilt magnet detent solenoid: Disconnection (Work equipment controller system)
E01	**DWN8KA**		
Contents of trouble	• Since the bucket tilt magnet detent solenoid power supply system is disconnected, no current flows when the bucket tilt magnet detent solenoid output is ON.		
Action of controller	• Keeps normal output condition to the bucket tilt magnet detent solenoid. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Bucket leveler does not work. • The bucket is not held at the tilt detent position.		
Related information	• The output state (ON/OFF) to the bucket tilt magnet detent solenoid can be checked with the monitoring function (Code: 40952, D-OUT-3). • Method of reproducing failure code: Engine started + bucket tilt detent		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective bucket tilt magnet detent solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S04 (male)		Resistance	
			Between (1) and (2)		35 – 45 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (37) – S04 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between S04 (female) (2) – chassis ground		Resistance	Max. 1 Ω
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	Bucket lever	Voltage	
			Between (37) and chassis ground	Neutral	Max. 1 V	
				Bucket detent operation	20 – 30 V	

Circuit diagram related to bucket magnet detent solenoid

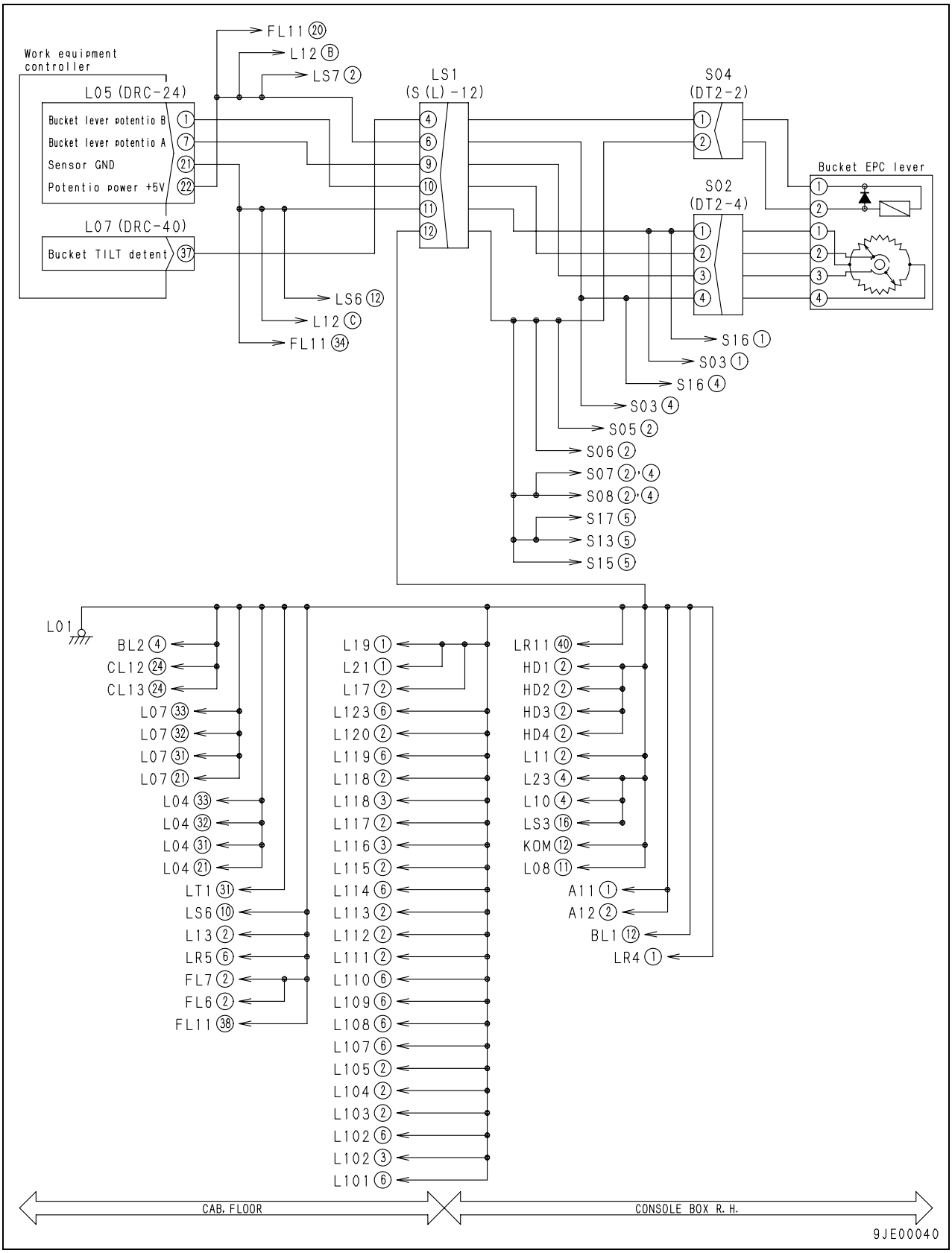


Failure code [DWN8KB] (Bucket tilt magnet detent solenoid: Short circuit)

Action code	Failure code	Trouble	Bucket tilt magnet detent solenoid: Short circuit (Work equipment controller system)
E01	**DWN8KB**		
Contents of trouble	• Since the bucket tilt magnet detent solenoid power supply system was shorted with the chassis ground, abnormal current flowed when the bucket tilt magnet detent solenoid output was ON.		
Action of controller	• Stops outputting the signal to the bucket tilt magnet detent solenoid. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Bucket leveler does not work. • The bucket is not held at the tilt detent position.		
Related information	• The output state (ON/OFF) to the bucket tilt magnet detent solenoid can be checked with the monitoring function (Code: 40952, D-OUT-3). • Method of reproducing failure code: Engine started + bucket tilt detent		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective bucket tilt magnet detent solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S04 (male)		Resistance	
			Between (1) and (2)		35 – 45 Ω	
			Between (1), (2) and chassis ground		Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (37) – S04 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	Bucket lever	Voltage	
			Between (37) and chassis ground	Neutral	Max. 1 V	
				Bucket detent operation	20 – 30 V	

Circuit diagram related to bucket magnet detent solenoid

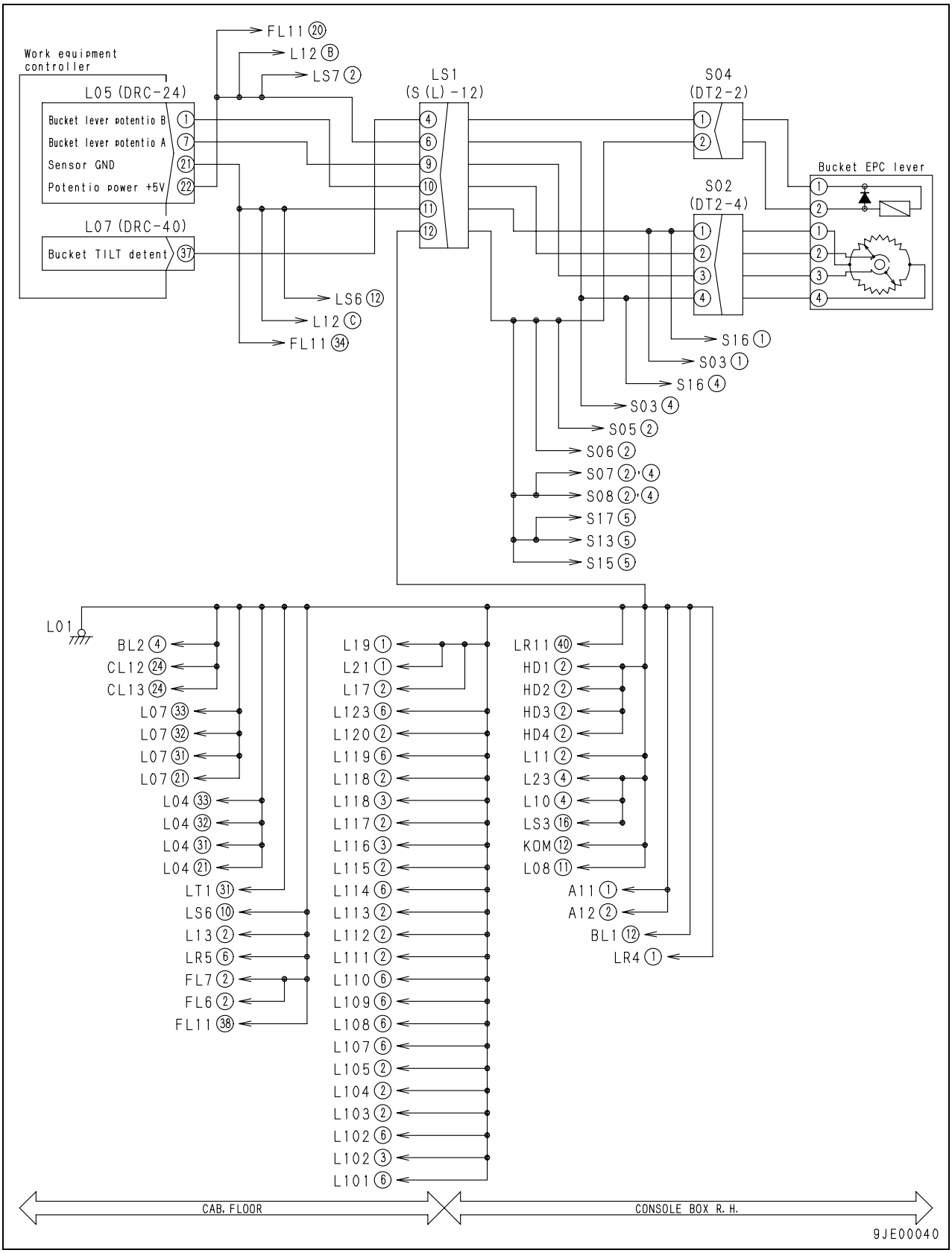


Failure code [DWN8KY] (Bucket tilt magnet detent solenoid: Shorted with the power source)

Action code	Failure code	Trouble	Bucket tilt magnet detent solenoid: Short circuit with power supply line (Work equipment controller system)
E01	**DWN8KY**		
Contents of trouble	• Since the bucket tilt magnet detent solenoid power supply system was shorted with the power source, abnormal voltage was applied when the bucket tilt magnet detent solenoid output was ON.		
Action of controller	• Stops outputting the signal to the bucket tilt magnet detent solenoid. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If you perform bucket tilt detent operation, detent condition is not automatically released (can be manually released). • If you do not perform bucket detent operation, return of the bucket lever to neutral is affected by the suction power of the magnet (lever control is deteriorated).		
Related information	• The output state (ON/OFF) to the bucket tilt magnet detent solenoid can be checked with the monitoring function (Code: 40952, D-OUT-3). • Method of reproducing failure code: Engine started		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective bucket tilt magnet detent solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S04 (male)		Resistance	
			Between (1) and (2)		35 – 45 Ω	
			Between (1), (2) and chassis ground		Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L07 (female) (37) – S04 (female) (1)		Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	Bucket lever	Voltage	
			Between (37) and chassis ground	Neutral	Max. 1 V	
				Bucket detent operation	20 – 30 V	

Circuit diagram related to bucket magnet detent solenoid

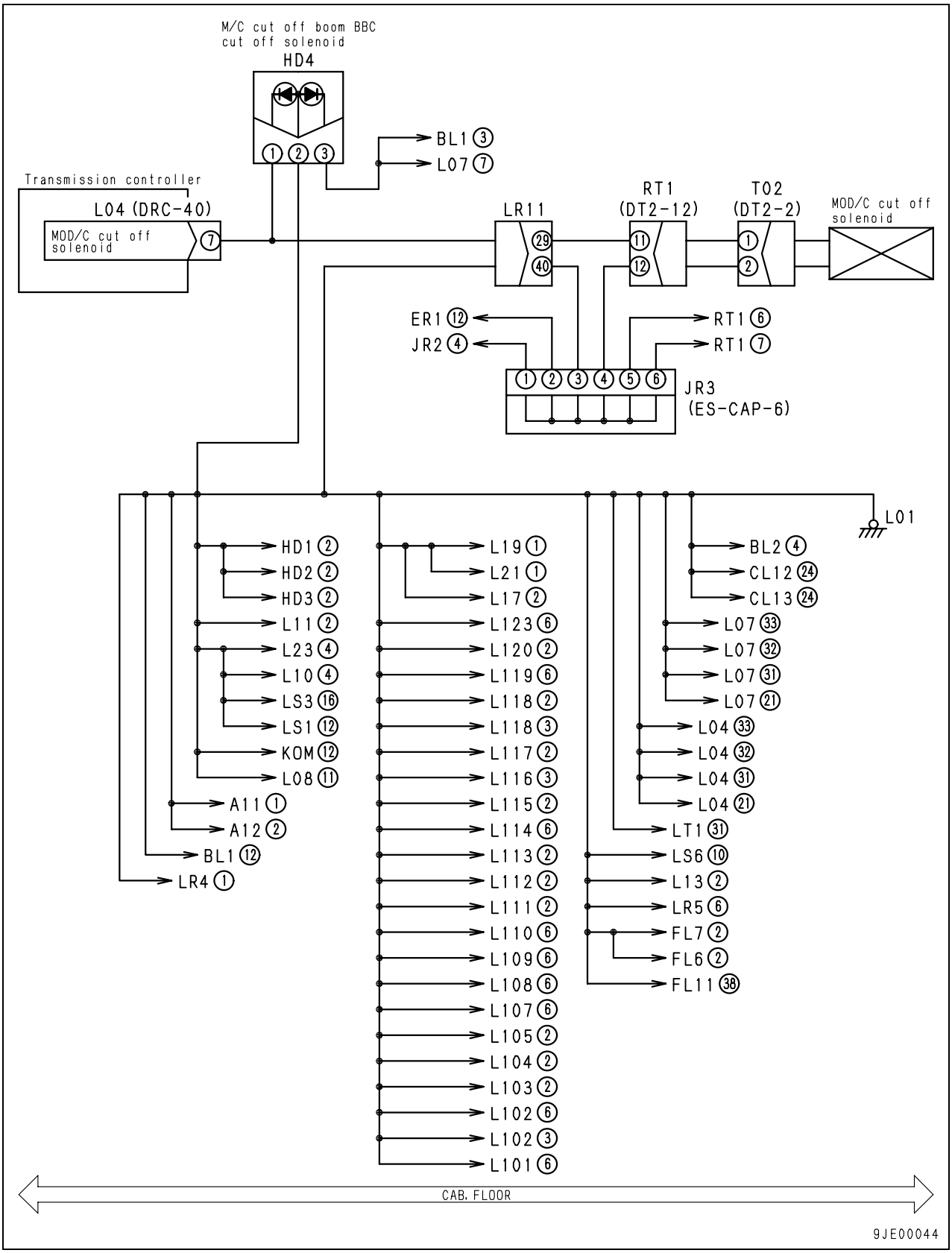


Failure code [DWNFKA] (Modulation clutch cut-off release solenoid: Disconnection)

Action code	Failure code	Trouble	Modulation clutch cut-off release solenoid: Disconnection (Transmission controller system)
E01	**DWNFKA**		
Contents of trouble	• Since the modulation clutch cut-off release solenoid power supply system is disconnected, no current flows when the modulation clutch cut-off release solenoid is ON.		
Action of controller	• If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The cut-off release function cannot be used. • The engine is not used as brake when left foot brake is used.		
Related information	• The output state (ON/OFF) to the modulation clutch cut-off release solenoid can be checked with the monitoring function (Code: 40949, D-OUT-0). • Method of reproducing failure code: Engine started + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective modulation clutch cut-off release solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			T02 (male)		Resistance	
			Between (1) and (2)		30 – 40 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (7) – T02 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between T02 (female) (2) – chassis ground		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L04	Directional lever or directional selector switch	Voltage	
			Between (7) and chassis ground	N position	Max. 1 V	
				F or R (when travelling)	20 – 30 V	

Circuit diagram related to modulation clutch cut-off release solenoid

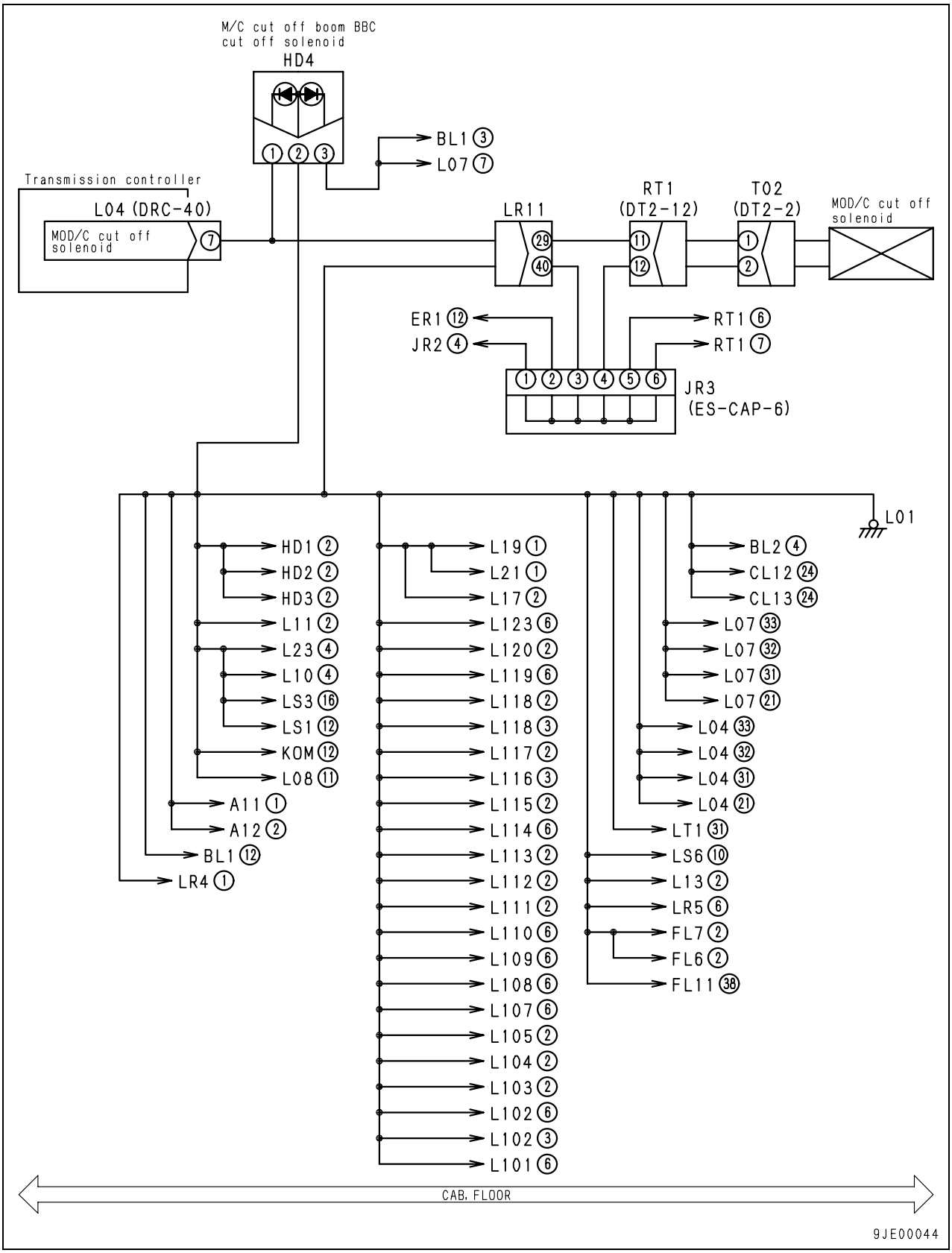


Failure code [DWNFKB] (Modulation clutch cut-off release solenoid: Short circuit)

Action code	Failure code	Trouble	Modulation clutch cut-off release solenoid: Short circuit (Transmission controller system)
E01	**DWNFKB**		
Contents of trouble	• Since the modulation clutch cut-off release solenoid power supply system was shorted with the chassis ground, abnormal current flowed when the modulation clutch cut-off release solenoid was ON.		
Action of controller	• Turns the output to the modulation clutch cut-off release solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The cut-off release function cannot be used. • The engine is not used as brake when left foot brake is used.		
Related information	• The output state (ON/OFF) to the modulation clutch cut-off release solenoid can be checked with the monitoring function (Code: 40949, D-OUT-0). • Method of reproducing failure code: Engine started + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective modulation clutch cut-off release solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			T02 (male)	Resistance		
			Between (1) and (2)	30 – 40 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (7) – T02 (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L04	Directional lever or directional selector switch	Voltage	
			Between (7) and chassis ground	N position	Max. 1 V	
				F or R (when travelling)	20 – 30 V	
	4	Defective diode (HD4)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON (See inspection procedure for diode).			
			HD4 (male)	Resistance		
			Between (1) – (2)	Min. 1 MΩ (No continuity)		
			Between (3) – (2)	Min. 1 MΩ (No continuity)		

Circuit diagram related to modulation clutch cut-off release solenoid

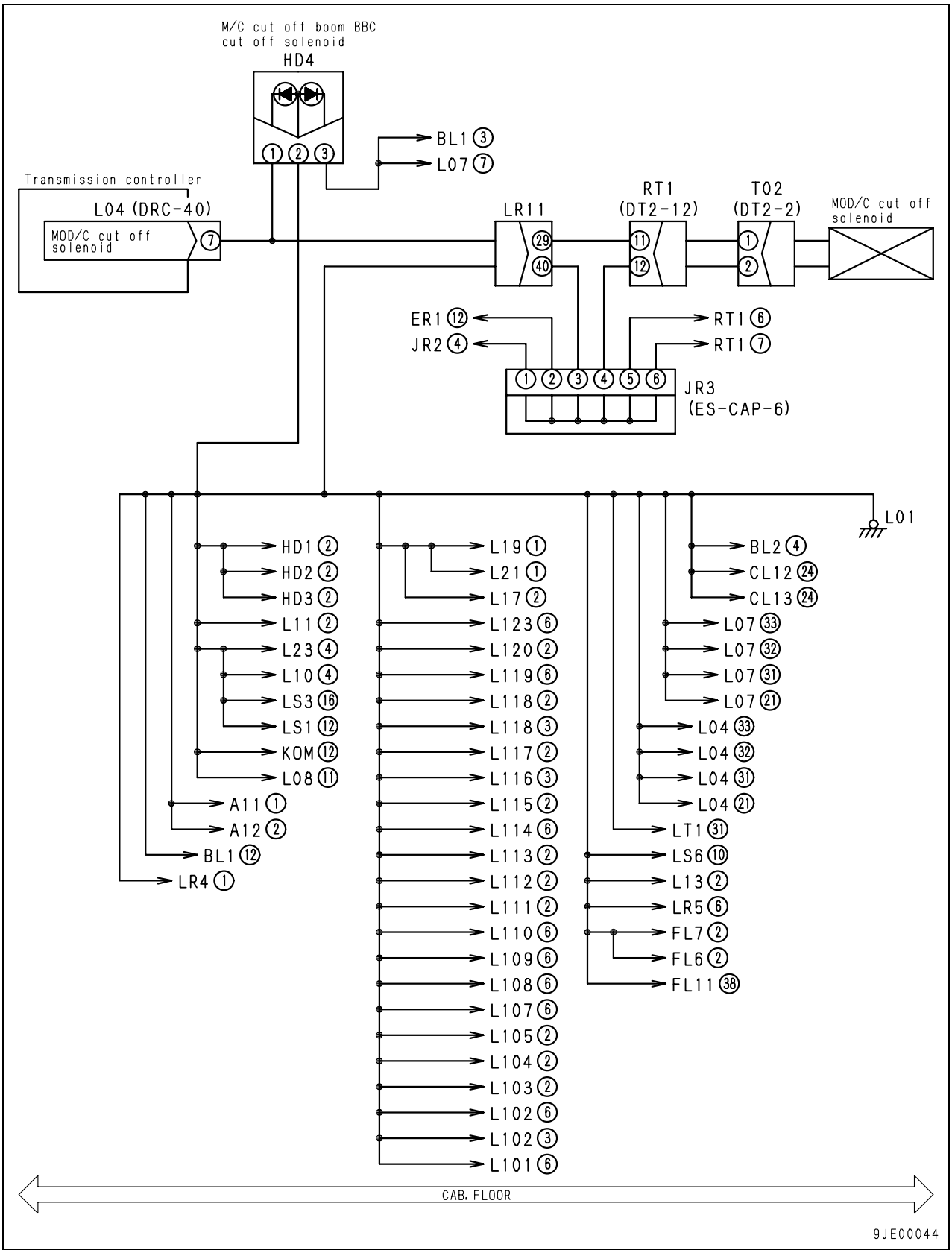


Failure code [DWNFKY] (Modulation clutch cut-off release solenoid: Short circuit with power source line)

Action code	Failure code	Trouble	Modulation clutch cut-off release solenoid: Short circuit with power supply line (Transmission controller system)
E03	**DWNFKY**		
Contents of trouble	• Since the modulation clutch cut-off release solenoid power supply system was shorted with the power source, abnormal voltage was applied when the modulation clutch cut-off release solenoid output was OFF.		
Action of controller	• Keeps the transmission in neutral. • Releases the transmission from neutral if you move the directional lever or directional selector switch to N (Neutral). • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until the directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The cut-off function cannot be used. • The modulation clutch cannot be cut off when left foot brake is used.		
Related information	• The output state (ON/OFF) to the modulation clutch cut-off release solenoid can be checked with the monitoring function (Code: 40949, D-OUT-0). • Method of reproducing failure code: Engine started + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective modulation clutch cut-off release solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			T02 (male)	Resistance		
			Between (1) and (2)	30 – 40 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L04 (female) (7) – T02 (female) (1)	Voltage	Max. 1 V	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L04	Directional selector switch or directional lever	Voltage	
			Between (7) and chassis ground	N position	Max. 1 V	
				F or R (when travelling)	20 – 30 V	

Circuit diagram related to modulation clutch cut-off release solenoid

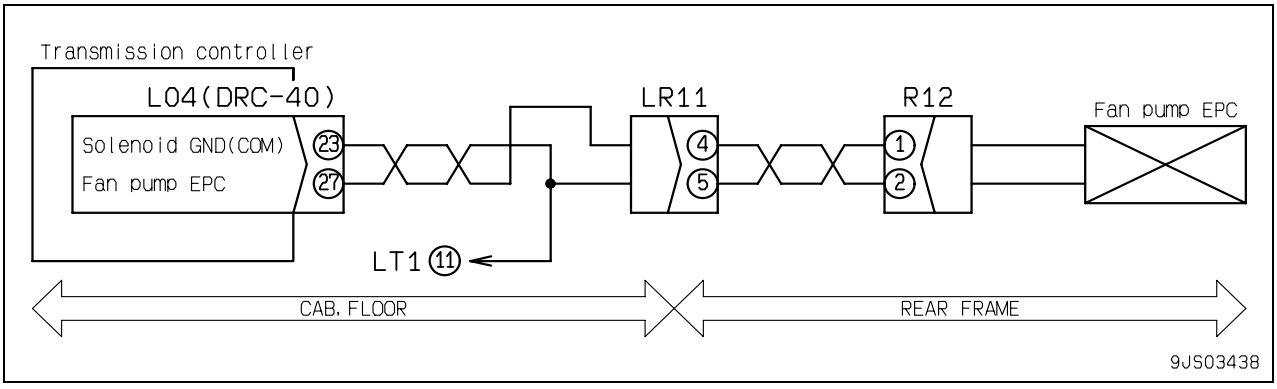


Failure code [DX16KA] (Fan pump EPC solenoid: Disconnection)

Action code	Failure code	Trouble	Fan pump EPC solenoid: Disconnection (Transmission controller system)
E01	**DX16KA**		
Contents of trouble	• Since the fan pump EPC solenoid system is disconnected, no current flows when the fan pump EPC solenoid output is ON.		
Action of controller	• Turns the output to the fan pump EPC solenoid OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The fan speed is set to the maximum.		
Related information	• The output state (current) to the fan pump EPC solenoid can be checked with the monitoring function (Code: 41400 FAN EPC DIR). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fan pump EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R12 (male)	Resistance	
			Between (1) and (2)	5 – 10 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L04 (female) (23) – R12 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L04 (female) (27) – R12 (female) (1)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (27) and (23)	5 – 10 Ω	

Circuit diagram related to fan pump EPC solenoid

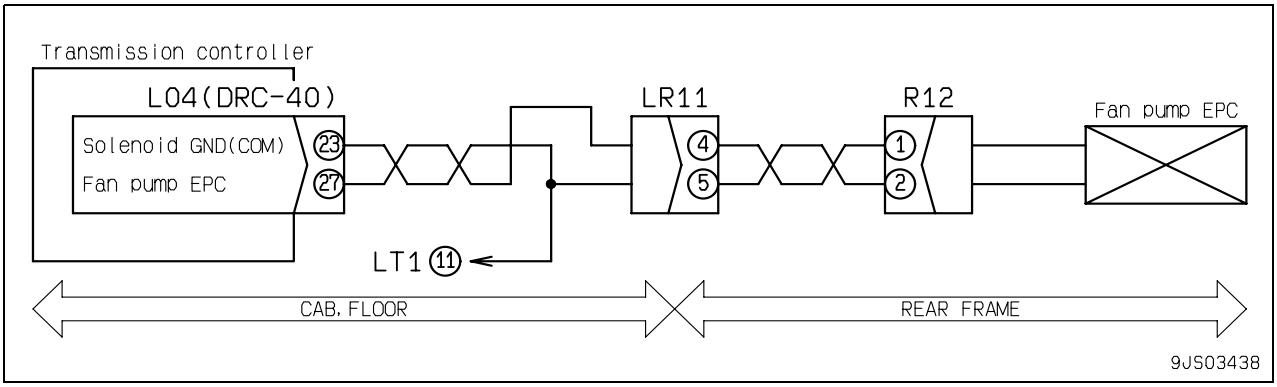


Failure code [DX16KB] (Fan pump EPC solenoid: Short circuit)

Action code	Failure code	Trouble	Fan pump EPC solenoid: Short circuit (Transmission controller system)
E01	**DX16KB**		
Contents of trouble	• Since the fan pump EPC solenoid system was shorted with the chassis ground, abnormal current flowed when the fan pump EPC solenoid output was ON.		
Action of controller	• Turns the output to the fan pump EPC solenoid OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The fan speed is set to the maximum.		
Related information	• The output state (current) to the fan pump EPC solenoid can be checked with the monitoring function (Code: 41400 FAN EPC DIR). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fan pump EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R12 (male)	Resistance	
			Between (1) and (2)	5 – 10 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L04 (female) (27) and R12 (female) (1)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (23) and (27)	5 – 10 Ω	
			Between (23) (27) and chassis ground	Min. 1 MΩ	

Circuit diagram related to fan pump EPC solenoid

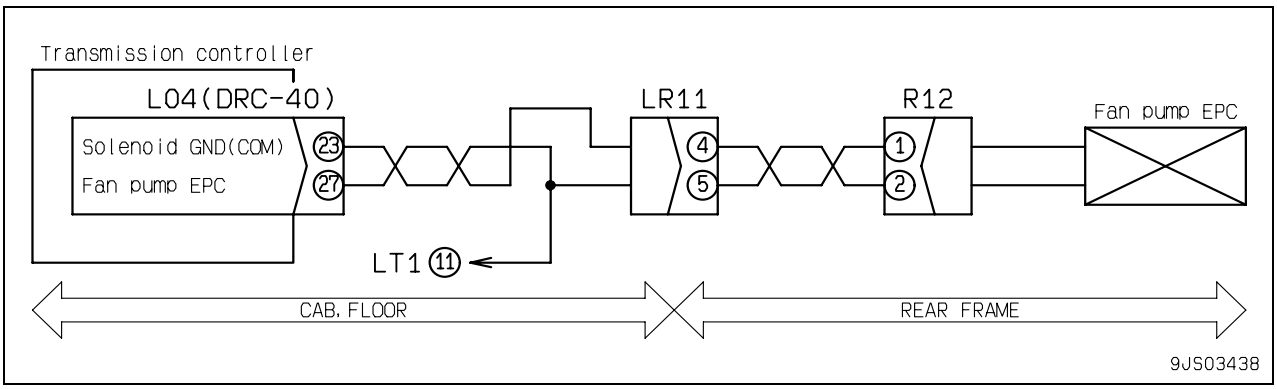


Failure code [DX16KY] (Fan pump EPC solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	Fan pump EPC solenoid: Short circuit with power supply line (Transmission controller system)
E01	**DX16KY**		
Contents of trouble	• Since the fan pump EPC solenoid system was shorted with the power source, abnormal voltage was applied when the fan pump EPC solenoid output was OFF.		
Action of controller	• Turns the output to the fan pump EPC solenoid OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• The fan speed is set to the minimum.		
Related information	• The output state (current) to the fan pump EPC solenoid can be checked with the monitoring function (Code: 41400 FAN EPC DIR). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fan pump EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R12 (male)	Resistance	
			Between (1) and (2)	5 – 10 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L04 (female) (27) and R12 (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (23) and (27)	5 – 10 Ω	
			Between (23), (27) and chassis ground	Min. 1 MΩ	

Circuit diagram related to fan pump EPC solenoid

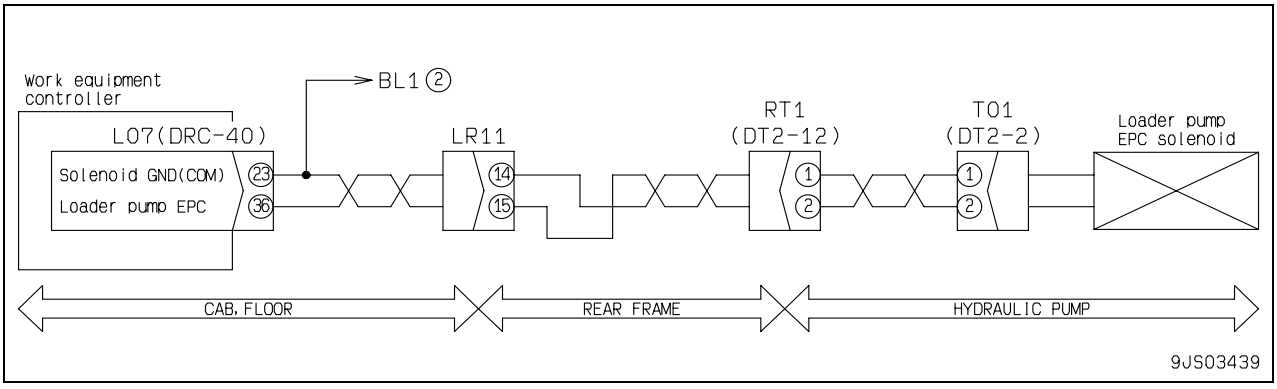


Failure code [DXA1KA] (Pump PC-EPC solenoid: Disconnection)

Action code	Failure code	Trouble	Pump PC-EPC solenoid: Disconnection (Work equipment controller system)
E01	**DXA1KA**		
Contents of trouble	• Since the loader pump PC-EPC solenoid system is disconnected, no current flows when the loader pump PC-EPC solenoid output is ON.		
Action of controller	• Keeps normal output condition to the loader pump PC-EPC solenoid. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Fuel consumption may become poor when engine speed is low. • Engine acceleration performance is deteriorated. • The lift arm may increase speed suddenly.		
Related information	• The output state (current) to the loader pump PC-EPC solenoid can be checked with the monitoring function (Code: 94500 PUMP EPC DIR). • Method of reproducing failure code: Start engine		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective loader pump PC-EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			T02 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L07 (female) (23) – T01 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L07 (female) (36) – T01 (female) (1)	Resistance	Max. 1 Ω
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (23) and (36)	5 – 15 Ω	

Circuit diagram related to loader pump PC-EPC solenoid

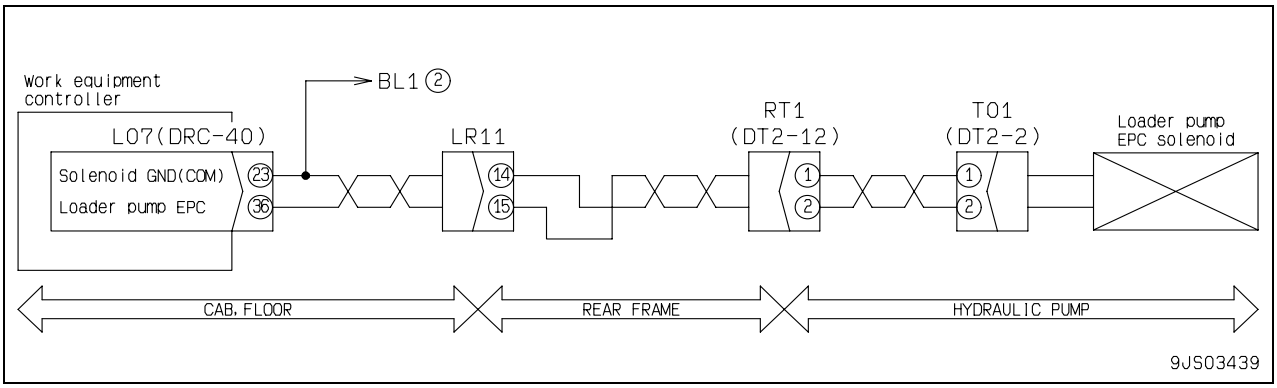


Failure code [DXA1KB] (Pump PC-EPC solenoid: Short circuit)

Action code	Failure code	Trouble	Pump PC-EPC solenoid: Short circuit (Work equipment controller system)
E01	**DXA1KB**		
Contents of trouble	• Since the loader pump PC-EPC solenoid system was disconnected, abnormal current flowed when the loader pump PC-EPC solenoid output was ON.		
Action of controller	• Stops outputting the signal to the loader pump PC-EPC solenoid. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Fuel consumption may become poor when engine speed is low. • Engine acceleration performance is deteriorated. • The lift arm may increase speed suddenly. • The wiring harness or controller may be burnt out.		
Related information	• The output state (current) to the loader pump PC-EPC solenoid can be checked with the monitoring function (Code: 94500 PUMP EPC DIR). • Method of reproducing failure code: Start engine		

Possible causes and standard value in normal state		Cause	Standard value in normal state/Remarks on troubleshooting		
	1	Defective loader pump PC-EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			T01 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L07 (female) (36) – T01 (female) (1)	Resistance	Min. 1 MΩ
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (23) and (36)	5 – 15 Ω	
			Between (23), (36) and chassis ground	Min. 1 MΩ	

Circuit diagram related to loader pump PC-EPC solenoid

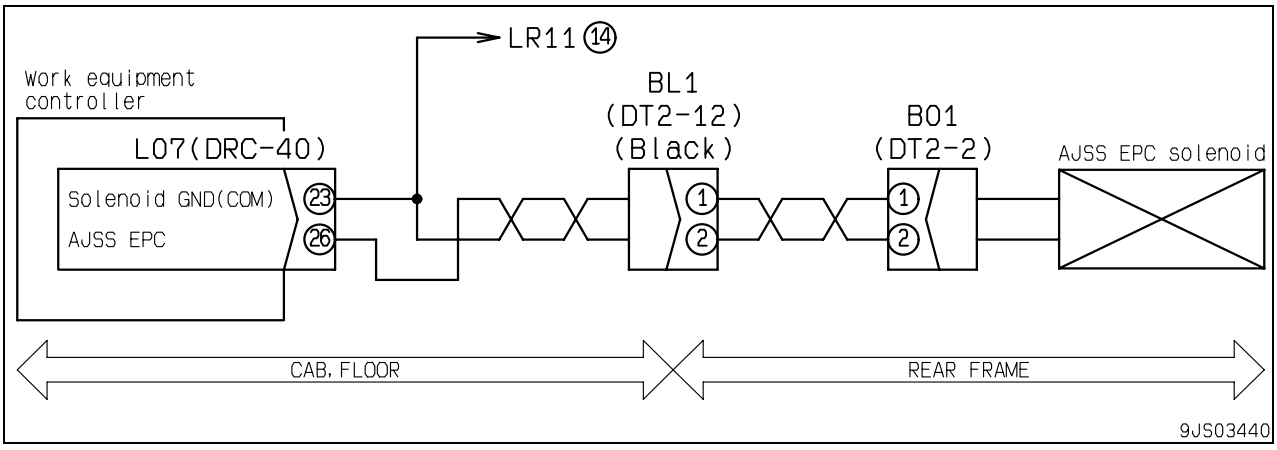


Failure code [DXF0KA] (AJSS EPC solenoid: Disconnection)

Action code	Failure code	Trouble	AJSS EPC solenoid: Disconnection (Work equipment controller system)
E01	**DXF0KA**		
Contents of trouble	• Since the AJSS EPC solenoid system is disconnected, no current flows when the AJSS EPC solenoid output is ON.		
Action of controller	• Stops outputting the signal to the AJSS EPC solenoid. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Steering according to AJSS operation becomes less effective.		
Related information	• The output state (current) to the AJSS EPC solenoid can be checked with the monitoring function (Code: 40908 AJSS EPC DIR). • Method of reproducing failure code: Engine started • This error is not displayed on a steering wheel specification machine. If it is displayed, select “NO” AJSS option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective AJSS EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			B01 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L07 (female) (23) – B01 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L07 (female) (26) – B01 (female) (1)	Resistance	Max. 1 Ω
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (23) and (26)	5 – 15 Ω	

Circuit diagram related to AJSS EPC solenoid

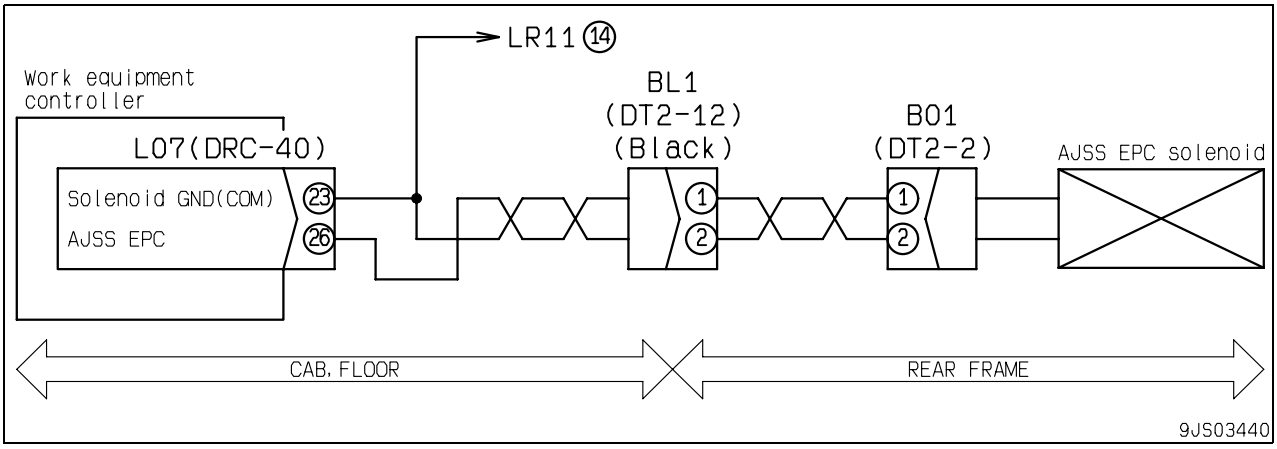


Failure code [DXF0KB] (AJSS EPC solenoid: Short circuit)

Action code	Failure code	Trouble	AJSS EPC solenoid: Short circuit (Work equipment controller system)
E01	**DXF0KB**		
Contents of trouble	• Since the AJSS EPC solenoid system was shorted with the chassis ground, abnormal current flowed when the AJSS EPC solenoid output was ON.		
Action of controller	• Stops outputting the signal to the AJSS EPC solenoid. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Steering according to AJSS operation becomes less effective. • The wiring harness or controller may be burnt out.		
Related information	• The output state (current) to the AJSS EPC solenoid can be checked with the monitoring function (Code: 40908 AJSS EPC DIR). • Method of reproducing failure code: Start engine • This error is not displayed on a steering wheel specification machine. If it is displayed, select “NO ADD” AJSS option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective AJSS EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			B01 (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (26) – B01 (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L07 (female)	Resistance		
			Between (23) and (26)	5 – 15 Ω		
			Between (23), (26) and chassis ground	Min. 1 MΩ		

Circuit diagram related to AJSS EPC solenoid

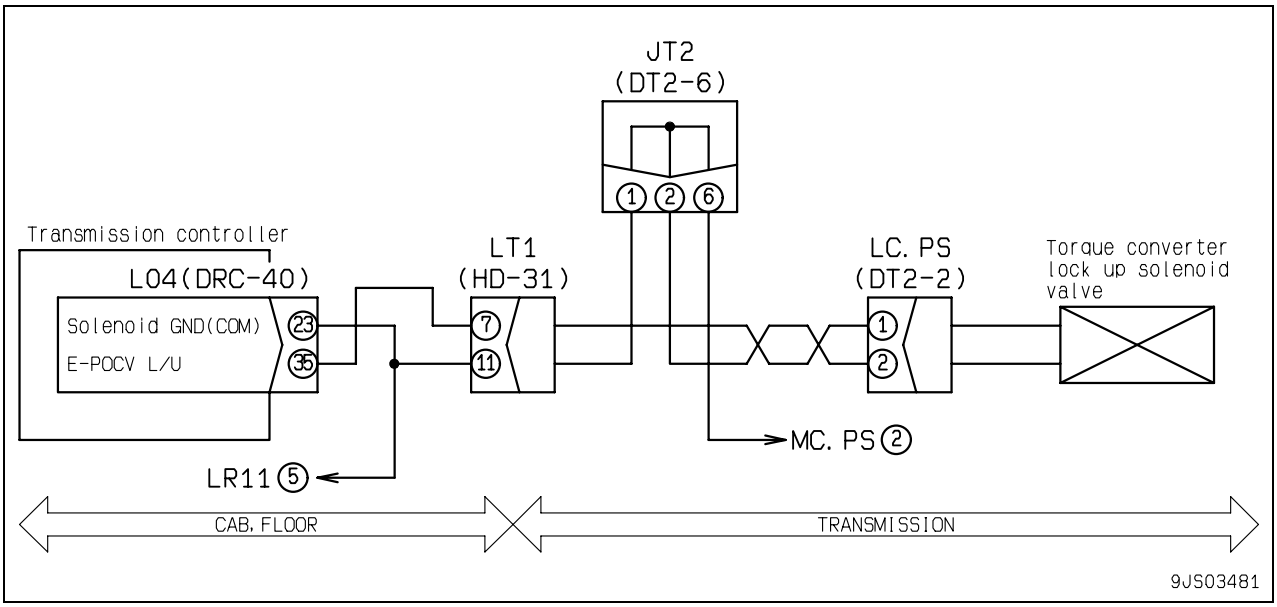


Failure code [DXH1KA] (Lockup ECMV solenoid: Disconnection)

Action code	Failure code	Trouble	Lockup ECMV solenoid: Disconnection (Transmission controller system)
E01	**DXH1KA**		
Contents of trouble	• Since the lockup ECMV solenoid system is disconnected, no current flows when the lockup solenoid output is ON.		
Action of controller	• Stops outputting the signal to the lockup ECMV solenoid. • Determines that the lockup fill switch is OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Torque converter lockup is not turned on		
Related information	• The output state (current) to the lockup ECMV solenoid can be checked with the monitoring function (Code: 31609 ECMV LU DIR). • Method of reproducing failure code: Start engine, turn the torque convertor lockup switch ON, and drive the machine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective lockup ECMV solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			LC.PS (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L04 (female) (23) – LC.PS (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L04 (female) (35) – LC.PS (female) (1)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (23) and (35)	5 – 15 Ω	

Circuit diagram related to lockup ECMV solenoid

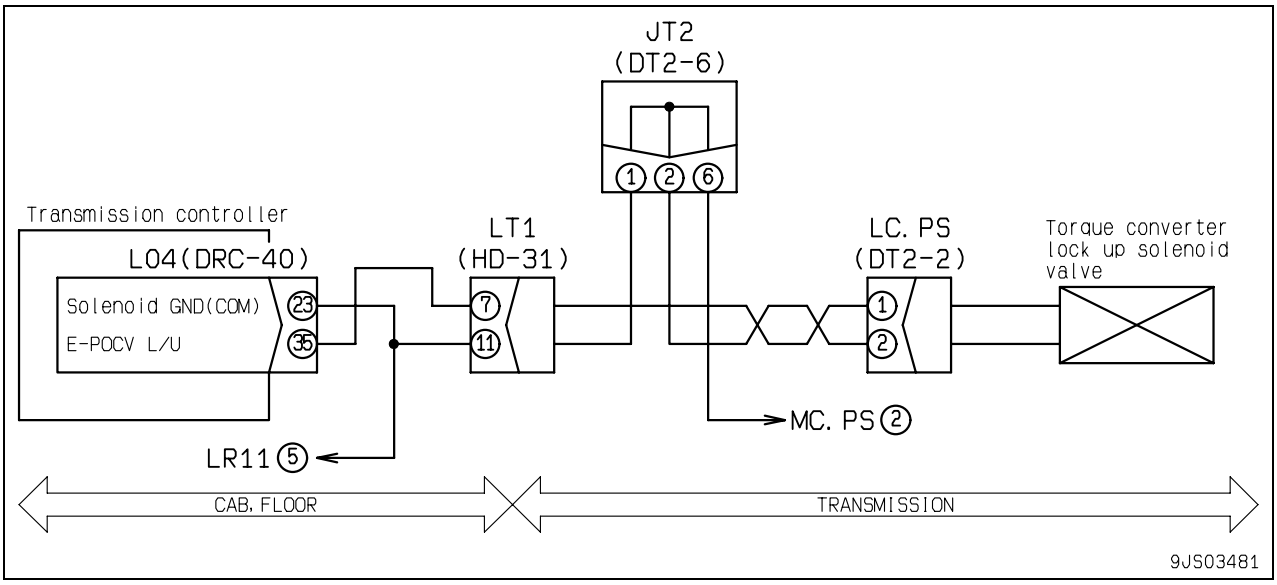


Failure code [DXH1KB] (Lockup ECMV solenoid: Short circuit)

Action code	Failure code	Trouble	Lockup ECMV solenoid: Short circuit (Transmission controller system)
E01	**DXH1KB**		
Contents of trouble	• Since the lockup ECMV solenoid system is short with the chassis ground, abnormal current flowed when the lockup solenoid output was ON.		
Action of controller	• Stops outputting the signal to the lockup ECMV solenoid. • Determines that the lockup fill switch is OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Torque converter lockup is not turned on.		
Related information	• The output state (current) to the lockup ECMV solenoid can be checked with the monitoring function (Code: 31609 ECMV LU DIR). • Method of reproducing failure code: Engine started + torque convertor lockup switch ON + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lockup ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			LC.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (35) – LC.PS (female) (2)	Resistance	Max. 1 Ω	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (23) and (35)	5 – 15 Ω		
			Between (23), (35) and chassis ground	Min. 1 MΩ		

Circuit diagram related to lockup ECMV solenoid

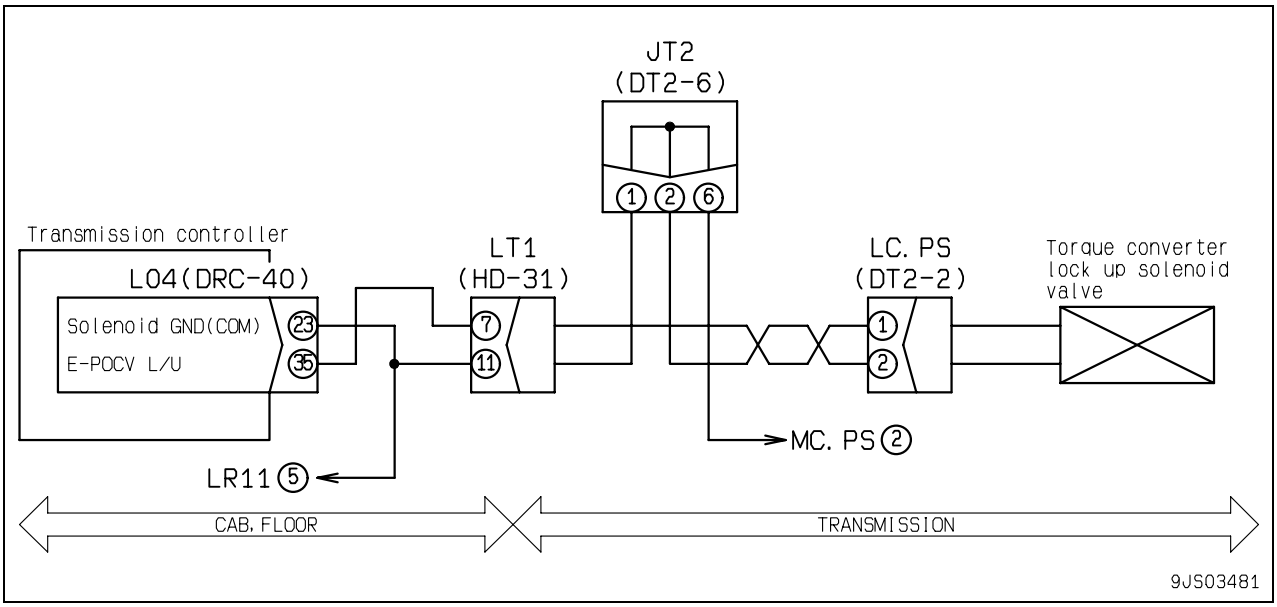


Failure code [DXH1KY] (Lockup ECMV solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	Lockup ECMV solenoid: Short circuit with power supply line (Transmission controller system)
E03	**DXH1KY**		
Contents of trouble	• Since the lockup ECMV solenoid system was shorted with the power source, abnormal voltage was applied when the lockup ECMV solenoid output was OFF.		
Action of controller	• Keeps the transmission in neutral. • Releases the transmission from neutral if you move the directional lever or directional selector switch to N (Neutral). • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until the directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• Keeps neutral until the directional lever or directional selector switch is moved to N (Neutral). • The lockup function is kept ON.		
Related information	• The output state (current) to the lockup ECMV solenoid can be checked with the monitoring function (Code: 31609 ECMV LU DIR) • Method of reproducing failure code: Engine started + torque convertor lockup switch ON + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective lockup ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			LC.PS (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L04 (female) (35) – LC.PS (female) (2)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (23) and (35)	5 – 15 Ω	
			Between (23), (35) and chassis ground	Min. 1 MΩ	

Circuit diagram related to lockup ECMV solenoid

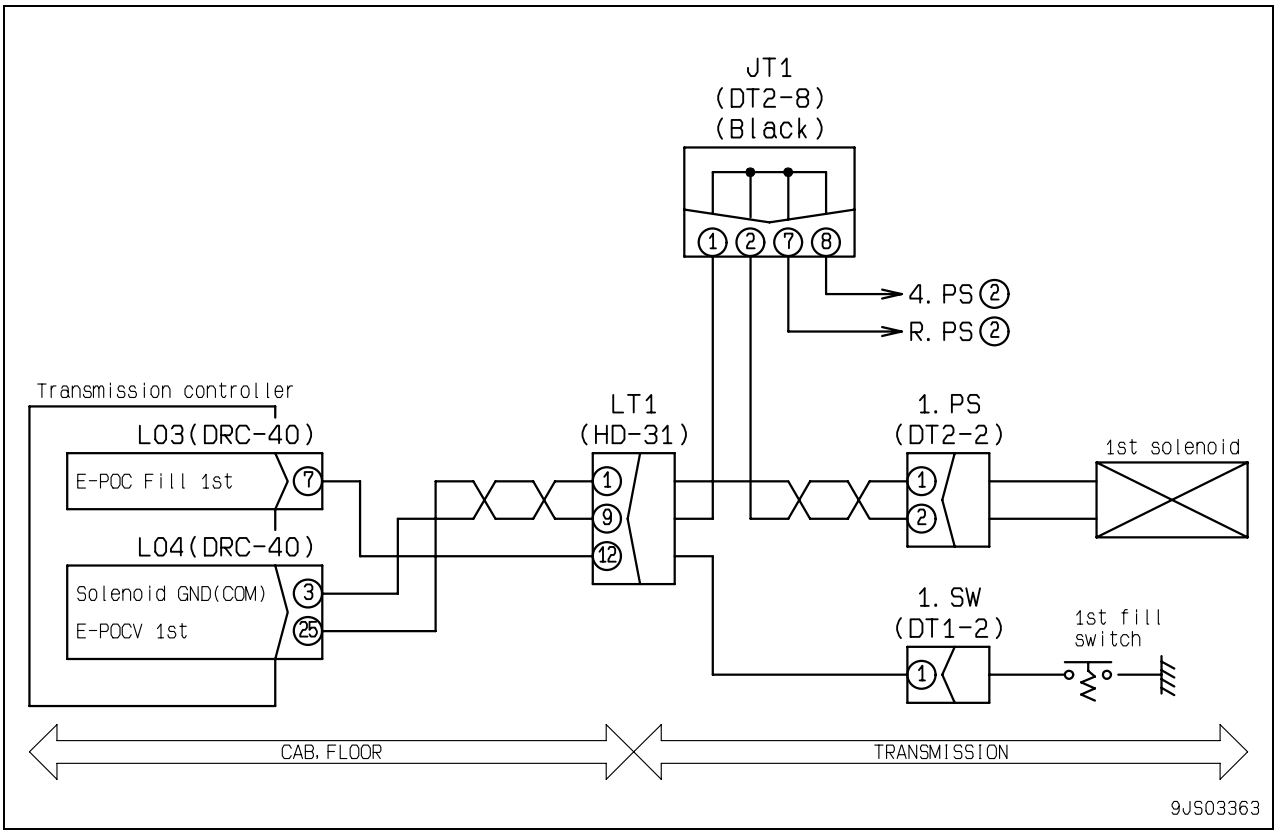


Failure code [DXH4KA] (1st clutch ECMV solenoid: Disconnection)

Action code	Failure code	Trouble	1st clutch ECMV solenoid: Disconnection (Transmission controller system)
E03	**DXH4KA**		
Contents of trouble	• When the 1st clutch ECMV solenoid system is disconnected, no current flows when 1st clutch ECMV solenoid output is ON.		
Action of controller	• Stops outputting the signal to the 1st clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission does not shift into 1st (The machine can travel in any gear speed other than 1st.)		
Related information	• The output state (current) to the 1st clutch ECMV solenoid can be checked with the monitoring function (Code: 31602, ECMV 1 DIR). • Method of reproducing failure code: Turn starting switch START, set the transmission manual/auto shift selector switch in the MANUAL position, and select 1st using the shift down switch or move the gear shift lever to 1st.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 1st clutch ECMV solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			1.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (3) – 1.PS (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L04 (female) (25) – 1.PS (female) (1)	Resistance	Max. 1 Ω	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (25) and (3)	5 – 15 Ω		

Circuit diagram related to 1st clutch ECMV solenoid

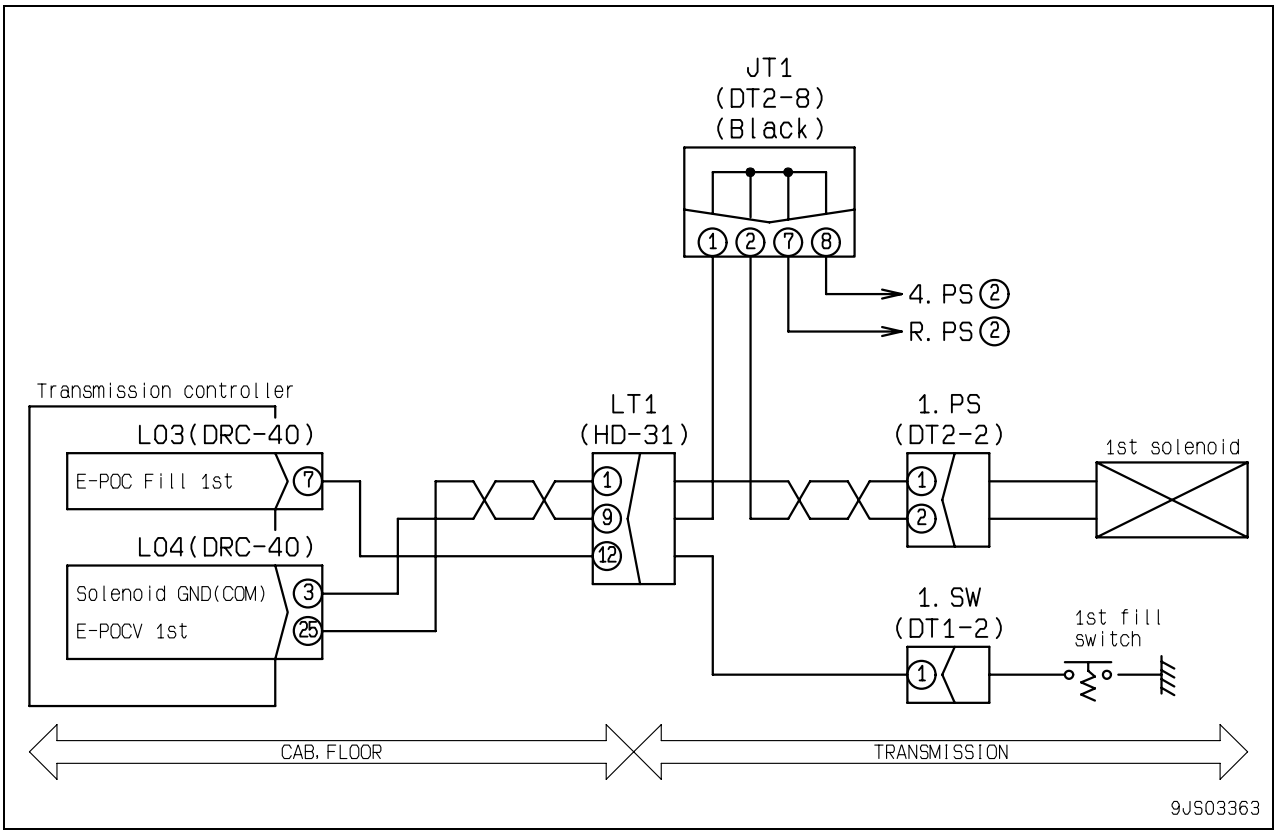


Failure code [DXH4KB] (1st clutch ECMV solenoid: Short circuit)

Action code	Failure code	Trouble	1st clutch ECMV solenoid: Short circuit (Transmission controller system)
E03	**DXH4KB**		
Contents of trouble	• When the 1st clutch ECMV solenoid system was shorted with the chassis ground, abnormal current flowed when 1st clutch ECMV solenoid output was ON.		
Action of controller	• Stops outputting the signal to the 1st clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission does not shift into 1st (The machine can travel in any gear speed other than 1st).		
Related information	• The output state (current) to the 1st clutch ECMV solenoid can be checked with the monitoring function (Code: 31602, ECMV 1 DIR). • Method of reproducing failure code: Turn starting switch START, set the transmission manual/auto shift selector switch in the MANUAL position, and select 1st using the shift down switch or move the gear shift lever to 1st.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 1st clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			1.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (25) – 1.PS (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (25) and (3)	5 – 15 Ω		
			Between (25), (3) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 1st clutch ECMV solenoid

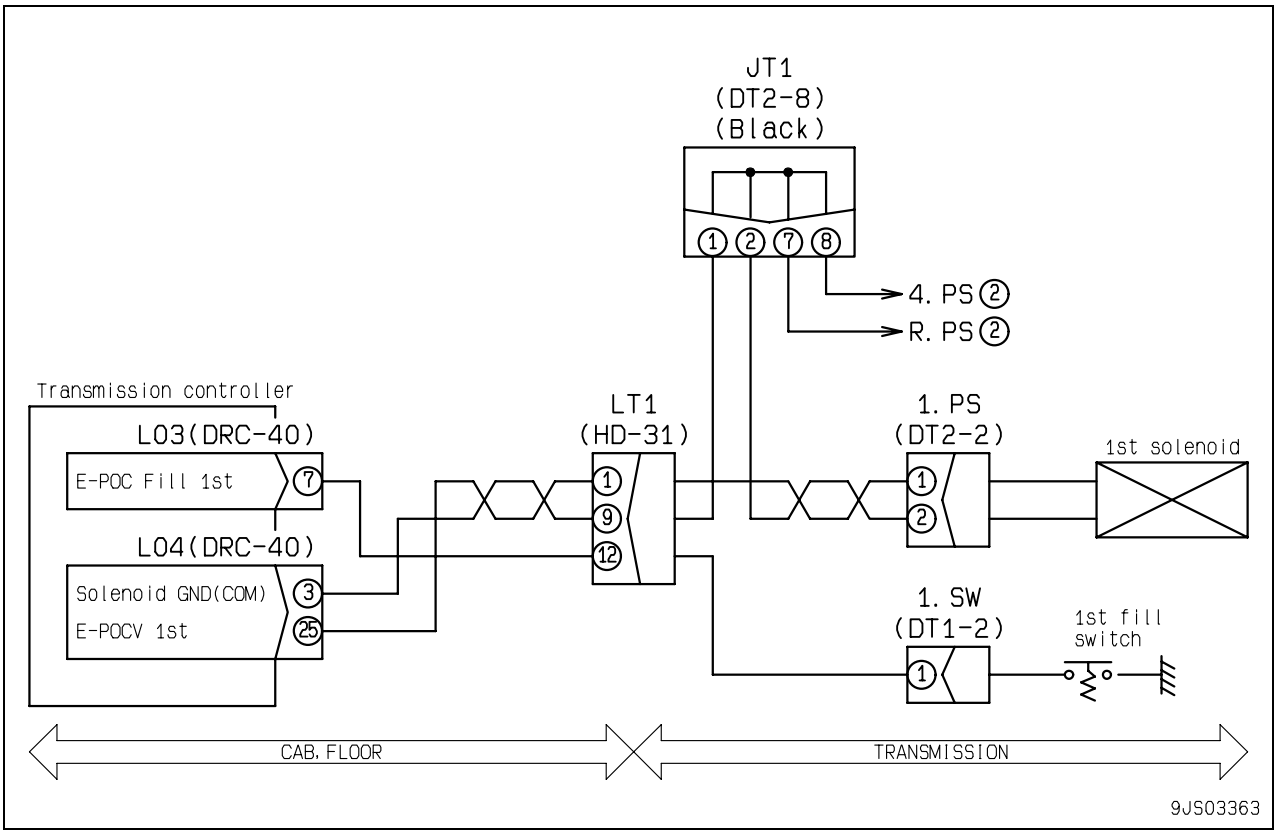


Failure code [DXH4KY] (1st clutch ECMV solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	1st clutch ECMV solenoid: Short circuit with power supply line (Transmission controller system)
E03	**DXH4KY**		
Contents of trouble	• When the 1st clutch ECMV solenoid system was shorted with the power source, abnormal voltage was applied when 1st clutch ECMV solenoid output was OFF.		
Action of controller	• Stops outputting the signal to the 2nd, 3rd, and 4th clutch ECMV solenoids. • Also stops outputting the signal to the F (Forward) and R (Reverse) clutch ECMV solenoids when the speed clutch output is OFF. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until the directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The transmission does not shift into 2nd, 3rd, nor 4th (the machine can travel at 1st).		
Related information	• The output state (current) to the 1st clutch ECMV solenoid can be checked with the monitoring function (Code: 31602, ECMV 1 DIR). • Method of reproducing failure code: Turn starting switch START, set the transmission manual/auto shift selector switch in the MANUAL position, and select 1st using the shift down switch or move the gear shift lever to 1st.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 1st clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			1.PS (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L04 (female) (25) – 1.PS (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (25) and (3)	5 – 15 Ω	
			Between (25), (3) and chassis ground	Min. 1 MΩ	

Circuit diagram related to 1st clutch ECMV solenoid



WA600-6 Wheel loader

Form No. SEN00573-01

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 11

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(Exhaust gas temperature (R): Overheat) 56

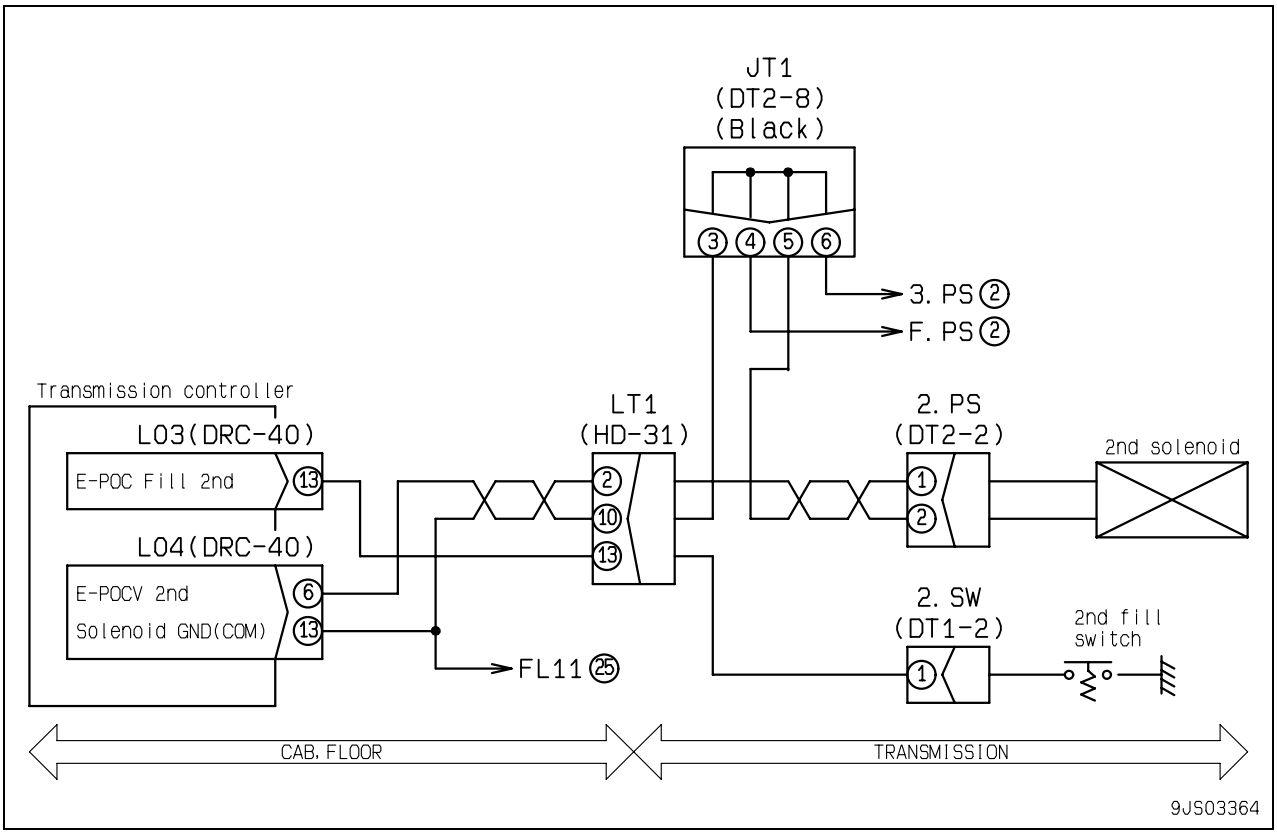
Troubleshooting by failure code (Display of code), Part 11

Failure code [DXH5KA] (2nd clutch ECMV solenoid: Disconnection)

Action code	Failure code	Trouble	2nd clutch ECMV solenoid: Disconnection (Transmission controller system)
E03	**DXH5KA**		
Contents of trouble	• When the 2nd clutch ECMV solenoid system is disconnected, no current flows when 2nd clutch ECMV solenoid output is ON.		
Action of controller	• Stops outputting the signal to the 2nd clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission does not shift into 2nd (The machine can travel in any gear speed other than 2nd.)		
Related information	• The output state (current) to the 2nd clutch ECMV solenoid can be checked with the monitoring function (Code: 31603, ECMV 2 DIR). • Method of reproducing failure code: Turn starting switch START, set the transmission manual/auto shift selector switch in the MANUAL position, and select 2nd using the shift down switch or move the gear shift lever to 2nd.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 2nd clutch ECMV solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			2.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (6) – 2.PS (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between L04 (female) (13) – 2.PS (female) (2)	Resistance	Max. 1 Ω	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (6) and (13)	5 – 15 Ω		

Circuit diagram related to 2nd clutch ECMV solenoid

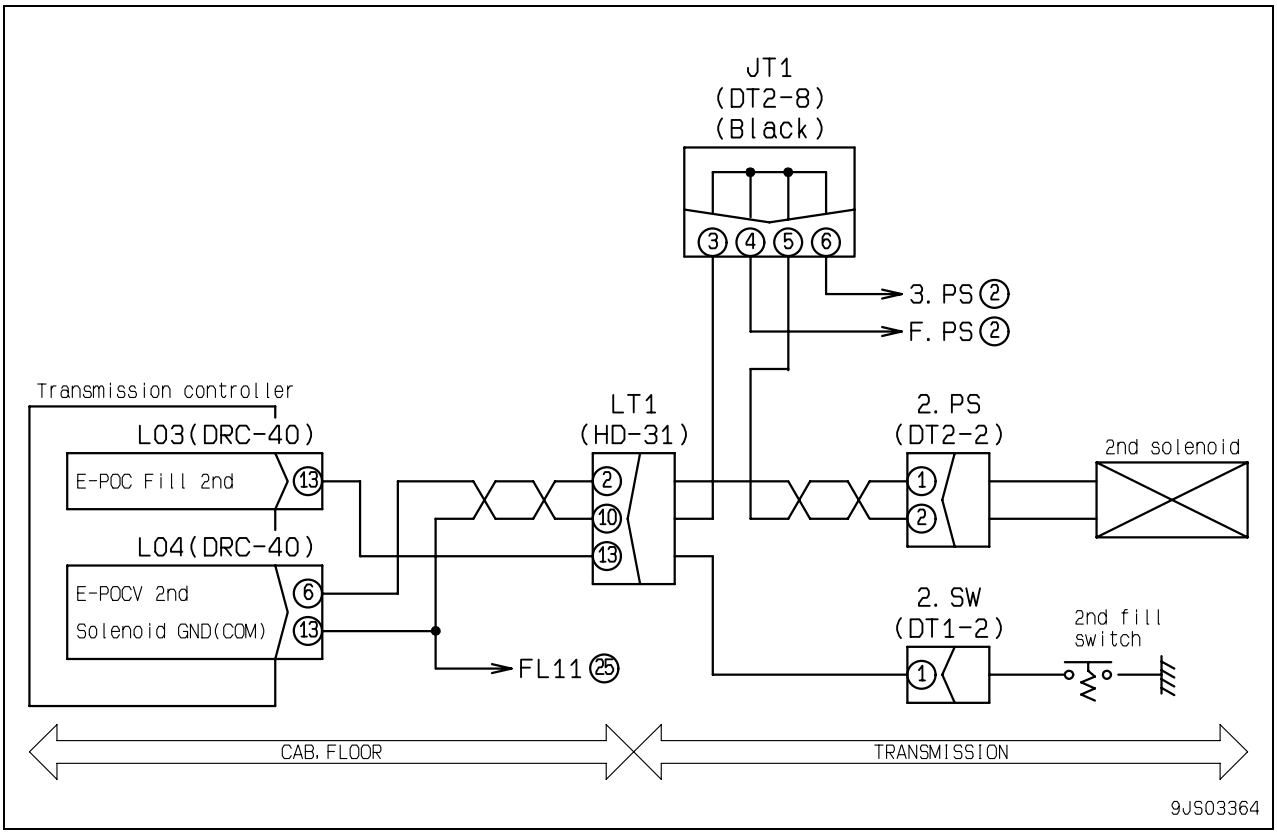


Failure code [DXH5KB] (2nd clutch ECMV solenoid: Short circuit)

Action code	Failure code	Trouble	2nd clutch ECMV solenoid: Short circuit (Transmission controller system)
E03	**DXH5KB**		
Contents of trouble	• When the 2nd clutch ECMV solenoid system was shorted with the chassis ground, abnormal current flowed when 2nd clutch ECMV solenoid output was ON.		
Action of controller	• Stops outputting the signal to the 2nd clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission does not shift into 2nd (The machine can travel in any gear speed other than 2nd.)		
Related information	• The output state (current) to the 2nd clutch ECMV solenoid can be checked with the monitoring function (Code: 31603, ECMV 2 DIR). • Method of reproducing failure code: Turn starting switch START, set the transmission manual/auto shift selector switch in the MANUAL position, and select 2nd using the shift down switch or move the gear shift lever to 2nd.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 2nd clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			2.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (6) – 2.PS (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (6) and (13)	5 – 15 Ω		
			Between (6), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 2nd clutch ECMV solenoid

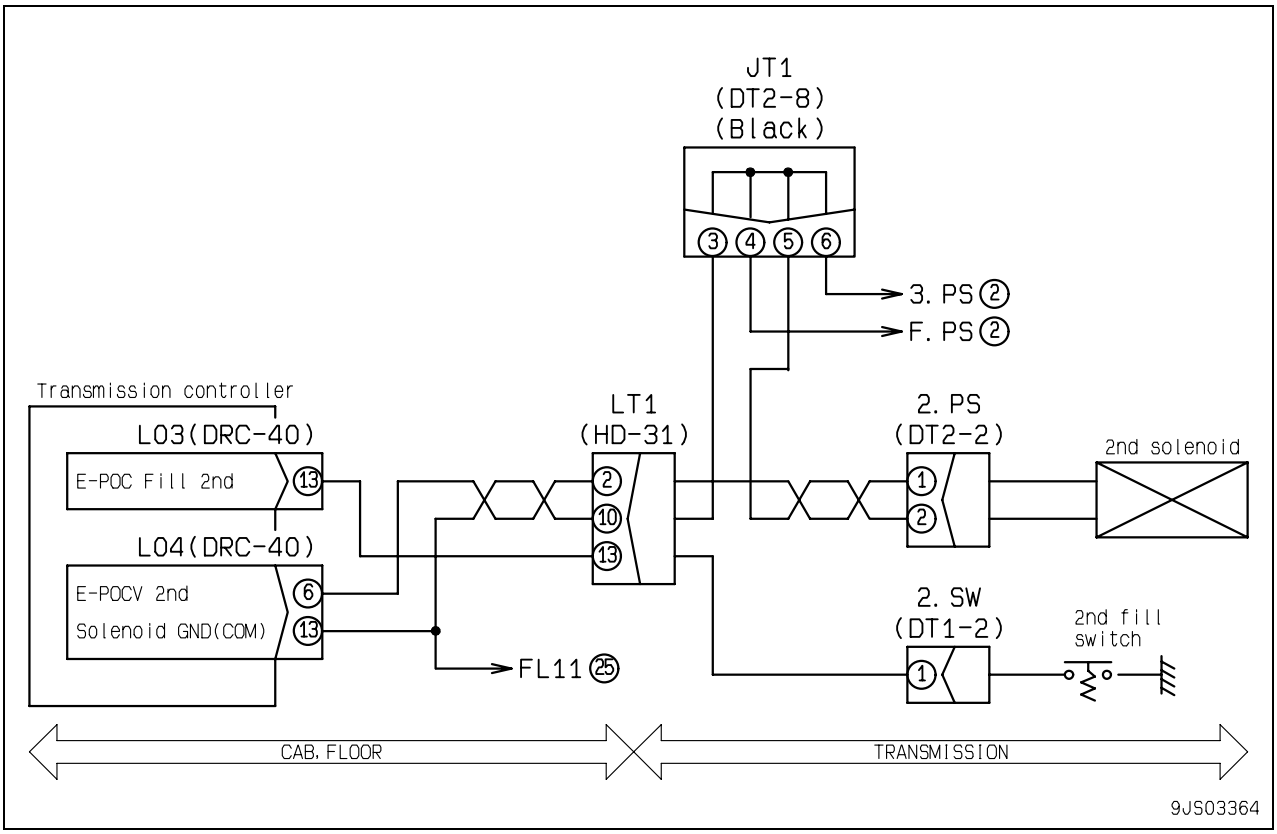


Failure code [DXH5KY] (2nd clutch ECMV solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	2nd clutch ECMV solenoid: Short circuit with power supply line (Transmission controller system)
E03	**DXH5KY**		
Contents of trouble	• When the 2nd clutch ECMV solenoid system was shorted with the power source, abnormal voltage was applied when 2nd clutch ECMV solenoid output was OFF.		
Action of controller	• Stops outputting the signal to the 1st, 3rd, and 4th clutch ECMV solenoids. • Also stops outputting the signal to the F (Forward) and R (Reverse) clutch ECMV solenoids when the speed clutch output is OFF. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until the directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The transmission does not shift into 1st, 3rd, nor 4th (the machine can travel at 2nd).		
Related information	• The output state (current) to the 2nd clutch ECMV solenoid can be checked with the monitoring function (Code: 31603, ECMV 2 DIR). • Method of reproducing failure code: Turn starting switch START, set the transmission manual/auto shift selector switch in the MANUAL position, and select 2nd using the shift down switch or move the gear shift lever to 2nd.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective 2nd clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			2.PS (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L04 (female) (6) – 2.PS (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (6) and (13)	5 – 15 Ω	
			Between (6), (13) and chassis ground	Min. 1 MΩ	

Circuit diagram related to 2nd clutch ECMV solenoid

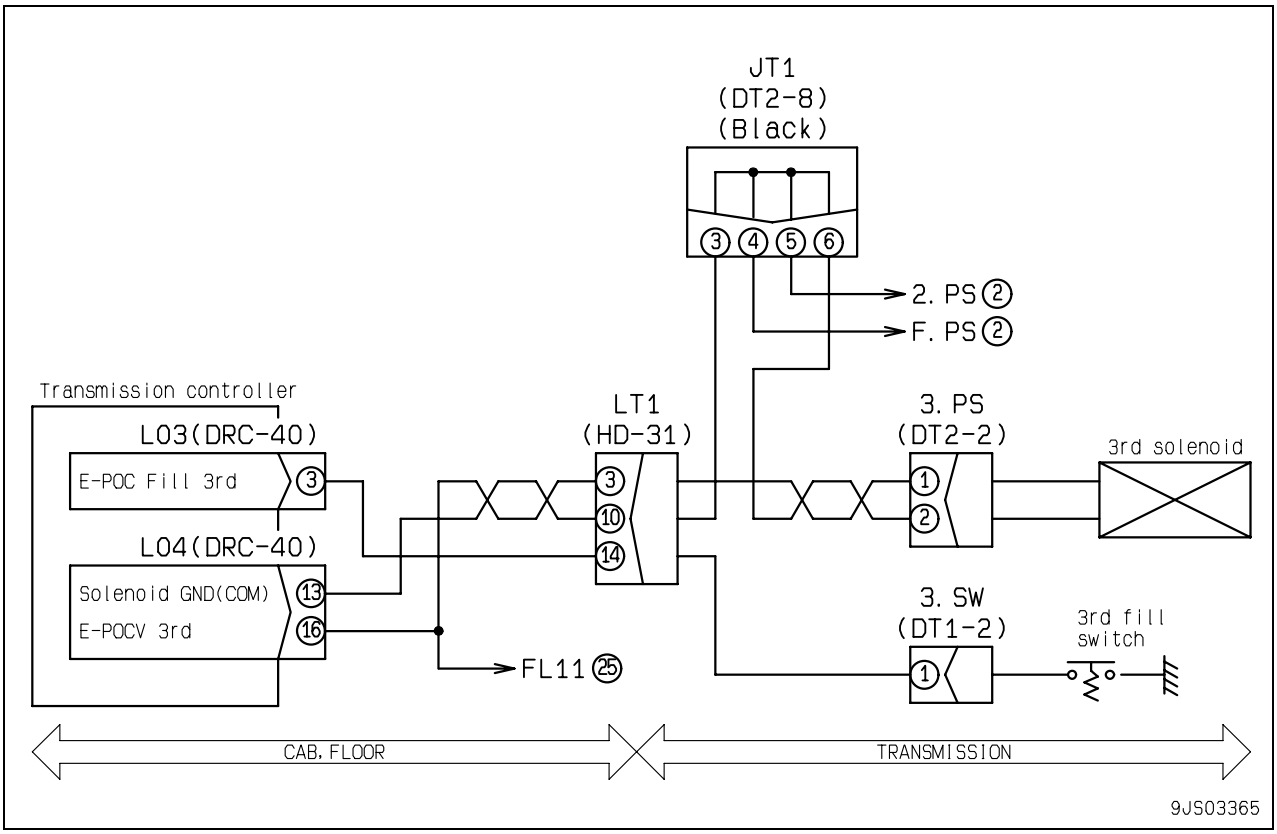


Failure code [DXH6KA] (3rd clutch ECMV solenoid: Disconnection)

Action code	Failure code	Trouble	3rd clutch ECMV solenoid: Disconnection (Transmission controller system)
E03	**DXH6KA**		
Contents of trouble	• When the 3rd clutch ECMV solenoid system is disconnected, no current flows when 3rd clutch ECMV solenoid output is ON.		
Action of controller	• Stops outputting the signal to the 3rd clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission does not shift into 3rd (The machine can travel in any gear speed other than 3rd.)		
Related information	• The output state (current) to the 3rd clutch ECMV solenoid can be checked with the monitoring function (Code: 31604, ECMV 3 DIR). • Method of reproducing failure code: Turn starting switch START, set the transmission manual/auto shift selector switch in the MANUAL position, and select 3rd using the shift down switch or move the gear shift lever to 3rd.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 3rd clutch ECMV solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			3.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (13) – 3.PS (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L04 (female) (16) – 3.PS (female) (1)	Resistance	Max. 1 Ω	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (16) and (13)	5 – 15 Ω		

Circuit diagram related to 3rd clutch ECMV solenoid

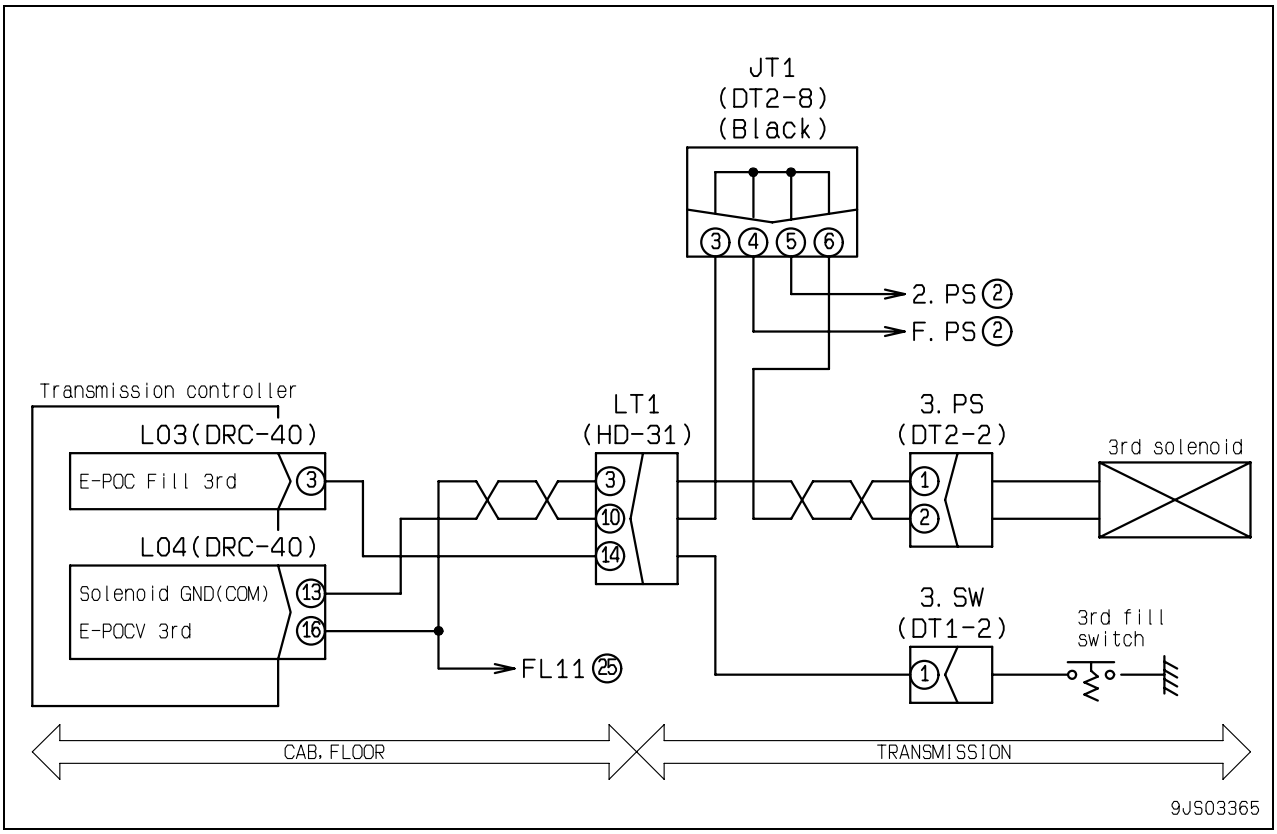


Failure code [DXH6KB] (3rd clutch ECMV solenoid: Short circuit)

Action code	Failure code	Trouble	3rd clutch ECMV solenoid: Short circuit (Transmission controller system)
E03	**DXH6KB**		
Contents of trouble	• When the 3rd clutch ECMV solenoid system was shorted with the chassis ground, abnormal current flowed when 3rd clutch ECMV solenoid output was ON.		
Action of controller	• Stops outputting the signal to the 3rd clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission does not shift into 3rd (The machine can travel in any gear speed other than 3rd.)		
Related information	• The output state (current) to the 3rd clutch ECMV solenoid can be checked with the monitoring function (Code: 31604, ECMV 3 DIR). • Method of reproducing failure code: Turn starting switch START, set the transmission manual/auto shift selector switch in the MANUAL position, and select 3rd using the shift down switch or move the gear shift lever to 3rd.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective 3rd clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			3.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (16) – 3.PS (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (16) and (13)	5 – 15 Ω		
			Between (16), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 3rd clutch ECMV solenoid

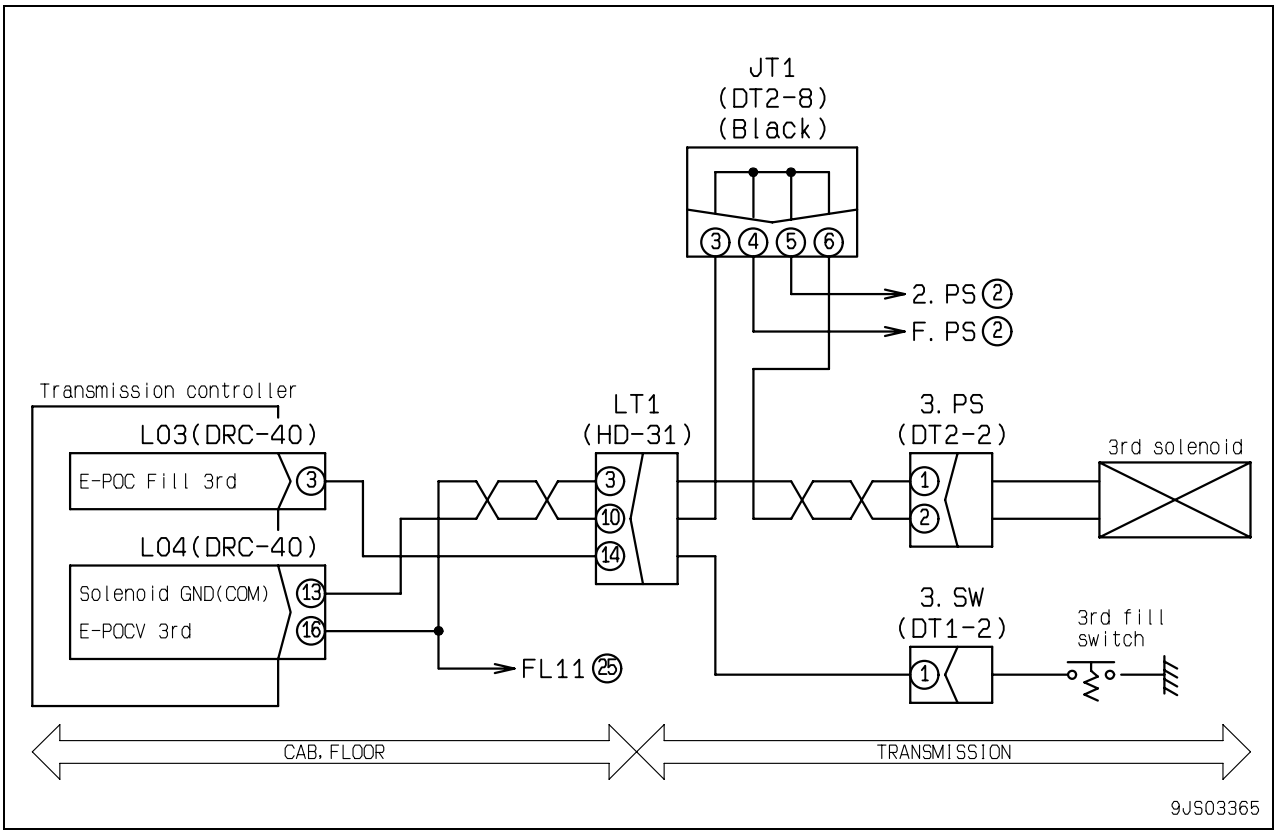


Failure code [DXH6KY] (3rd clutch ECMV solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	3rd clutch ECMV solenoid: Short circuit with power supply line (Transmission controller system)
E03	**DXH6KY**		
Contents of trouble	• When the 3rd clutch ECMV solenoid system was shorted with the power source, abnormal voltage was applied when 3rd clutch ECMV solenoid output was OFF.		
Action of controller	• Stops outputting the signal to the 1st, 2nd, and 4th clutch ECMV solenoids. • Also stops outputting the signal to the F (Forward) and R (Reverse) clutch ECMV solenoids when the speed clutch output is OFF. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until the directional lever or directional selector switch is set to Neutral.		
Problem that appears on machine	• The transmission does not shift into 1st, 2nd, nor 4th (the machine can travel at 3rd).		
Related information	• The output state (current) to the 3rd clutch ECMV solenoid can be checked with the monitoring function (Code: 31604, ECMV 3 DIR). • Method of reproducing failure code: Turn starting switch START, set the transmission manual/auto shift selector switch in the MANUAL position, and select 3rd using the shift down switch or move the gear shift lever to 3rd.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 3rd clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			3.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L04 (female) (16) – 3.PS (female) (1)	Voltage	Max. 1 V	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (16) and (13)	5 – 15 Ω		
			Between (16), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 3rd clutch ECMV solenoid

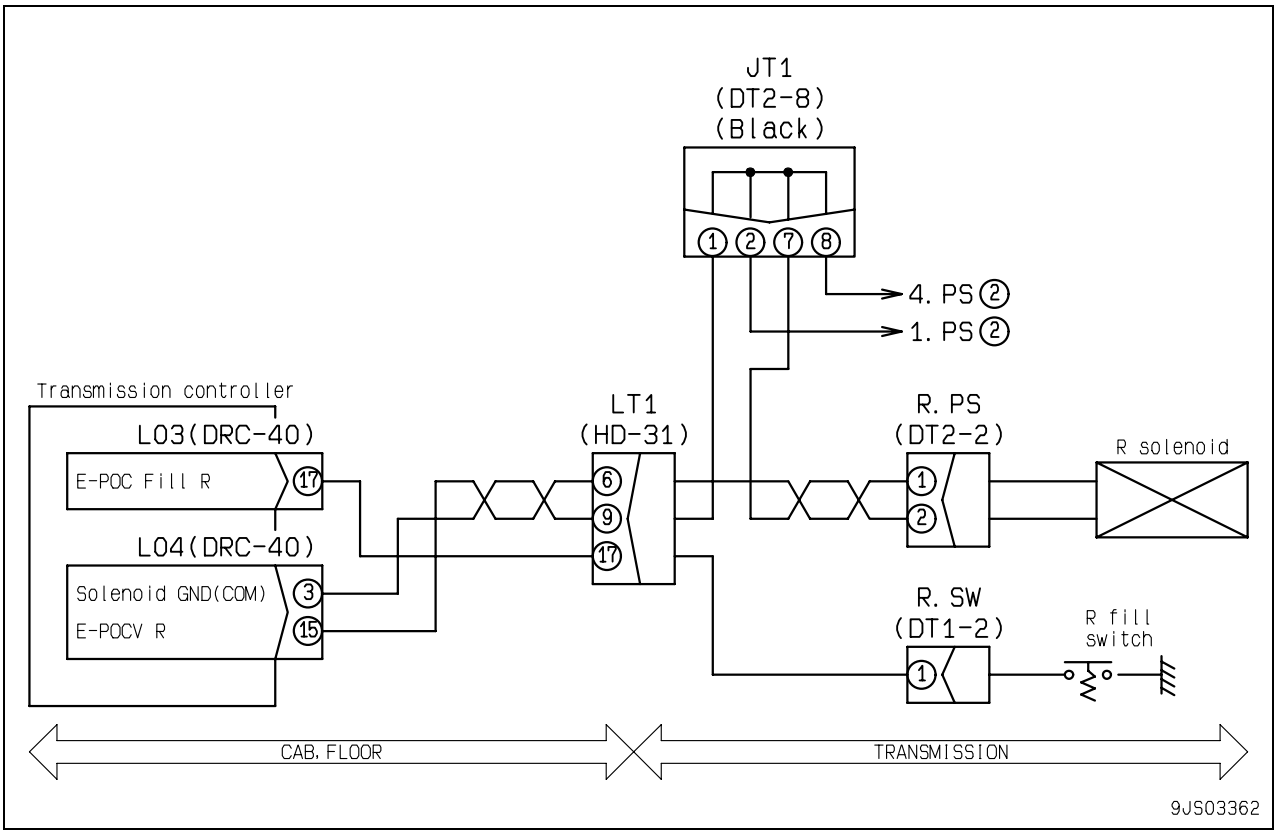


Failure code [DXH7KA] (R clutch ECMV solenoid: Disconnection)

Action code	Failure code	Trouble	R clutch ECMV solenoid: Disconnection (Transmission controller system)
E03	**DXH7KA**		
Contents of trouble	• When the R (Reverse) clutch ECMV solenoid system is disconnected, no current flows when R (Reverse) clutch ECMV solenoid output is ON.		
Action of controller	• Stops outputting the signal to the R (Reverse) clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission cannot be set in the R (Reverse) position (the machine can travel in F (Forward)).		
Related information	• The output state (current) to the R (Reverse) clutch ECMV solenoid can be checked with the monitoring function (Code: 31606, ECMV R DIR). • Method of reproducing failure code: Turn starting switch ON, and set the directional lever or directional selector switch to R (Reverse).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective R (Reverse) clutch ECMV solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R.PS (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L04 (female) (3) – R.PS (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L04 (female) (15) – R.PS (female) (1)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (15) and (3)	5 – 15 Ω	

Circuit diagram related to R (Reverse) clutch ECMV solenoid

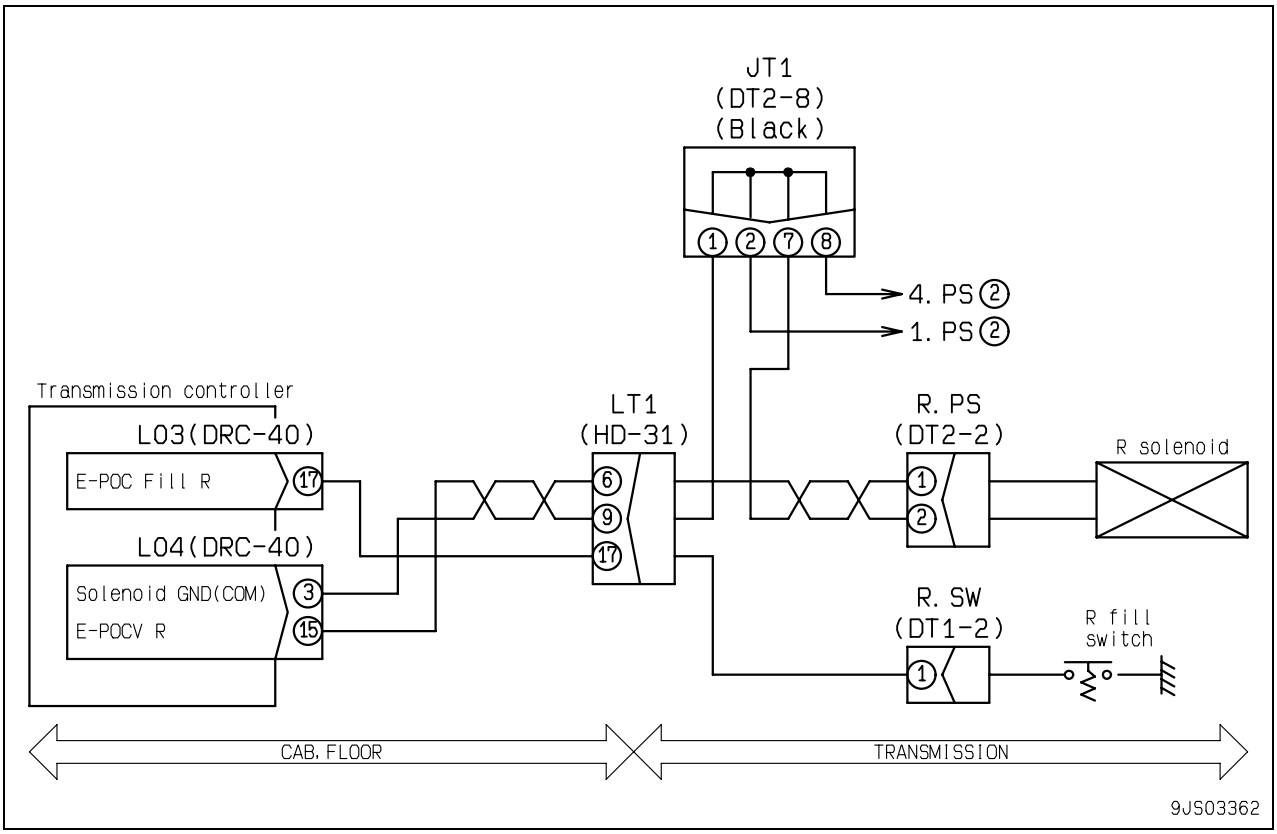


Failure code [DXH7KB] (R clutch ECMV solenoid: Short circuit)

Action code	Failure code	Trouble	R clutch ECMV solenoid: Short circuit (Transmission controller system)
E03	**DXH7KB**		
Contents of trouble	• When the R (Reverse) clutch ECMV solenoid system was shorted with the chassis ground, abnormal current flowed when R (Reverse) clutch ECMV solenoid output was ON.		
Action of controller	• Stops outputting the signal to the R (Reverse) clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission cannot be set in the R (Reverse) position (the machine can travel in F (Forward)).		
Related information	• The output state (current) to the R (Reverse) clutch ECMV solenoid can be checked with the monitoring function (Code: 31606, ECMV R DIR). • Method of reproducing failure code: Turn starting switch ON, and set the directional lever or directional selector switch to R (Reverse).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective R (Reverse) clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (15) – R.PS (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (15) and (3)	5 – 15 Ω		
			Between (15), (3) and chassis ground	Min. 1 MΩ		

Circuit diagram related to R (Reverse) clutch ECMV solenoid

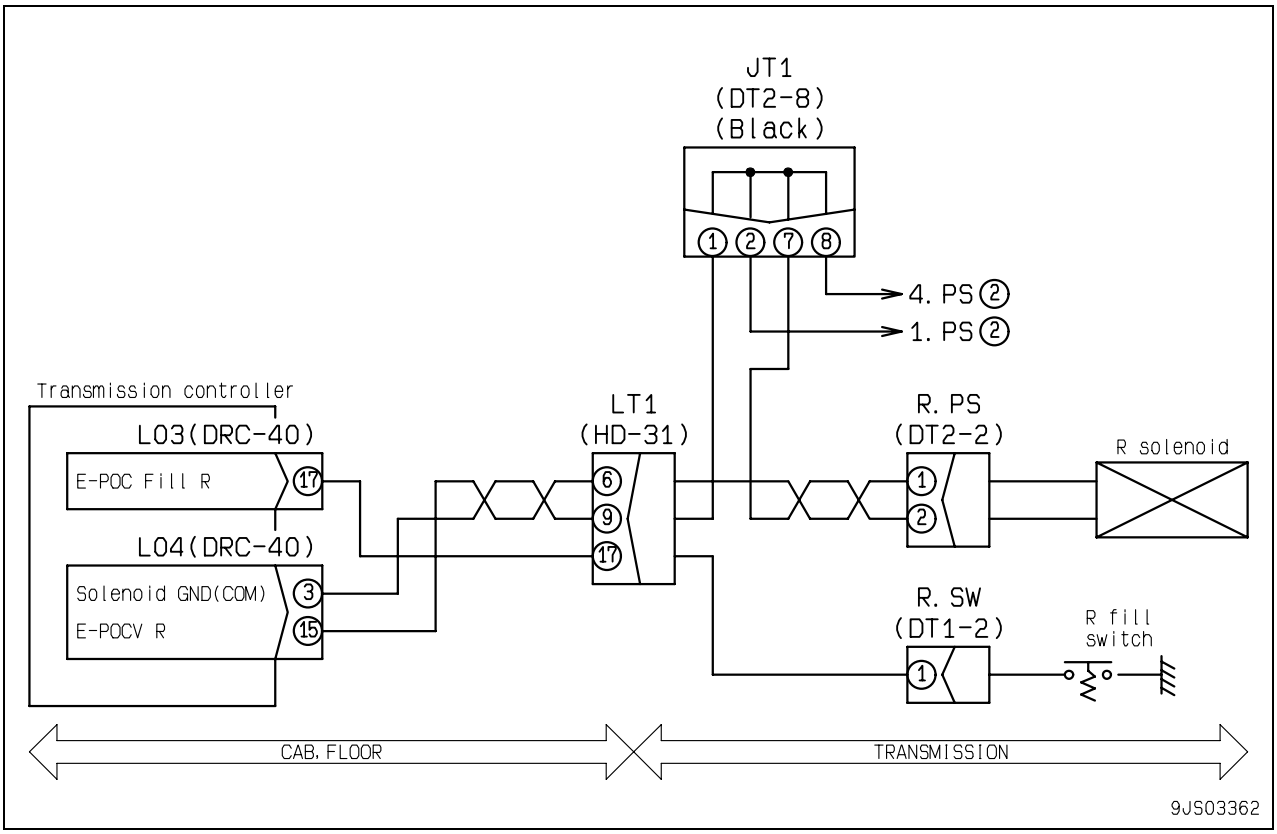


Failure code [DXH7KY] (R clutch ECMV solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	R clutch ECMV solenoid: Short circuit with power supply line (Transmission controller system)
E03	**DXH7KY**		
Contents of trouble	• Since the R (Reverse) ECMV solenoid system was shorted with the power source, abnormal voltage was applied when the R (Reverse) ECMV solenoid output was OFF.		
Action of controller	• Outputs the signal to the R (Reverse) clutch ECMV solenoid when the directional lever or directional switch is in R (Reverse). • Sets the transmission in N (Neutral) when the gear shift lever is in N (Neutral) or F (Forward). • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until the directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The machine can travel only in R (Reverse).		
Related information	• The output state (current) to the R clutch ECMV solenoid can be checked with the monitoring function (Code: 31606, ECMV R DIR). • Method of reproducing failure code: Turn starting switch ON, and set the directional lever or directional switch to R (Reverse).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective R (Reverse) clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (15) – R.PS (female) (1)	Voltage	Max. 1 V	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (15) and (3)	5 – 15 Ω		
			Between (15), (3) and chassis ground	Min. 1 MΩ		

Circuit diagram related to R (Reverse) clutch ECMV solenoid

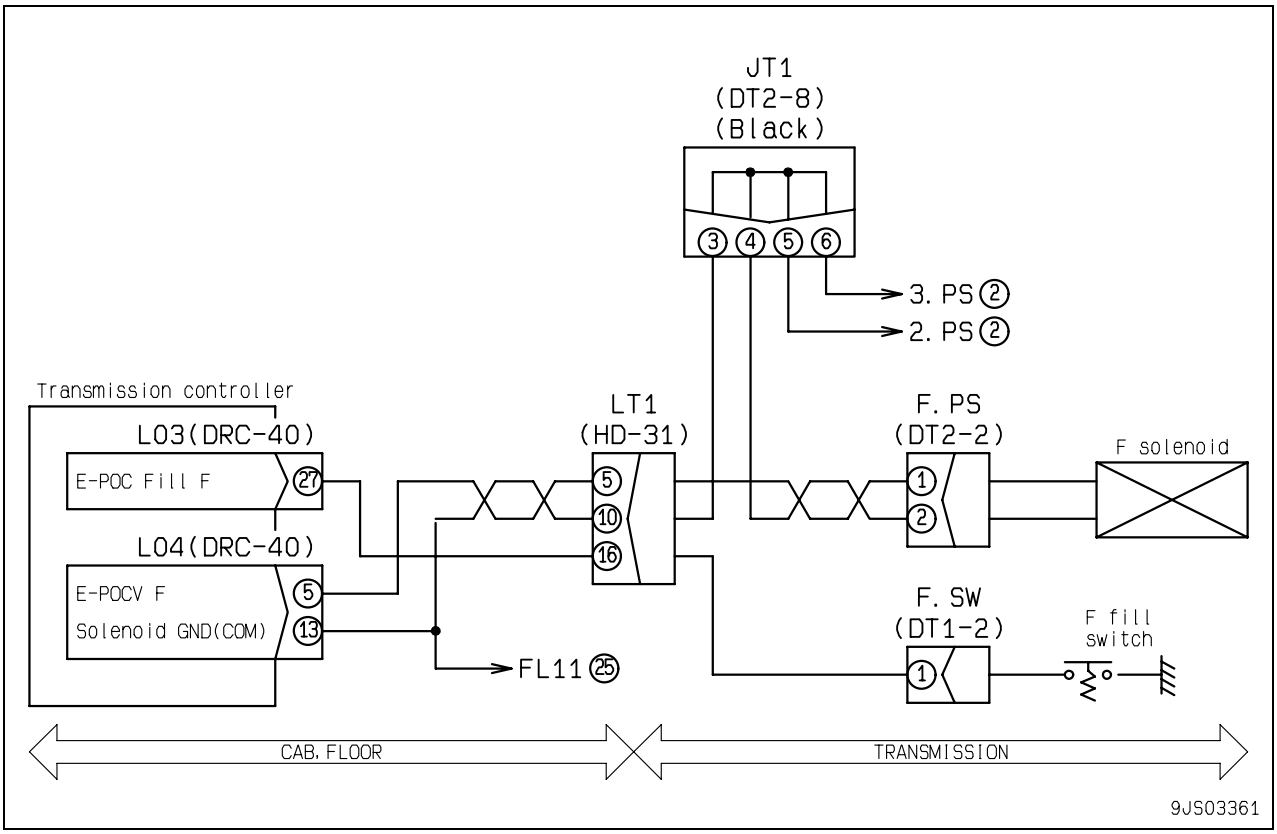


Failure code [DXH8KA] (F clutch ECMV solenoid: Disconnection)

Action code	Failure code	Trouble	F clutch ECMV solenoid: Disconnection (Transmission controller system)
E03	**DXH8KA**		
Contents of trouble	• When the F (Forward) clutch ECMV solenoid system is disconnected, no current flows when F (Forward) clutch ECMV solenoid output is ON.		
Action of controller	• Stops outputting the signal to the F (Forward) clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission cannot be set in the F (Forward) position (the machine can travel in R (Reverse)).		
Related information	• The output state (current) to the F clutch ECMV solenoid can be checked with the monitoring function (Code: 31608, ECMV F DIR). • Method of reproducing failure code: Turn starting switch ON, and set the directional lever or directional switch to F (Forward).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective F (Forward) clutch ECMV solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F.PS (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L04 (female) (13) – F.PS (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L04 (female) (5) – F.PS (female) (1)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (5) and (13)	5 – 15 Ω	

Circuit diagram related to F (Forward) clutch ECMV solenoid

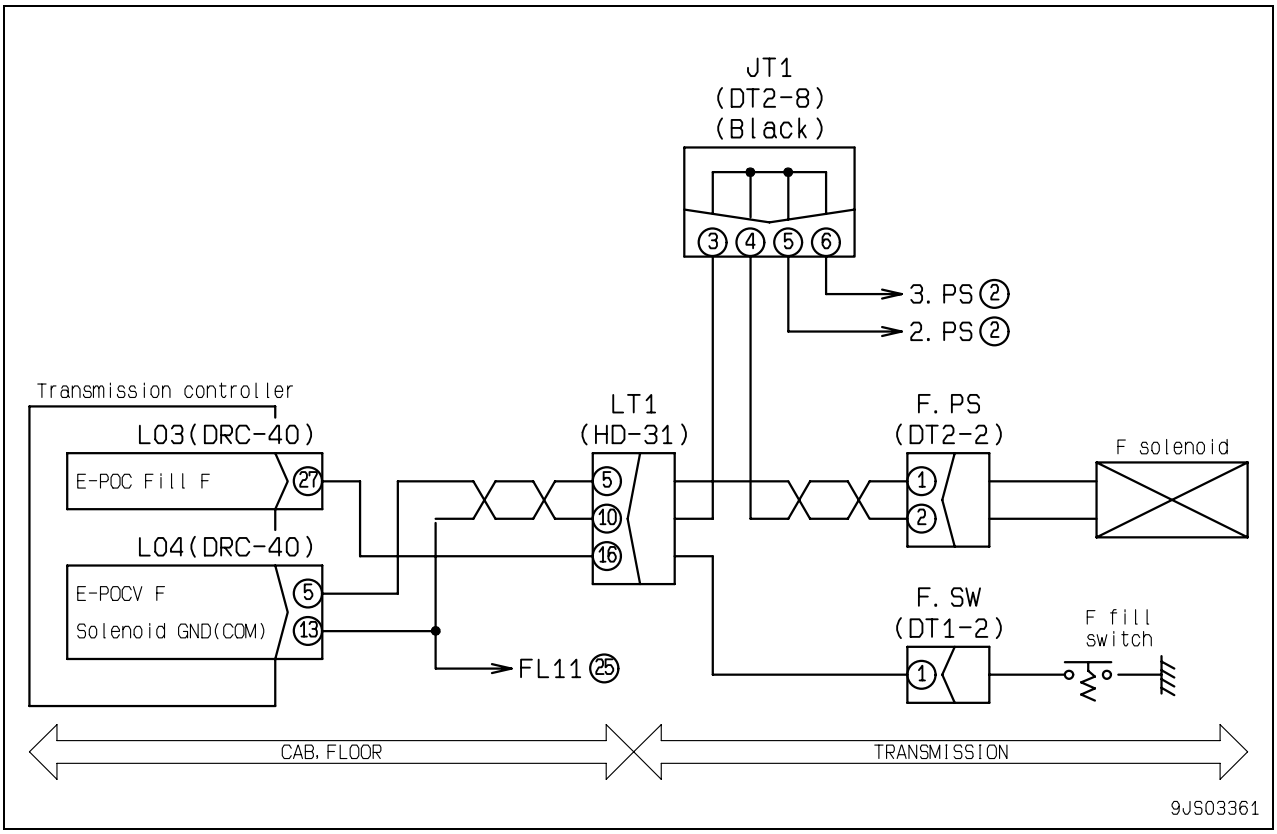


Failure code [DXH8KB] (F clutch ECMV solenoid: Short circuit)

Action code	Failure code	Trouble	F clutch ECMV solenoid: Short circuit (Transmission controller system)
E03	**DXH8KB**		
Contents of trouble	• When the F (Forward) clutch ECMV solenoid system was shorted with the chassis ground, abnormal current flowed when F (Forward) clutch ECMV solenoid output was ON.		
Action of controller	• Stops outputting the signal to the F (Forward) clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission cannot be set in the F (Forward) position (the machine can travel in R (Reverse)).		
Related information	• The output state (current) to the F (Forward) clutch ECMV solenoid can be checked with the monitoring function (Code: 31608, ECMV F DIR). • Method of reproducing failure code: Turn starting switch ON, and set the directional lever or directional switch to F (Forward).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective F (Forward) clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (5) – F.PS (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (5) and (13)	5 – 15 Ω		
			Between (5), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to F (Forward) clutch ECMV solenoid

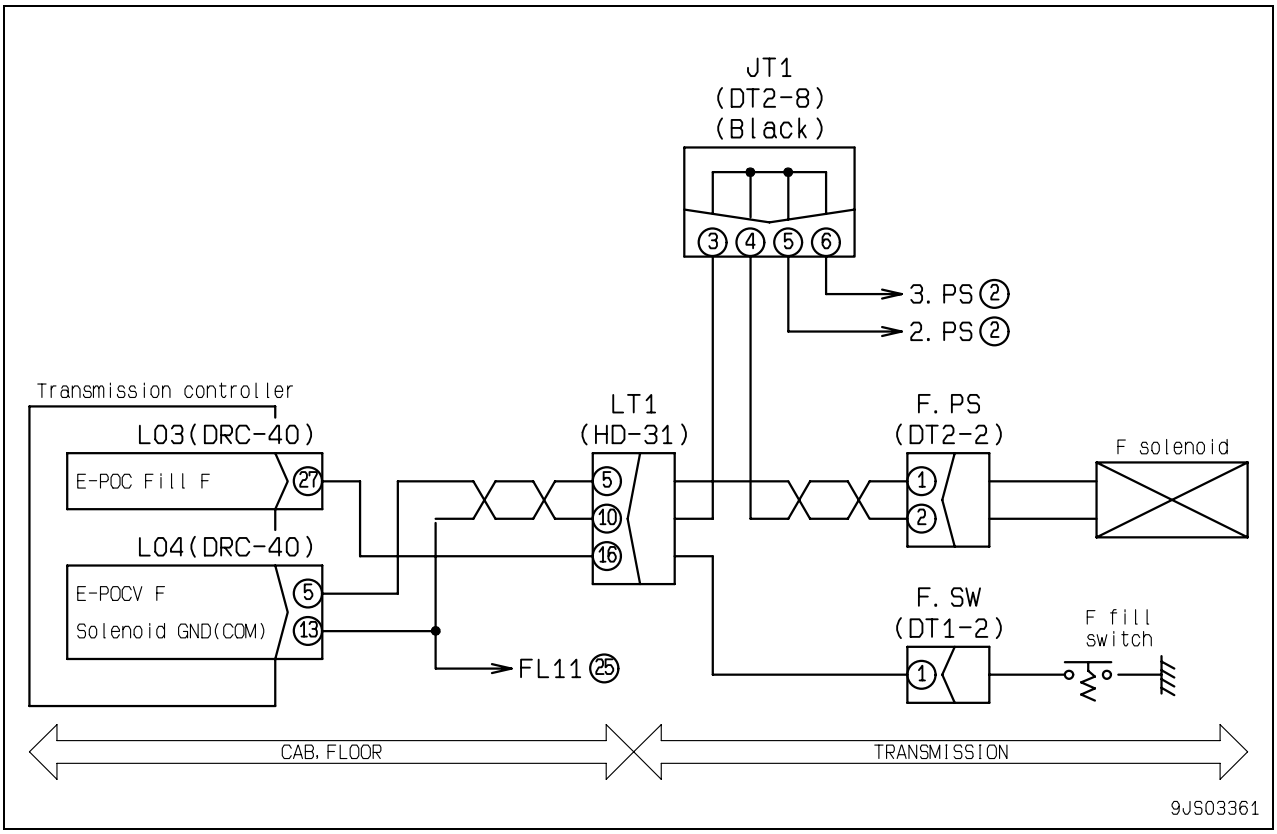


Failure code [DXH8KY] (F clutch ECMV solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	F clutch ECMV solenoid: Short circuit with power supply line (Transmission controller system)
E03	**DXH8KY**		
Contents of trouble	• Since the F (Forward) ECMV solenoid system was shorted with the power source, abnormal voltage was applied when the F (Forward) ECMV solenoid output was OFF.		
Action of controller	• Outputs the signal to the F (Forward) clutch ECMV solenoid when the directional lever or directional switch is in F (Forward). • Sets the transmission in N (Neutral) when the gear shift lever is in N (Neutral) or R (Reverse). • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until the directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The machine can travel only F (Forward).		
Related information	• The output state (current) to the F (Forward) clutch ECMV solenoid can be checked with the monitoring function (Code: 31608, ECMV F DIR). • Method of reproducing failure code: Turn starting switch ON, and set the directional lever or directional switch to F (Forward).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective F (Forward) clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (5) – F.PS (female) (1)	Voltage	Max. 1 V	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (5) and (13)	5 – 15 Ω		
			Between (5), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to F (Forward) clutch ECMV solenoid

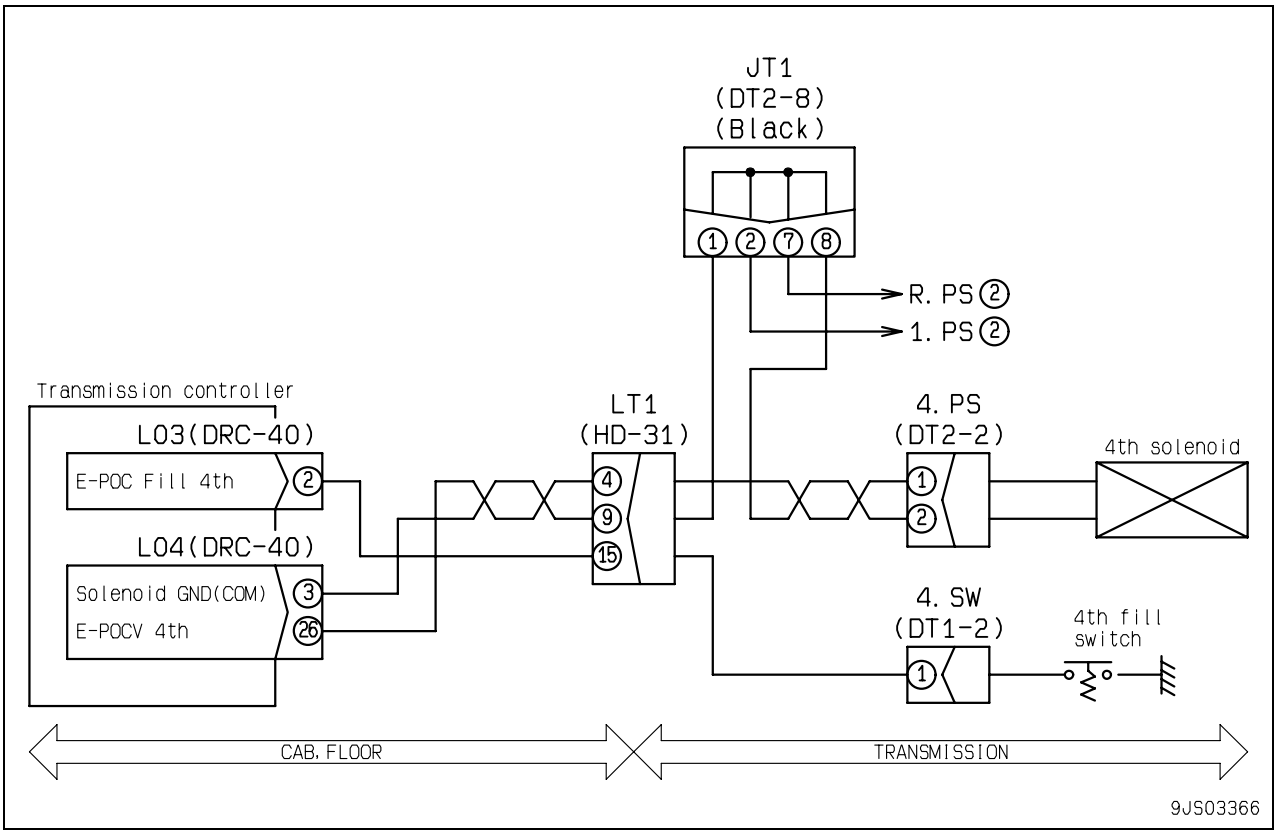


Failure code [DXHHKA] (4th clutch ECMV solenoid: Disconnection)

Action code	Failure code	Trouble	4th clutch ECMV solenoid: Disconnection (Transmission controller system)
E03	**DXHHKA**		
Contents of trouble	• When the 4th clutch ECMV solenoid system is disconnected, no current flows when 4th clutch ECMV solenoid output is ON.		
Action of controller	• Stops outputting the signal to the 4th clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission does not shift into 4th (The machine can travel in any gear speed other than 4th.)		
Related information	• The output state (current) to the 4th clutch ECMV solenoid can be checked with the monitoring function (Code: 31605, ECMV 4 DIR). • Method of reproducing failure code: Turn starting switch START, set the transmission manual/auto shift selector switch in the MANUAL position, and select 4th using the shift down switch or move the gear shift lever to 4th.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 4th clutch ECMV solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			4.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
	2	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (3) – 4.PS (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L04 (female) (26) – 4.PS (female) (1)	Resistance	Max. 1 Ω	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (26) and (3)	5 – 15 Ω		

Circuit diagram related to 4th clutch ECMV solenoid

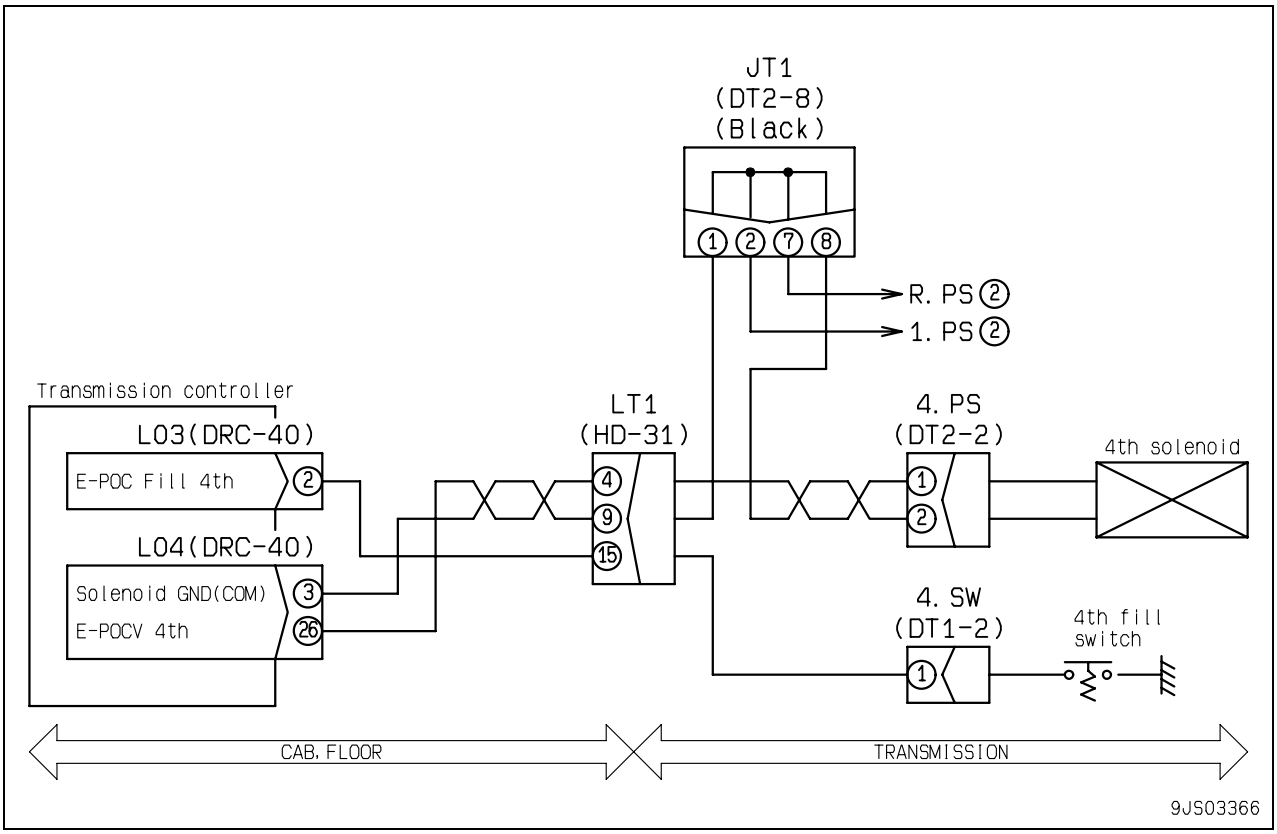


Failure code [DXHHKB] (4th clutch ECMV solenoid: Short circuit)

Action code	Failure code	Trouble	4th clutch ECMV solenoid: Short circuit (Transmission controller system)
E03	**DXHHKB**		
Contents of trouble	• When the 4th clutch ECMV solenoid system was shorted with the chassis ground, abnormal current flowed when 4th clutch ECMV solenoid output was ON.		
Action of controller	• Stops outputting the signal to the 4th clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The transmission does not shift into 4th (The machine can travel in any gear speed other than 4th.)		
Related information	• The output state (current) to the 4th clutch ECMV solenoid can be checked with the monitoring function (Code: 31605, ECMV 4 DIR). • Method of reproducing failure code: Turn starting switch START, set the transmission manual/auto shift selector switch in the MANUAL position, and select 4th using the shift down switch or move the gear shift lever to 4th.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 4th clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			4.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (26) – 4.PS (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (26) and (3)	5 – 15 Ω		
			Between (26), (3) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 4th clutch ECMV solenoid

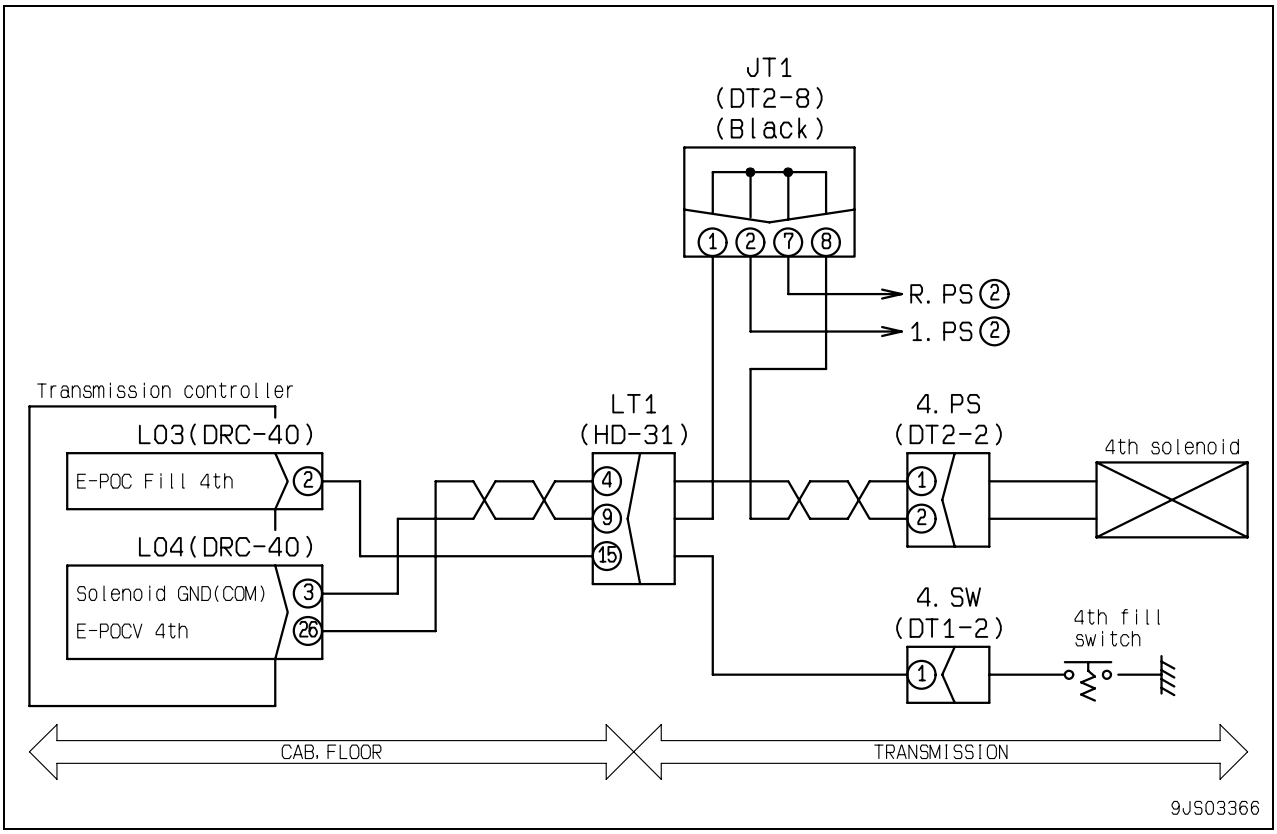


Failure code [DXHHKY] (4th clutch ECMV solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	4th clutch ECMV solenoid: Short circuit with power supply line (Transmission controller system)
E03	**DXHHKY**		
Contents of trouble	• When the 4th clutch ECMV solenoid system was shorted with the power source, abnormal voltage was applied when 4th clutch ECMV solenoid output was OFF.		
Action of controller	• Stops outputting the signal to the 1st, 2nd, and 3rd clutch ECMV solenoids. • Also stops outputting the signal to the F (Forward) and R (Reverse) clutch ECMV solenoids when the speed clutch output is OFF. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until the directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The transmission does not shift into 1st, 2nd, nor 3rd (the machine can travel at 4th).		
Related information	• The output state (current) to the 4th clutch ECMV solenoid can be checked with the monitoring function (Code: 31605, ECMV 4 DIR). • Method of reproducing failure code: Turn starting switch START, set the transmission manual/auto shift selector switch in the MANUAL position, and select 4th using the shift down switch or move the gear shift lever to 4th.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 4th clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			4.PS (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L04 (female) (26) – 4.PS (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (26) and (3)	5 – 15 Ω	
			Between (26), (3) and chassis ground	Min. 1 MΩ	

Circuit diagram related to 4th clutch ECMV solenoid

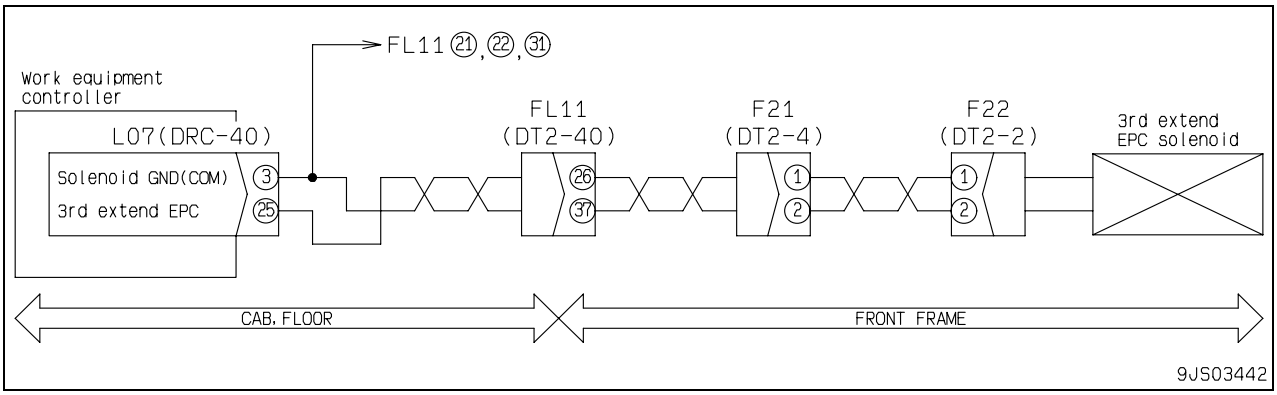


Failure code [DXHJKA] (3-spool valve extract EPC solenoid: Disconnection)

Action code	Failure code	Trouble	3-spool valve extract EPC solenoid: Disconnection (Work equipment controller system)
E03	**DXHJKA**		
Contents of trouble	• Since the 3-spool valve (attachment) extract EPC solenoid output signal system is disconnected, no current flows when the 3-spool valve (attachment) extract EPC solenoid output is ON.		
Action of controller	• Continues outputting. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The 3-spool valve (attachment) cylinder is not extracted.		
Related information	• The output state (current) to the 3-spool valve (attachment) extract EPC solenoid can be checked with the monitoring function (Code: 41906, 3RD EPC1 DIR). • 3-spool valve (attachment)-equipped model specification only • Method of reproducing failure code: Engine started + 3-spool valve (attachment) extract • This error is not displayed on a machine which is not equipped with 3-spool valve (attachment). If it is displayed, select “NO ADD” 3-spool valve option in option setting.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective 3-spool valve (attachment) extract EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F22 (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (3) – F22 (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L07 (female) (25) – F22 (female) (1)	Resistance	Max. 1 Ω	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L07 (female)	Resistance		
			Between (25) and (3)	5 – 15 Ω		

Circuit diagram related to 3-spool valve (attachment) extract EPC solenoid

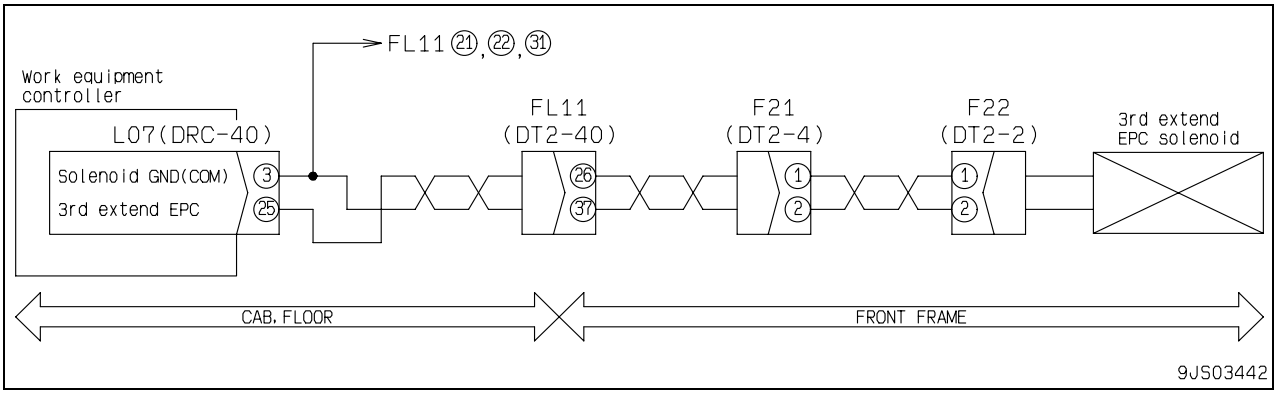


Failure code [DXHJKB] (3-spool valve extract EPC solenoid: Short circuit)

Action code	Failure code	Trouble	3-spool valve extract EPC solenoid: Short circuit (Work equipment controller system)
E03	**DXHJKB**		
Contents of trouble	• Since the 3-spool valve (attachment) extract EPC solenoid output signal system was shorted with the chassis ground, abnormal current flowed when the 3-spool valve (attachment) extract EPC solenoid output was ON.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The 3-spool valve (attachment) cylinder is not extracted. • The wiring harness or controller may be burnt out.		
Related information	• The output state (current) to the 3-spool valve (attachment) extract EPC solenoid can be checked with the monitoring function (Code: 41906, 3RD EPC1 DIR). • 3-spool valve (attachment)-equipped model specification only • Method of reproducing failure code: Engine started + 3-spool valve (attachment) extract • This error is not displayed on a machine which is not equipped with 3-spool valve (attachment). If it is displayed, select “NO” 3-spool valve option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 3-spool valve (attachment) extract EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F22 (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (25) – F22 (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L07 (female)	Resistance		
			Between (25) and (3)	5 – 15 Ω		

Circuit diagram related to 3-spool valve (attachment) extract EPC solenoid

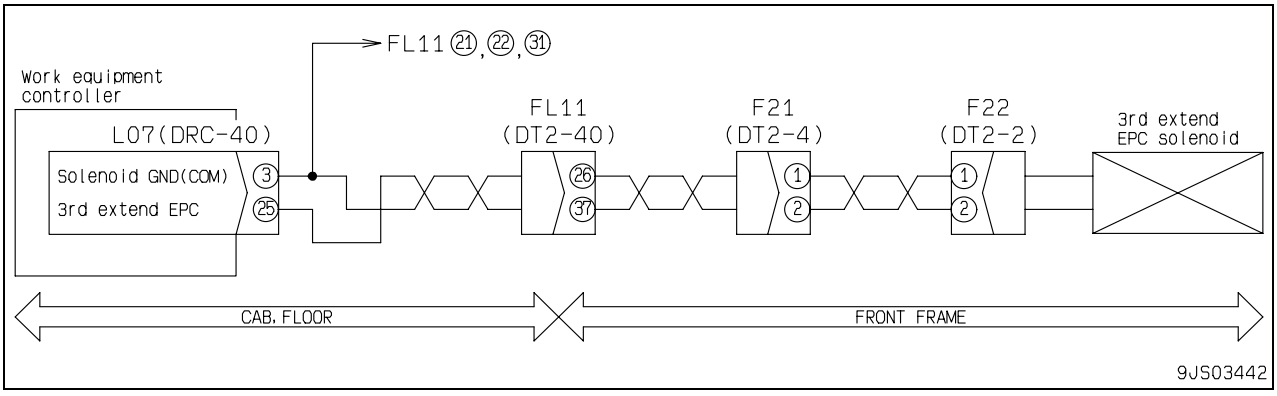


Failure code [DXHJKY] (3-spool valve extract EPC solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	3-spool valve extract EPC solenoid: Short circuit with power supply line (Work equipment controller system)
E03	**DXHJKY**		
Contents of trouble	• Since the 3-spool valve (attachment) extract EPC solenoid output signal system was shorted with the power source, abnormal voltage was applied when the 3-spool valve (attachment) extract EPC solenoid output was OFF.		
Action of controller	• Turns the output to the work equipment neutral lock solenoid ON. • Stops outputting the signal to the lift arm raise/lower, bucket dump/tilt, 3-spool valve (attachment) extract/retract EPC solenoid. • Stops outputting the signal to all work equipment detent. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The 3-spool valve (attachment) cylinder is not extracted. • The 3-spool valve (attachment) extract EPC solenoid may be burnt out.		
Related information	• The output state (current) to the 3-spool valve (attachment) extract EPC solenoid can be checked with the monitoring function (Code: 41906, 3RD EPC1 DIR). • 3-spool valve (attachment)-equipped model specification only • Method of reproducing failure code: Engine started + 3-spool valve (attachment) extract • This error is not displayed on a machine which is not equipped with 3-spool valve (attachment). If it is displayed, select “NO ADD” 3-spool valve option in option setting.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective 3-spool valve (attachment) extract EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F22 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L07 (female) (25) – F22 (female) (1)	Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (25) and (3)	5 – 15 Ω	

Circuit diagram related to 3-spool valve (attachment) extract EPC solenoid

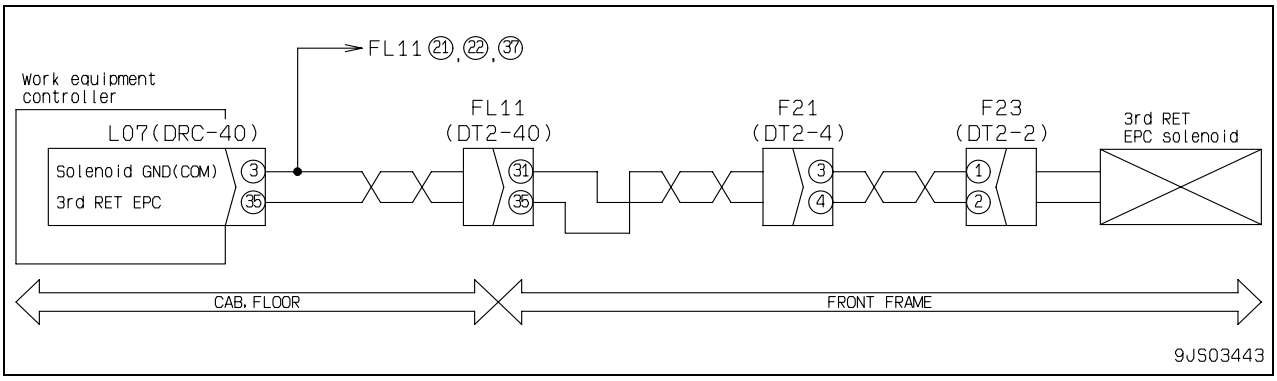


Failure code [DXHKKA] (3-spool valve retract EPC solenoid: Disconnection)

Action code	Failure code	Trouble	3-spool valve retract EPC solenoid: Disconnection (Work equipment controller system)
E03	**DXHKKA**		
Contents of trouble	• Since the 3-spool valve (attachment) retract EPC solenoid output signal system is disconnected, no current flows when the 3-spool valve (attachment) retract EPC solenoid output is ON.		
Action of controller	• Continues outputting. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The 3-spool valve (attachment) cylinder is not retracted.		
Related information	• The output state (current) to the 3-spool valve (attachment) retract EPC solenoid can be checked with the monitoring function (Code: 41907, 3RD EPC2 DIR). • 3-spool valve (attachment)-equipped model specification only • Method of reproducing failure code: Engine started + 3-spool valve (attachment) retract • This error is not displayed on a machine which is not equipped with 3-spool valve (attachment). If it is displayed, select “NO ADD” 3-spool valve option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 3-spool valve (attachment) retract EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F23 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L07 (female) (3) – F23 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L07 (female) (35) – F23 (female) (1)	Resistance	Max. 1 Ω
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (35) and (3)	5 – 15 Ω	

Circuit diagram related to 3-spool valve (attachment) retract EPC solenoid

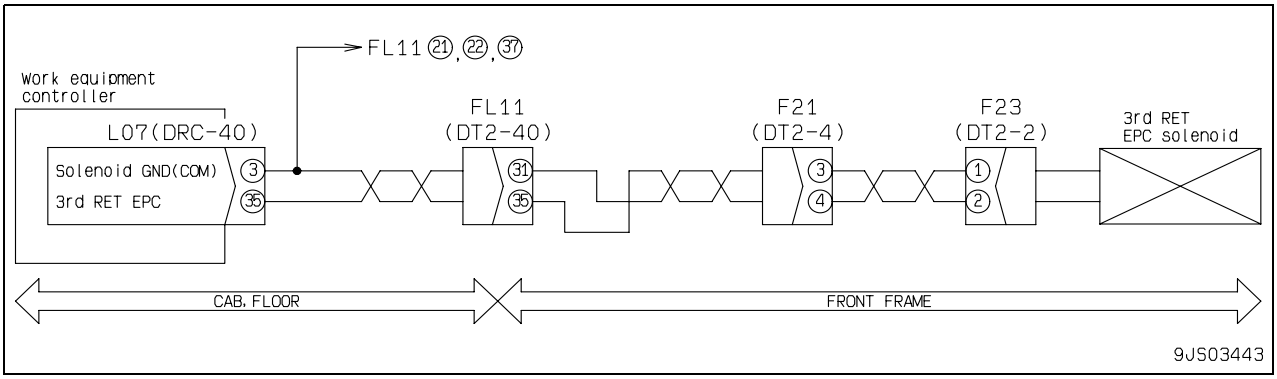


Failure code [DXHKKB] (3-spool valve retract EPC solenoid: Short circuit)

Action code	Failure code	Trouble	3-spool valve retract EPC solenoid: Short circuit (Work equipment controller system)
E03	**DXHKKB**		
Contents of trouble	• Since the 3-spool valve (attachment) retract EPC solenoid output signal system was shorted with the chassis ground, abnormal current flowed when the 3-spool valve (attachment) retract EPC solenoid output was ON.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The 3-spool valve (attachment) cylinder is not retracted. • The wiring harness or controller may be burnt out.		
Related information	• The output state (current) to the 3-spool valve (attachment) retract EPC solenoid can be checked with the monitoring function (Code: 41907, 3RD EPC2 DIR). • 3-spool valve (attachment)-equipped model specification only • Method of reproducing failure code: Engine started + 3-spool valve (attachment) retract • This error is not displayed on a machine which is not equipped with 3-spool valve (attachment). If it is displayed, select “NO ADD” 3-spool valve option in option setting.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 3-spool valve (attachment) retract EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			F23 (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (35) – F23 (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L07 (female)	Resistance		
			Between (35) and (3)	5 – 15 Ω		

Circuit diagram related to 3-spool valve (attachment) retract EPC solenoid

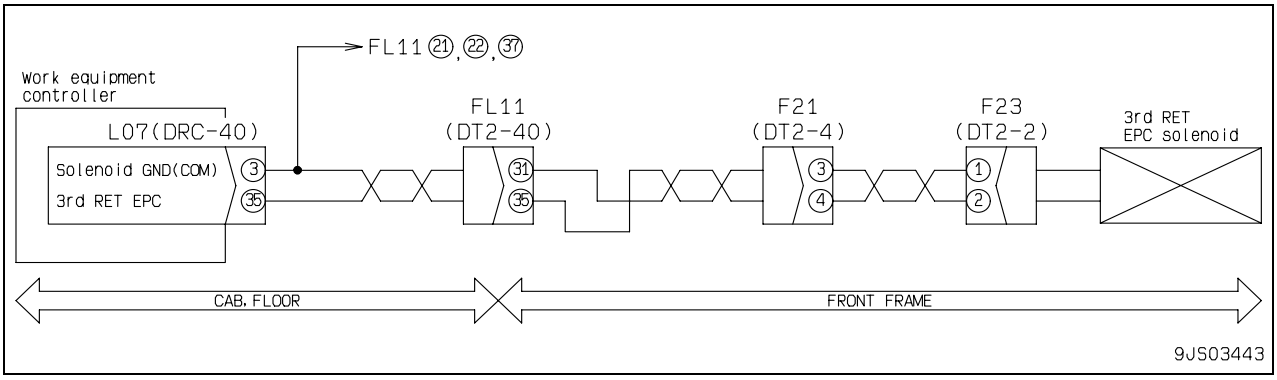


Failure code [DXHKKY] (3-spool valve retract EPC solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	3-spool valve retract EPC solenoid: Short circuit with power supply line (Work equipment controller system)
E03	**DXHKKY**		
Contents of trouble	• Since the 3-spool valve (attachment) retract EPC solenoid output signal system was shorted with the power source, abnormal voltage was applied when the 3-spool valve (attachment) retract EPC solenoid output was OFF.		
Action of controller	• Turns the output to the work equipment neutral lock solenoid ON. • Stops outputting the signal to the lift arm raise/lower, bucket dump/tilt, 3-spool valve (attachment) extract/retract EPC solenoid. • Stops outputting the signal to all work equipment detent. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The 3-spool valve (attachment) cylinder is not retracted. • The 3-spool valve (attachment) retract EPC solenoid may be burnt out.		
Related information	• The output state (current) to the 3-spool valve (attachment) retract EPC solenoid can be checked with the monitoring function (Code: 41907, 3RD EPC2 DIR). • 3-spool valve (attachment)-equipped model specification only • Method of reproducing failure code: Engine started • This error is not displayed on a machine which is not equipped with 3-spool valve (attachment). If it is displayed, select “NO ADD” 3-spool valve option in option setting.		

Possible causes and standard value in normal state		Cause	Standard value in normal state/Remarks on troubleshooting		
	1	Defective 3-spool valve (attachment) retract EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			F23 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L07 (female) (35) – F23 (female) (1)	Voltage	Max. 1 V
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (35) and (3)	5 – 15 Ω	

Circuit diagram related to 3-spool valve (attachment) retract EPC solenoid

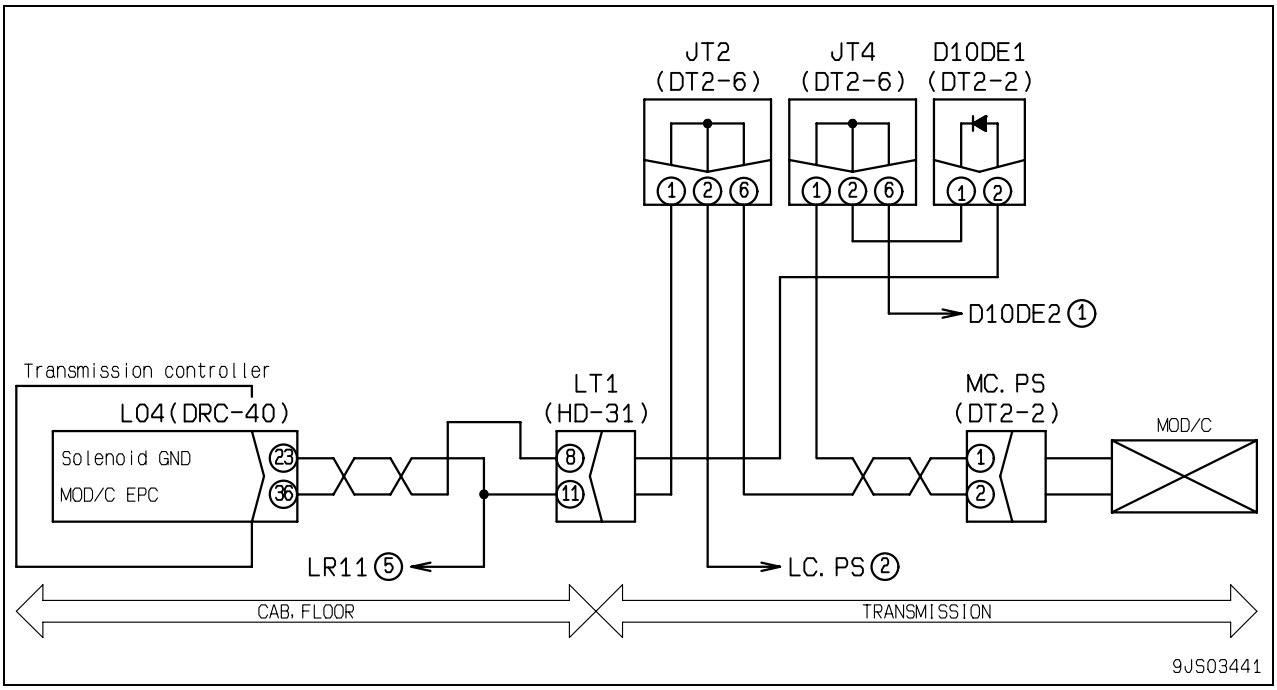


Failure code [DXHPKA] (Modulation clutch solenoid: Disconnection)

Action code	Failure code	Trouble	Modulation clutch ECMV solenoid: Disconnection (Transmission controller system)
E03	**DXHPKA**		
Contents of trouble	• Since the modulation clutch ECMV solenoid output signal system is disconnected, no current flows when the modulation clutch ECMV solenoid output is ON.		
Action of controller	• Stops outputting the signal to the modulation clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The machine cannot travel. • The machine may be able to travel with modulation direct coupling signal.		
Related information	• The output state (current) to the modulation clutch ECMV solenoid can be checked with the monitoring function (Code: 31640 ECMV MOD/C DIR). • Method of reproducing failure code: Engine started + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective modulation clutch ECMV solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			MC.PS (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection in wiring harness and defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L07 (female) (23) – MC.PS (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L07 (female) (36) – MC.PS (female) (1)	Resistance	Max. 1 Ω	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L07 (female)	Resistance		
			Between (36) and (23)	5 – 15 Ω		
			Between (36), (23) and chassis ground	Min. 1 MΩ		

Circuit diagram related to modulation clutch ECMV solenoid

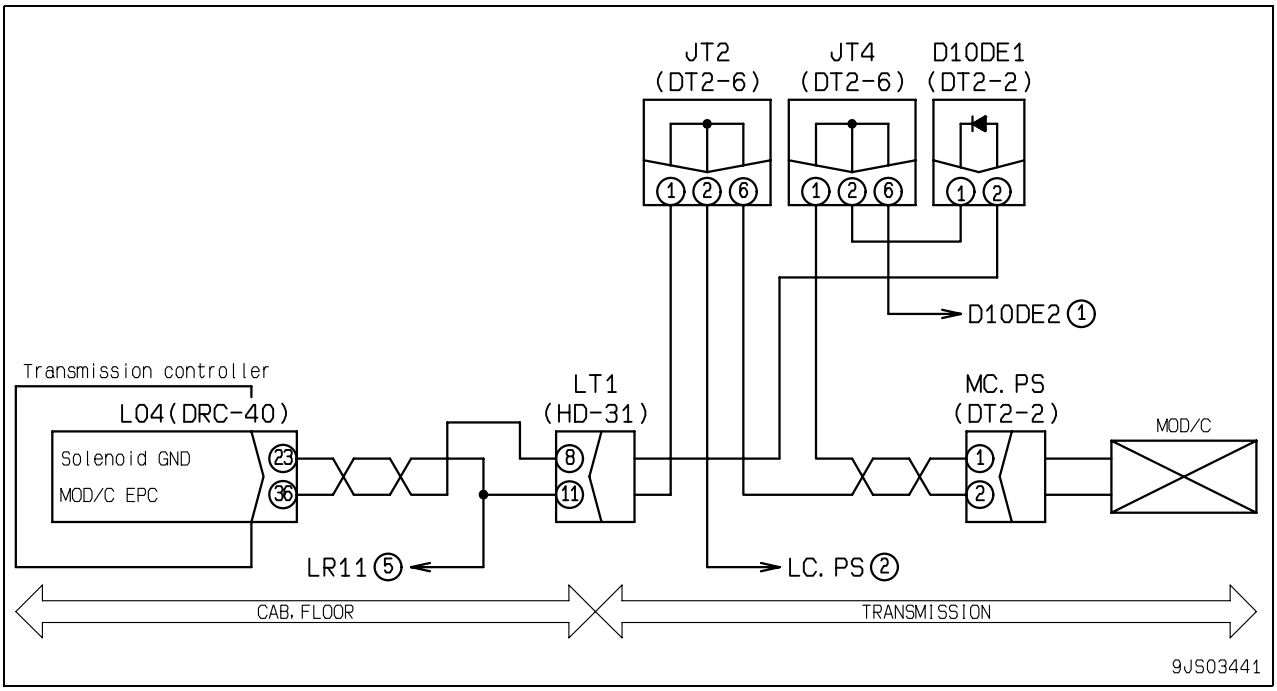


Failure code [DXHPKB] (Modulation clutch solenoid: Short circuit)

Action code	Failure code	Trouble	Modulation clutch ECMV solenoid: Short circuit (Transmission controller system)
E03	**DXHPKB**		
Contents of trouble	• Since the modulation clutch ECMV solenoid output signal system was shorted with the chassis ground, abnormal current flowed when the modulation clutch ECMV solenoid output was ON.		
Action of controller	• Stops outputting the signal to the modulation clutch ECMV solenoid. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The machine cannot travel. • The machine may be able to travel with modulation direct coupling signal.		
Related information	• The output state (current) to the modulation clutch ECMV solenoid can be checked with the monitoring function (Code: 31640 ECMV MOD/C DIR). • Method of reproducing failure code: Engine started + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective modulation clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			MC.PS (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L07 (female) (36) – MC.PS (female) (1)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L04 (female)	Resistance	
			Between (36) and (23)	5 – 15 Ω	

Circuit diagram related to modulation clutch ECMV solenoid

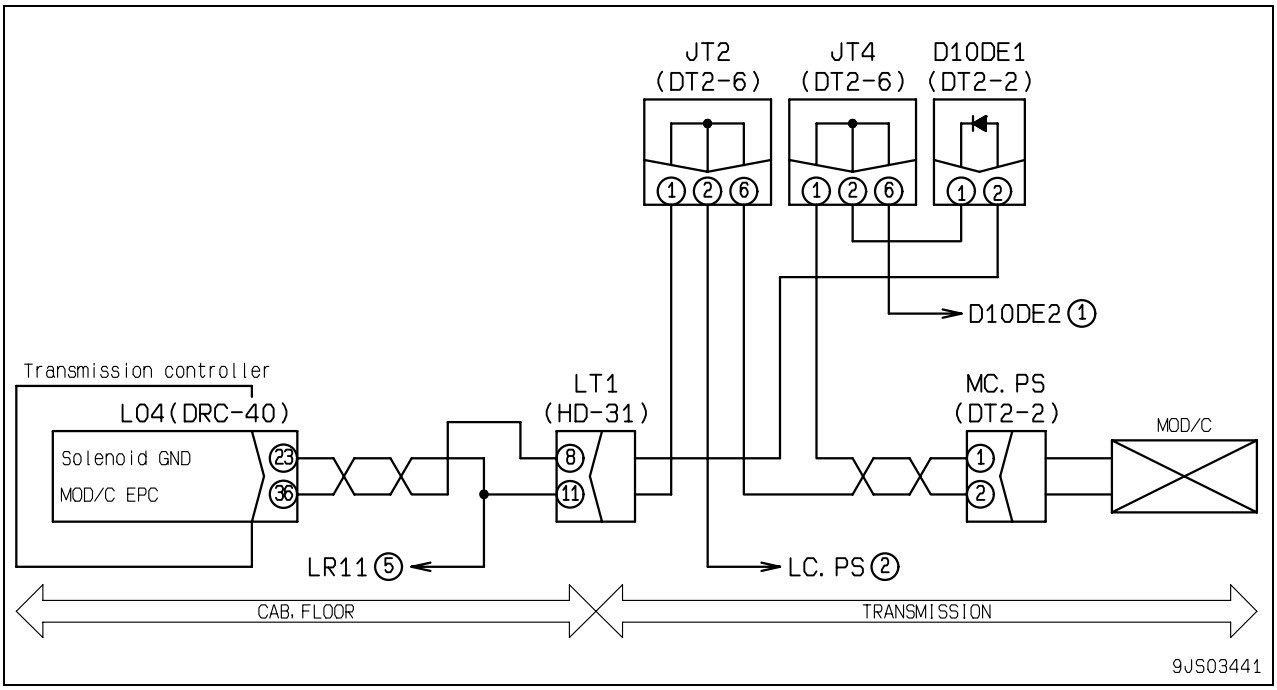


Failure code [DXHPKY] (Modulation clutch solenoid: Short circuit with power source line)

Action code	Failure code	Trouble	Modulation clutch ECMV solenoid: Short circuit with power supply line (Transmission controller system)
E03	**DXHPKB**		
Contents of trouble	• Since the modulation clutch ECMV solenoid output signal system was shorted with the power source, abnormal voltage was applied when the modulation clutch ECMV solenoid output was OFF.		
Action of controller	• Keeps the transmission in neutral. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until the directional lever or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The machine does not travel.		
Related information	• The output state (current) to the modulation clutch ECMV solenoid can be checked with the monitoring function (Code: 31640 ECMV MOD/C DIR). • Method of reproducing failure code: Engine started + Travel		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective modulation clutch ECMV solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			MC.PS (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L07 (female) (36) – MC.PS (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (36) and (23)	5 – 15 Ω	
			Between (36), (23) and chassis ground	Min. 1 MΩ	

Circuit diagram related to modulation clutch ECMV solenoid

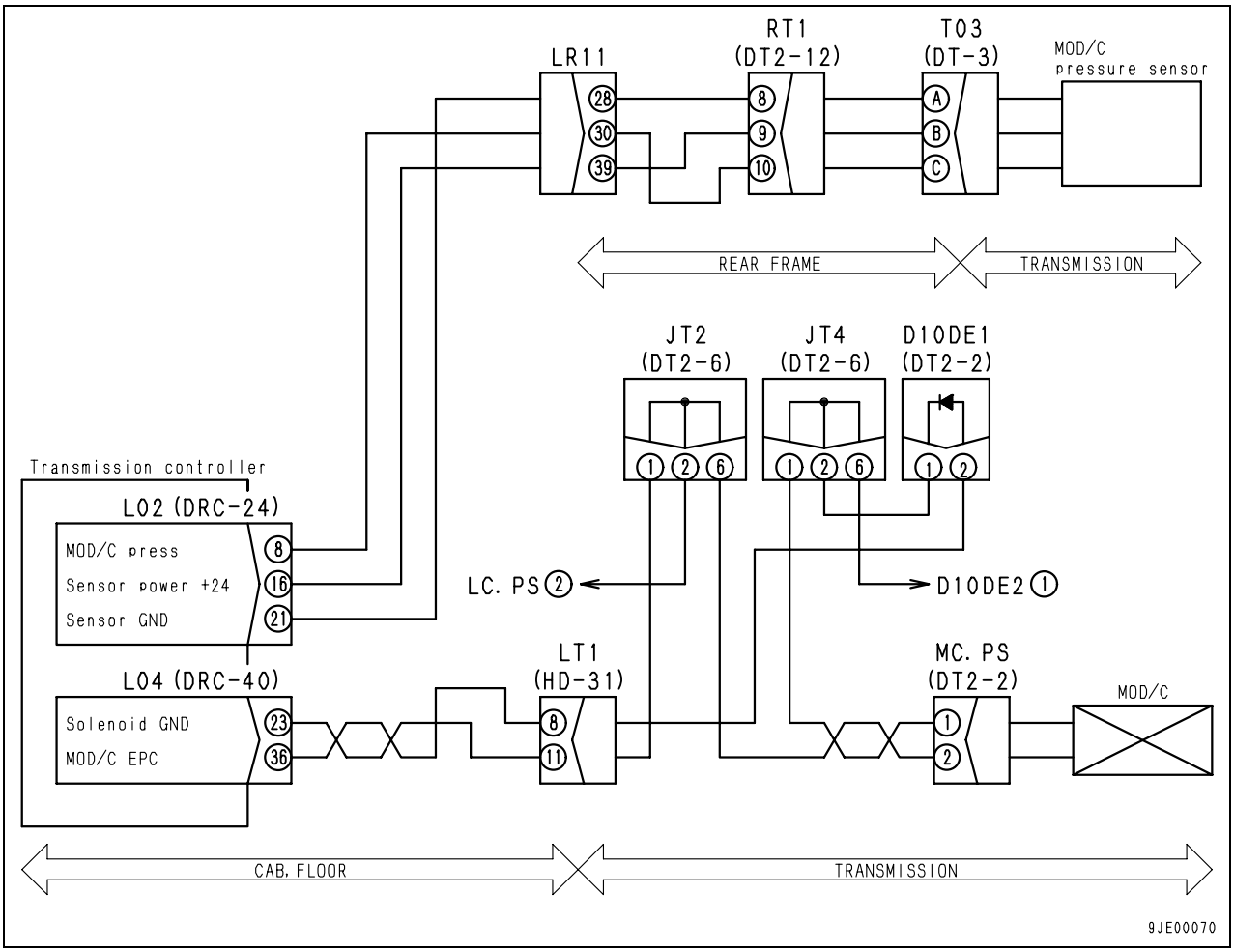


Failure code [DXHPMA] (Modulation clutch solenoid: Malfunction)

Action code	Failure code	Trouble	Modulation clutch ECMV solenoid: Malfunction (Transmission controller system)
E01	**DXHPMA**		
Contents of trouble	• Difference between the pressure detected by the modulation clutch pressure sensor and pressure commanded from the modulation clutch ECMV solenoid is 3 kg/cm^2 or more.		
Action of controller	• If cause of failure disappears, system resets itself.		
Problem that appears on machine	—		
Related information	• The output state (current) to the modulation clutch ECMV solenoid can be checked with the monitoring function (Code: 31640 ECMV MOD/C DIR). • The state (current) of the modulation clutch pressure can be checked with the monitoring function (Code: 92400, MOD/C PRESS). • The state (voltage) of the modulation clutch pressure can be checked with the monitoring function (Code: 92401, MOD/C PRESS). • Method of reproducing failure code: Engine started + Travel		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective modulation clutch ECMV solenoid (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			MC.PS (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L07 (female)	Resistance	
			Between (36) and (23)	5 – 15 Ω	
			Between (36), (23) and chassis ground	Min. 1 MΩ	
	3	Defective modulated clutch pressure sensor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Set transmission auto/manual shift selector switch to “Manual”. • Turn parking brake switch OFF. • Press right brake to prevent machine from moving. • Engine P mode		
			T03	Gear speed	Voltage
			Between (B) to (A)	Any speed	20 – 30 V
			Between (C) to (A)	F4 or R4 (Engine: High idle)	2.78 – 3.28 V

Circuit diagram related to modulation clutch ECMV solenoid

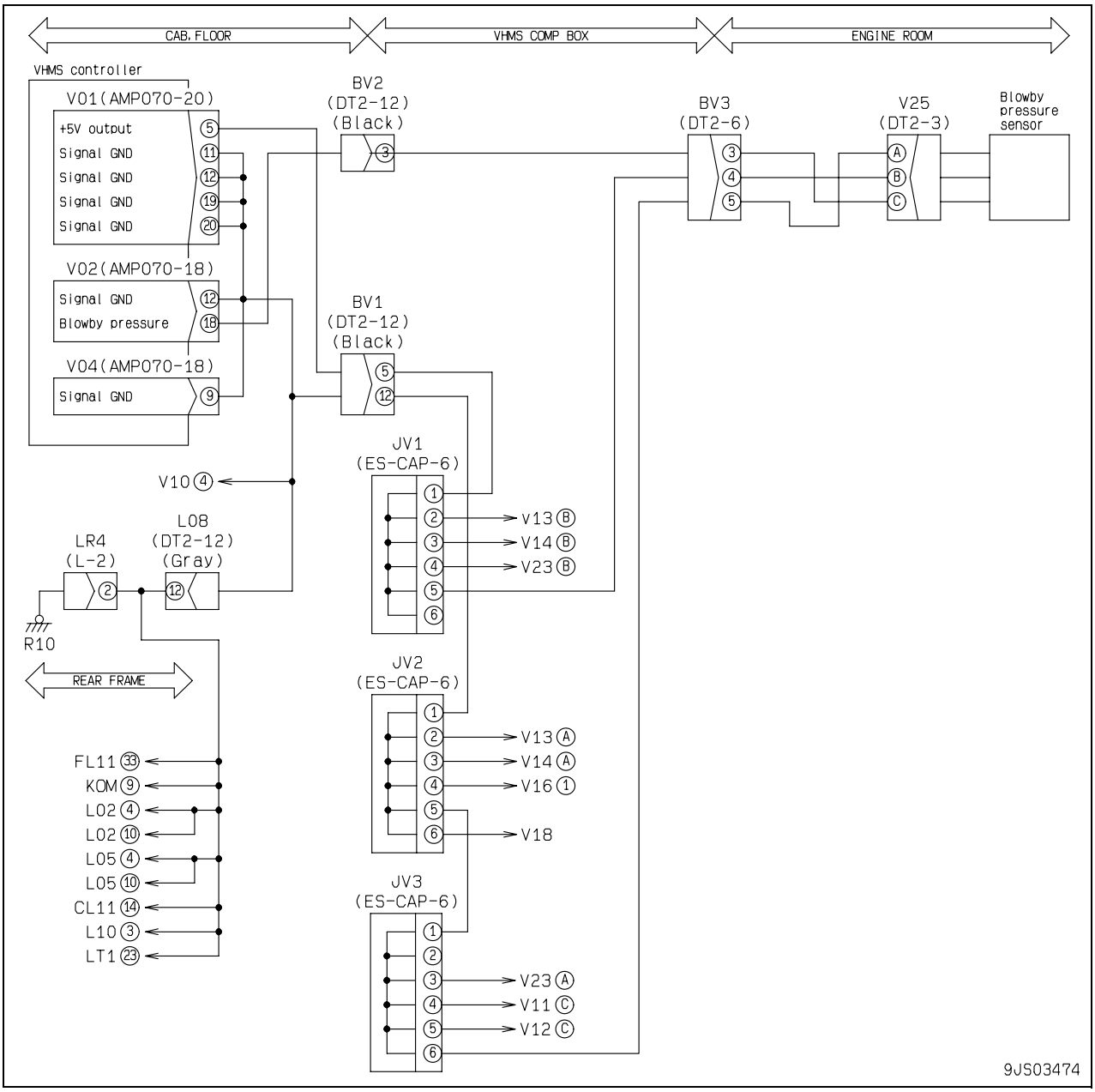


Failure code [F@BBZL] (or VHMS_LED display: “n3” → “38”) (Blow-by pressure: High error)

Action code	Failure code	Trouble	Blow-by pressure: High error (VHMS controller system)
—	**F@BBZL**		
Contents of trouble	• Blow-by pressure exceeded 9.41 kPa {960 mmH_2O}.		
Action of controller	• None in particular.		
Problem that appears on machine	• If the machine is operated as it is, the engine may be damaged.		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n3” → “38” • The input state (pressure) from the blow-by pressure sensor can be checked with the monitoring function (Code: 42801 BLOWBY PRESS) • If failure code: **DHE5KB** (Blow-by pressure sensor: Ground fault) or failure code: **DHE5KY** (Blow-by pressure sensor: Short circuit with power supply line) is displayed, troubleshooting for it is performed first. • Method of reproducing failure code: Start engine and carry out troubleshooting.		

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Blow-by pressure increases	Check the engine for abnormality. Correct, if any. Check the breather hose for clogging, bend, or break. If any, repair it.
	2	Defective blow-by pressure sensor	Check the blow-by pressure sensor for abnormality. Replace, if any.
	3	Defective VHMS controller	If the above items 1 and 2 is normal, the VHMS controller may be defective. (Troubleshooting cannot be carried out since the defect is in the machine monitor.)

Circuit diagram related to blow-by sensor

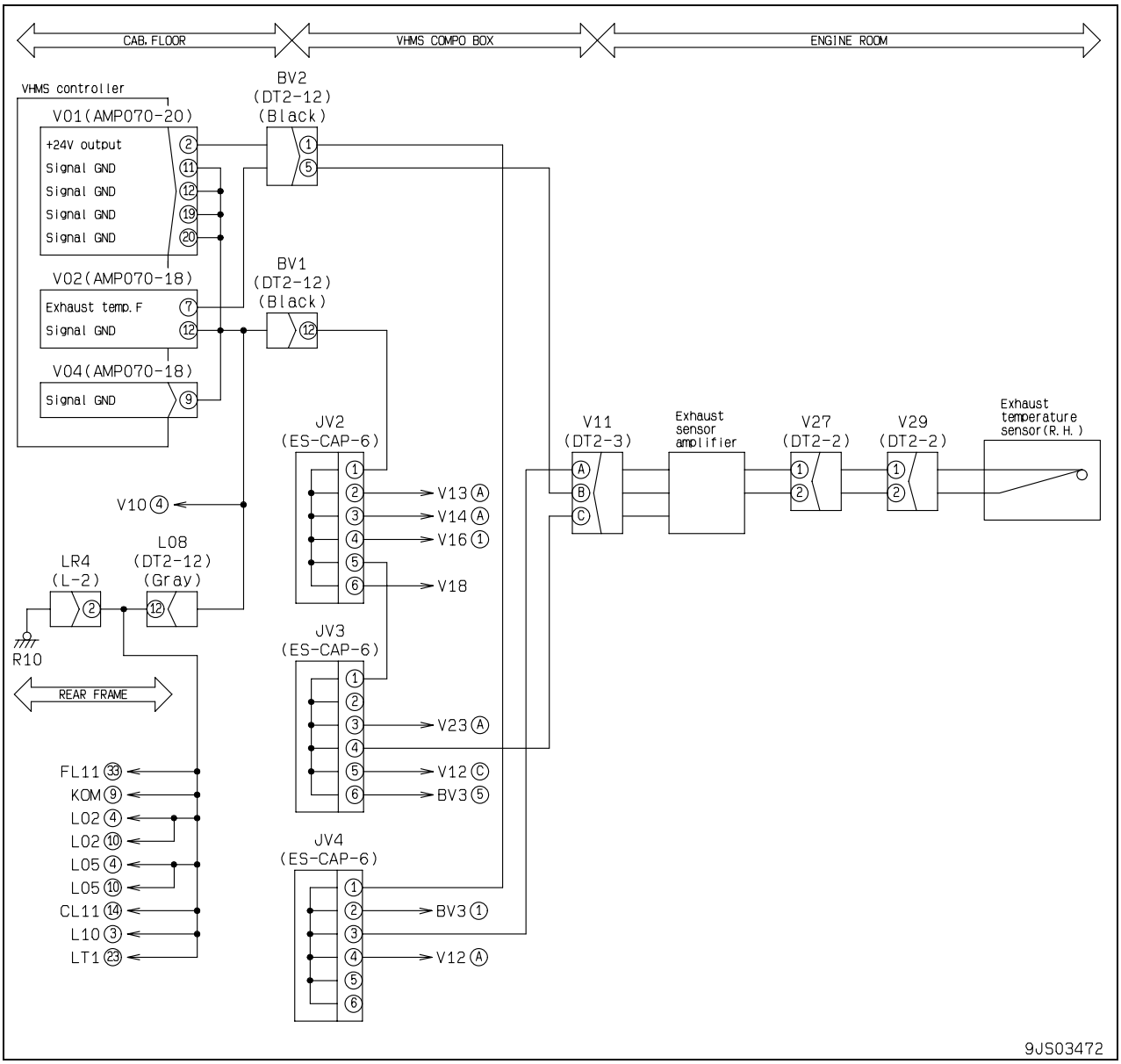


Failure code [F@BYNR] (or VHMS_LED display: “n3” → “62”) (Exhaust gas temperature (F): Abnormal heat)

Action code	Failure code	Trouble	Exhaust gas temperature (F): Abnormal heat (VHMS controller system)
—	**F@BYNR**		
Contents of trouble	• In the signal circuit of the exhaust gas temperature sensor at the engine front side, exhaust gas temperature beyond the limit line 2 was detected min. 10 seconds. (Exhaust gas temperature limit line 2: Straight line between 750°C at rated output speed at minimum and 800°C at max. torque speed at maximum)		
Action of controller	• None in particular.		
Problem that appears on machine	• If the machine is operated as it is, the engine may be damaged.		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n3” → “62”. • The input state (temperature) from the exhaust gas temperature sensor (F) can be checked with the monitoring function (Code: 42610 EXHAUST TEMP F). • If failure code: **DGT4KA** (Exhaust gas temperature sensor (F): Disconnection) or failure code: **DGT4KB** (Exhaust gas temperature sensor (F): Ground fault) is displayed, troubleshooting for it is performed first. • Method of reproducing failure code: Start engine and carry out troubleshooting.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Exhaust gas temperature at the engine front side abnormally rises. (When the system is normal)	Check the engine for abnormality. Correct, if any.		
	2	Defective VHMS controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			V02	Exhaust gas temperature	Voltage
			Between (7) and (12)	50 – 100°C	1.0 – 1.6 V
				300 – 400°C	2.1 – 2.7 V
				500 – 600°C	2.9 – 3.6 V
				700 – 800°C	3.8 – 4.4 V

Circuit diagram related to exhaust gas temperature sensor (F)

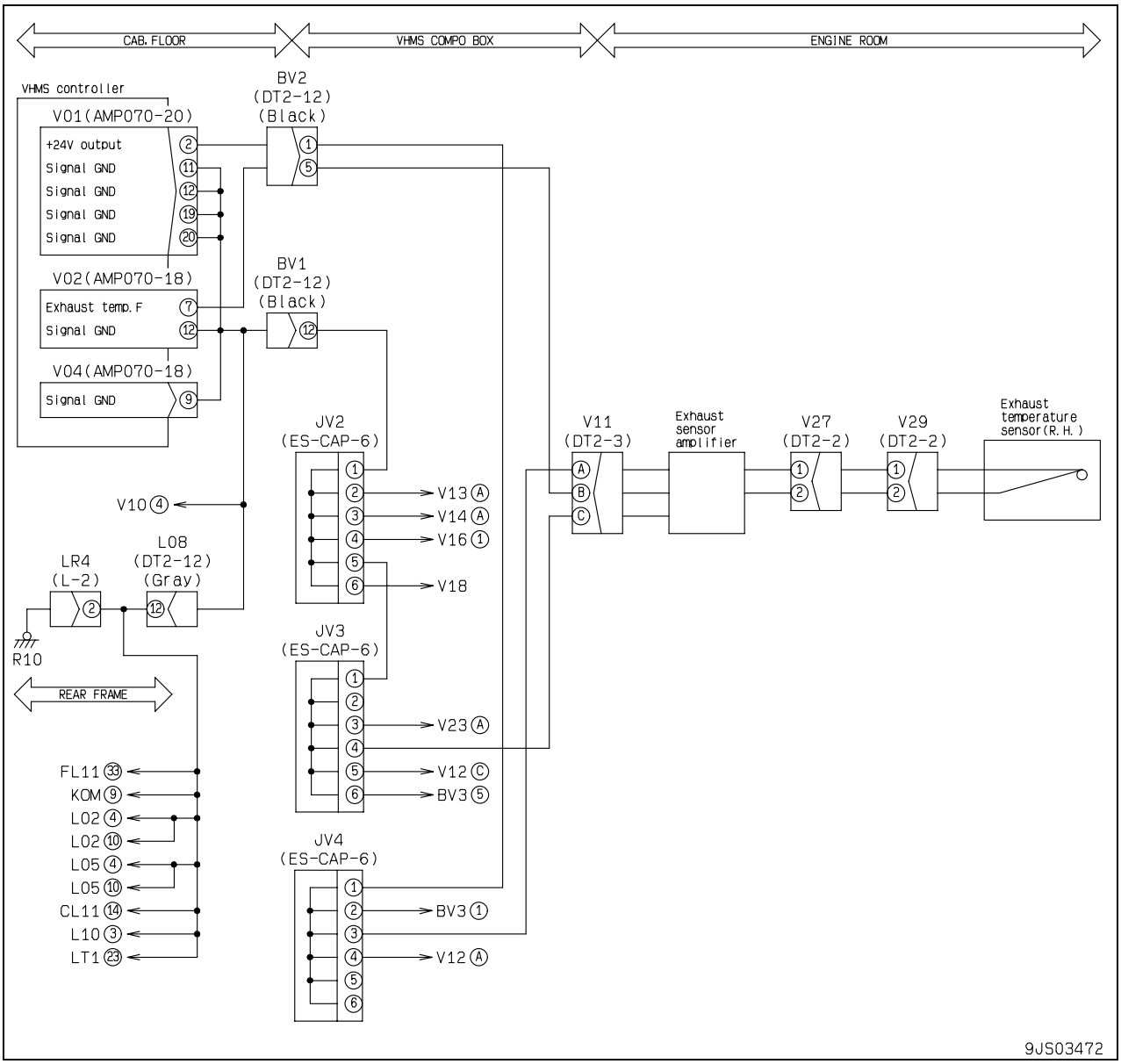


Failure code [F@BYNS] (or VHMS_LED display: “n3” → “61”) (Exhaust gas temperature (F): Overheat)

Action code	Failure code	Trouble	Exhaust gas temperature (F): Overheat (VHMS controller system)
—	**F@BYNS**		
Contents of trouble	• In the signal circuit of the exhaust gas temperature sensor at the engine front side, exhaust gas temperature beyond the limit line 1 was detected min. 1 seconds. (Exhaust gas temperature limit line 1: Straight line between 700°C at rated output speed at minimum and 750°C at max. torque speed at maximum)		
Action of controller	• None in particular.		
Problem that appears on machine	• If the machine is operated as it is, the engine may be damaged.		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n3” → “61” • The input state (temperature) from the exhaust gas temperature sensor (F) can be checked with the monitoring function (Code: 42610 EXHAUST TEMP F). • If failure code: **DGT4KA** (Exhaust gas temperature sensor (F): Disconnection) or failure code: **DGT4KB** (Exhaust gas temperature sensor (F): Ground fault) is displayed, troubleshooting for it is performed first. • Method of reproducing failure code: Start engine and carry out troubleshooting.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Exhaust gas temperature at the engine front side abnormally rises. (When the system is normal)	Check the engine for abnormality. Correct, if any.		
	2	Defective VHMS controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			V02	Exhaust gas temperature	Voltage
			Between (7) and (12)	50 – 100°C	1.0 – 1.6 V
				300 – 400°C	2.1 – 2.7 V
				500 – 600°C	2.9 – 3.6 V
				700 – 800°C	3.8 – 4.4 V

Circuit diagram related to exhaust gas temperature sensor (F)

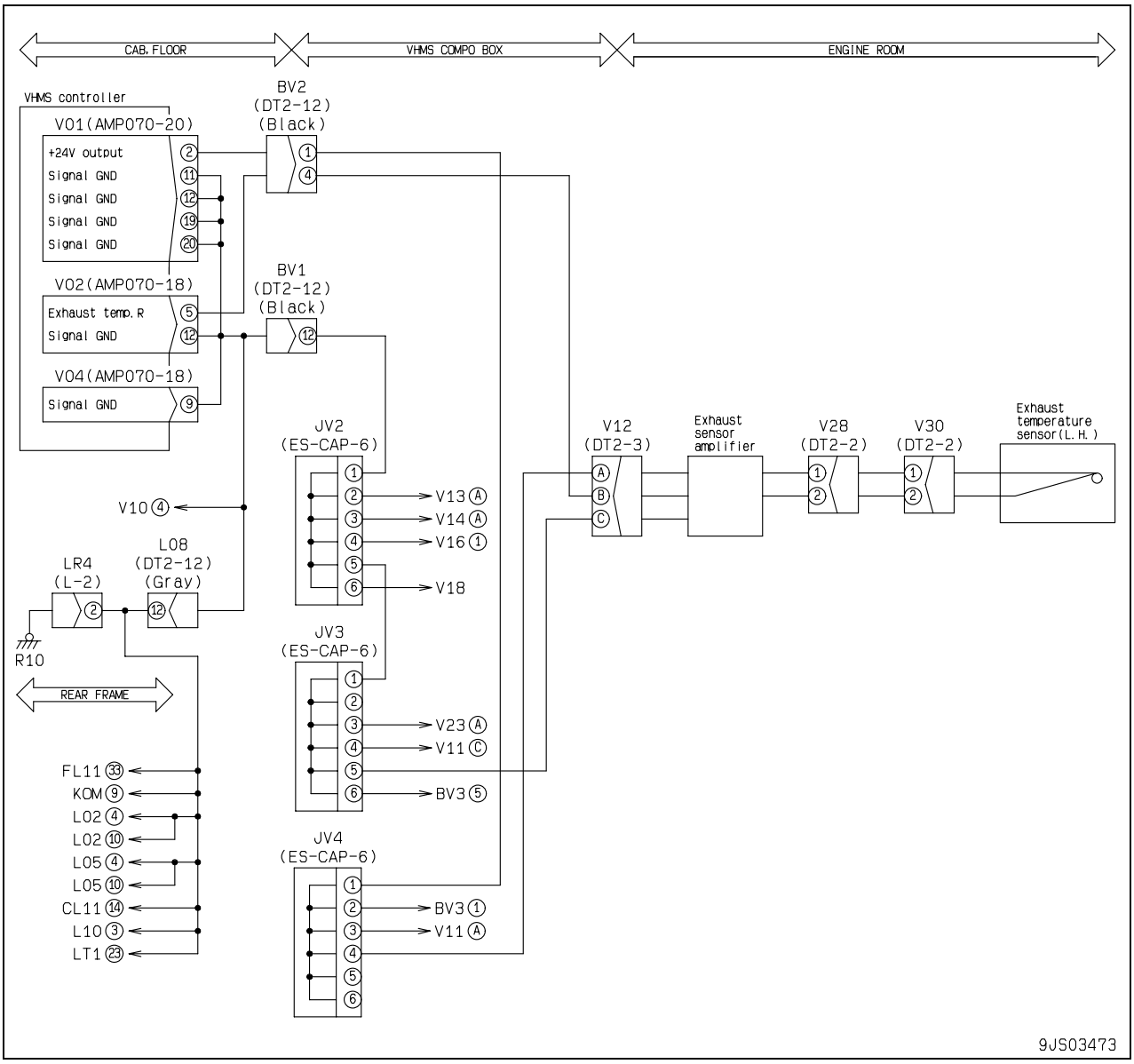


Failure code [F@BZNR] (or VHMS_LED display: “n3” → “72”) (Exhaust gas temperature (R): abnormal heat)

Action code	Failure code	Trouble	Exhaust gas temperature (R): Abnormal heat (VHMS controller system)
—	**F@BZNR**		
Contents of trouble	• In the signal circuit of the exhaust gas temperature sensor at the engine rear side, exhaust gas temperature beyond the limit line 2 was detected min. 10 seconds. (Exhaust gas temperature limit line 2: Straight line between 750°C at rated output speed at minimum and 800°C at max. torque speed at maximum)		
Action of controller	• None in particular.		
Problem that appears on machine	• If the machine is operated as it is, the engine may be damaged.		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n3” → “72”. • The input state (temperature) from the exhaust gas temperature sensor (R) can be checked with the monitoring function (Code: 42611 EXHAUST TEMP R). • If failure code: **DGT5KA** (Exhaust gas temperature sensor (R): Disconnection) or failure code: **DGT5KB** (Exhaust gas temperature sensor (R): Ground fault) is displayed, troubleshooting for it is performed first. • Method of reproducing failure code: Start engine and carry out troubleshooting.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Exhaust gas temperature at the engine rear side increases abnormally. (When the system is normal)	Check the engine for abnormality. Correct, if any.		
	2	Defective VHMS controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			V02	Exhaust gas temperature	Voltage
			Between (5) and (12)	50 – 100°C	1.0 – 1.6 V
				300 – 400°C	2.1 – 2.7 V
				500 – 600°C	2.9 – 3.6 V
				700 – 800°C	3.8 – 4.4 V

Circuit diagram related to exhaust gas temperature sensor (R)

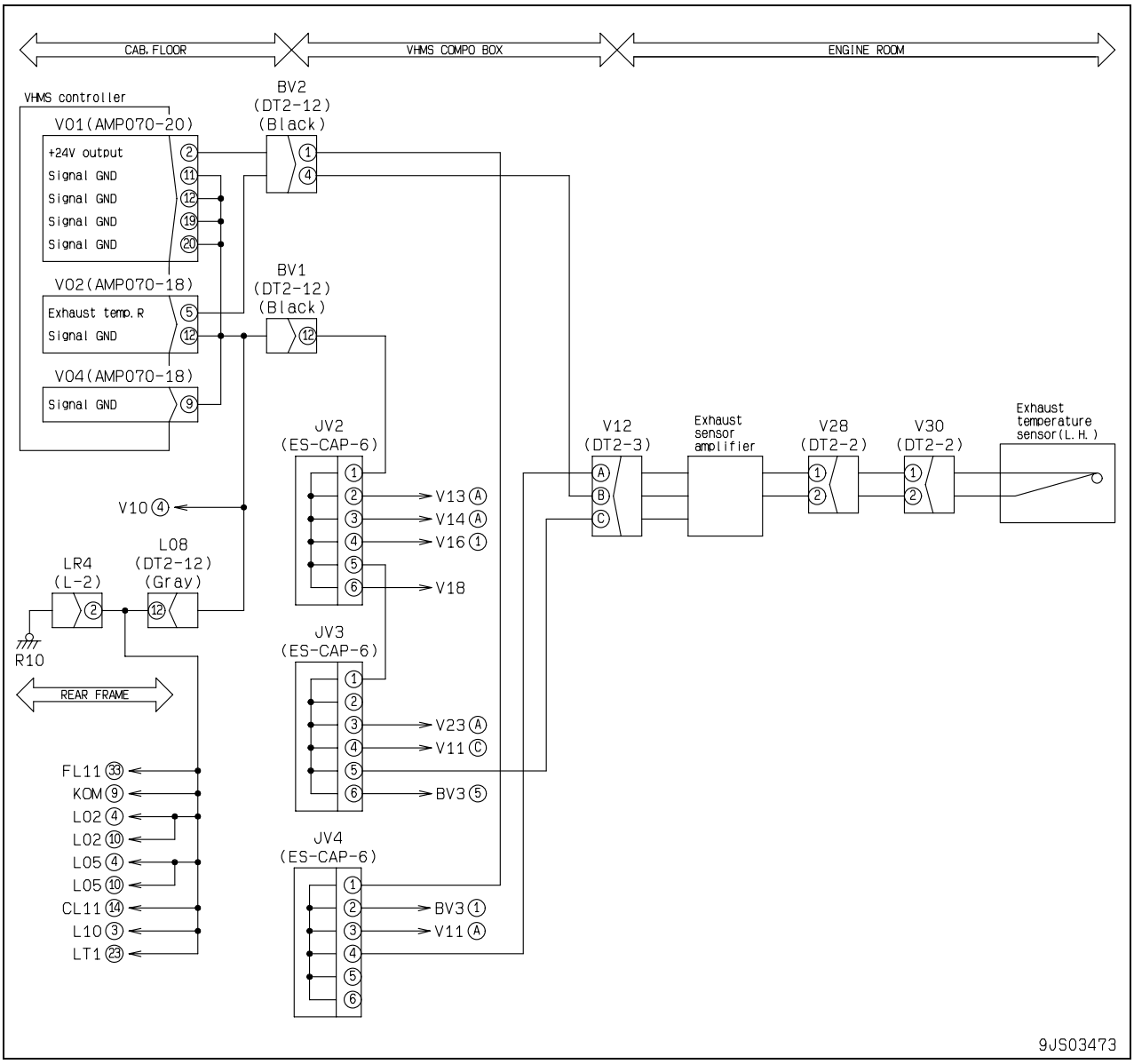


Failure code [F@BZNS] (or VHMS_LED display “n3” → “71”) (Exhaust gas temperature (R): Overheat)

Action code	Failure code	Trouble	Exhaust gas temperature (R): Overheat (VHMS controller system)
—	**F@BZNS**		
Contents of trouble	• In the signal circuit of the exhaust gas temperature sensor at the engine rear side, exhaust gas temperature beyond the limit line 1 was detected min. 1 second. (Exhaust gas temperature limit line 1: Straight line between 700°C at rated output speed at minimum and 750°C at max. torque speed at maximum)		
Action of controller	• None in particular.		
Problem that appears on machine	• If the machine is operated as it is, the engine may be damaged.		
Related information	• The machine monitor does not display any failure code (the relevant failure code can be checked by downloading data stored in the VHMS controller). • The LED of the VHMS controller displays “n3” → “71”. • The input state (temperature) from the exhaust gas temperature sensor (R) can be checked with the monitoring function (Code: 42611 EXHAUST TEMP R). • If failure code: **DGT5KA** (Exhaust gas temperature sensor (R): Disconnection) or failure code: **DGT5KB** (Exhaust gas temperature sensor (R): Ground fault) is displayed, troubleshooting for it is performed first. • Method of reproducing failure code: Start engine and carry out troubleshooting.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Exhaust gas temperature at the engine rear side increases abnormally. (When the system is normal)	Check the engine for abnormality. Correct, if any.		
	2	Defective VHMS controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			V02	Exhaust gas temperature	Voltage
			Between (5) and (12)	50 – 100°C	1.0 – 1.6 V
				300 – 400°C	2.1 – 2.7 V
				500 – 600°C	2.9 – 3.6 V
				700 – 800°C	3.8 – 4.4 V

Circuit diagram related to exhaust gas temperature sensor (R)



WA600-6 Wheel loader

Form No. SEN00574-01

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Printed in Japan 11-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

Troubleshooting of electrical system (E-mode)

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E-9 Backup lamp does not light or it keeps lighting up. 66
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E-13 Air conditioner does not operate or stop 80

Troubleshooting of electrical system (E-mode)

Before carrying out troubleshooting of electrical system

Connection table of fuse box and circuit breaker

★ This connection table shows the devices to which each power supply of the fuse box and circuit breaker supplies power (A switch power supply is a device which supplies power while the starting switch is in the ON position and a constant power supply is a device which supplies power while the starting switch is in the OFF and ON positions).

★ When carrying out troubleshooting related to the electrical system, you should check the fuse box and circuit breaker to see if the power is supplied normally.

Fuse box A

Type of power supply	Fuse No.	Capacity of fuse	Destination of power
Constant power supply Circuit breaker CBF1 (30A)	1	10A	Starting switch terminal B circuit
	2	10A	Hazard lamp circuit
	3	10A	Step lamp circuit
	4	10A	Transmission controller (B) circuit
	5	10A	Work equipment controller (B) circuit
	6	10A	Machine monitor (B), VHMS controller (B) circuit
Switch power supply Starting switch ACC	7	5A	Engine controller circuit
Switch power supply Circuit breaker CBF2 (105A)	8	10A	Horn circuit
	9	20A	Air conditioner circuit
	10	10A	Auto grease circuit
	11	20A	Rear glass heater circuit
	12	10A	Radio circuit
	13	20A	Air suspension seat, DC-DC converter circuit
	14	10A	VHMS controller (A) circuit
	15	10A	Spare

Fuse box B

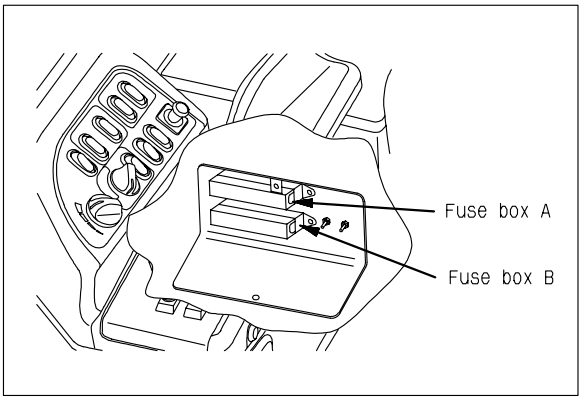
Type of power supply	Fuse No.	Capacity of fuse	Destination of power
Switch power supply Circuit breaker CBF3 (105A)	1	10A	Turn signal lamp circuit
	2	10A	Back-up lamp and blinking lamp circuit
	3	20A	Front working lamp circuit
	4	20A	Rear working lamp circuit
	5	10A	Transmission controller (A) circuit
	6	10A	Parking brake circuit
	7	10A	Work equipment controller (A) circuit
	8	10A	Machine monitor (A) circuit
	9	20A	Wiper and washer circuit
	10	10A	Spare
	11	20A	Main lamp circuit
Relay circuit power supply of small lamp	12	10A	Right clearance lamp
	13	10A	Left clearance lamp
Lighting switch circuit power supply	14	10A	Right headlamp
	15	10A	Left headlamp

Circuit breaker

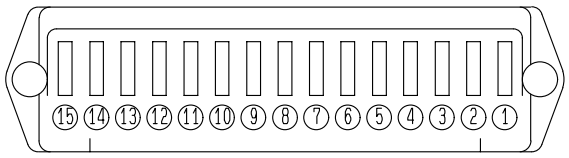
Type of power supply	Circuit breaker No.	Capacity of breaker	Destination of power
Constant power supply	CBF1	30A	Starting switch circuit, work equipment controller circuit, machine monitor circuit, VHMS controller circuit
Switch power supply	CBF2	105A	Fuse box (A): Circuits 8 – 15
Switch power supply	CBF3	105A	Fuse box (B): Circuits 1 – 11
Constant power supply	CBF4	20A	Engine controller circuit

Locations of fuse boxes and circuit breakers, and fuse Nos.

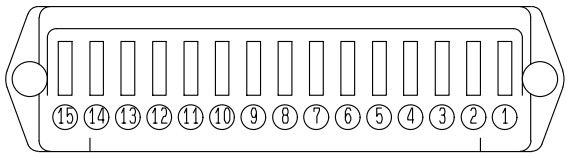
Fuse box



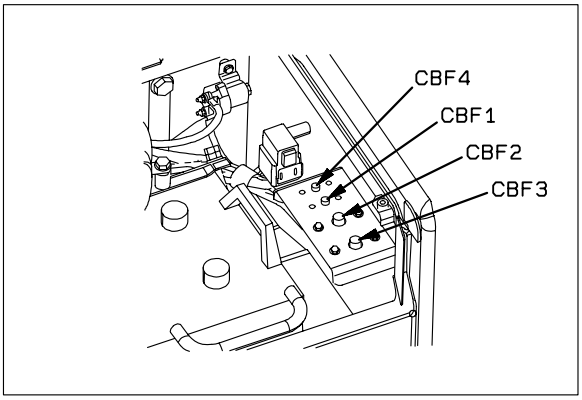
Fuse box A



Fuse box B



Curcuit breaker



9JS03465

Information in troubleshooting table

★ The following information is summarized in the troubleshooting table and the related electrical circuit diagram. Before carrying out troubleshooting, understand that information fully.

Trouble	**Problem that appears on machine**
Related information	**Information related to detected trouble or troubleshooting**

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1 2 3 4	**Causes by which a trouble is assumed to be defected (The order number indicates a serial number, not a priority sequence.)**	**<Described contents>** **• Standard value in normal state required to judge the assumed cause (good or not)** **• Remarks required to judge whether the cause is good** **<Phenomenon of defective harness>** **• Disconnection in wiring** **The connector connection is defective or wiring harness is disconnected.** **• Ground fault** **A harness not connected to the ground (earth) circuit comes into contact with the ground (earth) circuit.** **• Hot short circuit** **A harness not connected to the power (24 V) circuit comes into contact with the power (24V) circuit.** **• Short circuit** **A harness of an independent circuit abnormally comes into contact with one of another circuit.** **<Notes on troubleshooting>** **(1) Method of indicating connector numbers and handling of T-junction** **For troubleshooting, insert or connect T-junction adapter shown below unless especially specified.** **• When "male" or "female" is not indicated for a connector number, disconnect the connector, and insert the T-junction adapters in both the male and female.** **• When "male" or "female" is indicated for a connector number, disconnect connector, and insert the T-junction adapter in only either the male or female.** **(2) Pin number description sequence and tester lead handling** **For troubleshooting, connect the plus (+) and minus (–) leads as shown below unless especially specified.** **• Connect the plus (+) lead to a pin or harness indicated in the front.** **• Connect the minus (–) lead to a pin or harness indicated in the rear.**

Related circuit diagram

This is the excerpted circuit diagram related to trouble
- Connector No.: Indicates (Model – No. of pins) (Color).
- "Connector No. and pin No." from each branching/merging point: indicate the ends of branch or source of merging within the parts of the same wiring harness
- Arrow (⇔): Roughly indicates mounting place on machine.

E-1 Engine does not start.

Contents of trouble	• Engine does not start. (Steering wheel specification)
Related information	• The engine does not start, because the starting motor does not run due to troubles in the starting motor system and starting switch terminal C signal system. • Check that No. 1 fuse of fuse box A is normal. (If it is broken, check the related wiring harness for grounding fault.) • The input state (ON/OFF) from starting switch terminal C can be checked with the monitoring function (Code: 40906, D-IN-15). • If failure code [**D5ZHKA**], [**D5ZHKB**], [**D5ZHKZ**], [**DDK6KA**] is displayed, carry out troubleshooting for it first.

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Defective battery</td><td colspan="2">Specific gravity</td><td colspan="2">Min. 1.26</td></tr>
<tr><td colspan="2">Voltage</td><td colspan="2">Min. 25 V</td></tr>
<tr><td>2</td><td>Defective fuse No. 5 in fuse box B</td><td colspan="4">If fuse is broken, circuit probably has ground fault etc.
(See cause 11.)</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Defective battery</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>Battery relay</td><td>Switch position</td><td colspan="2">Voltage</td></tr>
<tr><td>Between terminals B and E</td><td>OFF</td><td colspan="2">20 – 30 V</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Defective starting motor (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF (with wiring harness connected), then turn starting switch START and carry out troubleshooting</td></tr>
<tr><td colspan="2">Starting motor</td><td colspan="2">Voltage</td></tr>
<tr><td>Between terminals B and E</td><td>Power supply input</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between terminals R and E</td><td>Battery input</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>Between terminals C and E</td><td>Starting input</td><td colspan="2">20 – 30 V</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">Defective alternator (Internal short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td colspan="2">Wiring harness between alternator terminal R and chassis ground</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Defective starting switch (Internal disconnection)</td><td colspan="4">★ Prepare with starting switch OFF, then keep starting switch OFF and turn it to START and carry out troubleshooting in each case.</td></tr>
<tr><td>Starting switch</td><td>Position of switch</td><td colspan="2">Resistance</td></tr>
<tr><td>Between terminals B (C51) and C (C53)</td><td>OFF
START</td><td colspan="2">Min. 1 MΩ
Max. 1 Ω</td></tr>
</table>

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="8">7</td><td rowspan="8">Defective FNR (directional) lever switch
(Internal disconnection or short circuit)</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>L04</td><td>FNR (Direction) lever</td><td>Voltage</td></tr>
<tr><td>Between (1) and (10)</td><td>Any gear speed</td><td>20 – 30 V</td></tr>
<tr><td rowspan="2">Between (2) and (10)</td><td>N (Neutral)</td><td>20 – 30 V</td></tr>
<tr><td>Other than above</td><td>Max. 1 V</td></tr>
<tr><td rowspan="2">Between (3) and (10)</td><td>F (Forward)</td><td>20 – 30 V</td></tr>
<tr><td>Other than above</td><td>Max. 1 V</td></tr>
<tr><td rowspan="2">Between (4) and (10)</td><td>R (Reverse)</td><td>20 – 30 V</td></tr>
<tr><td>Other than above</td><td>Max. 1 V</td></tr>
<tr><td rowspan="12">8</td><td rowspan="12">Defective diode (R21, R22, R23, R24, R25 or R26)
(Internal disconnection)</td><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>R21 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td>Between (1) and (2)</td><td>Measure at (1) in diode range.</td><td>Secured</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>R22 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td>Between (3) and (2)</td><td>Measure at (3) in diode range.</td><td>Secured</td></tr>
<tr><td>Between (1) and (2)</td><td>Measure at (1) in diode range.</td><td>Secured</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>R23 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td>Between (2) and (1)</td><td>Measure at (2) in diode range.</td><td>Secured</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>R24 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td>Between (2) and (1)</td><td>Measure at (2) in diode range.</td><td>Secured</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>R25 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td>Between (2) and (1)</td><td>Measure at (2) in diode range.</td><td>Secured</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>R26 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td>Between (2) and (1)</td><td>Measure at (2) in diode range.</td><td>Secured</td></tr>
<tr><td rowspan="5">9</td><td rowspan="5">Defective neutral safety relay (L103)
(Internal defect)</td><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">L103 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td>200 – 400 Ω</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch to START and carry out troubleshooting.</td></tr>
<tr><td colspan="3">When neutral safety relay (L103) is replaced with a relay of the same type, if the condition becomes normal, the neutral safety relay is defective.</td></tr>
</table>

<table>
<tr><td rowspan="19">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">10</td><td rowspan="4">Defective AJSS neutral safety relay (L104)
(Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">L104 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td colspan="2">200 – 400 Ω</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch to START and carry out troubleshooting.</td></tr>
<tr><td rowspan="4">11</td><td rowspan="4">Defective neutral holding relay (L112)
(Internal defect)</td><td colspan="4">When AJSS neutral safety relay (L104) is replaced with a relay of the same type, if the condition becomes normal, the AJSS neutral safety relay is defective.</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">L112 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td colspan="2">200 – 400 Ω</td></tr>
<tr><td rowspan="14">12</td><td rowspan="14">Disconnection in wiring harness
(Disconnection or defective contact of connector)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch to START and carry out troubleshooting.</td></tr>
<tr><td colspan="4">When neutral holding relay (L112) is replaced with a relay of the same type, if the condition becomes normal, the neutral holding relay is defective.</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>Wiring harness between starting motor terminal B – starting motor terminal B</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between D12 – starting motor terminal B</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between starting motor terminal E – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between CL12 (female) (3) – L103 (female) (5), – L112 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between L103 (female) (3) – L104 (female) (6), – L112 (female) (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between L104 (female) (3) – R23 (female) (2), – R24 (female) (2), – R25 (female) (2), – R26 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between R23 (female) (1) or R24 (female) (1) – E01 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between R25 (female) (1) or R26 (female) (1) – E02 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between L112 (female) (5) – R22 (female) (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between R22 (female) (2) – L103 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between L07 (female) (4) – L104 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between L103 (female) (2), L104 (female) (2) or L112 (female) (2) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between L04 (female) (3) – R22 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
</table>

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	13	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between starting motor terminal B – starting motor terminal B		Resistance	Min. 1 MΩ
			Wiring harness between D12 – starting motor terminal B		Resistance	Min. 1 MΩ
			Wiring harness between CL12 (female) (3) – L103 (female) (5), – L112 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between L103 (female) (3) – L104 (female) (6), – L112 (female) (3)		Resistance	Min. 1 MΩ
			Wiring harness between L104 (female) (3) – R23 (female) (2), – R24 (female) (2), – R25 (female) (2), – R26 (female) (2), – circuit branch end		Resistance	Min. 1 MΩ
			Wiring harness between R23 (female) (1) or R24 (female) (1) – E01 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between R25 (female) (1) or R26 (female) (1) – E02 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between L112 (female) (5) and R22 (female) (3)		Resistance	Min. 1 MΩ
			Wiring harness between R22 (female) (2) and L103 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between L07 (female) (4) – L104 (female) (1)		Resistance	Min. 1 MΩ
	14	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between alternator terminal R – E01 (female) (2), – E02 (female) (2), – circuit branch end		Voltage	Max. 1 V
	15	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	AJSS	Voltage	
			Between (4) – chassis ground	Neutral	Max. 1 V	
				Other than above	20 – 30 V	

Contents of trouble	• Engine does not start. (AJSS specification)
Related information	• The engine does not start, because the starting motor does not run due to troubles in the starting motor system and starting switch terminal C signal system. • Check that No. 1 fuse of fuse box A is normal. (If it is broken, check the related wiring harness for grounding fault.) • The input state (ON/OFF) from starting switch terminal C can be checked with the monitoring function (Code: 40906, D-IN-15). • If failure code [**DDK4KA**], [**D5ZHKA**], [**D5ZHKB**], [**D5ZHKZ**] is displayed, carry out troubleshooting for it first.

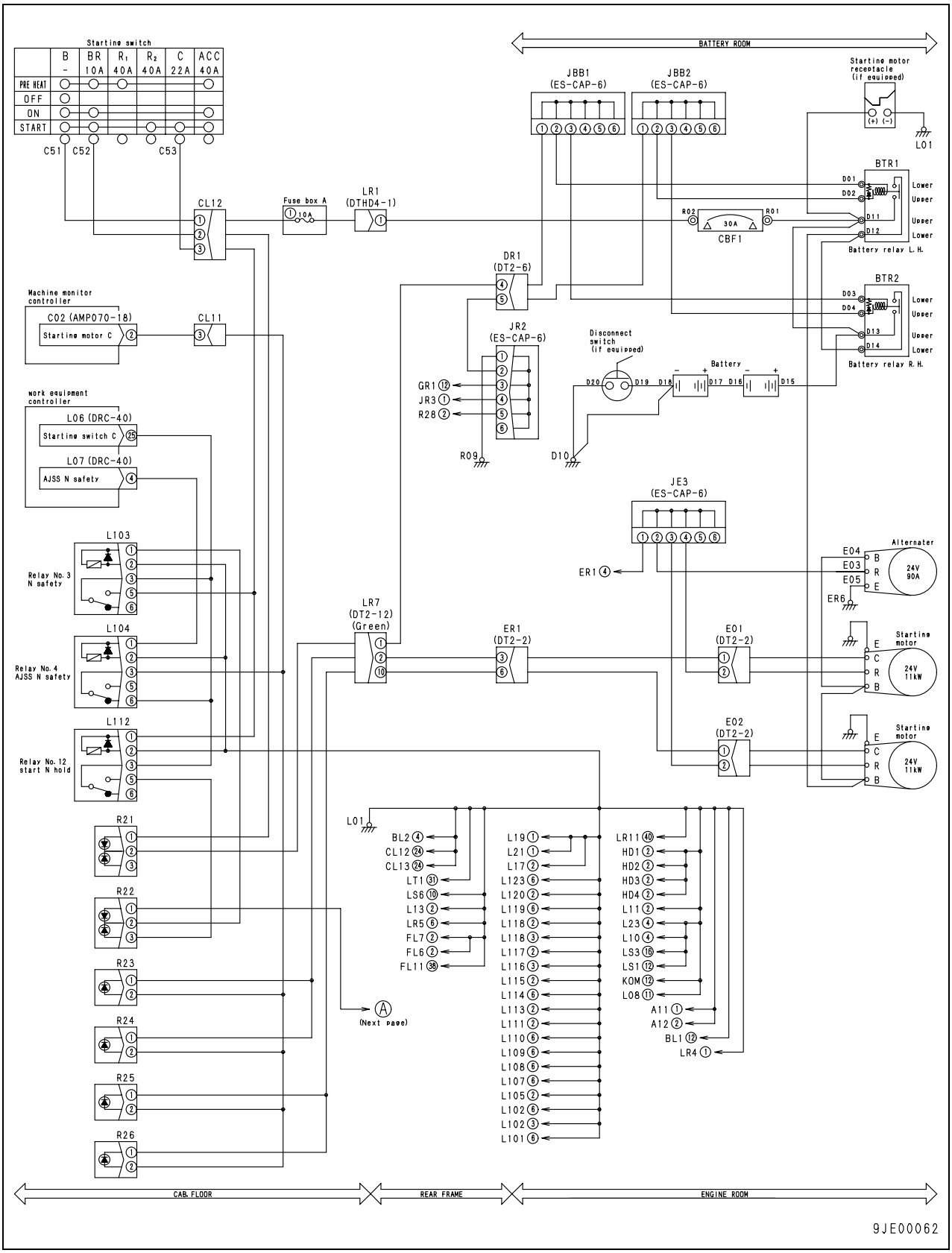
	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective battery	Specific gravity		Min. 1.26	
			Voltage		Min. 25 V	
	2	Defective fuse No. 5 in fuse box B	If fuse is broken, circuit probably has ground fault etc. (See cause 11.)			
	3	Defective battery	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Battery relay	Switch position	Voltage	
			Between terminals B and E	OFF	20 – 30 V	
				ON	Max. 1 V	
	4	Defective starting motor (Internal defect)	★ Prepare with starting switch OFF (with wiring harness connected), then turn starting switch START and carry out troubleshooting			
			Starting motor		Voltage	
			Between terminals B and E	Power supply input	20 – 30 V	
			Between terminals R and E	Battery input	Max. 1 V	
			Between terminals C and E	Starting input	20 – 30 V	
			If the starting motor does not run even if power supply input, battery input and starting input is normal, the starting motor is defective.			
	5	Defective alternator (Internal short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between alternator terminal R and chassis ground		Voltage	Max. 1 V
	6	Defective starting switch (Internal disconnection)	★ Prepare with starting switch OFF, then keep starting switch OFF and turn it to START and carry out troubleshooting in each case.			
			Starting switch	Position of switch	Resistance	
			Between terminals B (C51) and C (C53)	OFF	Min. 1 MΩ	
				START	Max. 1 Ω	

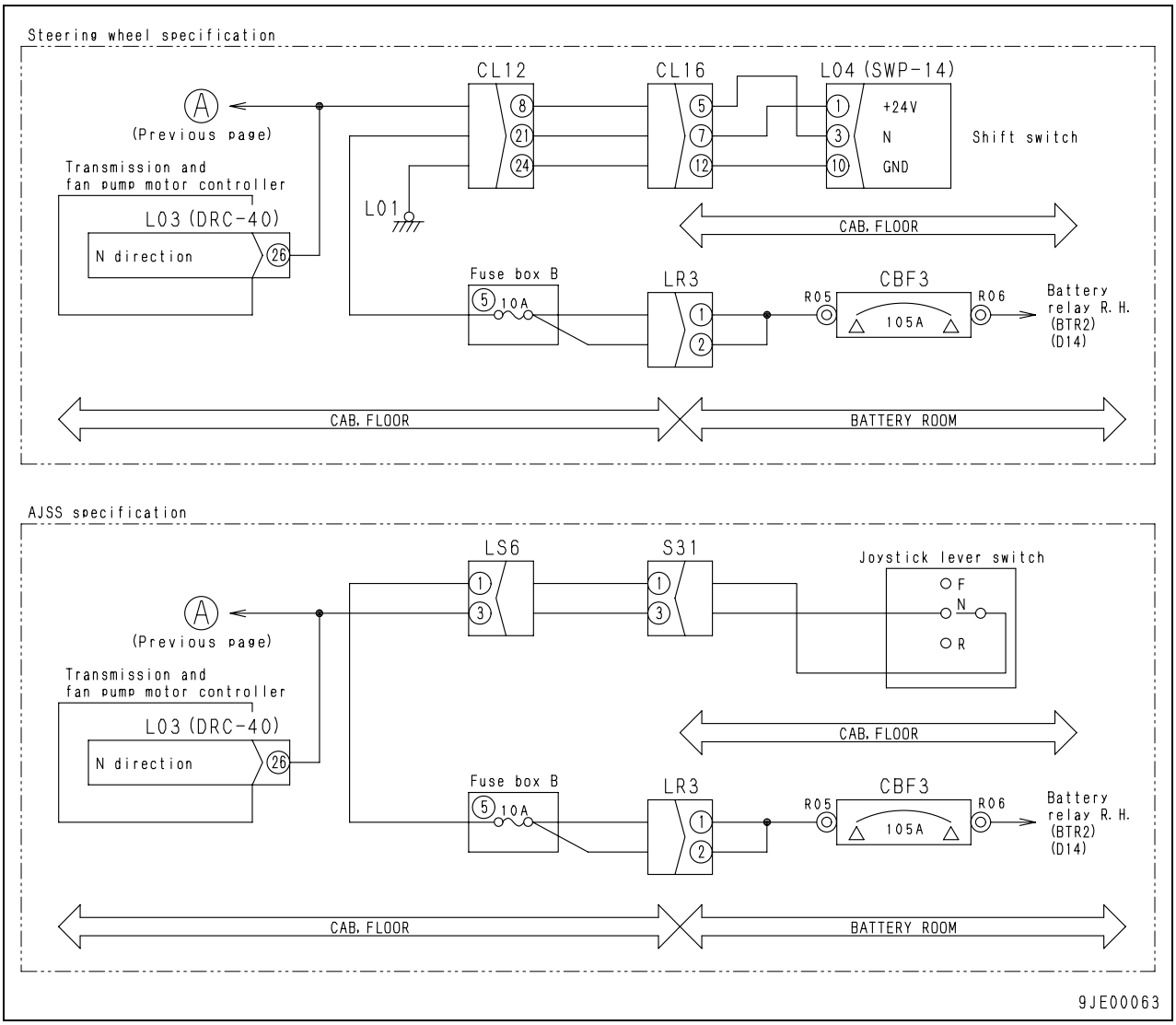
<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="8">7</td><td rowspan="8">Defective AJSS FNR switch (Internal disconnection or short circuit)</td><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>S31 (male)</td><td>AJSS FNR switch</td><td>Resistance</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>F (Forward)</td><td>Max. 1 Ω</td></tr>
<tr><td>Other than above</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="2">Between (1) and (3)</td><td>N (Neutral)</td><td>Max. 1 Ω</td></tr>
<tr><td>Other than above</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="2">Between (1) and (4)</td><td>R (Reverse)</td><td>Max. 1 Ω</td></tr>
<tr><td>Other than above</td><td>Min. 1 M Ω</td></tr>
<tr><td>Between (1), (2), (3), (4) – chassis ground</td><td>Any position</td><td>Min. 1 M Ω</td></tr>
<tr><td rowspan="12">8</td><td rowspan="12">Defective diode (R21, R22, R23, R24, R25 or R26) (Internal disconnection)</td><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>R21 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td>Between (1) and (2)</td><td>Measure at (1) in diode range.</td><td>Secured</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>R22 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td>Between (3) and (2)</td><td>Measure at (3) in diode range.</td><td>Secured</td></tr>
<tr><td>Between (1) and (2)</td><td>Measure at (1) in diode range.</td><td>Secured</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>R23 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td>Between (2) and (1)</td><td>Measure at (2) in diode range.</td><td>Secured</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>R24 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td>Between (2) and (1)</td><td>Measure at (2) in diode range.</td><td>Secured</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>R25 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td>Between (2) and (1)</td><td>Measure at (2) in diode range.</td><td>Secured</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>R26 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td>Between (2) and (1)</td><td>Measure at (2) in diode range.</td><td>Secured</td></tr>
<tr><td rowspan="5">9</td><td rowspan="5">Defective neutral safety relay (L103) (Internal defect)</td><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">L103 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td>200 – 400 Ω</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch to START and carry out troubleshooting.</td></tr>
<tr><td colspan="3">When neutral safety relay (L103) is replaced with a relay of the same type, if the condition becomes normal, the neutral safety relay is defective.</td></tr>
</table>

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">10</td><td rowspan="4">Defective AJSS neutral safety relay (L104)
(Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">L104 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td colspan="2">200 – 400 Ω</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch to START and carry out troubleshooting.</td></tr>
<tr><td rowspan="4">11</td><td rowspan="4">Defective neutral holding relay (L112)
(Internal defect)</td><td colspan="4">When AJSS neutral safety relay (L104) is replaced with a relay of the same type, if the condition becomes normal, the AJSS neutral safety relay is defective.</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">L112 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td colspan="2">200 – 400 Ω</td></tr>
<tr><td rowspan="16">12</td><td rowspan="16">Disconnection in wiring harness
(Disconnection or defective contact of connector)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch to START and carry out troubleshooting.</td></tr>
<tr><td colspan="4">When neutral holding relay (L112) is replaced with a relay of the same type, if the condition becomes normal, the neutral holding relay is defective.</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>Wiring harness between starting motor terminal B – starting motor terminal B</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between D12 – starting motor terminal B</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between starting motor terminal E – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between CL12 (female) (3) – L103 (female) (5), – L112 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between L103 (female) (3) – L104 (female) (6), – L112 (female) (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between L104 (female) (3) – R23 (female) (2), – R24 (female) (2), – R25 (female) (2), – R26 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between R23 (female) (1) or R24 (female) (1) – E01 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between R25 (female) (1) or R26 (female) (1) – E02 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between L112 (female) (5) – R22 (female) (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between R22 (female) (2) – L103 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between L07 (female) (4) – L104 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between L103 (female) (2), L104 (female) (2) or L112 (female) (2) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between S31 (female) (3) – R22 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
</table>

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	13	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between starting motor terminal B – starting motor terminal B		Resistance	Min. 1 MΩ
			Wiring harness between D12 – starting motor terminal B		Resistance	Min. 1 MΩ
			Wiring harness between CL12 (female) (3) – L103 (female) (5), – L112 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between L103 (female) (3) – L104 (female) (6), – L112 (female) (3)		Resistance	Min. 1 MΩ
			Wiring harness between L104 (female) (3) – R23 (female) (2), – R24 (female) (2), – R25 (female) (2), – R26 (female) (2), – circuit branch end		Resistance	Min. 1 MΩ
			Wiring harness between R23 (female) (1) or R24 (female) (1) – E01 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between R25 (female) (1) or R26 (female) (1) – E02 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between L112 (female) (5) and R22 (female) (3)		Resistance	Min. 1 MΩ
			Wiring harness between R22 (female) (2) and L103 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between L07 (female) (4) – L104 (female) (1)		Resistance	Min. 1 MΩ
	14	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between alternator terminal R – E01 (female) (2), – E02 (female) (2), – circuit branch end		Voltage	Max. 1 V
	15	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L07	AJSS	Voltage	
			Between (4) – chassis ground	Neutral	Max. 1 V	
				Other than above	20 – 30 V	

Circuit diagram related to engine starting system




Steering wheel specification
CL12
CL16
L04 (SWP-14)
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Transmission and
fan pump motor controller
L03 (DRC-40)
N direction
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L01
8
21
24
5
7
12
1
3
10
+24V
N
GND
Shift switch
CAB. FLOOR
Fuse box B
5
10A
LR3
1
2
CBF3
R05
105A
R06
Battery
relay R. H.
(BTR2)
(D14)
CAB. FLOOR
BATTERY ROOM
AJSS specification
LS6
S31
Joystick lever switch
F
N
R
(Previous page)
Transmission and
fan pump motor controller
L03 (DRC-40)
N direction
26
CAB. FLOOR
Fuse box B
5
10A
LR3
CBF3
R05
105A
R06
Battery
relay R. H.
(BTR2)
(D14)
CAB. FLOOR
BATTERY ROOM
9JE00063

E-2 Wiper does not operate

Contents of trouble	(1) Front wiper does not operate. (Steering wheel specification)
Related information	• Since the front wiper switch, timer, or wiring harness is defective, the front wiper does not operate.

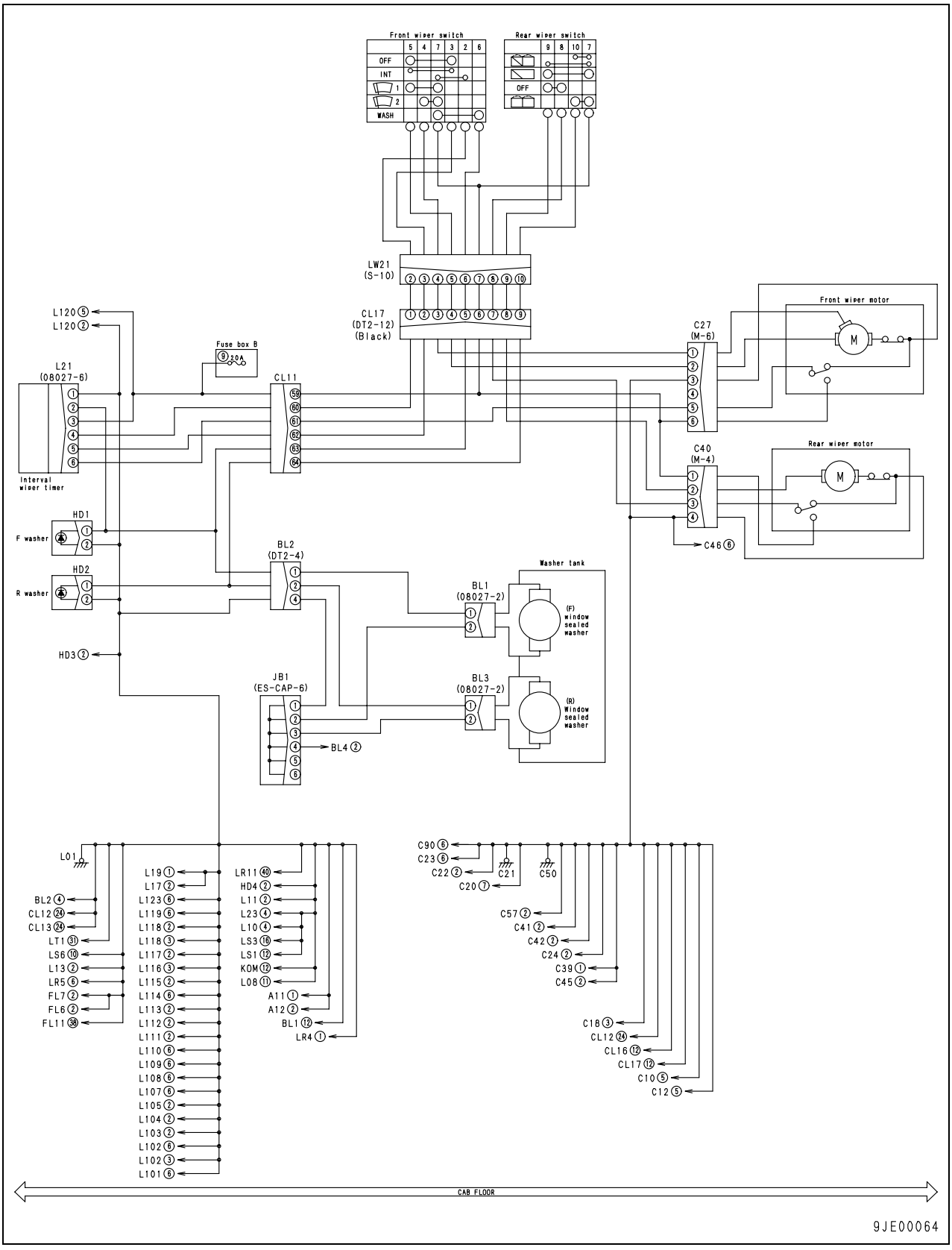
<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse No. 9 of fuse box B</td><td colspan="4">If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 6.)</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Defective front wiper motor (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td>C27</td><td colspan="2">Wiper switch</td><td>Voltage</td></tr>
<tr><td>Between (2) and chassis ground</td><td colspan="2">Lo</td><td>20 – 30 V</td></tr>
<tr><td>Between (1) and chassis ground</td><td colspan="2">Hi</td><td>20 – 30 V</td></tr>
<tr><td>Between (6) and chassis ground</td><td colspan="2">Normal</td><td>20 – 30 V</td></tr>
<tr><td colspan="4">• If wiper switch is turned OFF while wiper is operating, voltage is applied between C27 (5) and chassis ground until wiper motor stops.</td></tr>
<tr><td rowspan="6">3</td><td rowspan="6">Defective wiper timer (relay) (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td>LW21 (female)</td><td colspan="2">Wiper switch</td><td>Voltage</td></tr>
<tr><td>Between (3) and chassis ground</td><td colspan="2">Normal</td><td>20 – 30 V</td></tr>
<tr><td>Between (4) and chassis ground</td><td colspan="2">INT</td><td>20 – 30 V</td></tr>
<tr><td>Between (2) and chassis ground</td><td colspan="2">Washer side</td><td>20 – 30 V</td></tr>
<tr><td>Between (5) and chassis ground</td><td colspan="2">INT (If wiper switch is set in INT, voltage is output intermittently.)</td><td>Repeat 20 to 30 V ↔ 0 V</td></tr>
<tr><td rowspan="8">4</td><td rowspan="8">Defective front wiper switch (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td colspan="3">C13</td><td>Voltage</td></tr>
<tr><td colspan="3">Between (5) and chassis ground</td><td>20 – 30 V</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>LW21 (female)</td><td colspan="2">Wiper switch</td><td>Resistance</td></tr>
<tr><td>Between (7) and (5)</td><td colspan="2">Lo</td><td>Max. 1 Ω</td></tr>
<tr><td>Between (7) and (4)</td><td colspan="2">Hi</td><td>Max. 1 Ω</td></tr>
<tr><td>Between (7) and (2)</td><td colspan="2">INT</td><td>Max. 1 Ω</td></tr>
<tr><td>Between (1) and (5)</td><td colspan="2">INT and OFF</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Other than above</td><td>Min. 1 MΩ</td></tr>
</table>

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	5	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between LW21 (female) (2) – L21 (female) (4)	Resis-tance	Max. 1 Ω
			Wiring harness between LW21 (female) (3) – L21 (female) (5)	Resis-tance	Max. 1 Ω
			Wiring harness between LW21 (female) (4) – C27 (female) (1)	Resis-tance	Max. 1 Ω
			Wiring harness between LW21 (female) (5) – L21 (female) (2)	Resis-tance	Max. 1 Ω
			Wiring harness between LW21 (female) (7) – fuse No. 9 of fuse box B, – circuit branch end	Resis-tance	Max. 1 Ω
			Wiring harness between LW21 (female) (6) – BL2 (female) (1)	Resis-tance	Max. 1 Ω
			Wiring harness between C27 (female) (3) – chassis ground	Resis-tance	Max. 1 Ω
			Wiring harness between L21 (female) (1) – chassis ground	Resis-tance	Max. 1 Ω
	6	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between LW21 (female) (2) – L21 (female) (4)	Resis-tance	Min. 1 MΩ
			Wiring harness between LW21 (female) (3) – L21 (female) (5)	Resis-tance	Min. 1 MΩ
			Wiring harness between LW21 (female) (4) – C27 (female) (1)	Resis-tance	Min. 1 MΩ
			Wiring harness between LW21 (female) (5) – L21 (female) (2), – circuit branch end	Resis-tance	Min. 1 MΩ
			Wiring harness between LW21 (female) (7) – fuse No. 9 of fuse box B, – circuit branch end	Resis-tance	Min. 1 MΩ
			Wiring harness between LW21 (female) (6) – BL2 (female) (1)	Resis-tance	Min. 1 MΩ

Contents of trouble	(2) Rear wiper does not operate. (Steering wheel specification)
Related information	• Since the rear wiper switch, or wiring harness is defective, the rear wiper does not operate.

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective rear wiper motor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C40	Wiper switch	Voltage	
			Between (2) and chassis ground	ON	20 – 30 V	
			Between (1) and chassis ground	Normal	20 – 30 V	
			• If wiper switch is turned OFF while wiper is operating, voltage is applied between C40 (1) and chassis ground until wiper motor stops.			
	2	Defective rear wiper switch (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			LW21	Voltage		
			Between (7) and chassis ground	20 – 30 V		
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			LW21	Wiper switch	Resistance	
			Between (7) and (9)	ON	Max. 1 Ω	
			Between (8) and (9)	OFF	Max. 1 Ω	
			Other than above		Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between LW21 (female) (7) – C40 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between LW21 (female) (8) – C40 (female) (3)	Resistance	Max. 1 Ω	
			Wiring harness between LW21 (female) (9) – C40 (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between CN40 (female) (4) and chassis ground	Resistance	Max. 1 Ω	
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between LW21 (female) (8) – C40 (female) (3)	Resistance	Min. 1 MΩ	
			Wiring harness between LW21 (female) (9) – C40 (female) (2)	Resistance	Min. 1 MΩ	
			Wiring harness between LW21 (female) (7) – C40 (female) (1), – circuit branch end	Resistance	Min. 1 MΩ	

Circuit diagram related to wiper (Steering wheel specification)



Contents of trouble	(3) Front wiper does not operate. (AJSS specification)
Related information	• Since the front wiper switch, timer, or wiring harness is defective, the front wiper does not operate.

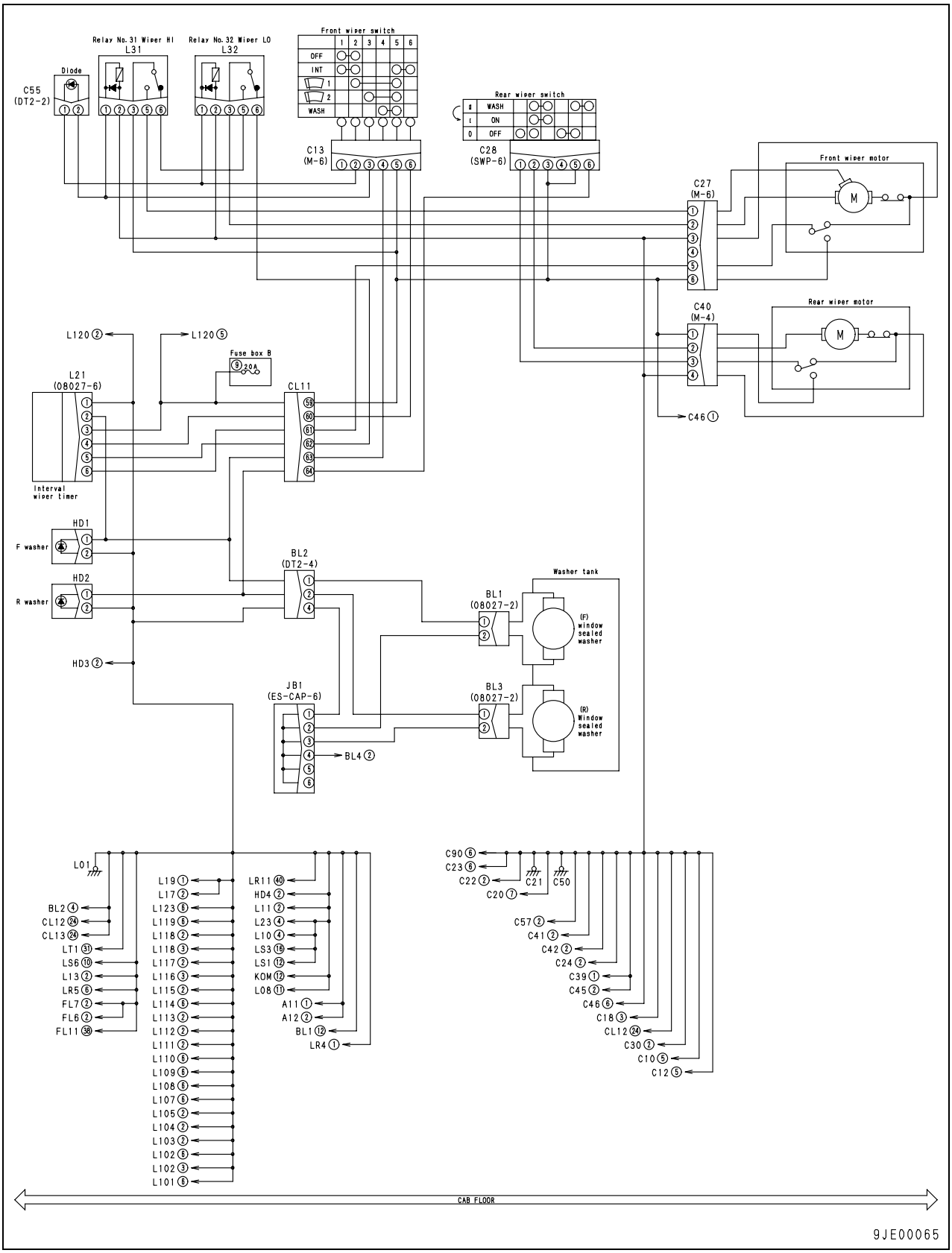
<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse No. 9 of fuse box B</td><td colspan="3">If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 6.)</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Defective front wiper motor (Internal defect)</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td>C27</td><td>Wiper switch</td><td>Voltage</td></tr>
<tr><td>Between (2) and chassis ground</td><td>Lo</td><td>20 – 30 V</td></tr>
<tr><td>Between (1) and chassis ground</td><td>Hi</td><td>20 – 30 V</td></tr>
<tr><td>Between (6) and chassis ground</td><td>Normal</td><td>20 – 30 V</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Defective wiper timer (relay) (Internal defect)</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td>L21</td><td>Wiper switch</td><td>Voltage</td></tr>
<tr><td>Between (3) and chassis ground</td><td>Normal</td><td>20 – 30 V</td></tr>
<tr><td>Between (4) and chassis ground</td><td>INT</td><td>20 – 30 V</td></tr>
<tr><td>Between (2) and chassis ground</td><td>Washer side</td><td>20 – 30 V</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Defective front wiper switch (Internal defect)</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td>Between (5) and chassis ground</td><td>INT (If wiper switch is set in INT, voltage is output intermittently.)</td><td>Repeat 20 to 30 V ↔ 0 V</td></tr>
<tr><td colspan="2">C13</td><td>Voltage</td></tr>
<tr><td colspan="2">Between (5) and chassis ground</td><td>20 – 30 V</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L21</td><td>Wiper switch</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (5) and (2)</td><td>Lo</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Between (5) and (3)</td><td>Hi</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Between (5) and (6)</td><td>INT</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td>INT and OFF</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Other than above</td><td>Min. 1 MΩ</td></tr>
</table>

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	5	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C13 (female) (1) – L21 (female) (5)	Resis-tance	Max. 1 Ω
			Wiring harness between C13 (female) (2) – C27 (female) (2)	Resis-tance	Max. 1 Ω
			Wiring harness between C13 (female) (3) – C27 (female) (1)	Resis-tance	Max. 1 Ω
			Wiring harness between C13 (female) (4) – L21 (female) (2)	Resis-tance	Max. 1 Ω
			Wiring harness between C13 (female) (5) – fuse No. 9 of fuse box B, – circuit branch end	Resis-tance	Max. 1 Ω
			Wiring harness between C13 (female) (6) – L21 (female) (4)	Resis-tance	Max. 1 Ω
			Wiring harness between C27 (female) (3) – chassis ground	Resis-tance	Max. 1 Ω
			Wiring harness between L21 (female) (1) – chassis ground	Resis-tance	Max. 1 Ω
	6	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C13 (female) (1) – L21 (female) (5)	Resis-tance	Min. 1 MΩ
			Wiring harness between C13 (female) (2) – C27 (female) (2)	Resis-tance	Min. 1 MΩ
			Wiring harness between C13 (female) (3) – C27 (female) (1)	Resis-tance	Min. 1 MΩ
			Wiring harness between C13 (female) (4) – L21 (female) (2), – circuit branch end	Resis-tance	Min. 1 MΩ
			Wiring harness between C13 (female) (5) – fuse No. 9 of fuse box B, – circuit branch end	Resis-tance	Min. 1 MΩ
			Wiring harness between C13 (female) (6) – L21 (female) (4)	Resis-tance	Min. 1 MΩ

Contents of trouble	(4) Rear wiper does not operate. (AJSS specification)
Related information	• Since the rear wiper switch, or wiring harness is defective, the rear wiper does not operate.

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective rear wiper motor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C40	Wiper switch	Voltage	
			Between (2) and chassis ground	ON	20 – 30 V	
			Between (4) and chassis ground	Normal	20 – 30 V	
			• If wiper switch is turned OFF while wiper is operating, voltage is applied between C40 (1) and chassis ground until wiper motor stops.			
	2	Defective rear wiper switch (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			C28		Voltage	
			Between (3) and chassis ground		20 – 30 V	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C28	Wiper switch	Resistance	
			Between (2) and (3)	ON	Max. 1 Ω	
			Between (1) and (2)	OFF	Max. 1 Ω	
			Other than above		Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C28 (female) (1) – C40 (female) (3)		Resis-tance	Max. 1 Ω
			Wiring harness between C28 (female) (2) – C40 (female) (2)		Resis-tance	Max. 1 Ω
			Wiring harness between C28 (female) (3) – C40 (female) (1)		Resis-tance	Max. 1 Ω
			Wiring harness between C40 (female) (4) – chassis ground		Resis-tance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C28 (female) (1) – C40 (female) (3)		Resis-tance	Min. 1 MΩ
			Wiring harness between C28 (female) (2) – C40 (female) (2)		Resis-tance	Min. 1 MΩ
			Wiring harness between C28 (female) (3) – C40 (female) (1), – circuit branch end		Resis-tance	Min. 1 MΩ

Circuit diagram related to wiper (AJSS specification)



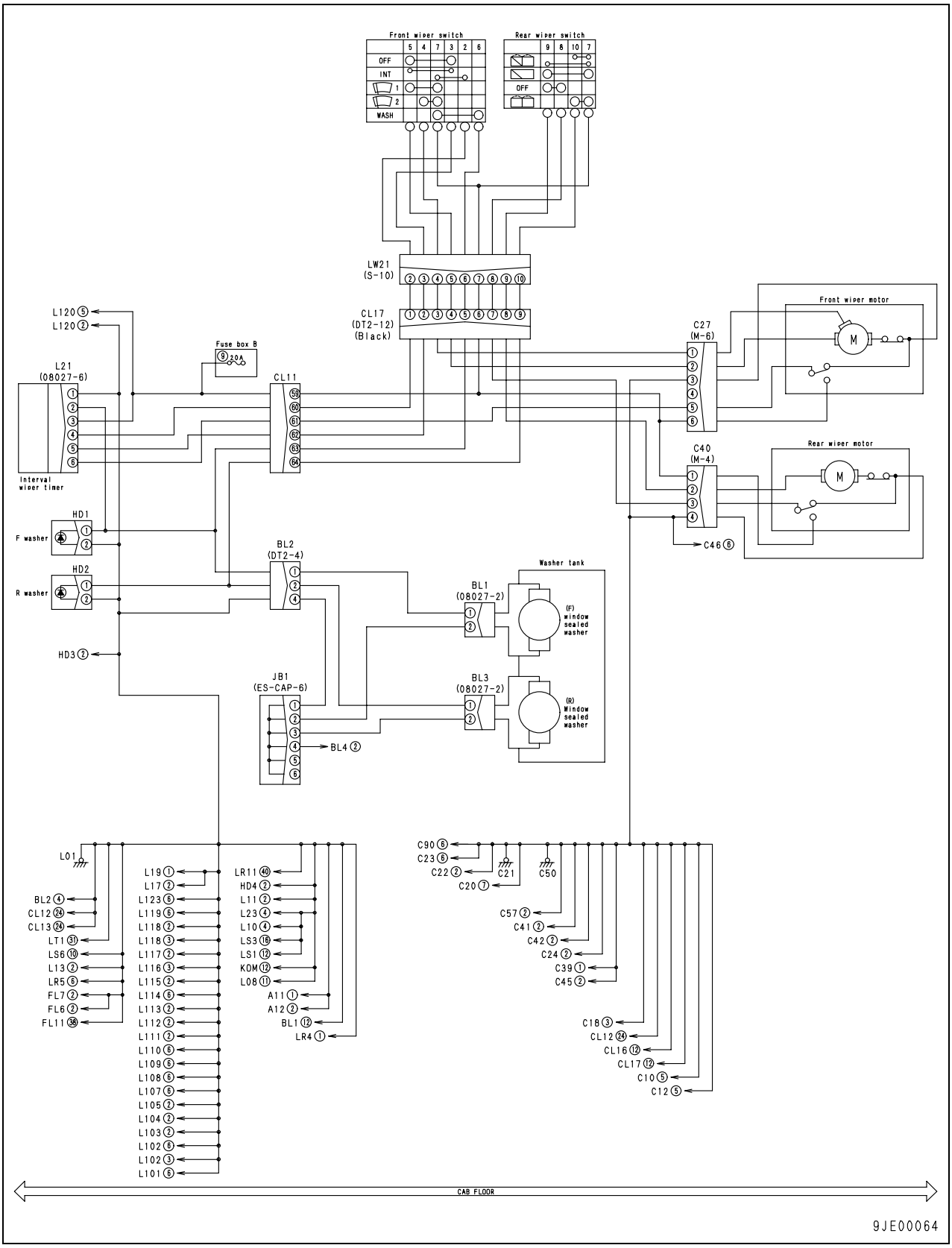
E-3 Windshield washer does not operate

Contents of trouble	(1) Windshield washer does not operate. (Steering wheel specification)
Related information	• Since the windshield washer motor, switch, timer (for only front), or wiring harness is defective, the windshield washer does not operate. • Perform the following troubleshooting when the wiper operates normally. (If the wiper does not operate normally, carry out troubleshooting for “E-2 Wiper does not operate” first.)

<table>
<tr><th colspan="2" rowspan="2">Cause</th><th colspan="4">Standard value in normal state/Remarks on troubleshooting</th></tr>
<tr></tr>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td rowspan="3">1</td><td rowspan="3">Defective front washer motor (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td colspan="2">BL1</td><td colspan="2">Voltage</td></tr>
<tr><td colspan="2">Between (1) and chassis ground</td><td colspan="2">20 – 30 V</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Defective rear washer motor (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td colspan="2">BL3</td><td colspan="2">Voltage</td></tr>
<tr><td colspan="2">Between (1) and chassis ground</td><td colspan="2">20 – 30 V</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Defective diode (HD1, HD2, HD3)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON (See test procedure for diode).</td></tr>
<tr><td colspan="2">HD1, HD2, HD3 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td colspan="2">Min. 1 MΩ (continuity is broken)</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Defective front wiper switch (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td colspan="2">LW21</td><td colspan="2">Voltage</td></tr>
<tr><td colspan="2">Between (7) and chassis ground</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>LW21 (male)</td><td>Washer switch of front wiper switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (7) and (6)</td><td>ON</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>Between (7), (6) and chassis ground</td><td>Normal</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="6">5</td><td rowspan="6">Defective rear wiper switch (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td colspan="2">LW21</td><td colspan="2">Voltage</td></tr>
<tr><td colspan="2">Between (7) and chassis ground</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>LW21 (male)</td><td>Washer switch of rear wiper switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (7) and (10)</td><td>ON</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>Between (7), (10) and chassis ground</td><td>Normal</td><td colspan="2">Min. 1 MΩ</td></tr>
</table>

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	5	Defective rear wiper switch (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			LW21 (male)	Washer switch of rear wiper switch	Resistance	
			Between (7) and (10)	ON	Max. 1 Ω	
			Between (7), (10) and chassis ground	Normal	Min. 1 MΩ	
	6	Defective wiper timer (relay) (for only front wiper)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L21 (male)	Washer switch of front wiper switch	Voltage	
			Between (3) and chassis ground	Normal	20 – 30 V	
			Between (2) and chassis ground	ON	20 – 30 V	
			Between (5) and chassis ground	0.2 – 0.8 sec after ON	20 – 30 V	
	7	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between LW21 (female) (6) – BL1 (female) (1), – L21 (female) (2)		Resis-tance	Max. 1 Ω
			Wiring harness between LW21 (female) (7) – fuse No. 9 of fuse box B		Resis-tance	Max. 1 Ω
			Wiring harness between LW21 (female) (10) – BL3 (female) (1)		Resis-tance	Max. 1 Ω
			Wiring harness between BL1 (female) (2), BL3 (female) (2) – chassis ground		Resis-tance	Max. 1 Ω
	8	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wring harness between LW21 (female) (6) – BL1 (female) (1), – L21 (female) (2), – circuit branch end		Resis-tance	Min. 1 MΩ
			Wiring harness between LW21 (female) (7) – fuse No. 9 of fuse box B, – circuit branch end		Resis-tance	Min. 1 MΩ
			Wiring harness between LW21 (female) (10) – BL3 (female) (1), – circuit branch end		Resis-tance	Min. 1 MΩ

Circuit diagram related to windshield washer (Steering wheel specification)

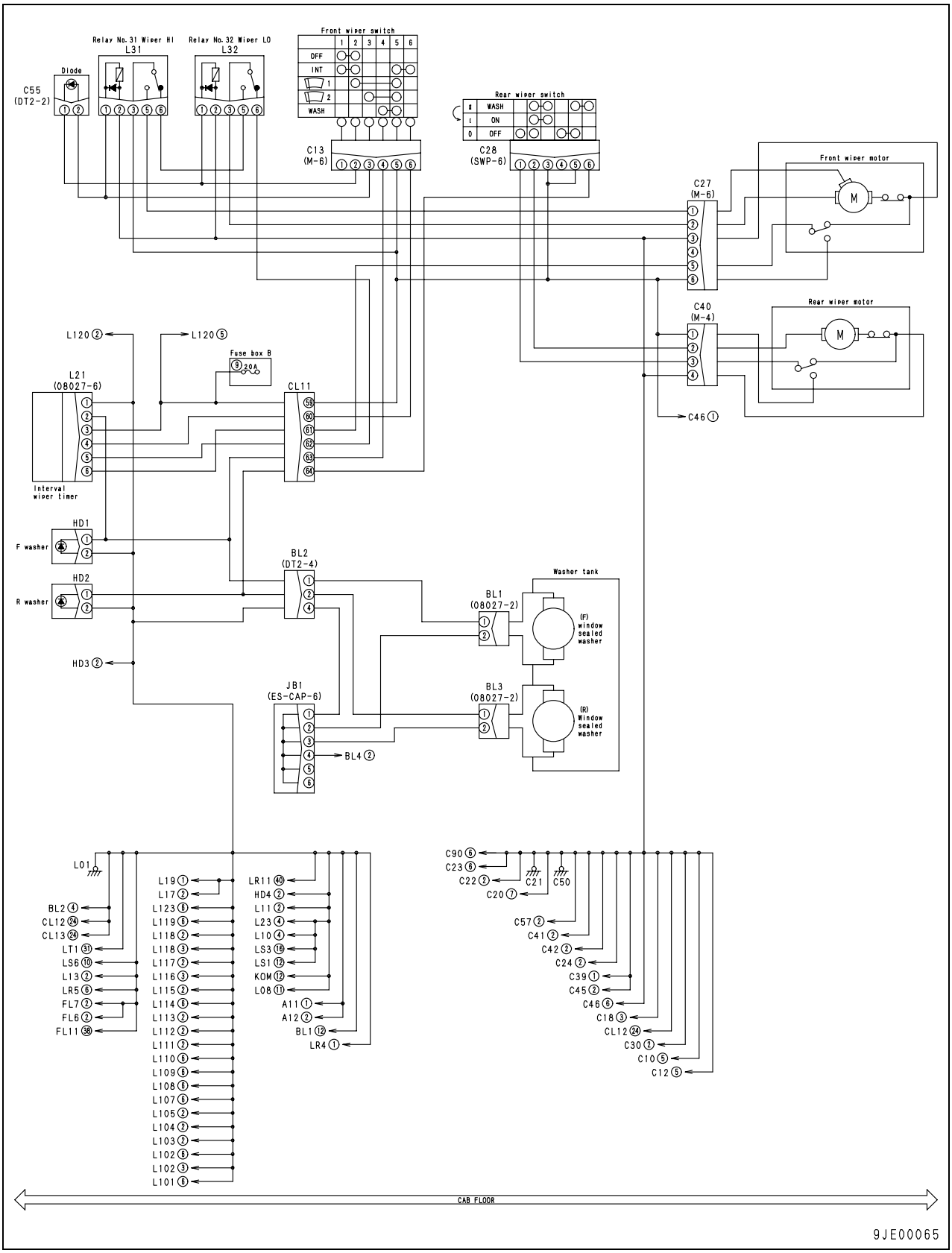


Contents of trouble	(2) Windshield washer does not operate. (AJSS specification)
Related information	• Since the windshield washer motor, switch, timer (for only front), or wiring harness is defective, the windshield washer does not operate. • Perform the following troubleshooting when the wiper operates normally. (If the wiper does not operate normally, carry out troubleshooting for “E-2 Wiper does not operate” first.)

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective front washer motor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			BL1	Voltage	
			Between (1) and chassis ground	20 – 30 V	
	2	Defective rear washer motor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			BL3	Voltage	
			Between (1) and chassis ground	20 – 30 V	
	3	Defective diode (HD1, HD2, HD3)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON (See test procedure for diode).		
			HD1, HD2, HD3 (male)	Resistance	
			Between (1) and (2)	Min. 1 MΩ (continuity is broken)	
	4	Defective front wiper switch (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			C13	Voltage	
			Between (5) and chassis ground	20 – 30 V	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			C13 (male)	Washer switch of front wiper switch	Resistance
			Between (5) and (4)	ON	Max. 1 Ω
				OFF	Min. 1 MΩ
			Between (5), (4) and chassis ground	Normal	Min. 1 MΩ
	5	Defective rear wiper switch (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			C28	Voltage	
			Between (3), (5) and chassis ground	20 – 30 V	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			C28 (male)	Washer switch of rear wiper switch	Resistance
			Between (5) and (6)	ON	Max. 1 Ω
				OFF	Min. 1 MΩ
			Between (5), (6) and chassis ground	Normal	Min. 1 MΩ

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	5	Defective rear wiper switch (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C28 (male)	Washer switch of rear wiper switch	Resistance	
			Between (3) and (2)	ON	Max. 1 Ω	
			Between (3), (2) and chassis ground	Normal	Min. 1 MΩ	
	6	Defective wiper timer (relay) (for only front wiper)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L21 (male)	Washer switch of front wiper switch	Voltage	
			Between (3) and chassis ground	Normal	20 – 30 V	
			Between (2) and chassis ground	ON	20 – 30 V	
			Between (5) and chassis ground	0.2 – 0.8 sec after ON	20 – 30 V	
	7	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C13 (female) (4) – BL1 (female) (1), – L21 (female) (2)		Resis-tance	Max. 1 Ω
			Wiring harness between C13 (female) (5), C28 (female) (3), (5) or C47 (female) (3), (5) – fuse No. 9 of fuse box B		Resis-tance	Max. 1 Ω
			Wiring harness between C28 (female) (6) – BL3 (female) (1)		Resis-tance	Max. 1 Ω
			Wiring harness between BL1 (female) (2), BL3 (female) (2) or BL5 (female) (2) – chassis ground		Resis-tance	Max. 1 Ω
	8	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wring harness between C13 (female) (4) – BL1 (female) (1), – L21 (female) (2), – circuit branch end		Resis-tance	Min. 1 MΩ
			Wiring harness between C13 (female) (5), C28 (female) (3), (5) or C47 (female) (3), (5) – fuse No. 9 of fuse box B, – circuit branch end		Resis-tance	Min. 1 MΩ
			Wiring harness between C28 (female) (6) – BL3 (female) (1), – circuit branch end		Resis-tance	Min. 1 MΩ

Circuit diagram related to windshield washer (AJSS specification)



E-4 Headlamp, clearance lamp, tail lamp, and license lamp do not light up or go off

Contents of trouble	(1) None of headlamp, clearance lamp, tail lamp, and license lamp does not light up. (Steering wheel specification)
Related information	• Since the lamp system main circuit is disconnected or shorted with the chassis ground, none of the lamps lights up. • Headlamp at SMALL position: Clearance lamp, tail lamp, license lamp, machine monitor night lamp light up. • Headlamp at HEAD position: Above lamps and headlamp light up. • Input state (Voltage) from lamp switch (small lamp) to machine monitor can be checked with monitoring function (Code: 40200 SMALL LAMP). • Input state (ON/OFF) from lamp switch (headlamp) to machine monitor can be checked with monitoring function (Code: 40900 D-IN-0). • Input state (ON/OFF) from dimmer switch (high beam) to machine monitor can be checked with monitoring function (Code: 40904 D-IN-34).

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse No. 11 of fuse box B</td><td colspan="4">If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 4.)</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Defective lamp switch (Internal disconnection or short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L02 (male)</td><td>Headlamp switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) and (5)</td><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>SMALL or HEAD</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>SMALL</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>HEAD</td><td>Max. 1 Ω</td><td colspan="2"></td></tr>
<tr><td>Between (1), (2), (5) and chassis ground</td><td>Normal</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Disconnection in wiring harness (Disconnection or defective contact of connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between fuse No. 11 of fuse box B – L02 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Grounding fault in wiring harness (Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between fuse No. 11 of fuse box B – L02 (female) (1), – circuit branch end</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
</table>

Contents of trouble	(2) Either of headlamp low and high beams does not light up or go off. (Steering wheel specification)
Related information	• The switch, lamp, or wiring harness of the lamp switch and dimmer switch (low and high beams) is defective. • Carry out the following troubleshooting when the clearance lamp, tail lamp, and license lamp light up and go off normally. • Input state (ON/OFF) from lamp switch (headlamp) to machine monitor can be checked with monitoring function (Code: 40900 D-IN-0). • Input state (ON/OFF) from dimmer switch (high beam) to machine monitor can be checked with monitoring function (Code: 40904 D-IN-34).

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No. 14 or No. 15 of fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 5.)			
	2	Defective lamp switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L02 (male)	Headlamp switch	Resistance	
			Between (1) and (2)	OFF	Min. 1 MΩ	
				SMALL	Min. 1 MΩ	
				HEAD	Max. 1 Ω	
			Between (1), (2) and chassis ground	Normal	Min. 1 MΩ	
	3	Defective dimmer switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L02 (male)	Dimmer switch	Resistance	
			Between (3) and (6)	Low	Min. 1 MΩ	
				High	Max. 1 Ω	
			Between (3), (6) and chassis ground	Normal	Min. 1 MΩ	
	4	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (1) – fuse No. 11 of fuse box B		Resistance	Max. 1 Ω
			Wiring harness between fuse No. 15 of fuse box B – left HEAD (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between fuse No. 14 of fuse box B – right HEAD (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between relay L118 (female) (3) – chassis ground		Resistance	Max. 1 Ω
	5	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (1) – fuse No. 11 of fuse box B		Resistance	Min. 1 MΩ
			Wiring harness between fuse No. 15 of fuse box B – left HEAD (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between fuse No. 14 of fuse box B – right HEAD (female) (2)		Resistance	Min. 1 MΩ
	6	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting • Headlamp switch is OFF			
			Wiring harness between L02 (female) (1) – fuse No. 11 of fuse box B		Voltage	Max. 1 V
			Wiring harness between fuse No. 15 of fuse box B – left HEAD (female) (2)		Voltage	Max. 1 V
			Wiring harness between fuse No. 14 of fuse box B – right HEAD (female) (2)		Voltage	Max. 1 V

Contents of trouble	(3) Headlamp low beam does not light up or go off. (Steering wheel specification)
Related information	• The switch, lamp, or wiring harness of the headlamp (low beam) is disconnected or shorted with the chassis ground. • Carry out the following troubleshooting when the high beam lights up (goes off) normally. • Input state (ON/OFF) from lamp switch (headlamp) to machine monitor can be checked with monitoring function (Code: 40900 D-IN-0). • Input state (ON/OFF) from dimmer switch (high beam) to machine monitor can be checked with monitoring function (Code: 40904 D-IN-34).

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Broken bulb</td><td colspan="4">If a specific headlamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Defective dimmer switch (Internal disconnection or short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L02 (male)</td><td colspan="2">Dimmer switch</td><td>Resistance</td></tr>
<tr><td rowspan="2">Between (3) and (6)</td><td colspan="2">Low</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">High</td><td>Max. 1 Ω</td></tr>
<tr><td>Between (3), (6) and chassis ground</td><td colspan="2">Normal</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective dimmer relay (L118)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">L118 (male)</td><td>Resistance</td></tr>
<tr><td colspan="3">Between (1) and (2)</td><td>200 – 400 Ω</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Disconnection in wiring harness (Disconnection or defective contact of connector)</td><td colspan="4">When dimmer relay (L118) is replaced with a relay of the same type, if the condition becomes normal, the dimmer relay is defective.</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between L118 (female) (6) – HEAD (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Grounding fault in wiring harness (Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between L118 (female) (6) – HEAD (female) (1), – circuit branch end</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
</table>

Contents of trouble	(4) Headlamp high beam does not light up or go off. (Steering wheel specification)
Related information	• The switch, lamp, or wiring harness of the headlamp (high beam) is disconnected or shorted with the chassis ground. • Carry out the following troubleshooting when the low beam lights up (goes off) normally. • Input state (ON/OFF) from lamp switch (headlamp) to machine monitor can be checked with monitoring function (Code: 40900 D-IN-0). • Input state (ON/OFF) from dimmer switch (high beam) to machine monitor can be checked with monitoring function (Code: 40904 D-IN-34).

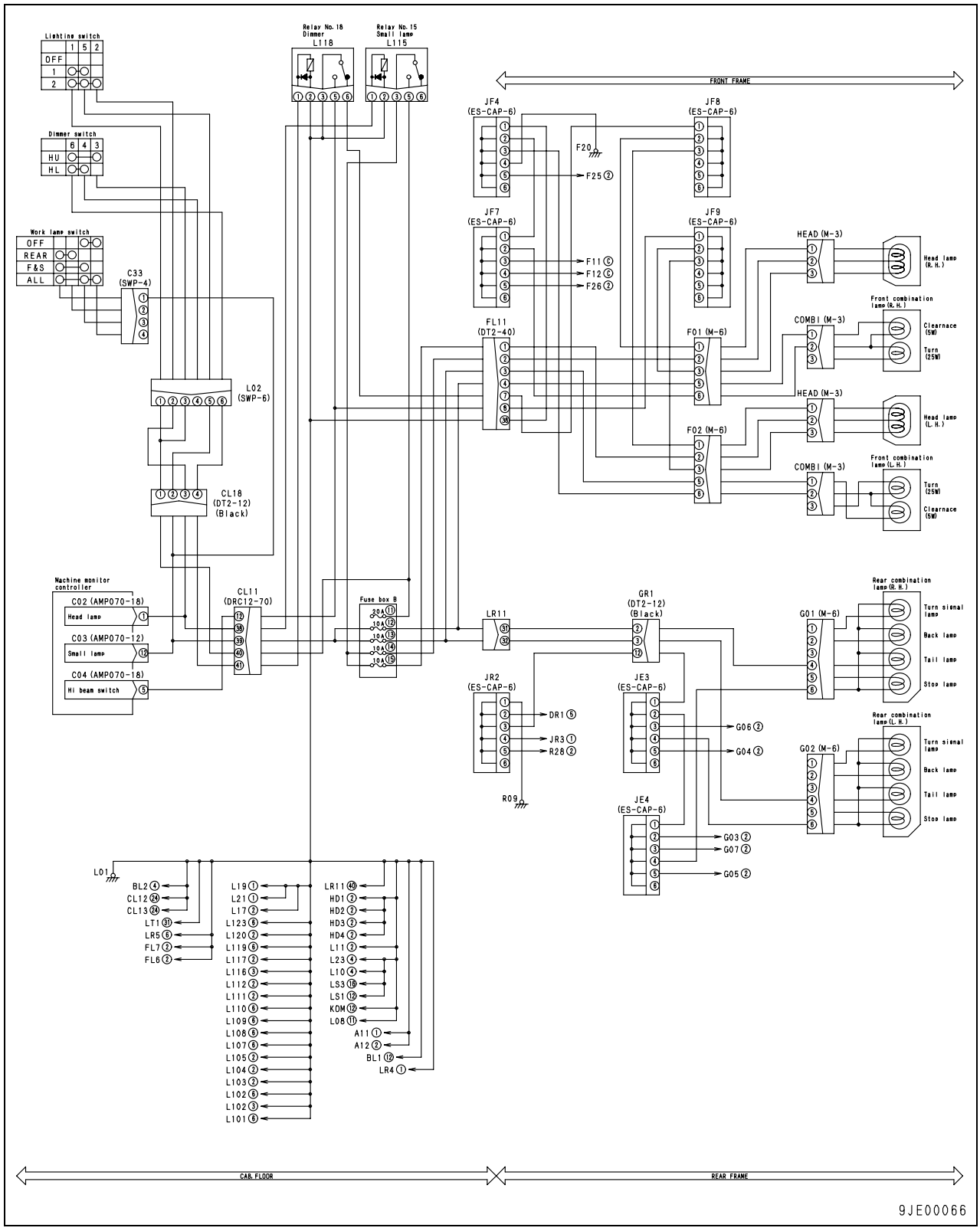
	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Broken bulb	If a specific headlamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.			
	2	Defective dimmer switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L02 (male)	Dimmer switch	Resistance	
			Between (3) and (6)	Low	Min. 1 MΩ	
				High	Max. 1 Ω	
			Between (3), (6) and chassis ground	Normal	Min. 1 MΩ	
	3	Defective dimmer relay (L118)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L118 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			When dimmer relay (L118) is replaced with a relay of the same type, if the condition becomes normal, the dimmer relay is defective.			
	4	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (6) – L118 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between L118 (female) (2) – chassis ground	Resistance	Max. 1 Ω	
			Wiring harness between HEAD (3) and L118 (female) (5)	Resistance	Max. 1 Ω	
	5	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (6) – L118 (female) (1)	Resistance	Min. 1 MΩ	
			Wiring harness between L118 (female) (5) – HEAD (3), – circuit branch end	Resistance	Min. 1 MΩ	

Contents of trouble	(5) Clearance lamp does not light up or go off. (Steering wheel specification) (6) Tail lamp does not light up or go off. (Steering wheel specification)
Related information	• The switch, lamp, or wiring harness of the clearance lamp or tail lamp system is defective. • Carry out the following troubleshooting when the headlamp and turn signal lights up. • The input state (voltage) from the headlamp switch (small lamp) can be checked with the monitoring function (Code: 40200, SMALL LAMP).

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Broken bulb	If a specific lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.			
	2	Defective fuse No. 12 or No. 13 of fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 6.)			
	3	Defective headlamp switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L02 (male)	Headlamp switch	Resistance	
			Between (1) and (5)	OFF	Min. 1 MΩ	
				SMALL	Max. 1 Ω	
				HEAD	Max. 1 Ω	
			Between (1), (5) and chassis ground	Normal	Min. 1 MΩ	
	4	Defective small lamp relay (L115)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L115 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			When small lamp relay (L115) is replaced with a relay of the same type, if the condition becomes normal, the small lamp relay is defective.			
	5	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (2) – L115 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between L115 (female) (2) – chassis ground	Resistance	Max. 1 Ω	
			Wiring harness between L115 (female) (3) – fuse No. 14 or No. 15 of fuse box B	Resistance	Max. 1 Ω	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 12 of fuse box B – right HEAD (female) (1), – G01 (female) (4)	Resistance	Max. 1 Ω	
			Wiring harness between fuse No. 13 of fuse box B – left HEAD (female) (1), – G02 (female) (4)	Resistance	Max. 1 Ω	
			Wiring harness between COMBI (female) (2) – chassis ground	Resistance	Max. 1 Ω	
			Wiring harness between G01 (female) (6) – chassis ground	Resistance	Max. 1 Ω	
			Wiring harness between G02 (female) (6) – chassis ground	Resistance	Max. 1 Ω	

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	6	Grounding fault in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L02 (female) (2) – L115 (female) (1)	Resis-tance	Min. 1 MΩ
			Wiring harness between L115 (female) (3) – fuse No. 14 or No. 15 of fuse box B	Resis-tance	Min. 1 MΩ
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 12 of fuse box B – right HEAD (female) (1), – G01 (female) (4)	Resis-tance	Min. 1 MΩ
			Wiring harness between fuse No. 13 of fuse box B – left HEAD (female) (1), – G02 (female) (4)	Resis-tance	Min. 1 MΩ
	7	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting • Headlamp switch is OFF		
			Wiring harness between L02 (female) (2) – L115 (female) (1)	Voltage	Max. 1 V
			Between L115 (female) (3) – fuse No. 14 or No. 15 of fuse box B wiring harness and chassis ground	Voltage	Max. 1 V
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between fuse No. 12 of fuse box B – right HEAD (female) (1), – G01 (female) (4)	Voltage	Max. 1 V
			Wiring harness between fuse No. 13 of fuse box B – left HEAD (female) (1), – G02 (female) (4)	Voltage	Max. 1 V

Circuit diagram related to headlamp, clearance lamp and tail lamp (Steering wheel specification)



Contents of trouble	(7) None of headlamp, clearance lamp, tail lamp, and license lamp does not light up. (AJSS specification)
Related information	• Since the lamp system main circuit is disconnected or shorted with the chassis ground, none of the lamps lights up. • Headlamp at SMALL position: Clearance lamp, tail lamp, license lamp, machine monitor night lamp light up. • Headlamp at HEAD position: Above lamps and headlamp light up. • Input state (Voltage) from lamp switch (small lamp) to machine monitor can be checked with monitoring function (Code: 40200 SMALL LAMP). • Input state (ON/OFF) from lamp switch (headlamp) to machine monitor can be checked with monitoring function (Code: 40900 D-IN-0). • Input state (ON/OFF) from dimmer switch (high beam) to machine monitor can be checked with monitoring function (Code: 40904 D-IN-34).

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No. 11 of fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 4.)			
	2	Defective lamp switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C15 (male)	Headlamp switch	Resistance	
			Between (4) and (3)	OFF	Min. 1 MΩ	
				SMALL or HEAD	Max. 1 Ω	
			Between (4) and (2)	OFF	Min. 1 MΩ	
				SMALL	Min. 1 MΩ	
				HEAD	Max. 1 Ω	
			Between (2), (3), (4) and chassis ground	Normal	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 11 of fuse box B – C15 (female) (4)		Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 11 of fuse box B – C15 (female) (4), – circuit branch end		Resistance	Min. 1 MΩ

Contents of trouble	(8) Either of headlamp low and high beams does not light up or go off. (AJSS specification)
Related information	• The switch, lamp, or wiring harness of the lamp switch and dimmer switch (low and high beams) is defective. • Carry out the following troubleshooting when the clearance lamp, tail lamp, and license lamp light up and go off normally. • Input state (ON/OFF) from lamp switch (headlamp) to machine monitor can be checked with monitoring function (Code: 40900 D-IN-0). • Input state (ON/OFF) from dimmer switch (high beam) to machine monitor can be checked with monitoring function (Code: 40904 D-IN-34).

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No. 14 or No. 15 of fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 5.)			
	2	Defective lamp switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C15 (male)	Headlamp switch	Resistance	
			Between (4) and (2)	OFF	Min. 1 MΩ	
				SMALL	Min. 1 MΩ	
				HEAD	Max. 1 Ω	
			Between (4), (2) and chassis ground	Normal	Min. 1 MΩ	
	3	Defective dimmer switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C16 (male)	Dimmer switch	Resistance	
			Between (4) and (2)	Low	Min. 1 MΩ	
				High	Max. 1 Ω	
			Between (4), (2) and chassis ground	Normal	Min. 1 MΩ	
	4	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C15 (female) (4) – fuse No. 11 of fuse box B		Resistance	Max. 1 Ω
			Wiring harness between fuse No. 15 of fuse box B – left HEAD (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between fuse No. 14 of fuse box B – right HEAD (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between relay L118 (female) (3) – chassis ground		Resistance	Max. 1 Ω
	5	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C15 (female) (4) – fuse No. 11 of fuse box B		Resistance	Min. 1 MΩ
			Wiring harness between fuse No. 15 of fuse box B – left HEAD (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between fuse No. 14 of fuse box B – right HEAD (female) (2)		Resistance	Min. 1 MΩ
	6	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting • Headlamp switch is OFF			
			Wiring harness between C15 (female) (4) – fuse No. 11 of fuse box B		Voltage	Max. 1 V
			Wiring harness between fuse No. 15 of fuse box B – left HEAD (female) (2)		Voltage	Max. 1 V
			Wiring harness between fuse No. 14 of fuse box B – right HEAD (female) (2)		Voltage	Max. 1 V

Contents of trouble	(9) Headlamp low beam does not light up or go off. (AJSS specification)
Related information	• The switch, lamp, or wiring harness of the headlamp (low beam) is disconnected or shorted with the chassis ground. • Carry out the following troubleshooting when the high beam lights up (goes off) normally. • Input state (ON/OFF) from lamp switch (headlamp) to machine monitor can be checked with monitoring function (Code: 40900 D-IN-0). • Input state (ON/OFF) from dimmer switch (high beam) to machine monitor can be checked with monitoring function (Code: 40904 D-IN-34).

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Broken bulb</td><td colspan="5">If a specific headlamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Defective dimmer switch (Internal disconnection or short circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>C16 (male)</td><td colspan="2">Dimmer switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (4) and (2)</td><td colspan="2">Low</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td colspan="2">High</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (4), (2) and chassis ground</td><td colspan="2">Normal</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective dimmer relay (L118)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">L118 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="3">Between (1) and (2)</td><td colspan="2">200 – 400 Ω</td></tr>
<tr><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Disconnection in wiring harness (Disconnection or defective contact of connector)</td><td colspan="5">When dimmer relay (L118) is replaced with a relay of the same type, if the condition becomes normal, the dimmer relay is defective.</td></tr>
<tr><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between L118 (female) (6) – HEAD (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Grounding fault in wiring harness (Contact with ground circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between L118 (female) (6) – HEAD (female) (1), – circuit branch end</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
</table>

Contents of trouble	(10) Headlamp high beam does not light up or go off. (AJSS specification)
Related information	• The switch, lamp, or wiring harness of the headlamp (high beam) is disconnected or shorted with the chassis ground. • Carry out the following troubleshooting when the low beam lights up (goes off) normally. • Input state (ON/OFF) from lamp switch (headlamp) to machine monitor can be checked with monitoring function (Code: 40900 D-IN-0). • Input state (ON/OFF) from dimmer switch (high beam) to machine monitor can be checked with monitoring function (Code: 40904 D-IN-34).

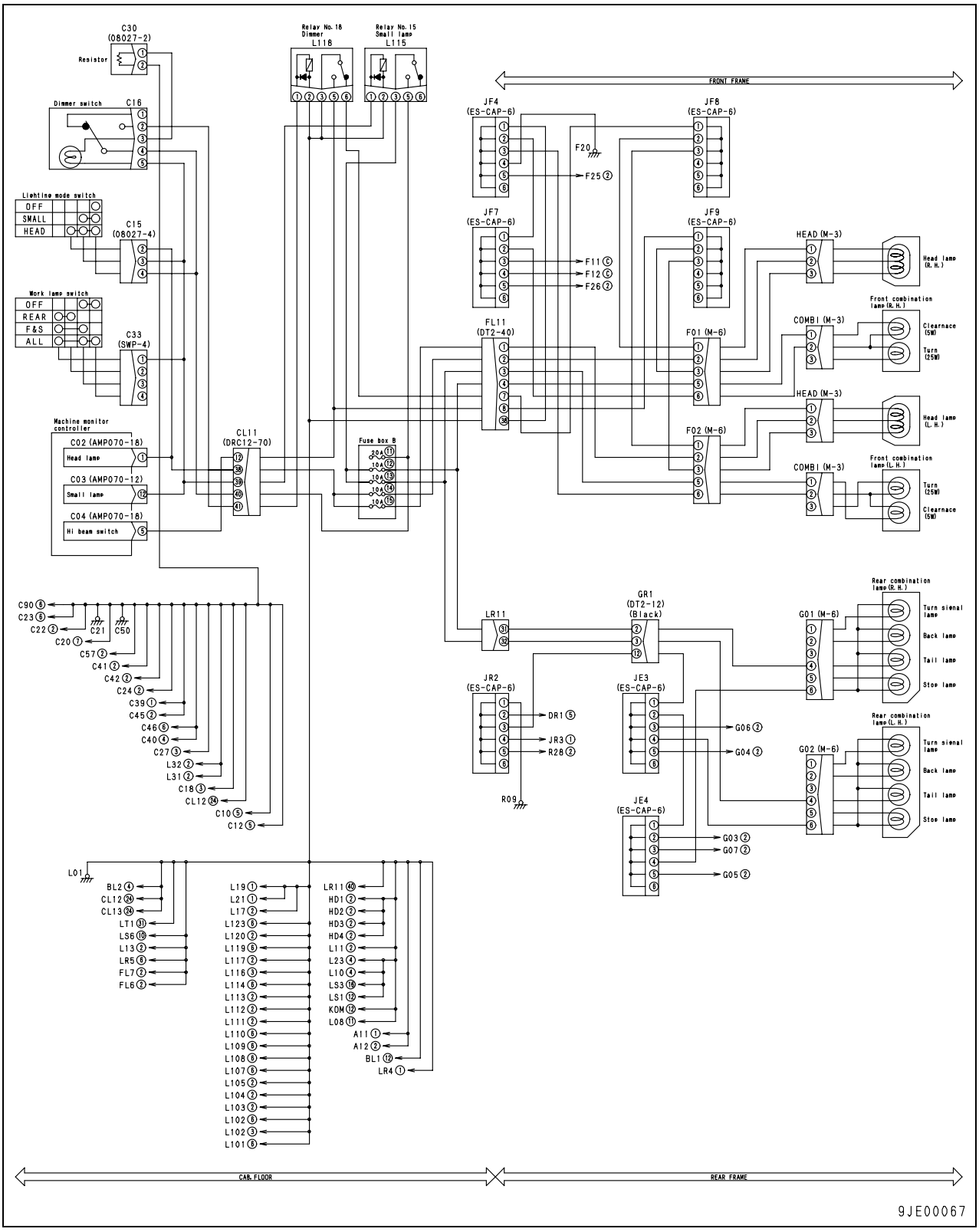
	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Broken bulb	If a specific headlamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.			
	2	Defective dimmer switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C16 (male)	Dimmer switch	Resistance	
			Between (4) and (2)	Low	Min. 1 MΩ	
				High	Max. 1 Ω	
			Between (4), (2) and chassis ground	Normal	Min. 1 MΩ	
	3	Defective dimmer relay (L118)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L118 (male)		Resistance	
			Between (1) and (2)		200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			When dimmer relay (L118) is replaced with a relay of the same type, if the condition becomes normal, the dimmer relay is defective.			
	4	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C16 (female) (2) – L118 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L118 (female) (2) – chassis ground		Resistance	Max. 1 Ω
			Wiring harness between HEAD (3) and L118 (female) (5)		Resistance	Max. 1 Ω
	5	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C16 (female) (2) – L118 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between L118 (female) (5) – HEAD (3), – circuit branch end		Resistance	Min. 1 MΩ

Contents of trouble	(11) Clearance lamp does not light up or go off. (AJSS specification) (12) Tail lamp does not light up or go off. (AJSS specification)
Related information	• The switch, lamp, or wiring harness of the clearance lamp or tail lamp system is defective. • Carry out the following troubleshooting when the headlamp and turn signal light up. • The input state (voltage) from the headlamp switch (small lamp) can be checked with the monitoring function (Code: 40200, SMALL LAMP).

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Broken bulb	If a specific lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.			
	2	Defective fuse No. 12 or No. 13 of fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 6.)			
	3	Defective headlamp switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C15 (male)	Headlamp switch	Resistance	
			Between (4) and (3)	OFF	Min. 1 MΩ	
				SMALL	Max. 1 Ω	
				HEAD	Max. 1 Ω	
			Between (4), (3) and chassis ground	Normal	Min. 1 MΩ	
	4	Defective small lamp relay (L115)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L115 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			When small lamp relay (L115) is replaced with a relay of the same type, if the condition becomes normal, the small lamp relay is defective.			
	5	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C15 (female) (3) – L115 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between L115 (female) (2) – chassis ground	Resistance	Max. 1 Ω	
			Wiring harness between L115 (female) (3) – fuse No. 14 or No. 15 of fuse box B	Resistance	Max. 1 Ω	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 12 of fuse box B – right HEAD (female) (1), – G01 (female) (4)	Resistance	Max. 1 Ω	
			Wiring harness between fuse No. 13 of fuse box B – left HEAD (female) (1), – G02 (female) (4)	Resistance	Max. 1 Ω	
			Wiring harness between COMBI (female) (2) – chassis ground	Resistance	Max. 1 Ω	
			Wiring harness between G01 (female) (6) – chassis ground	Resistance	Max. 1 Ω	
			Wiring harness between G02 (female) (6) – chassis ground	Resistance	Max. 1 Ω	

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	6	Grounding fault in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C15 (female) (3) – L115 (female) (1)	Resis-tance	Min. 1 MΩ
			Wiring harness between L115 (female) (3) – fuse No. 14 or No. 15 of fuse box B	Resis-tance	Min. 1 MΩ
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 12 of fuse box B – right HEAD (female) (1), – G01 (female) (4)	Resis-tance	Min. 1 MΩ
			Wiring harness between fuse No. 13 of fuse box B – left HEAD (female) (1), – G02 (female) (4)	Resis-tance	Min. 1 MΩ
	7	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting • Headlamp switch is OFF		
			Wiring harness between C15 (female) (3) – L115 (female) (1)	Voltage	Max. 1 V
			Between L115 (female) (3) – fuse No. 14 or No. 15 of fuse box B wiring harness and chassis ground	Voltage	Max. 1 V
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between fuse No. 12 of fuse box B – right HEAD (female) (1), – G01 (female) (4)	Voltage	Max. 1 V
			Wiring harness between fuse No. 13 of fuse box B – left HEAD (female) (1), – G02 (female) (4)	Voltage	Max. 1 V

Circuit diagram related to headlamp, clearance lamp and tail lamp (AJSS specification)



E-5 Working lamp does not light up or go off.

Contents of trouble	(1) Either of front working lamp and rear working lamp does not light up
Related information	• The working lamp system power supply wiring harness is disconnected or shorted with the chassis ground. • If the clearance lamp does not light up or go off either, carry out troubleshooting for the clearance lamp first.

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="13">1</td><td rowspan="13">Defective working lamp switch (Internal disconnection or short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>C33 (male)</td><td>Working lamp switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="4">Between (1) and (2)</td><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>REAR</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>FRONT (& SIDE)</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>ALL</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="4">Between (1) and (3)</td><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>REAR</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>FRONT (& SIDE)</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>ALL</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td rowspan="4">Between (1) and (4)</td><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>REAR</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>FRONT (& SIDE)</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>ALL</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (1), (2), (3), (4) and chassis ground</td><td>Normal</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Disconnection in wiring harness (Disconnection or defective contact of connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between L02 (female) (5) – C33 (Steering wheel specification)</td><td>Resis-tance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between C15 (female) (3) – C33 (female) (1) (AJSS specification)</td><td>Resis-tance</td><td>Max. 1 Ω</td></tr>
</table>

Contents of trouble	(2) Front working lamp does not light up or go off.
Related information	• The switch, lamp, or wiring harness of the front working lamp system is defective • If the clearance lamp does not light up or go off either, carry out troubleshooting for the clearance lamp first.

<table>
<tr><td rowspan="6">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="2">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Broken bulb</td><td colspan="2">If a specific working lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.</td></tr>
<tr><td>2</td><td>Defective fuse No. 3 of fuse box B</td><td colspan="2">If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 6.)</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Defective front working lamp relay (L109)</td><td colspan="2">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L109 (male)</td><td>Resistance</td></tr>
<tr><td>Between (5) and (6)</td><td>200 – 400 Ω</td></tr>
</table>

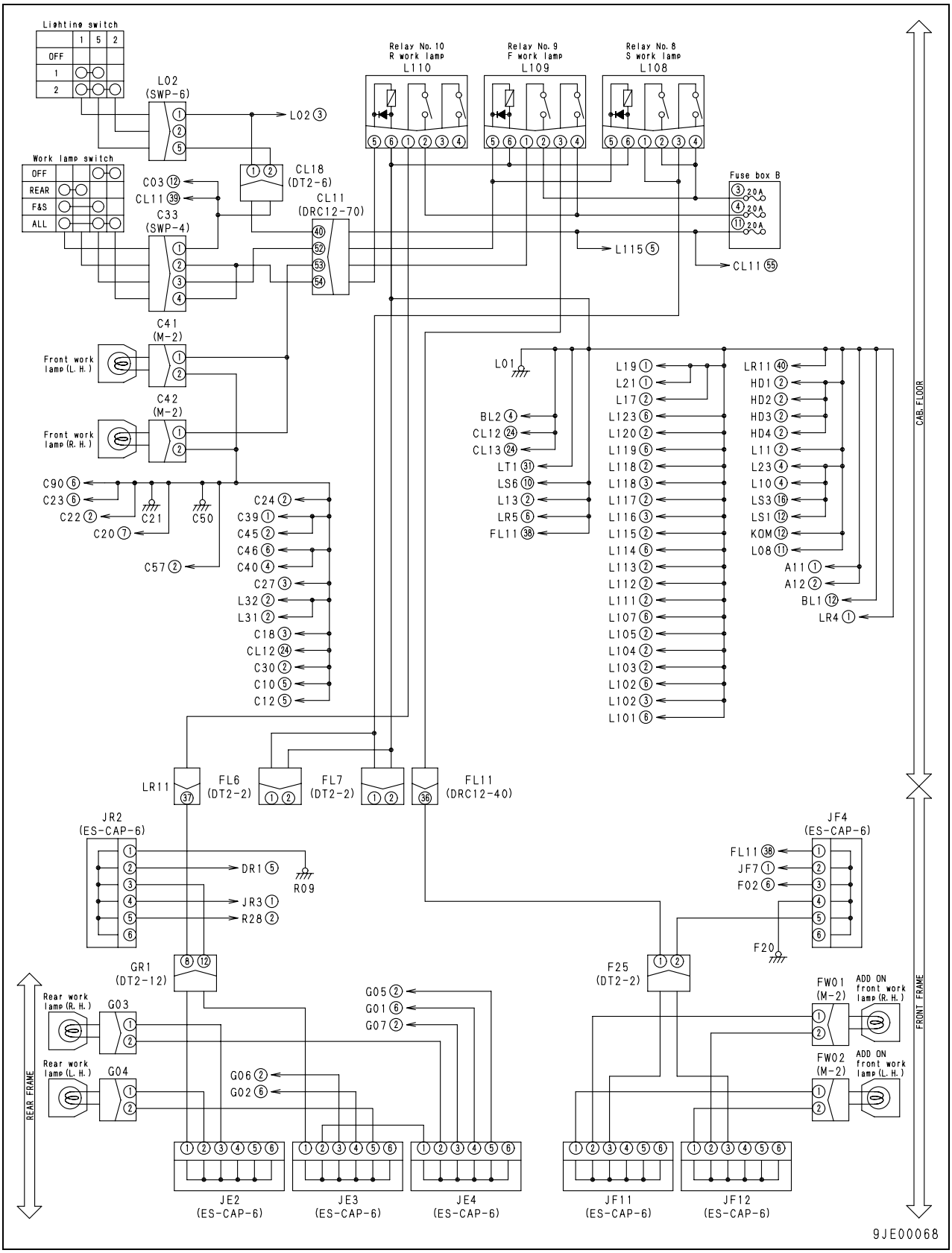
<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Defective front working lamp relay (L109)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td colspan="4">When front working lamp relay (L109) is replaced with a relay of the same type, if the condition becomes normal, the front working lamp relay is defective.</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Defective working lamp switch (Internal disconnection or short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>C33 (male)</td><td>Working lamp switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="4">Between (1) and (3)</td><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>REAR</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>FRONT (& SIDE)</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>ALL</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (1), (3) and chassis ground</td><td>Normal</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="9">5</td><td rowspan="9">Disconnection in wiring harness (Disconnection or defective contact of connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between C33 (female) (3) – L109 (female) (5)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L109 (female) (6) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L109 (female) (1) – C41 (female) (1), – C42 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between C41 (female) (2), C42 (female) (2) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between fuse No. 3 of fuse box B – L109 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L109 (female) (3) – FW01 (female) (1), – FW02 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between FW01 (female) (2), FW02 (female) (2) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between fuse No. 4 of fuse box B – L109 (female) (4)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="5">6</td><td rowspan="5">Grounding fault in wiring harness (Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between C33 (female) (3) – L109 (female) (5), – circuit branch end</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L109 (female) (1) – C41 (female) (1), – C42 (female) (1)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between fuse No. 3 of fuse box B – L109 (female) (2), – circuit branch end</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L109 (female) (3) – FW01 (female) (1), – FW02 (female) (1), – circuit branch end</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="3">7</td><td rowspan="3">Hot short in wiring harness (Contact with 24 V circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td colspan="2">Wiring harness between L109 (female) (1) – C41 (female) (1), – C42 (female) (1)</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td colspan="2">Wiring harness between L109 (female) (3) – FW01 (female) (1), – FW02 (female) (1), – circuit branch end</td><td>Voltage</td><td>Max. 1 V</td></tr>
</table>

Contents of trouble	(3) Rear working lamp does not light up or go off.
Related information	• The switch, lamp, or wiring harness of the rear working lamp system is defective. • If the clearance lamp does not light up or go off either, carry out troubleshooting for the clearance lamp first.

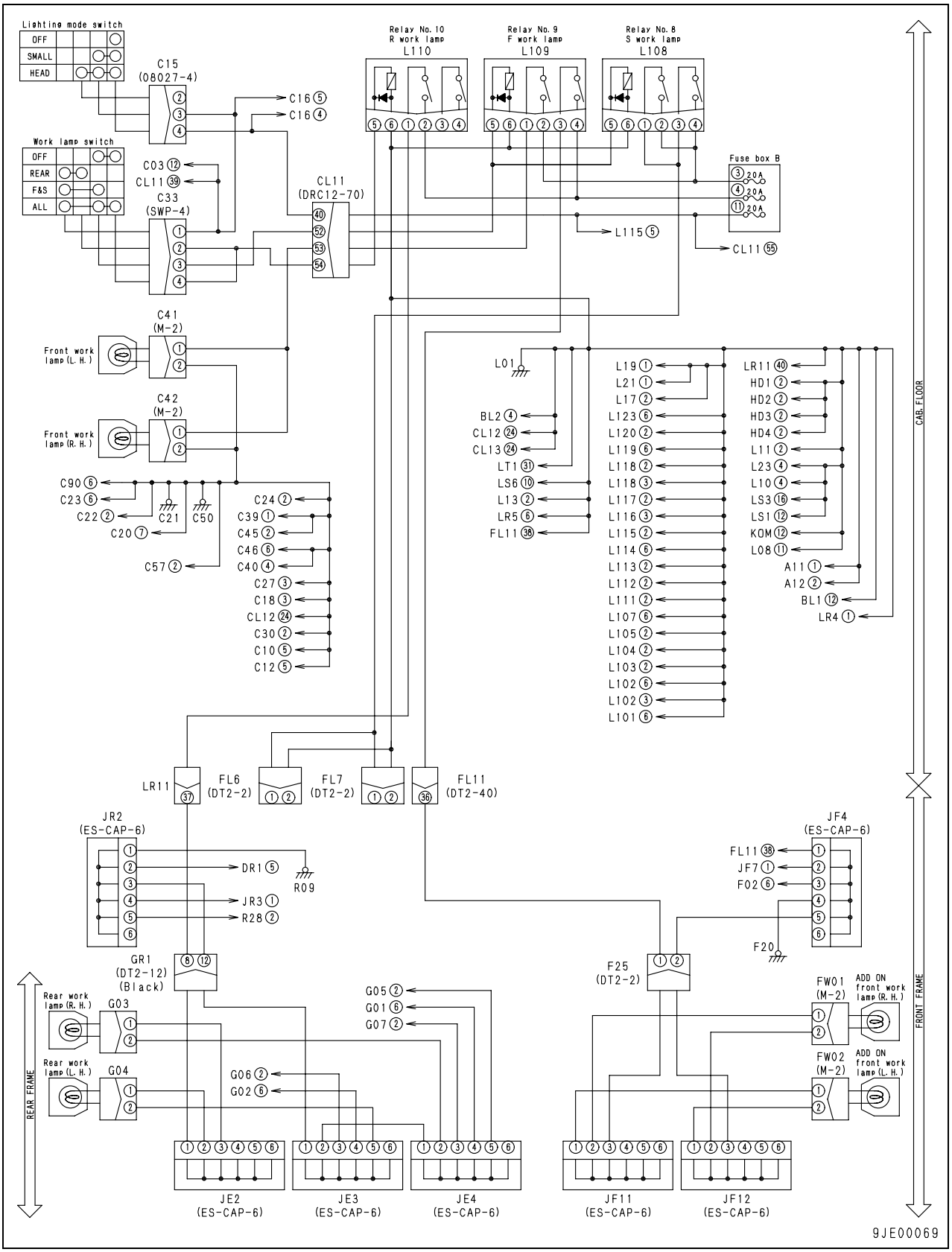
<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Broken bulb</td><td colspan="5">If a specific working lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.</td></tr>
<tr><td>2</td><td>Defective fuse No. 4 of fuse box B</td><td colspan="5">If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 6.)</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective rear working lamp relay (L110)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">L110 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="3">Between (5) and (6)</td><td colspan="2">200 – 400 Ω</td></tr>
<tr><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td colspan="5">When rear working lamp relay (L110) is replaced with a relay of the same type, if the condition becomes normal, the rear working lamp relay is defective.</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Defective working lamp switch (Internal disconnection or short circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>C33 (male)</td><td>Working lamp switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="4">Between (1) and (2)</td><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>REAR</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>FRONT (& SIDE)</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>ALL</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>Between (1), (2) and chassis ground</td><td>Normal</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="6">5</td><td rowspan="6">Disconnection in wiring harness (Disconnection or defective contact of connector)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between C33 (female) (2) – L110 (female) (5)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between L110 (female) (6) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between L110 (female) (1) – G03 (female) (1), – G04 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between G03 (female) (2) or G04 (female) (2) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between fuse No. 4 of fuse box B – L110 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
</table>

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	6	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C33 (female) (2) – L110 (female) (5), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between L110 (female) (1) – G03 (female) (1), – G04 (female) (1), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between fuse No. 4 of fuse box B – L110 (female) (2), – circuit branch end • If one of above conditions is applicable, ADD front working lamp (if equipped) is also in failure. For machines equipped with, ADD front working lamp also does not light up.	Resistance	Min. 1 MΩ
	7	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L110 (female) (1) – G03 (female) (1), – G04 (female) (1), – circuit branch end	Resistance	Max. 1 Ω

Circuit diagram related to working lamp (Steering wheel specification)



Circuit diagram related to working lamp (AJSS specification)



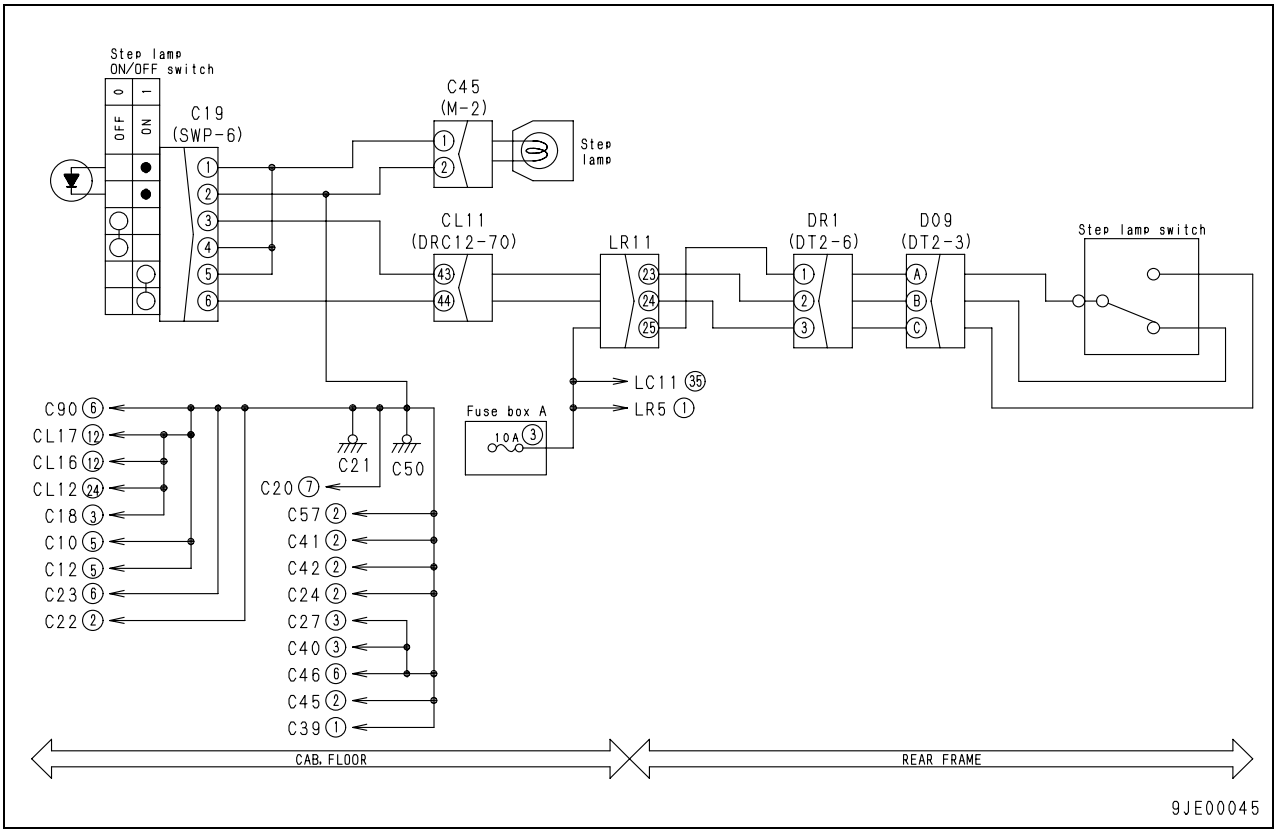
E-6 Step lamp does not light up or go off

Contents of trouble	Step lamp does not light up or go off
Related information	• The switch, lamp, or wiring harness of the step lamp or tail lamp system is defective. • The step lamp switch is installed in 2 places: upper left section from the operator's seat and the step section. Both switches can be used to turn on/off the step lamp.

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Broken bulb	If a specific lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.			
	2	Defective fuse No. 3 of fuse box A	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 6.)			
	3	Defective step lamp switch (at upper left section from operator's seat) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C19 (male)	Step lamp switch	Resistance	
			Between (3) and (4)	Up or Down	Min. 1 MΩ	
				Down or Up	Max. 1 Ω	
			Between (5) and (6)	Up or Down	Max. 1 Ω	
				Down or Up	Min. 1 MΩ	
			Between (3), (4), (5), (6) and chassis ground	Normal	Min. 1 MΩ	
	4	Defective step lamp switch (at step section) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			D09 (male)	Step lamp switch	Resistance	
			Between (A) and (B)	Up or Down	Min. 1 MΩ	
				Down or Up	Max. 1 Ω	
			Between (A) and (C)	Up or Down	Max. 1 Ω	
				Down or Up	Min. 1 MΩ	
			Between (A), (B), (C) and chassis ground	Normal	Min. 1 MΩ	
	5	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 3 of fuse box A – D09 (female) (A)		Resis-tance	Max. 1 Ω
			Wiring harness between D09 (female) (B) – C19 (female) (3)		Resis-tance	Max. 1 Ω
			Wiring harness between D09 (female) (C) – C19 (female) (6)		Resis-tance	Max. 1 Ω
			Wiring harness between C19 (female) (4), (5) – C45 (female) (1)		Resis-tance	Max. 1 Ω
			Wiring harness between C45 (female) (2) – chassis ground		Resis-tance	Max. 1 Ω

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	6	Grounding fault in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 3 of fuse box A – D09 (female) (A)	Resistance	Min. 1 MΩ
			Wiring harness between D09 (female) (B) – C19 (female) (3)	Resistance	Min. 1 MΩ
			Wiring harness between D09 (female) (C) – C19 (female) (6)	Resistance	Min. 1 MΩ
			Wiring harness between C19 (female) (4), (5) – C45 (female) (1)	Resistance	Min. 1 MΩ
	7	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C19 (female) (4), (5) – C45 (female) (1) • Switch over the switch and measure the voltage again	Voltage	Max. 1 V (After switched over: 20 – 30 V)

Circuit diagram related to step lamp



E-7 Turn signal lamp and hazard lamp do not light up or go off

Contents of trouble	(1) Either of turn signal lamp and hazard lamp does not light up or go off. (Steering wheel specification) (STD)
Related information	• The switch, lamp, or wiring harness of the turn signal lamp and hazard lamp system is defective.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse No. 1 of fuse box B and No.2 of fuse box A	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See causes 6.)		
	2	Defective hazard relay (L113)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L113 (male)	Resistance	
			Between (5) and (6)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			When hazard relay (L113) is replaced with a relay of the same type, if the condition becomes normal, the hazard relay is defective.		
	3	Defective flasher unit (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L19 (male)	Voltage	
			Between (3) and (1)	20 – 30 V	
			Between (4) and (1)	Repeat 20 to 30 V ↔ 0 V.	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L19 (male)	Resistance	
			Between (3) or (4) and chassis ground	Min. 1 MΩ	
	4	Defective turn signal lamp and hazard lamp switches (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L03 (male)	Turn signal lamp and hazard lamp switches	Resistance
			Between (2) and (3)	Turn signal lever: Left	Min. 1 MΩ
				Turn signal lever: Neutral	Min. 1 MΩ
				Turn signal lever: Right	Max. 1 Ω
				Hazard lamp switch: ON	Max. 1 Ω
			Between (2) and (4)	Turn signal lever: Left	Max. 1 Ω
				Turn signal lever: Neutral	Min. 1 MΩ
				Turn signal lever: Right	Min. 1 MΩ
				Hazard lamp switch: ON	Max. 1 Ω
			Between (1) – (5)	Hazard lamp switch: ON	Max. 1 Ω
				Hazard lamp switch: OFF	Min. 1 MΩ
			Between (2), (3), (4) and chassis ground	Normal	Min. 1 MΩ

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	5	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L113 (female) (3) and L19 (female) (3)	Resistance	Max. 1 Ω
			Between L113 (female) (6) – fuse B (1)	Resistance	Max. 1 Ω
			Wiring harness between L113 (female) (5) – fuse A (2)	Resistance	Max. 1 Ω
			Wiring harness between L19 (female) (4) – L03 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L19 (female) (1) – chassis ground	Resistance	Max. 1 Ω
	6	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L113 (female) (3) – L19 (female) (3)	Resistance	Min. 1 MΩ
			Wiring harness between L19 (female) (4) – L03 (female) (2)	Resistance	Min. 1 MΩ
	7	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L113 (female) (3) – L19 (female) (3)	Voltage	Max. 1 V
			Wiring harness between L19 (female) (4) – L03 (female) (2)	Voltage	Max. 1 V

Contents of trouble	(2) Either of turn signal lamp and hazard lamp does not light up or go off. (AJSS specification)
Related information	• The switch, lamp, or wiring harness of the turn signal lamp and hazard lamp system is defective.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse No. 1 of fuse box B and No.2 of fuse box A	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See causes 4.)		
	2	Defective flasher unit (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			L19 (male)	Voltage	
			Between (3) and (1)	20 – 30 V	
			Between (4) and (1)	Repeat 20 to 30 V ↔ 0 V.	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L19 (male)	Resistance	
			Between (3) or (4) and chassis ground	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L113 (female) (3) – L19 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between L19 (female) (1) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between L19 (female) (4) – circuit branch end point	Resistance	Max. 1 Ω

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L113 (female) (3) – L19 (female) (3)	Resistance	Min. 1 MΩ
			Wiring harness between L19 (female) (4) – circuit branch end point	Resistance	Min. 1 MΩ
	5	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L113 (female) (3) – L19 (female) (3)	Voltage	Max. 1 V
			Wiring harness between L19 (female) (4) – circuit branch end point	Voltage	Max. 1 V

Contents of trouble	(3) Turn signal lamp does not light up or go off (Steering wheel specification)
Related information	• The switch, lamp, or wiring harness of the turn signal lamp system is defective.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Broken bulb	If a specific turn signal lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.		
	2	Defective turn signal lamp and hazard lamp switches (Internal disconnection or short circuit)	L03 (male)	Turn signal lamp and hazard lamp switches	Resistance
			Between (2) and (3)	Turn signal lever: Left	Min. 1 MΩ
				Turn signal lever: Neutral	Min. 1 MΩ
				Turn signal lever: Right	Max. 1 Ω
			Between (2) and (4)	Turn signal lever: Left	Max. 1 Ω
				Turn signal lever: Neutral	Min. 1 MΩ
				Turn signal lever: Right	Min. 1 MΩ
			Between (2), (3), (4) and chassis ground	Normal	Max. 1 Ω
	3	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L03 (female) (3) – G01 (female) (1), – right COMBI (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between L03 (female) (4) – G02 (female) (1), – left COMBI (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between G01 (female) (6) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between G02 (female) (6) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between right and left COMBI (female) (2) – chassis ground	Resistance	Max. 1 Ω

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L03 (female) (3) – G01 (female) (1), – right COMBI (female) (3), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between L03 (female) (4) – G02 (female) (1), – left COMBI (female) (3), – circuit branch end	Resistance	Min. 1 MΩ
	5	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L03 (female) (3) – G01 (female) (1), – right COMBI (female) (3), – circuit branch end	Voltage	Max. 1 V
			Wiring harness between L03 (female) (4) – G02 (female) (1), – left COMBI (female) (3), – circuit branch end	Voltage	Max. 1 V

Contents of trouble	(4) Turn signal lamp does not light up or go off (AJSS specification)
Related information	• The switch, lamp, or wiring harness of the turn signal lamp system is defective. • The input state from the turn signal switch to the controller can be checked with the monitoring function (Code: 40913 D-IN30, D-IN31). • The output state from the controller to the winker relay can be checked with the monitoring function (Code: 40954 D-0UT16, D-OUT17).

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Broken bulb	If a specific turn signal lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.		
	2	Defective turn signal lever switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			S22 (male)	Turn signal lever	Resistance
			Between (5) and (4)	Neutral	Min. 1 MΩ
				Right	Min. 1 MΩ
				Left	Max. 1 Ω
			Between (5) and (6)	Neutral	Min. 1 MΩ
				Right	Max. 1 Ω
				Left	Min. 1 MΩ
			Between (4), (5), (6) and chassis ground	Normal	Min. 1 MΩ
	3	Defective turn signal lamp relay (right) (L121)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L121 (male)		Resistance
			Between (1) and (2)		200 – 400 Ω
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			When turn signal lamp relay (right) (L121) is replaced with a relay of the same type, if the condition becomes normal, the turn signal lamp relay (right) is defective.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	4	Defective turn signal lamp relay (left) (L122)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L122 (male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			When turn signal lamp relay (left) (L122) is replaced with a relay of the same type, if the condition becomes normal, the turn signal lamp relay (left) is defective.		
	5	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between S22 (female) (4) – L06 (female) (38)	Resistance	Min. 1 MΩ
			Wiring harness between S22 (female) (6) – L06 (female) (6)	Resistance	Min. 1 MΩ
			Between S22 (female) (5) – chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L121 (female) (1) or L122 (female) (1) – fuse No. 1 of fuse box B	Resistance	Max. 1 Ω
			Wiring harness between L121 (female) (2) – L06 (female) (18)	Resistance	Max. 1 Ω
			Wiring harness between L122 (female) (2) – L06 (female) (8)	Resistance	Max. 1 Ω
			Wiring harness between L121 (female) (3) – G01 (female) (1), – right COMBI (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between L122 (female) (3) – G02 (female) (1), – left COMBI (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between G01 (female) (6) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between G02 (female) (6) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between right COMBI (female) (2) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between left COMBI (female) (2) – chassis ground	Resistance	Max. 1 Ω
	6	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Between S22 (female) (4) – L06 (female) (38)	Resistance	Min. 1 MΩ
			Between S22 (female) (6) – L06 (female) (2)	Resistance	Min. 1 MΩ
			Wiring harness between L121 (female) (1) or L122 (female) (1) – fuse No. 1 of fuse box B	Resistance	Min. 1 MΩ
			Wiring harness between L121 (female) (2) – L06 (female) (18)	Resistance	Min. 1 MΩ
			Wiring harness between L122 (female) (2) – L06 (female) (8)	Resistance	Min. 1 MΩ
			Wiring harness between L121 (female) (3) – G01 (female) (1), – right COMBI (female) (3), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between L122 (female) (3) – G02 (female) (1), – left COMBI (female) (3), – circuit branch end	Resistance	Min. 1 MΩ

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	7	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L121 (female) (3) – G01 (female) (1), – right COMBI (female) (3), – circuit branch end		Voltage	Max. 1 V
			Wiring harness between L122 (female) (3) – G02 (female) (1), – left COMBI (female) (3), – circuit branch end		Voltage	Max. 1 V
	8	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L06 (2)	Press turn signal switch R	Voltage	Max. 1 V
				Release turn signal switch R	Voltage	8 – 10 V
			L06 (38)	Press turn signal switch L	Voltage	Max. 1 V
				Release turn signal switch L	Voltage	8 – 10 V
			L06 (18)	Press turn signal switch R	Voltage	Max. 1 V
				Press turn signal switch R again	Voltage	20 – 30 V
			L06 (8)	Press turn signal switch L	Voltage	Max. 1 V
				Press turn signal switch L again	Voltage	20 – 30 V

Contents of trouble	(5) Hazard lamp does not light up or go off (Steering wheel specification)
Related information	• The switch or lamp of the hazard lamp is defective. • Carry out the following troubleshooting when the turn signal lamp flashes normally.

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse in fuse box A (2)	If fuse is broken, circuit probably has ground fault.			
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between fuse box B (2) – L113 (female) (5)		Resistance	Max. 1 Ω
			Between fuse box B (2) – L113 (female) (1)		Resistance	Max. 1 Ω
			Between L113 (female) (2) – L03 (female) (1)		Resistance	Max. 1 Ω
			Between L03 (female) (5) – chassis ground		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Contact with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L113 (female) (2) – L03 (female) (1)		Resistance	Min. 1 MΩ
	4	Defective hazard lamp switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L03 (male)	Hazard lamp switch	Resistance	
			Between (2) and (3), (4)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (2), (3), (4) and chassis ground	Normal	Min. 1 MΩ	

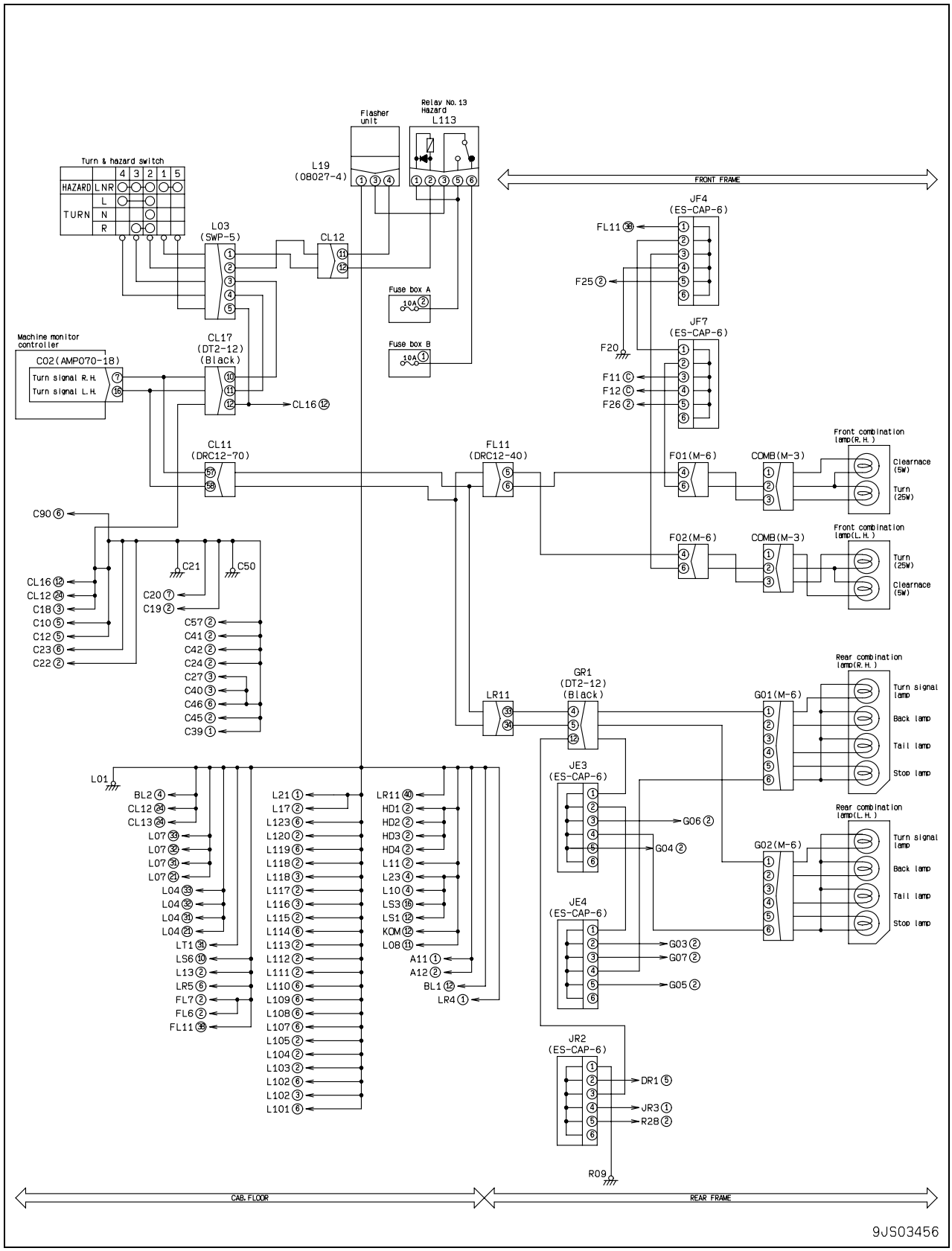
	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	5	Defective hazard lamp relay (L113)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L113 (male)	Resistance	
			Between (1) – (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Replace hazard lamp relay (L113) with another relay of same type. If condition becomes normal at this time, hazard lamp relay is defective.		

Contents of trouble	(6) Hazard lamp does not light up or go off (AJSS specification)
Related information	• The switch or lamp of the hazard lamp is defective. • Carry out the following troubleshooting when the turn signal lamp flashes normally.

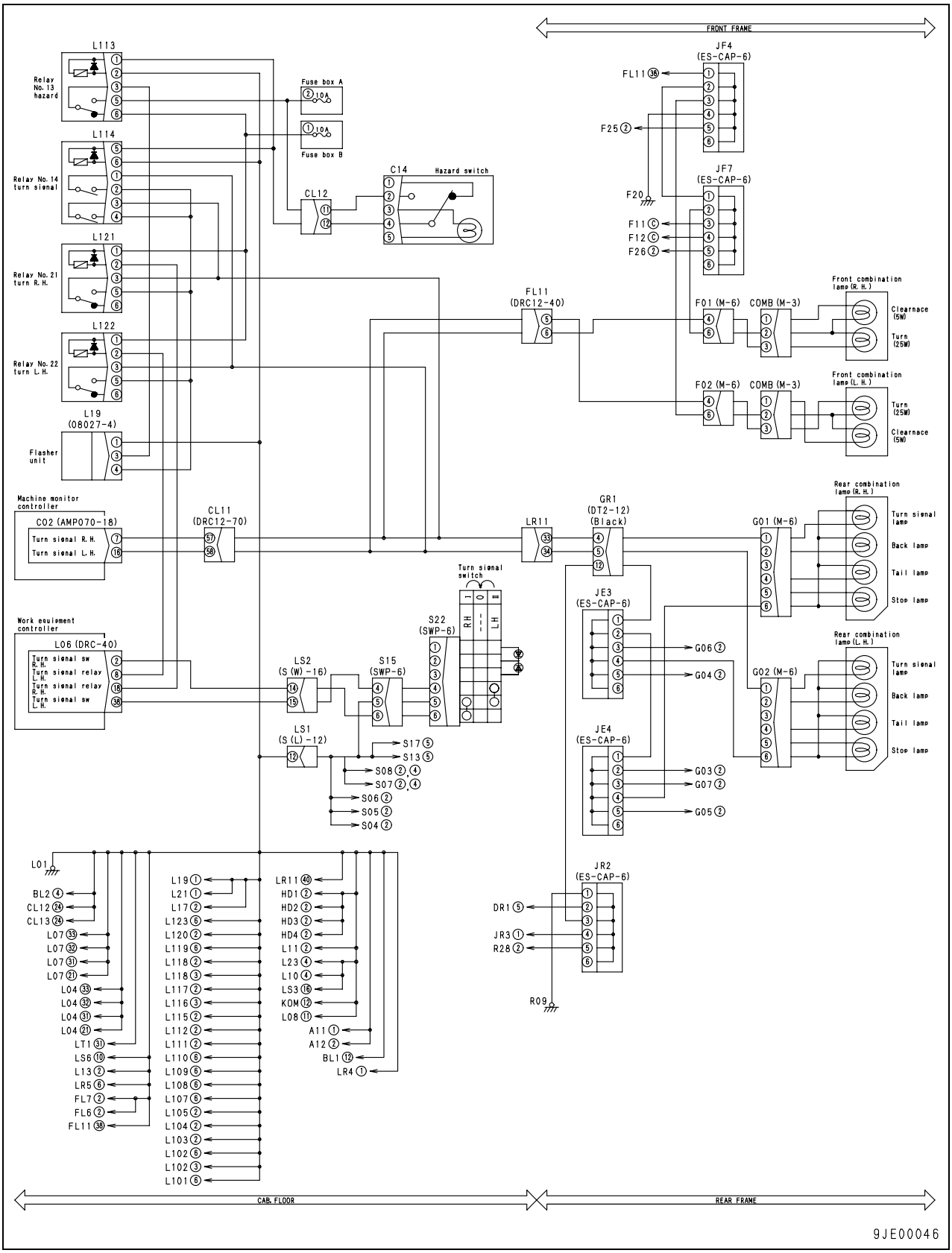
	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse in fuse box A (2)	If fuse is broken, circuit probably has ground fault.			
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between fuse box A (2) – CN14 (female) (2)	Resistance	Max. 1 Ω	
			Between C14 (female) (4) – L113 (female) (1)	Resistance	Max. 1 Ω	
			Between C14 (female) (4) – L114 (female) (5)	Resistance	Max. 1 Ω	
	3	Ground fault in wiring harness (Contact with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between C14 (female) (4) – L113 (female) (1)	Resistance	Min. 1 MΩ	
			Between C14 (female) (4) – L114 (female) (5)	Resistance	Min. 1 MΩ	
	4	Defective hazard lamp switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C14 (male)	Hazard lamp switch	Resistance	
			Between (2) and (4)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (2), (4) and chassis ground	Normal	Min. 1 MΩ	
	5	Defective hazard lamp relay (L113)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L113 (male)	Resistance		
			Between (1) – (2)	200 – 400 Ω		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Replace hazard lamp relay (L113) with another relay of same type. If condition becomes normal at this time, hazard lamp relay is defective.			

<table>
<tr><td rowspan="6">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="2">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="5">6</td><td rowspan="5">Defective turn signal lamp relay (L114)</td><td colspan="2">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L114 (male)</td><td>Resistance</td></tr>
<tr><td>Between (1) – (2)</td><td>200 – 400 Ω</td></tr>
<tr><td colspan="2">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Replace turn signal lamp relay (L114) with another relay of same type. If condition becomes normal at this time, turn signal lamp relay is defective.</td></tr>
</table>

Circuit diagram related to turn signal lamp and hazard lamp (Steering wheel specification)



Circuit diagram related to turn signal lamp and hazard lamp (AJSS specification)



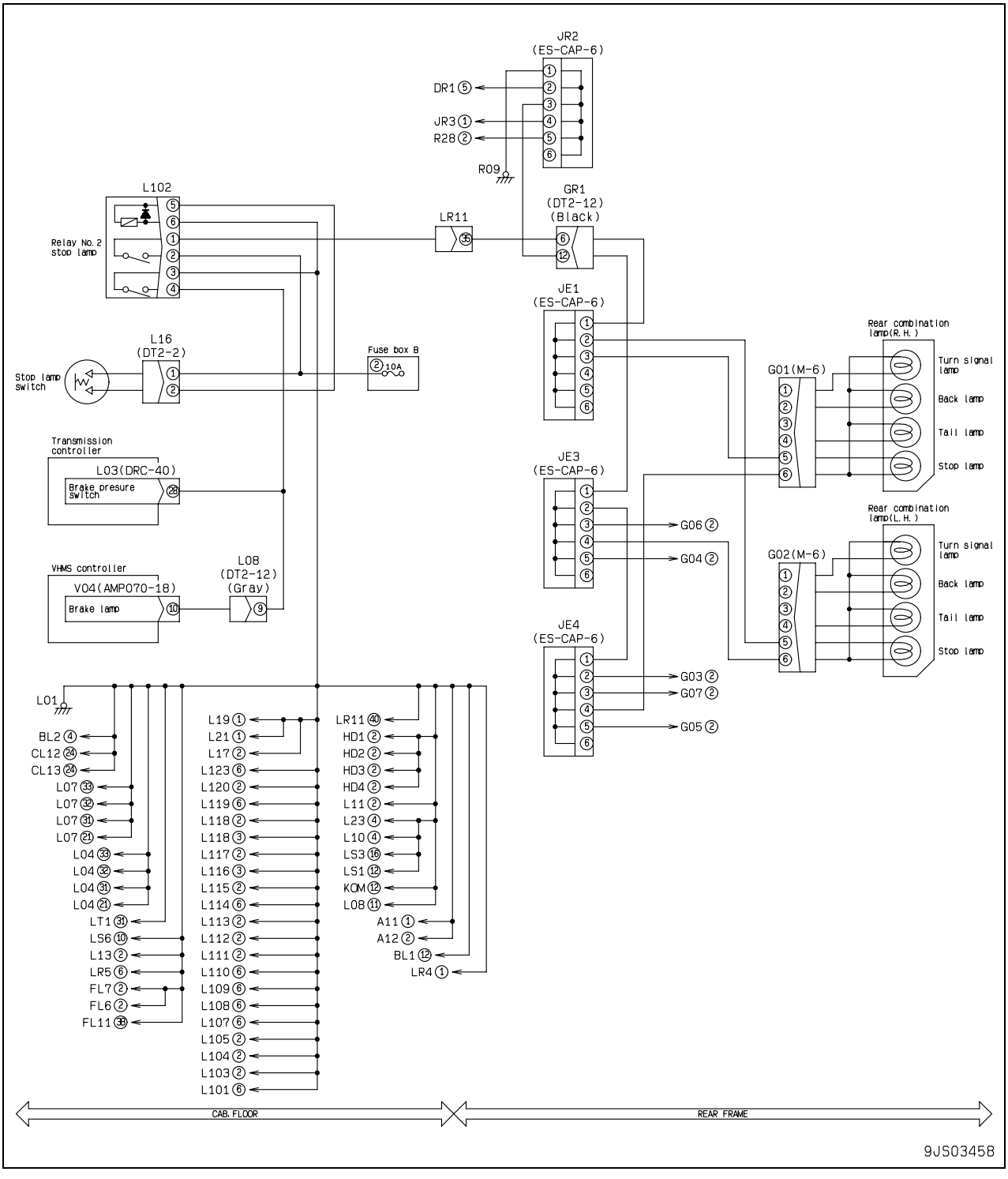
E-8 Brake lamp does not light or it keeps lighting up.

Contents of trouble	Brake lamp does not light or it keeps lighting up.
Related information	• The lamp or wiring harness of the brake lamp system is abnormal. • The input state of brake lamp switch signal to the controller can be checked with the monitoring function (Code: 40942 D-IN-32).

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Broken bulb	If a specific brake lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.			
	2	Defective fuse No. 2 of fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 6.)			
	3	Defective brake lamp relay (L102) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L102 (male)		Resistance	
			Between (1) and (2)		200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			When brake lamp relay (L102) is replaced with a relay of the same type, if the condition becomes normal, the brake lamp relay is defective.			
	4	Defective brake lamp switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			L16 (male)	Brake pedal	Resistance	
			Between (1) and (2)	Pressed	Max. 1 Ω	
				Released	Min. 1 MΩ	
			Between (1), (2) and chassis ground	Normal	Min. 1 MΩ	
	5	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 2 of fuse box B – L102 (female) (2), – L16 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L16 (female) (2) – L102 (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between L102 (female) (6) – chassis ground		Resistance	Max. 1 Ω
			Wiring harness between L102 (female) (1) – G01 (female) (5), – G02 (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between G01 (female) (6) – chassis ground		Resistance	Max. 1 Ω
			Wiring harness between G02 (female) (6) – chassis ground		Resistance	Max. 1 Ω
	6	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 2 of fuse box B – L102 (female) (2), – L16 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between L16 (female) (2) – L102 (female) (5)		Resistance	Min. 1 MΩ
			Wiring harness between L102 (female) (1) – G01 (female) (5), – G02 (female) (5), – circuit branch end		Resistance	Min. 1 MΩ

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	7	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L16 (female) (2) – L102 (female) (5)	Voltage	Max. 1 V
			Wiring harness between L102 (female) (1) – G01 (female) (5), – G02 (female) (5), – circuit branch end	Voltage	Max. 1 V

Circuit diagram related to brake lamp

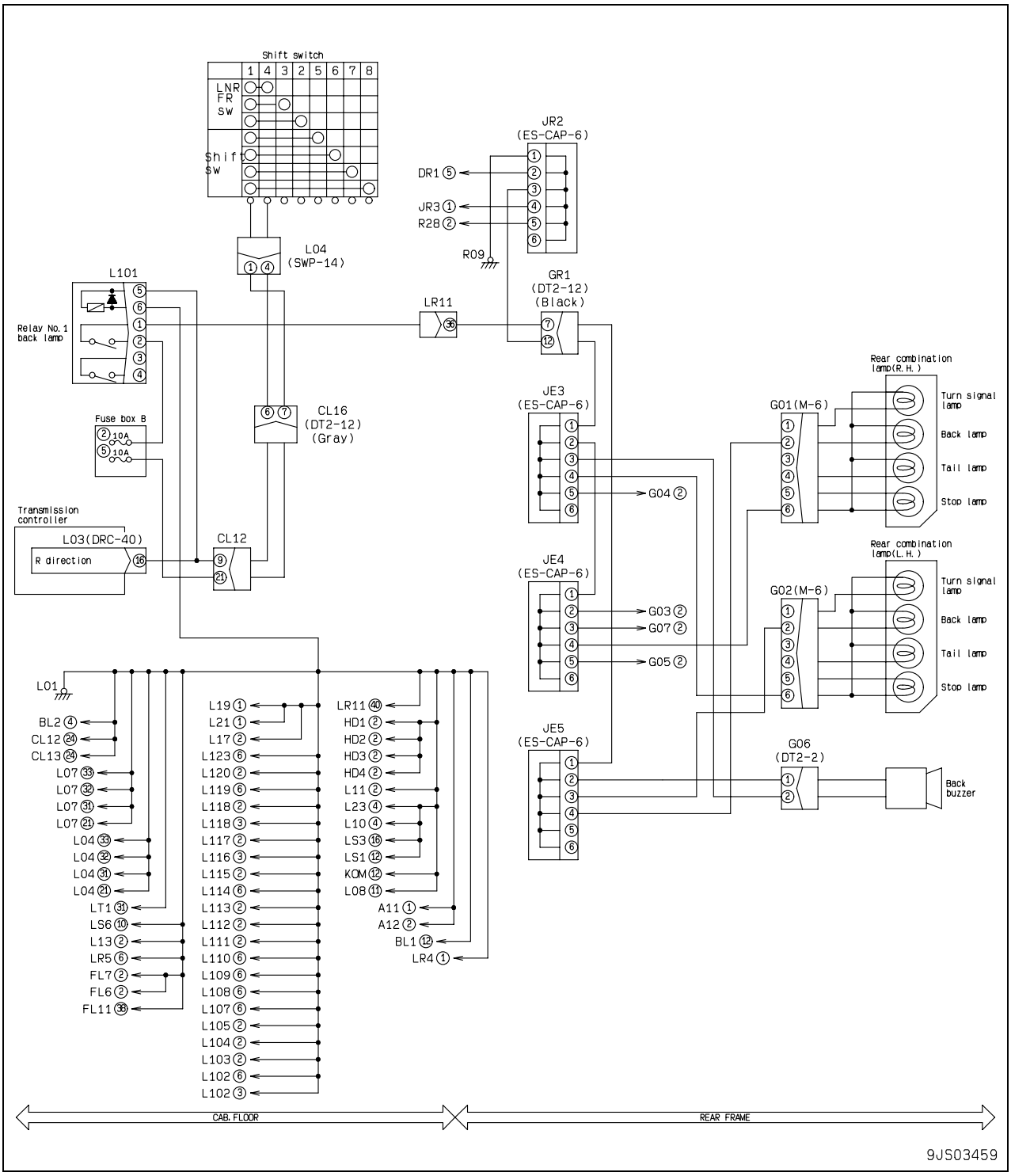


E-9 Backup lamp does not light or it keeps lighting up.

Contents of trouble	Backup lamp does not light or it keeps lighting up. (Steering wheel specification)
Related information	• The transmission controller monitors the primary circuit of the backup lamp relay for a trouble. (If disconnection or short circuit occurs, failure code **D160KA** or **D160KB** is displayed.)

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Broken bulb	If a specific backup lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.		
	2	Defective fuse No. 2 of fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 5.)		
	3	Defective backup lamp relay (L101) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L101 (male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			When backup lamp relay (L101) is replaced with a relay of the same type, if the condition becomes normal, the backup lamp relay is defective.		
	4	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 2 of fuse box B – L101 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L101 (female) (1) – G01 (female) (2), – G02 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L101 (female) (5) – L04 (female) (4)	Resistance	Max. 1 Ω
			Wiring harness between L101 (female) (6) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between G01 (female) (6) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between G02 (female) (6) – chassis ground	Resistance	Max. 1 Ω
	5	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 2 of fuse box B – L101 (female) (2)	Resistance	Min. 1 MΩ
			Wiring harness between L101 (female) (1) – G01 (female) (2), – G02 (female) (2), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between L101 (female) (5) – L04 (female) (4), – circuit branch end	Resistance	Min. 1 MΩ
	6	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L101 (female) (1) – G01 (female) (2), – G02 (female) (2), – circuit branch end	Voltage	Max. 1 V

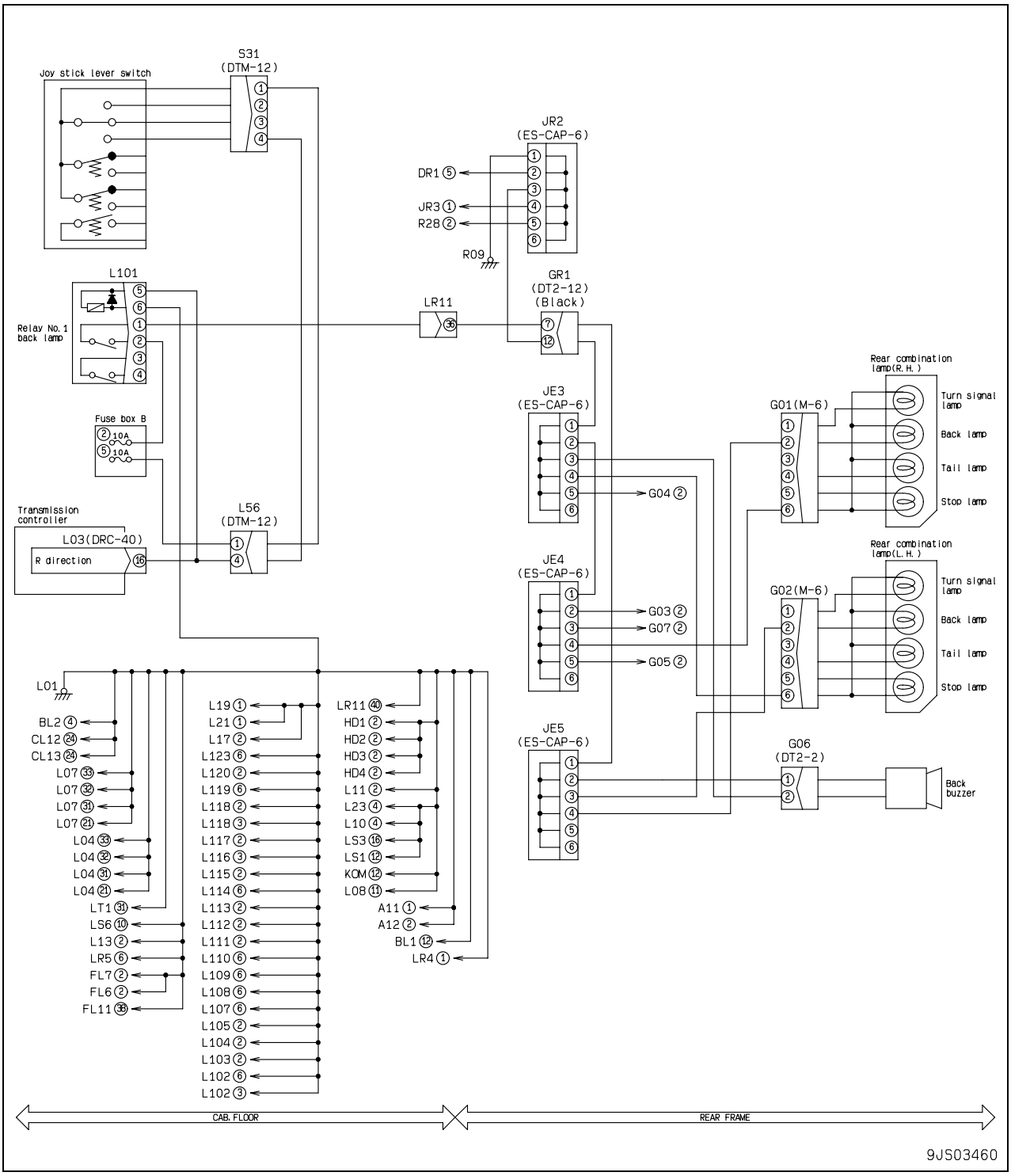
Circuit diagram related to backup lamp relay (Steering wheel specification)



Contents of trouble	Backup lamp does not light or it keeps lighting up. (AJSS specification)
Related information	• The transmission controller monitors the primary circuit of the backup lamp relay for a trouble. (If disconnection or short circuit occurs, failure code **D160KA** or **D160KB** is displayed.)

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Broken bulb	If a specific backup lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.		
	2	Defective fuse No. 2 of fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 5.)		
	3	Defective backup lamp relay (L101) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L101 (male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			When backup lamp relay (L101) is replaced with a relay of the same type, if the condition becomes normal, the backup lamp relay is defective.		
	4	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 2 of fuse box B – L101 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L101 (female) (1) – G01 (female) (2), – G02 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L101 (female) (5) and S31 (female) (4)	Resistance	Max. 1 Ω
			Wiring harness between L101 (female) (6) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between G01 (female) (6) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between G02 (female) (6) – chassis ground	Resistance	Max. 1 Ω
	5	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 2 of fuse box B – L101 (female) (2)	Resistance	Min. 1 MΩ
			Wiring harness between L101 (female) (1) – G01 (female) (2), – G02 (female) (2), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between L101 (female) (5) – S31 (female) (4), – circuit branch end	Resistance	Min. 1 MΩ
	6	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting		
			Wiring harness between L101 (female) (1) – G01 (female) (2), – G02 (female) (2), – circuit branch end	Voltage	Max. 1 V

Circuit diagram related to backup lamp relay (AJSS specification)

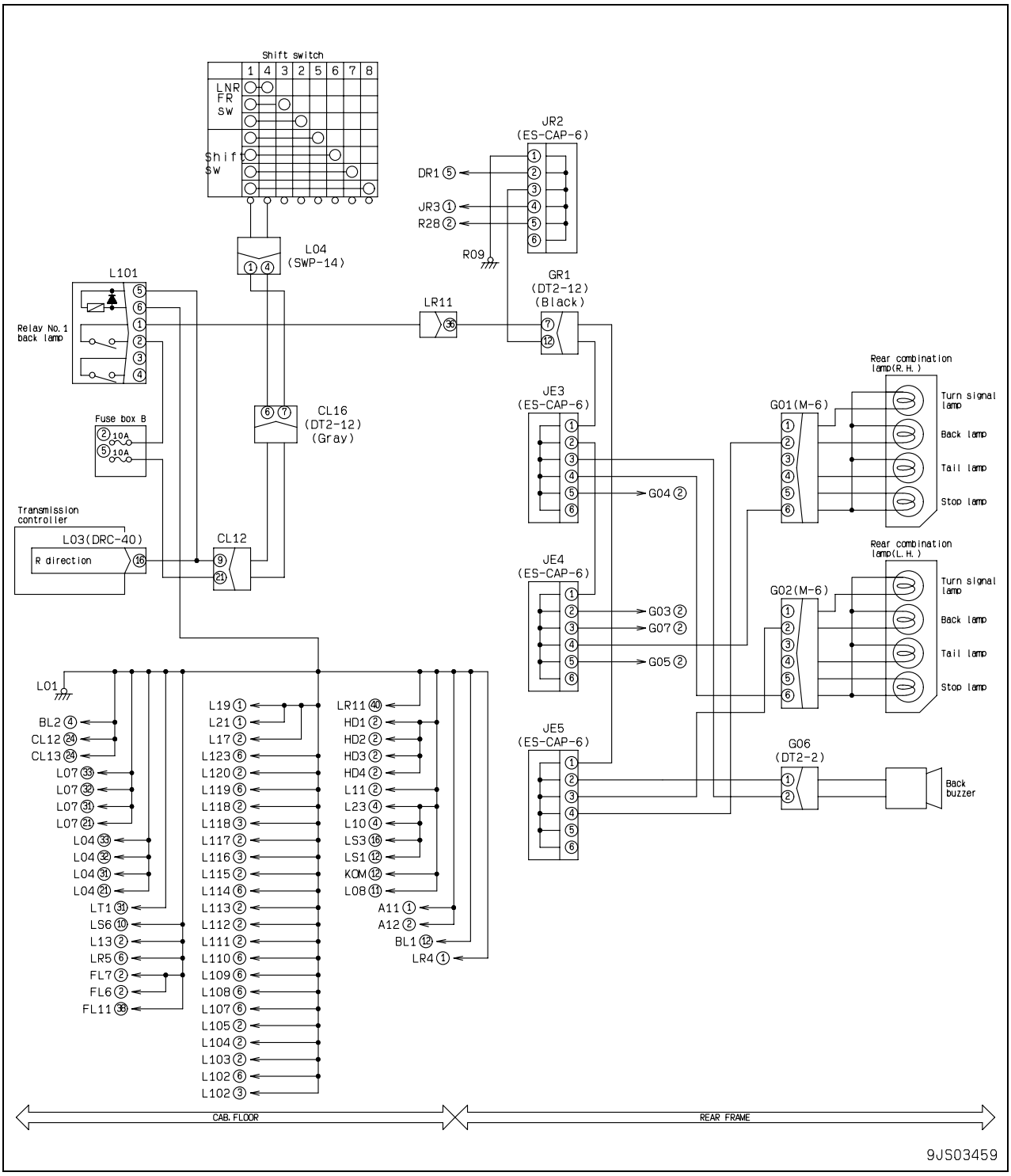


E-10 Backup buzzer does not sound or it keeps sounding.

Contents of trouble	Backup buzzer does not sound or it keeps sounding (Steering wheel specification)
Related information	• The transmission controller monitors the primary circuit of the backup lamp relay for a trouble. (If disconnection or short circuit occurs, failure code **D160KA** or **D160KB** is displayed.)

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective backup buzzer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			G06	Gear shift lever	Voltage	
			Between (1) and (2)	R	Max. 1 V	
				Other than R	20 – 30 V	
	2	Defective fuse No. 2 of fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 5.)			
	3	Defective backup lamp relay (L101) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L101 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			When backup lamp relay (L101) is replaced with a relay of the same type, if the condition becomes normal, the backup lamp relay is defective.			
	4	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 2 of fuse box B – L101 (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L101 (female) (1) – G06 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between L101 (female) (5) – L04 (female) (4)	Resistance	Max. 1 Ω	
			Wiring harness between L101 (female) (6) – chassis ground	Resistance	Max. 1 Ω	
			Wiring harness between G06 (female) (2) – chassis ground	Resistance	Max. 1 Ω	
	5	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 2 of fuse box B – L101 (female) (2)	Resistance	Min. 1 MΩ	
			Wiring harness between L101 (female) (1) – G06 (female) (1), – circuit branch end	Resistance	Min. 1 MΩ	
			Wiring harness between L101 (female) (5) – L04 (female) (4), – circuit branch end	Resistance	Min. 1 MΩ	
	6	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L101 (female) (1) – G06 (female) (1), – circuit branch end	Voltage	Max. 1 V	

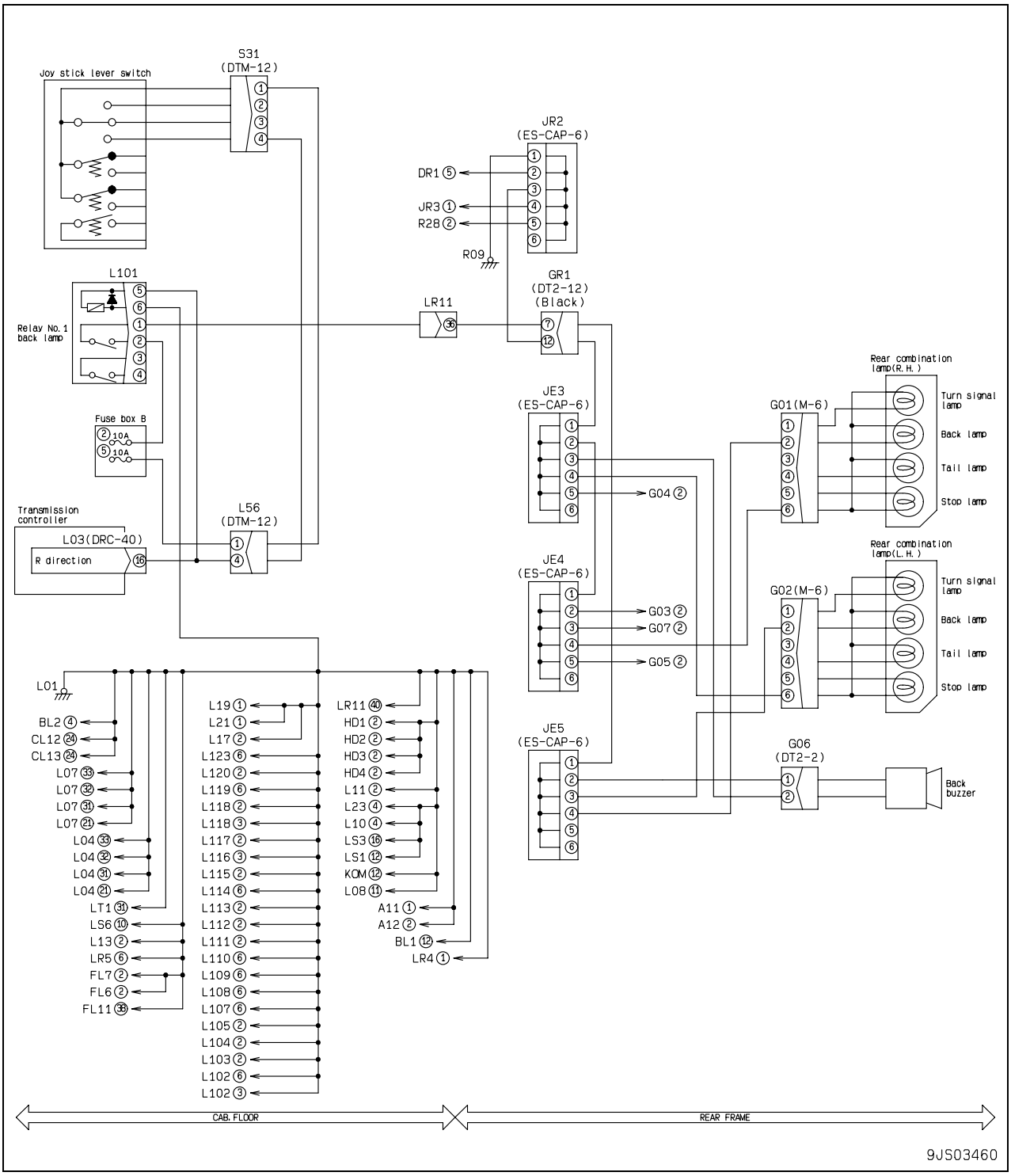
Circuit diagram related to backup buzzer (Steering wheel specification)



Contents of trouble	Backup buzzer does not sound or it keeps sounding (AJSS specification)
Related information	• The transmission controller monitors the primary circuit of the backup lamp relay for a trouble. (If disconnection or short circuit occurs, failure code **D160KA** or **D160KB** is displayed.)

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective backup buzzer (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			G06	Gear shift lever	Voltage	
			Between (1) and (2)	R	Max. 1 V	
				Other than R	20 – 30 V	
	2	Defective fuse No. 2 of fuse box B	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 5.)			
	3	Defective backup lamp relay (L101) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L101 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			When backup lamp relay (L101) is replaced with a relay of the same type, if the condition becomes normal, the backup lamp relay is defective.			
	4	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 2 of fuse box B – L101 (female) (2)	Resis-tance	Max. 1 Ω	
			Wiring harness between L101 (female) (1) – G06 (female) (1)	Resis-tance	Max. 1 Ω	
			Wiring harness between L101 (female) (5) – S31 (female) (4)	Resis-tance	Max. 1 Ω	
			Wiring harness between L101 (female) (6) – chassis ground	Resis-tance	Max. 1 Ω	
			Wiring harness between G06 (female) (2) – chassis ground	Resis-tance	Max. 1 Ω	
	5	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 2 of fuse box B – L101 (female) (2)	Resis-tance	Min. 1 MΩ	
			Wiring harness between L101 (female) (1) – G06 (female) (1), – circuit branch end	Resis-tance	Min. 1 MΩ	
			Wiring harness between L101 (female) (5) – S31 (female) (4), – circuit branch end	Resis-tance	Min. 1 MΩ	
	6	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			Wiring harness between L101 (female) (1) – G06 (female) (1), – circuit branch end	Voltage	Max. 1 V	

Circuit diagram related to backup buzzer (AJSS specification)



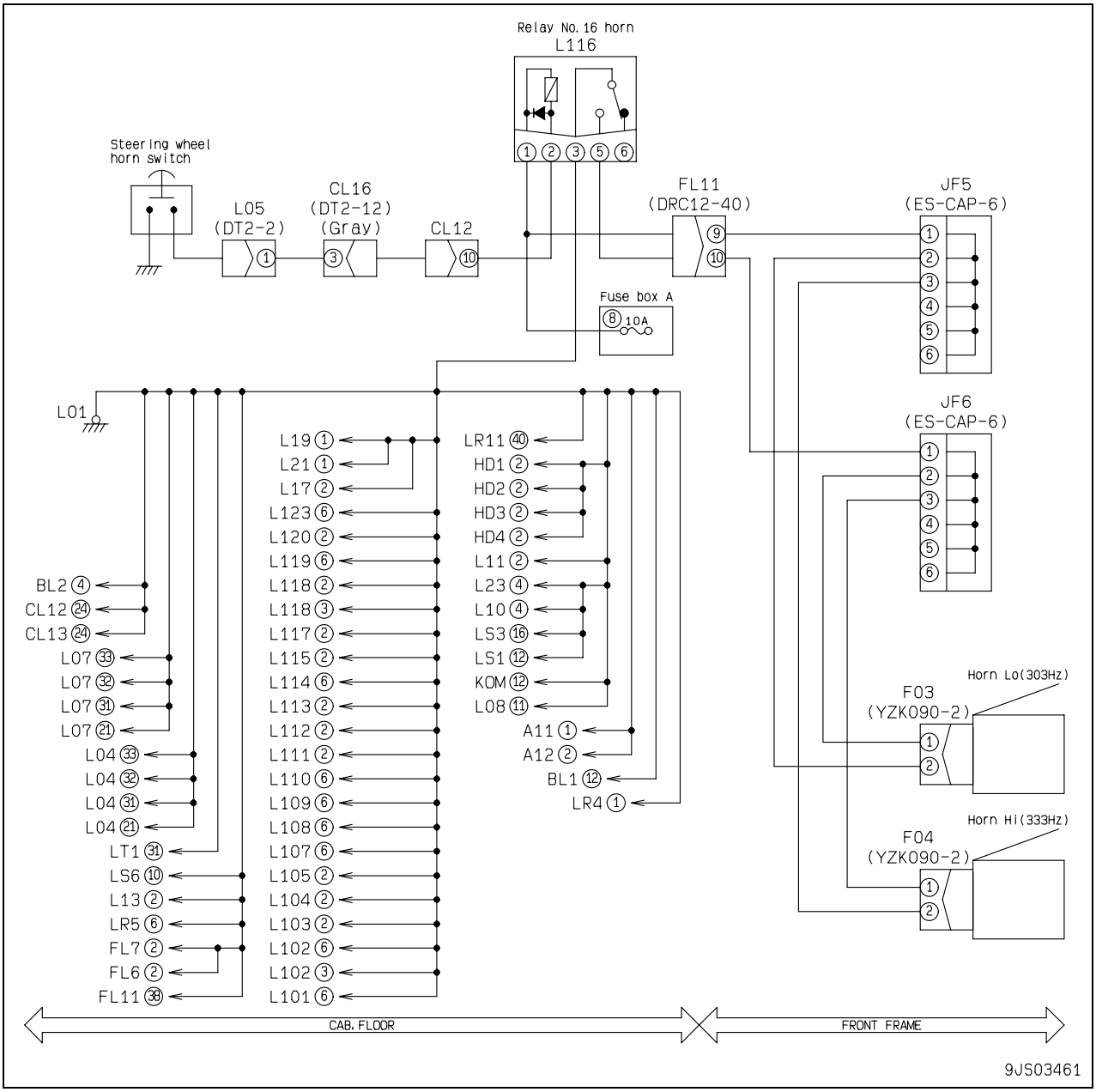
E-11 Horn does not sound or it keeps sounding.

Contents of trouble	Horn does not sound or it keeps sounding (Steering wheel specification)
Related information	• The relay, switch, horn, or wiring harness of the horn system is abnormal.

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse No. 8 of fuse box A</td><td colspan="5">If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 6.)</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective horn relay (L116) (Internal disconnection or short circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">L116 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="3">Between (1) and (2)</td><td colspan="2">200 – 400 Ω</td></tr>
<tr><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td colspan="5">When horn relay (L116) is replaced with a relay of the same type, if the condition becomes normal, the horn relay is defective.</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Defective horn switch (Internal disconnection or short circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L05 (male)</td><td colspan="2">Horn switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) and chassis ground</td><td colspan="2">ON</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td colspan="2">OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Defective horn (Internal disconnection or short circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (Disconnect connector and measure on female side)</td></tr>
<tr><td>F03, F04</td><td colspan="2">Horn switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between F03 (1) and (2)</td><td colspan="2">ON</td><td colspan="2">Max. 1 V</td></tr>
<tr><td colspan="2">OFF</td><td colspan="2">20 – 30 V</td></tr>
<tr><td rowspan="2">Between F04 (1) and (2)</td><td colspan="2">ON</td><td colspan="2">Max. 1 V</td></tr>
<tr><td colspan="2">OFF</td><td colspan="2">20 – 30 V</td></tr>
<tr><td rowspan="6">5</td><td rowspan="6">Disconnection in wiring harness (Disconnection or defective contact of connector)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between fuse No. 8 of fuse box A – L116 (female) (1), – F03 (female) (2), – F04 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between L116 (female) (2) – L05 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between L116 (female) (3) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between L116 (female) (5) – F03 (female) (1), – F04 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between horn switch – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
</table>

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
	6	Grounding fault in wiring harness (Contact with ground circuit)	Wiring harness between fuse No. 8 of fuse box A – L116 (female) (1), – F03 (female) (2), – F04 (female) (2), – circuit branch end	Resis-tance	Min. 1 MΩ
			Wiring harness between L116 (female) (2) – L05 (male) (1)	Resis-tance	Min. 1 MΩ
			Wiring harness between F03 (female) (1), F04 (female) (1) – L116 (female) (5)	Resis-tance	Min. 1 MΩ

Circuit diagram related to horn

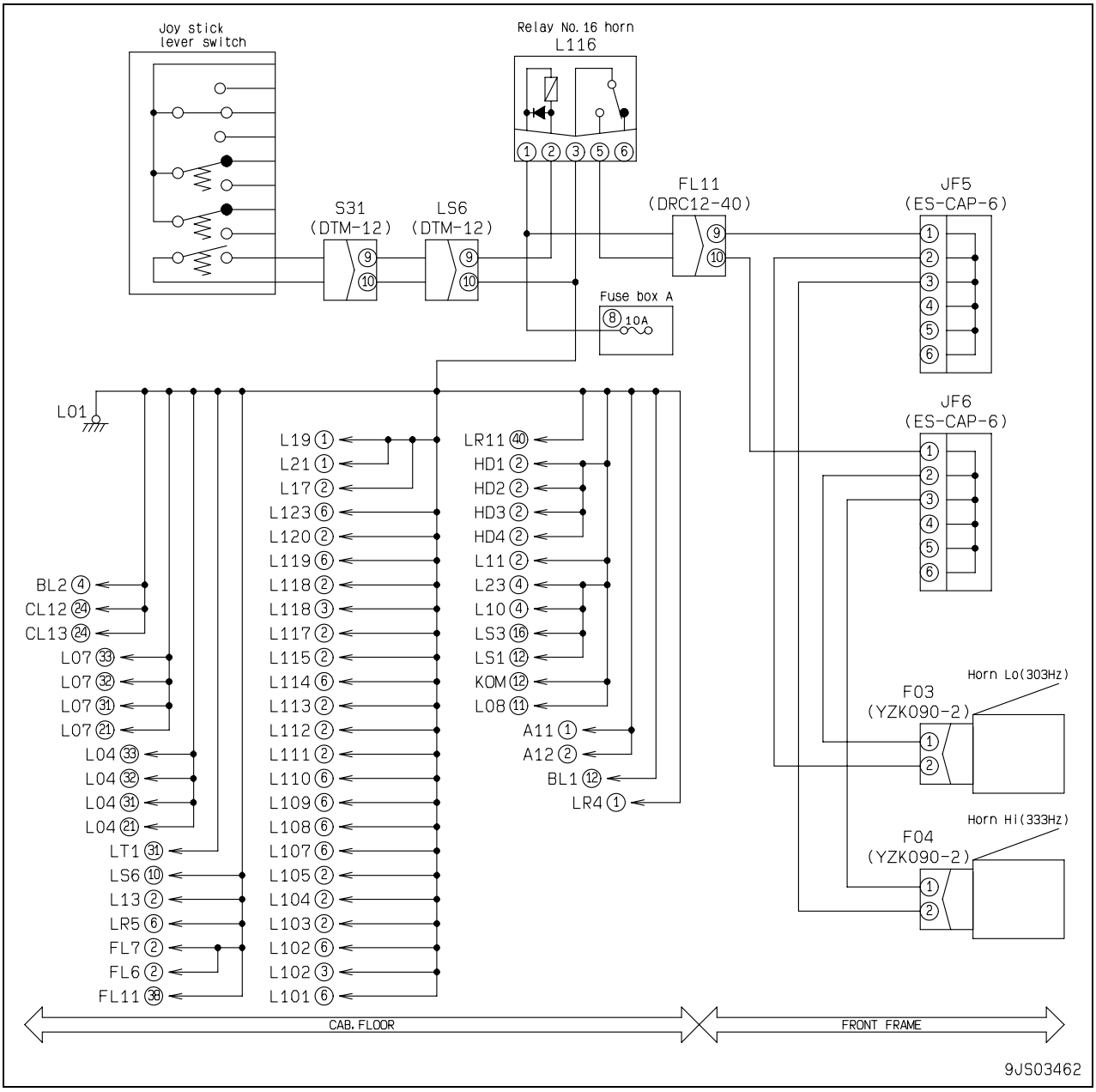


Contents of trouble	Horn does not sound or it keeps sounding (AJSS specification)
Related information	• The relay, switch, horn, or wiring harness of the horn system is abnormal.

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No. 8 of fuse box A	If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 6.)			
	2	Defective horn relay (L116) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L116 (male)		Resistance	
			Between (1) and (2)		200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting			
			When horn relay (L116) is replaced with a relay of the same type, if the condition becomes normal, the horn relay is defective.			
	3	Defective AJSS horn switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S31 (male)	Horn switch	Resistance	
			Between (9) and (10)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (9) or (10) and chassis ground	Normal	Min. 1 MΩ	
	4	Defective horn (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (Disconnect connector and measure on female side)			
			F03, F04 (female)	Horn switch	Voltage	
			Between F03 (female) (1) and (2)	ON	20 – 30 V	
				OFF	Max. 1 V	
			Between F04 (female) (1) and (2)	ON	20 – 30 V	
				OFF	Max. 1 V	
	5	Disconnection in wiring harness (Disconnection or defective contact of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 8 of fuse box A – L116 (female) (1), – F03 (female) (2), – F04 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L116 (female) (2) – S31 (female) (9)		Resistance	Max. 1 Ω
			Wiring harness between L116 (female) (3) – chassis ground		Resistance	Max. 1 Ω
			Wiring harness between L116 (female) (5) – F03 (female) (1), – F04 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between S31 (female) (10) – chassis ground.		Resistance	Max. 1 Ω

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
	6	Grounding fault in wiring harness (Contact with ground circuit)	Wiring harness between fuse No. 8 of fuse box A – L116 (female) (1), – F03 (female) (2), – F04 (female) (2), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between L116 (female) (2) – S31 (male) (9)	Resistance	Min. 1 MΩ
			Wiring harness between F03 (female) (1), F04 (female) (1) – L116 (female) (5)	Resistance	Min. 1 MΩ

Circuit diagram related to horn

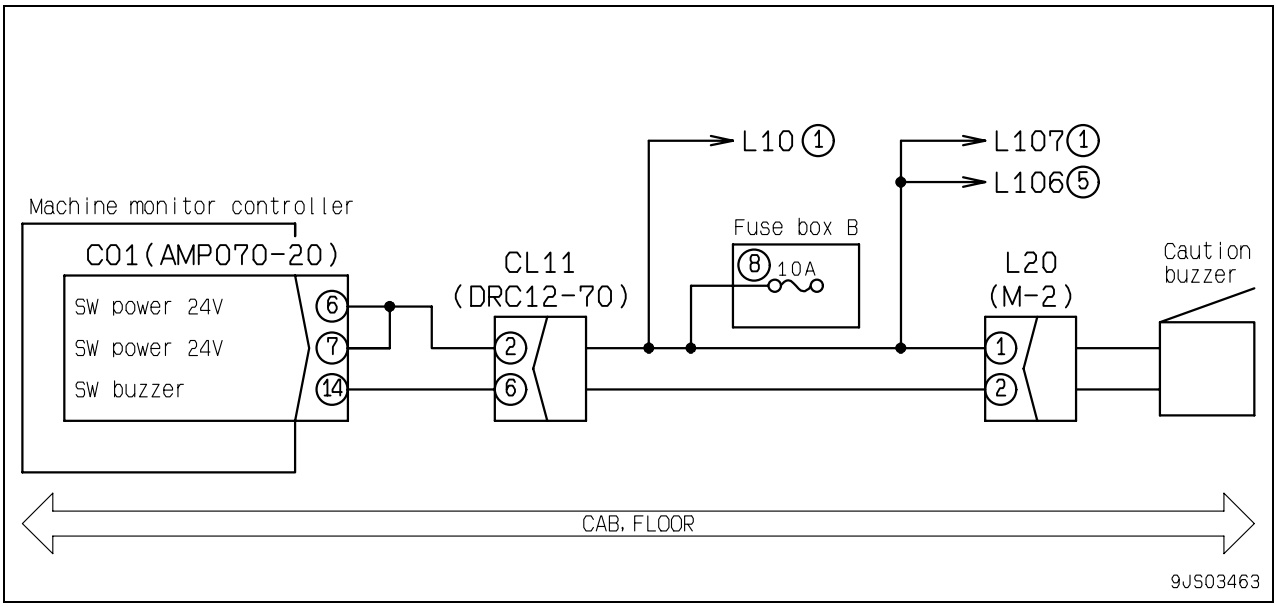


E-12 Alarm buzzer does not sound or it keeps sounding

Contents of trouble	• Alarm buzzer does not sound or it keeps sounding
Related information	• The alarm buzzer output circuit is disconnected or shorted with the chassis ground. • The output state (ON/OFF) to the alarm buzzer can be checked with the monitoring function (Code: 40952, D-OUT-0). • If failure code [**DV00KB**] (Alarm buzzer: Short circuit) is displayed, carry out troubleshooting for it first.

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse No. 8 of fuse box B</td><td colspan="4">If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 4.)</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective alarm buzzer (Internal short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting
• Check 2 seconds after starting switch is turned ON.</td></tr>
<tr><td>L20 (female)</td><td>Alarm buzzer</td><td colspan="2">Normal/Defective</td></tr>
<tr><td rowspan="2">Ground (2)</td><td>Sounds</td><td colspan="2">Buzzer is normal</td></tr>
<tr><td>Does not sound.</td><td colspan="2">Buzzer is defective</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Disconnection in wiring harness (Disconnection or defective contact of connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between fuse No. 8 of fuse box B – L20 (female) (1)</td><td>Resis-tance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between L20 (female) (2) – C01 (female) (14)</td><td>Resis-tance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Grounding fault in wiring harness (Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between fuse No. 8 of fuse box B – L20 (female) (1), – circuit branch end</td><td>Resis-tance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">Wiring harness between L20 (female) (2) – C01 (female) (14)</td><td>Resis-tance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Defective machine monitor</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td>C01</td><td>Starting switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (14) and chassis ground</td><td>For 2 sec after ON (Alarm buzzer does not sound)</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>For 2 – 3 sec after ON (Alarm buzzer sounds)</td><td colspan="2">Max. 1 V</td></tr>
</table>

Circuit diagram related to alarm buzzer

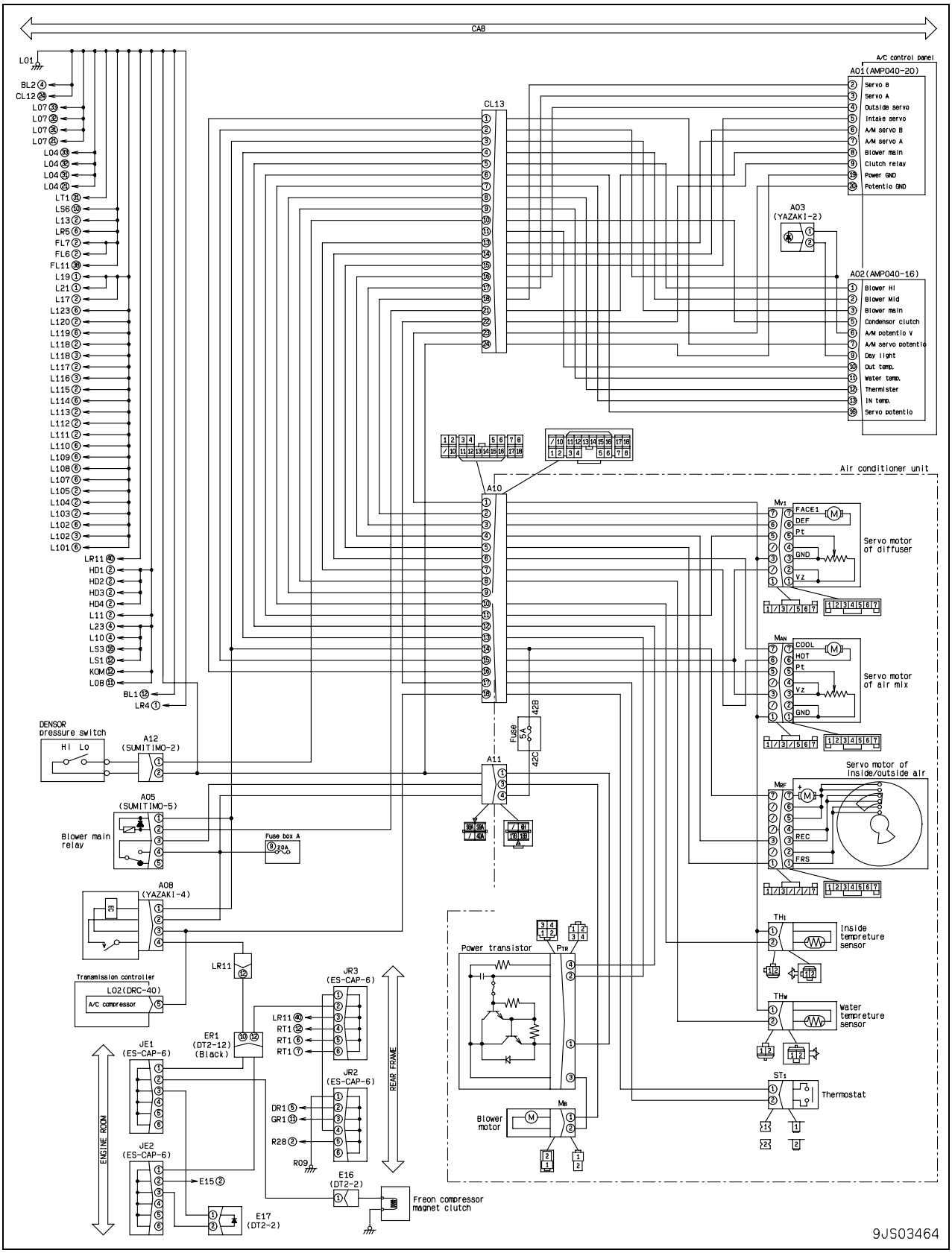


E-13 Air conditioner does not operate or stop

Contents of trouble	Air conditioner does not operate or stop.
Related information	• The following is troubleshooting for only the section between the air conditioner and operator's cab. For troubleshooting for the air conditioner unit, see the Shop Manual for the air conditioner.

<table>
<tr><td rowspan="12">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse No. 9 of fuse box A</td><td colspan="5">If the fuse is burnt, the circuit probably has a grounding fault, etc. (See cause 2.)</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Grounding fault in wiring harness
(Contact with ground circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.
• When fuse No. 9 of fuse box A is broken</td></tr>
<tr><td colspan="3">Wiring harness between fuse No. 9 of fuse box A – A05 (female) (4), – A08 (female) (2), – A11 (female) (4)</td><td>Resis-tance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="5">• If fuse No. 9 of fuse box A is broken while the above trouble-shooting result is normal, blower main relay, magnet clutch relay, blower motor or fuse (5A) in air conditioner unit and its connecting wiring harness are defective.</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Disconnection or grounding fault in air conditioner control panel power supply or ground wire harness
(Disconnection or defective contact of connector or contact with ground circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting</td></tr>
<tr><td rowspan="3">Wiring harness between A02 (female) (3) – A01 (female) (19)</td><td>Starting switch</td><td colspan="3">Voltage</td></tr>
<tr><td>ON</td><td colspan="3">20 – 30 V</td></tr>
<tr><td>OFF</td><td colspan="3">Max. 1 V</td></tr>
<tr><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between A02 (female) (3) – A01 (female) (19)</td><td>Resis-tance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Disconnection or grounding fault in relay wiring harness
(Disconnection or defective contact of connector or contact with ground circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then hold starting switch OFF and ON and carry out troubleshooting in each case.</td></tr>
<tr><td>Relay</td><td colspan="2">Starting switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Wiring harness between A05 (female) (1) and chassis ground</td><td colspan="2">ON</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="2">OFF</td><td colspan="2">Max. 1 V</td></tr>
<tr><td rowspan="2">Wiring harness between A08 (female) (1) and chassis ground</td><td colspan="2">ON</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="2">OFF</td><td colspan="2">Max. 1 V</td></tr>
<tr><td colspan="6">If the above troubleshooting result is normal, each relay and its con-necting wiring harness are defective.</td></tr>
</table>

Circuit diagram related to air conditioner



WA600-6 Wheel loader

Form No. SEN00563-01

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

Troubleshooting of hydraulic and mechanical system (H-mode)

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H-20 Lift arm speed is low or rising force of lift arm is insufficient 33
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Troubleshooting of hydraulic and mechanical system (H-mode)

Method of using troubleshooting chart

This troubleshooting chart determines the location from the problem occurring on the machine and categorizes the problem under one of the main components, such as the steering system or work equipment hydraulic system. Use the following procedure to carry out accurate troubleshooting swiftly.

Step 1. Ask operator questions

- The questions to ask the operator are given under the problem. If the answer to the question matches the content given, the cause given after the arrow is the probable cause.Keeping the content of the questions in mind, read the matrix and proceed with **Step 2** and **Step 3** to pinpoint the correct cause.

Example: Steering does not turn

Ask the operator and check the following points.

- Did the problem suddenly start?
  → **Related equipment broken**
- Was the steering wheel heavy before?
  → **Wear of related parts, defective seal**

Step 2. Checks before troubleshooting

- Before measuring the oil pressure or starting the troubleshooting, confirm the checks before starting items, check for leakage of oil, or for loose bolts. This will prevent wasting time when troubleshooting. The items given under “Checks before troubleshooting” are checks that are particularly important to make about the condition of the machine before starting the actual troubleshooting.

Example: Checks before starting troubleshooting

- Is oil level and type of oil in hydraulic tank correct?
- Is there any oil leakage from steering valve or demand valve?
- Is steering linkage adjusted properly?

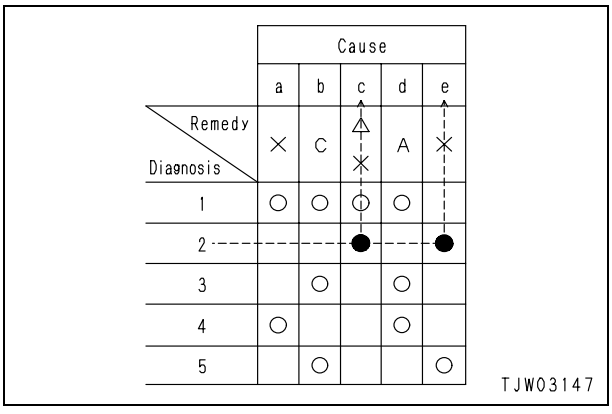
Step 3. Method of reading matrix

1. Operate the machine when carrying out troubleshooting of the items in the Diagnosis column. If any problems occur as the result of the troubleshooting, put a check against the item.
   ★ When carrying out the troubleshooting, check the easier items first. It is not necessary to follow the number order.

   [Example]

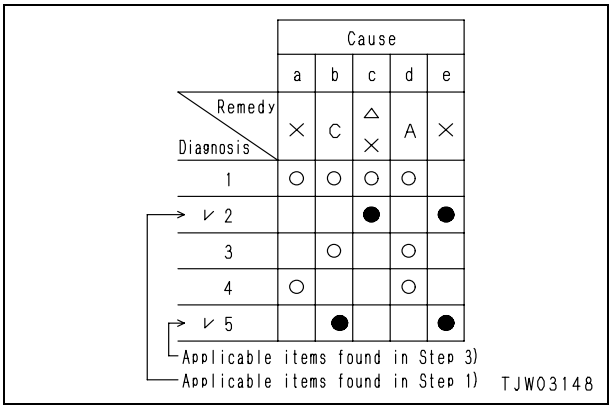
No.	Remedy / Diagnosis
1	Steering does not turn in both directions (left and right)
2	Steering turns only in one direction (left or right)
3	Steering is heavy when turned in both directions (left and right)
4	Steering wheel is heavy in one direction (left or right)
5	Work equipment moves

2. Find the matching cause in the Cause column. If a problem is found, the ○ marks on the same line as the troubleshooting are the causes. (In Diagnosis item 2 in the same diagram below the cause is **c** or **e**.)
   When there is one ○ mark:
   Carry out troubleshooting for the other items marked with ○ in the same Cause column to check if the problem occurs, then make repairs.
   When there are two or more ○ marks:
   Go to Step 3 to narrow down the cause.

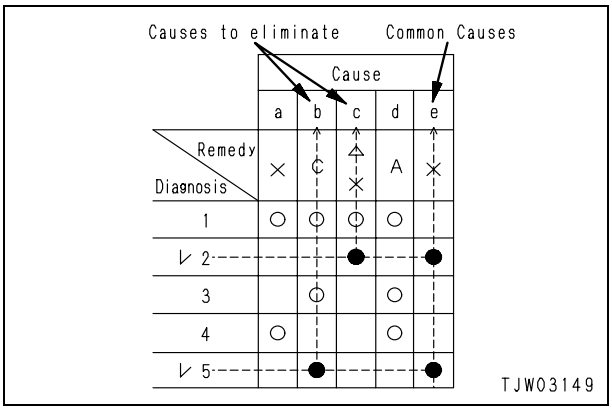


3. Operate the machine and carry out troubleshooting of the items not checked in Step 1. Operate the machine in the same way as in Step 1, and if any problem occurs, put a check against the item. (In Troubleshooting item 5 in the diagram below, the problem was re-enacted.)

4. Find the matching cause in the cause column. In the same way as in Step 2, if a problem is found, the ○ marks on the same line for the troubleshooting item are the causes. (In Diagnosis item 5 in the diagram below the cause is **b** or **e**.)



5. Narrow down the causes.
Of the causes found in Step 2 and Step 4, there are common items (○ marks on the line for each Diagnosis item and in the same Cause column as each other) that have causes common with the problem items found in the troubleshooting in Step 1 and Step 3.
★ The items that are not common (items that do not have ○ marks in the same cause common as each other) are probably not the cause, so they can be eliminated. (The causes for Diagnosis item 2 in the diagram below are **c** or **e**, and the causes in Diagnosis item 5 are **b** or **e**, so Cause **e** is the common cause.)



6. Repeat the operation in Steps 3, 4, and 5 until the cause is narrowed down to 1 item (1 common item).
★ If cause items are 2 or more, continue until number of items becomes minimum.

7. Remedy
After narrowing down the common causes, taken the action given in the remedy line.
Marks and remedies in remedy line
×: Replace △: Repair A: Adjust C: Clean

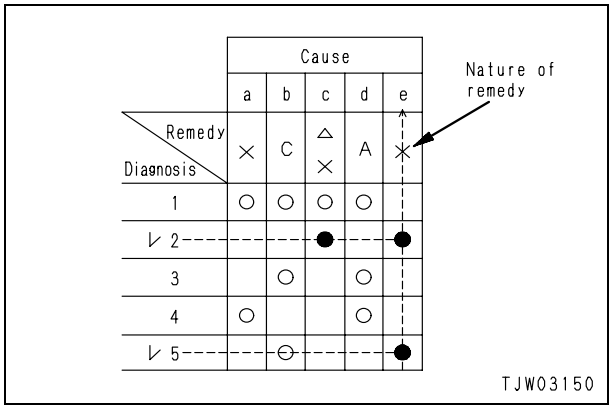


Table of failure modes and causes

Failure mode / Part that can cause failures		Defective engine	Defective PTO	Clogging of torque converter charging pump strainer	Clogging or air intake on torque converter charging pump suction side	Defective torque converter charging pump	Internal breakage of torque converter	Defective regulator valve	Clogged or broken torque converter oil cooler	Defective operation of torque converter relief valve	Drop of transmission main relief valve set pressure	Clogging of last chance filter	Defective operation of relevant ECMV	Defect of transmission controller system	Internal breakage of transmission	Wear or seizure of relevant clutch
Power train	Machine does not start		○	○	○	○	○			○	○	○	○		○	○
	Torque converter lockup is not switched (engine stalls)												○			○
	Torque converter lockup is not turned on										○	○	○		○	○
	Travel speed is slow, thrusting force is weal, uphill traveling power is weak, and gear is not shifted	○		○	○	○	○	○	○	○	○	○	○		○	
	Shocks are large at the times of starting and shifting gear			○	○	○					○	○	○	○		
	Time lag is large at the times of starting and shifting gear			○	○	○					○	○	○			
	Torque converter oil temperature is high	○		○	○	○	○		○		○				○	
Steering	Steering does not turn [machine with steering wheel]		○													
	Steering does not turn [machine with AJSS]		○													
	Turning, response of steering is poor [machine with steering wheel]		○													
	Turning, response of steering is poor [machine with AJSS]		○													
	Steering is heavy [machine with steering wheel]															
	When machine turns, it shakes or makes large shocks [machine with steering wheel]															
	When machine turns, it shakes or makes large shocks [machine with AJSS]															
Brake	Wheel brake does not work or does not work well		○													
	Wheel brake is not released or it drags															
	Parking brake does not work or does not work well															
	Parking brake is not released or it drags (including emergency release system)															
Work equipment	Lift arm does not rise		○													
	Lift arm speed is low or rising force of lift arm is insufficient															
	When rising, lift arm comes to move slowly at specific height															
	Lift arm cylinder cannot hold down the bucket (Bucket floats)															
	Hydraulic drifts of lift arm occur often															
	Lift arm wobbles during operation															
	Bucket does not tilt back		○													
	Bucket speed is low or tilting back force is insufficient															
	Bucket comes to operate slowly in the midst of tilting-back															
	Bucket cylinder cannot hold down bucket															
	Hydraulic drifts of bucket occur often															
	Bucket wobbles during travel with cargo (Work equipment valve is set to “HOLD”)															
	Engine speed lowers remarkably or engine stalls during work equipment control		○													
	Large shocks are made when work equipment starts and stops															
	When work equipment circuit is relieved singly, other work equipment moves															
	ECSS does not operate, and pitching housing occurs															

Defective clutch piston	Defective seal of relevant clutch piston	Defective seal of relevant clutch shaft	Clogging of transmission breather	Defective operation of transmission oil temperature sensor	Defective transmission output shaft speed sensor	Defective seal of work equipment and steering system hydraulic pump shaft	Clogging or air intake on steering pump suction side	Defective steering pump	Defective steering pump servo	Defective Orbit-roll	Defective steering stop valve	Defective steering main relief valve	Defective demand spool	Defective steering spool of steering valve	Defective safety-suction valve	Defective seal of steering cylinder piston	Clogging of AJSS EPC solenoid valve line filter	Defective AJSS EPC solenoid valve	Defective operation of rotary valve	Defective steering wheel or steering shaft	Defective seal of brake piston	Defective operation of brake piston	Internal breakage of wheel brake	Wear of wheel brake disc	Seized wheel brake disc plate	Defective brake pump	Clogging or air intake on brake pump suction side	Air in wheel brake circuit	Defective brake valve	Troubleshooting No.
	○	○																												H-1
																														H-2
	○	○	○																											H-3
	○	○	○	○																										H-4
○	○	○			○																									H-5
	○	○			○																									H-6
				○		○																								H-7
							○	○		○	○	○	○	○	○	○											○			H-8
							○	○					○	○	○	○	○	○	○								○			H-9
							○	○	○	○	○	○	○	○	○	○											○			H-10
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																														H-33
					○																									H-34

Failure mode / Part that can cause failures		Defective operation of wheel brake emergency switch	Gas leakage from accumulator, defective seal of piston	Defective accumulator charge valve	Defective slack adjuster	Defective axle oil	Defective operation of check valve (between last chance filter and parking brake solenoid)	Defective parking brake emergency release valve	Defective operation of parking brake solenoid valve	Defective parking brake spring	Defective operation of parking brake piston	Defective seal of parking brake piston	Wear of parking brake disc	Seized parking brake disc plate	Defective harness of parking brake switch line
Power train	Machine does not start						○	○	○			○			
	Torque converter lockup is not switched (engine stalls)														
	Torque converter lockup is not turned on														
	Travel speed is slow, thrusting force is weal, uphill traveling power is weak, and gear is not shifted											○			
	Shocks are large at the times of starting and shifting gear											○			
	Time lag is large at the times of starting and shifting gear														
	Torque converter oil temperature is high														
Steering	Steering does not turn [machine with steering wheel]			○											
	Steering does not turn [machine with AJSS]			○											
	Turning, response of steering is poor [machine with steering wheel]			○											
	Turning, response of steering is poor [machine with AJSS]			○											
	Steering is heavy [machine with steering wheel]			○											
	When machine turns, it shakes or makes large shocks [machine with steering wheel]			○											
	When machine turns, it shakes or makes large shocks [machine with AJSS]			○											
Brake	Wheel brake does not work or does not work well		○	○	○	○									
	Wheel brake is not released or it drags				○										
	Parking brake does not work or does not work well							○	○	○	○		○		
	Parking brake is not released or it drags (including emergency release system)	○						○	○			○		○	
Work equipment	Lift arm does not rise														
	Lift arm speed is low or rising force of lift arm is insufficient														
	When rising, lift arm comes to move slowly at specific height														
	Lift arm cylinder cannot hold down bucket (Bucket floats)														
	Hydraulic drifts of lift arm occur often														
	Lift arm wobbles during operation														
	Bucket does not tilt back														
	Bucket speed is low or tilting back force is insufficient														
	Bucket comes to operate slowly in the midst of tilting-back														
	Bucket cylinder cannot hold down bucket														
	Hydraulic drifts of bucket occur often														
	Bucket wobbles during travel with cargo (Work equipment valve is set to “HOLD”)														
	Engine speed lowers remarkably or engine stalls during work equipment control														
	Large shocks are made when work equipment starts and stops														
	When work equipment circuit is relieved singly, other work equipment moves														
	ECSS does not operate, and pitching housing occurs		○												

Clogging or air intake on work equipment pump suction side	Defective work equipment controller	Defective work equipment pump	Defective work equipment pump servo	Defective work equipment valve body	Defective work equipment main relief valve	Defective work equipment unload valve	Defective lift arm spool of work equipment valve	Defective bucket spool of work equipment valve	Defective lift arm load check valve of work equipment valve	Defective safety-suction valve on bucket head side of work equipment valve	Defective safety-suction valve on bucket bottom side of work equipment valve	Defective lift arm cylinder	Defective bucket cylinder	Defective seal of lift arm cylinder piston	Defective seal of bucket cylinder piston	Defective stroke of lift arm EPC lever	Defective stroke of bucket EPC lever	Defect in electrical system of lift arm or bucket EPC lever	Clearance error of pin or bush of working equipment linkage	Defective ECSS solenoid valve	Defective ECSS charge valve	Troubleshooting No.
																						H-1
																						H-2
																						H-3
																						H-4
																						H-5
																						H-6
																						H-7
																						H-8
																						H-9
																						H-10
																						H-11
																						H-12
																						H-13
																						H-14
																						H-15
																						H-16
																						H-17
																						H-18
○		○	○	○	○	○	○		○					○								H-19
○		○	○	○	○	○	○		○					○							○	H-20
○		○	○	○	○	○	○		○			○		○							○	H-21
○		○	○	○	○	○	○		○					○		○					○	H-22
				○			○		○			○										H-23
○		○	○	○	○	○	○		○			○		○							○	H-24
○		○	○	○	○	○		○			○				○							H-25
○		○	○	○	○	○		○			○				○						○	H-26
○		○	○	○	○	○		○			○				○						○	H-27
○		○	○	○	○	○		○		○	○				○		○				○	H-28
				○				○			○		○		○							H-29
										○					○				○			H-30
		○	○																			H-31
							○	○										○				H-32
							○	○														H-33
	○																			○		H-34

H-1 Machine does not start

Ask the operator about the following:

- Has the machine come not to start suddenly?
  → Seizure of clutch, breakage of parts
  Did the machine cause any abnormal noise at the time and where?

Checks before troubleshooting

- Does the machine monitor function normally?
- Has the machine monitor displayed any failure code of the electrical system?
- Are the transmission oil level and the oil type appropriate?
- Did you smell deteriorated or burnt transmission oil?
- Have the transmission filter and strainer been clogged?
- Can you find any damage or oil leak from the appearance?
- Has the drive shaft been broken?
- Have the wheel brake and the parking brake been locked?

No.	Diagnosis \ Remedy		a △ x	b △ C	c △ x	d x	e △ x	f △ x	g △ x	h x	i *	j △ x	k *	l *	m x	n △ x	o △ x	p x	q x
			Cause																
			Torque converter charging pump				Torque converter	Main relief valve			ECMV	Transmission				Check valve	Parking brake emergency release valve	Parking brake	
			a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q
			The PTO is defective	Clogging of strainer	Clogging or air intake on suction side	The charging pump is defective	Internal breakage of torque converter	Defective operation of torque converter relief valve	Set pressure drop of main relief valve	Clogging of last chance filter	Defective operation of relevant ECMV	Internal breakage of transmission	Wear or seizure of relevant clutch	The relevant clutch piston seal is defective	The relevant clutch shaft seal is defective	Defective operation of check valve (between last chance filter and parking brake solenoid)	Defective operation of spool of parking brake emergency release valve	Defective operation of parking brake solenoid valve	The parking brake piston seal is defective
1	The machine does not start at all gear speeds		○	○	○	○	○	○	○	○		○				○	○	○	○
2	The machine does not start at specific gear speeds										○	○	○	○	○				
3	When the transmission oil temperature is low, the charging pump or the transmission filter causes any abnormal noise (s)			○	○														
4	When the transmission oil temperature rises, the machine comes not to start					○								○	○				○
5	Metal (Aluminum, copper, iron, etc.) powders are adhered to the transmission filter or the strainer					○	○					○							
6	When the stall speed of the torque converter is measured	The speed is higher at all gear speeds	○	○	○	○	○	○	○	○									
7		The speed is higher at specific gear speeds									○	○	○	○	○				
8	When the ECMV output (Clutch) oil pressure is measured	The oil pressure is low at all gear speeds	○	○	○	○			○	○									○
9		The oil pressure is low at specific gear speeds									○	○		○	○				
10		The oil pressure does not become stable as the gauge fluctuates		○	○														
11	When the torque converter relief (Inlet) oil pressure is measured, the oil pressure is low.		○	○	○	○	○	○											

*: Proceed to the paragraph of “Defective clutch and ECMV specifying method (Check by failure code).”

*** Defective clutch and ECMV specifying method**
(Check by failure code)

★ For the checking method of failure code display, see the paragraph of “Special functions of machine monitor.”

★ When replacing the ECMV for diagnosis, remove mud and dust around the ECMV completely and clean it, and then tighten the mounting bolt with the specified torque.

★ For the following diagnoses, start the engine and select the manual mode:

Table of applicable clutches

			Clutch					
			F	R	1st	2nd	3rd	4th
Gear speed	N	In the automatic mode				●		
		In the manual mode			○	○	○	○
	F1		●		●			
	F2		●			●		
	F3		●				●	
	F4		●					●
	R1			●	●			
	R2			●		●		
	R3			●			●	
	R4			●				●

★ When the gear speed is N in the manual mode, the clutch of the gear speed (Marked with ○), to which the gear shift lever is set, is ON.

● Even if the gear shift lever is used when the gear speed is N, the clutch position cannot be changed.

No.		Diagnosis / Remedy	Failure code	Cause: Transmission a: Wear or seizure of F clutch disc or wear of piston seal	b: Wear or seizure of R clutch disc or wear of piston seal	c: Wear or seizure of 1st clutch disc or wear of piston seal	d: Wear or seizure of 2nd clutch disc or wear of piston seal	e: Wear or seizure of 3rd clutch disc or wear of piston seal	f: Wear or seizure of 4th clutch disc or wear of piston seal	ECMV g: Defective operation of F clutch ECMV (Fill switch)	h: Defective operation of R clutch ECMV (Fill switch)	i: Defective operation of 1st clutch ECMV (Fill switch)	j: Defective operation of 2nd clutch ECMV (Fill switch)	k: Defective operation of 3rd clutch ECMV (Fill switch)	l: Defective operation of 4th clutch ECMV (Fill switch)
				x	x	x	x	x	x	x	x	x	x	x	x
1	(1)	The code is not displayed at R1-R4 but is displayed at F1-F4	15SAL1	○						○					
	(2)	When the failure code is 15SAL1 after the diagnosis in (1), the failure code comes not to be displayed when the F fill switch connector (CN-F.SW) is disconnected. When the failure code is 15SALH, the failure code comes not to be displayed when the ECMV is replaced with any one other than F clutch ECMV	15SALH							○					
2	(1)	The code is not displayed at F1-F4 but is displayed at R1-R4	15SBL1		○						○				
	(2)	When the failure code is 15SBL1 after the diagnosis in (1), the failure code comes not to be displayed when the R fill switch connector (CN-R.SW) is disconnected. When the failure code is 15SBLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than R clutch ECMV	15SBLH								○				
3	(1)	The code is not displayed at F2, F3, and F4 but is displayed at F1	15SEL1			○						○			
	(2)	When the failure code is 15SEL1 after the diagnosis in (1), the failure code comes not to be displayed when the 1st fill switch connector (CN-1.SW) is disconnected. When the failure code is 15SELH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 1st clutch ECMV	15SELH									○			
4	(1)	The code is not displayed at F1, F3, and F4 but is displayed at F2	15SFL1				○						○		
	(2)	When the failure code is 15SFL1 after the diagnosis in (1), the failure code comes not to be displayed when the 2nd fill switch connector (CN-2.SW) is disconnected. When the failure code is 15SFLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 2nd clutch ECMV	15SFLH										○		
5	(1)	The code is not displayed at F1, F2, and F4 but is displayed at F3	15SGL1					○						○	
	(2)	When the failure code is 15SGL1 after the diagnosis in (1), the failure code comes not to be displayed when the 3rd fill switch connector (CN-3.SW) is disconnected. When the failure code is 15SGLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 3rd clutch ECMV	15SGLH											○	
6	(1)	The code is not displayed at F1, F2, and F3 but is displayed at F4	15SHL1						○						○
	(2)	When the failure code is 15SHL1 after the diagnosis in (1), the failure code comes not to be displayed when the 4th fill switch connector (CN-4.SW) is disconnected. When the failure code is 15SHLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 4th clutch ECMV	15SHLH												○

H-2 Torque converter lockup is not switched (engine stalls)

Checks before troubleshooting

- Is the oil level of transmission case appropriate?

No.	Diagnosis / Remedy	Cause a: Defective operation of lockup clutch ECMV	Cause b: Wear or seizure of lockup clutch disc
		x	x
1	Lockup oil pressure does not drop to 0	○	
2	Lockup cannot be turned off even when the lockup oil pressure is 0		○

H-3 Torque converter lockup is not turned on

Ask the operator about the following:

- Has the lockup come not to turn on suddenly?
- → **Seizure or breakage inside torque converter**
- Did any abnormal noise occur at the time? → **Breakage of parts**

Checks before troubleshooting

- Is the oil level of transmission case appropriate?
- Is there any external oil leakage?

Check of abnormality

- Main relief oil pressure
- Lockup oil pressure
- Travel speed

No.	Diagnosis	Transmission controller self-diagnosis code / Remedy	△ x	Cause a: Drop of transmission main relief valve set pressure	b: Defective operation of lockup clutch ECMV	c: Defective seal of lockup clutch piston	d: Wear or seizure of lockup clutch disc	e: Crack on lockup clutch case	f: Clogging of last chance filter	g: Defective seal of lockup clutch shaft
1	Main relief oil pressure is low		○							
2	Main relief oil pressure is normal, but lockup oil pressure is low or 0			○	○		○	○	○	
3	Main relief oil pressure and oil pressure is normal, but lockup oil pressure is low or 0						○			
4	Time to lockup actuation takes long	15SJLH		○						

H-4 Travel speed is slow, thrusting force is weak, uphill traveling power is weak, and gear is not shifted

Ask the operator about the following:

- Has the abnormality occurred suddenly?
  → Breakage of related equipment
  Did any abnormal noise occur at the time and where?
- Have any abnormal signs come to occur gradually?
  → Wear of related equipment, defective seal

Check of abnormality

- Execute digging and measure traveling speeds on a level ground and on a slope to check whether the abnormality actually occurs or is a matter of operator's sense

Checks before troubleshooting

- Is any failure code of the electrical system displayed on the machine monitor?
- Are the transmission oil level and the oil type appropriate?
- Haven't the transmission filter and strainer been clogged?
- Is any external oil leak found on the mating faces of piping and valves around the torque converter and the transmission?
- Isn't the wheel brake or the parking brake being dragged?
- Are the tire air pressure and the tread shape appropriate?
- Is the operating method correct?

NOTE: When the inspection result was “Engine degradation,” proceed to Troubleshooting of engine (S-mode).

No.	Diagnosis \ Remedy		a Clogging of strainer	b Clogging or air intake on pump suction side	c The charging pump is defective	d Defective operation of regulator valve	e Clogging of oil cooler and piping (After torque converter outlet)	f Breakage of oil cooler and piping (After torque converter outlet)	g Oil leak inside torque converter	h Internal breakage of torque converter	i Defective operation of torque converter relief valve	j Drop of main relief valve set pressure	k Clogging of last chance filter	l Defective operation of relevant ECMV	m Internal breakage of transmission	n Defective seal of relevant clutch piston	o Defective seal of relevant clutch shaft	p Clogging of breather	q Defective seal of parking brake piston	r Defective seal of work equipment and steering system hydraulic pump shaft (Mixing of hydraulic oil in transmission case)	s Engine degradation
			Torque converter charging pump			Regulator valve	Torque converter oil cooler		Torque converter		Main relief valve			ECMV	Transmission				Parking brake	Others	
			C x	△ x	x	△ x	△ x	x	△ x	△ x	△ x	△ x	x	*	△ x	*	x	C x	x	△ x	Note
1	Any abnormality occurs at all gear speeds		○	○	○	○	○	○	○	○	○	○	○		○			○	○	○	○
2	Any abnormality occurs at specific gear speeds													○	○	○	○				
3	When the transmission oil temperature is low, the charging pump or the transmission filter causes any abnormal noise		○	○																	
4	The torque converter oil temperature is heated abnormally high		○	○	○	○	○	○	○	○	○				○			○		○	
5	The transmission oil level rises and falls					○	○	○										○		○	○
6	Metal (Aluminum, copper, iron, etc.) powders are adhered to the transmission filter or the strainer				○					○					○						
7	The engine low idle and high idle speeds are measured to be abnormal									○					○						○
8	When the stall speed of the torque converter is measured	The speed is high	○	○	○			○	○	○	○		○		○			○			
9		The speed is low																			○
10	When the ECMV output (Clutch) oil pressure is measured	The oil pressure drops as the oil temperature rises			○											○	○		○		
11		The oil pressure is low at all gear speeds	○	○	○							○	○		○			○	○		○
12		The oil pressure is low at specific gear speeds												○	○	○	○				
13		The oil pressure does not become stable as the gauge fluctuates	○	○																	
14	When the torque converter relief (Inlet) oil pressure is measured, the oil pressure is low. (No. 11 – 13 are normal.)								○	○	○										
15	When the oil pressure at the torque converter outlet is measured, the oil pressure is low. (No. 14 is normal.)							○													

*: Proceed to the paragraph of “Defective clutch and ECMV specifying method (Check by failure code).”

*** Defective clutch and ECMV specifying method**
(Check by failure code)

★ For the checking method of failure code display, see the paragraph of “Special functions of machine monitor.”
★ When replacing the ECMV for diagnosis, remove mud and dust around the ECMV completely and clean it, and then tighten the mounting bolt with the specified torque.
★ For the following diagnoses, start the engine and select the manual mode:

Table of applicable clutches

			Clutch					
			F	R	1st	2nd	3rd	4th
Gear speed	N	In the automatic mode				●		
		In the manual mode			○	○	○	○
	F1		●		●			
	F2		●			●		
	F3		●				●	
	F4		●					●
	R1			●	●			
	R2			●		●		
	R3			●			●	
	R4			●				●

★ When the gear speed is N in the manual mode, the clutch of the gear speed (Marked with ○), to which the gear shift lever is set, is ON.
● Even if the gear shift lever is used when the gear speed is N, the clutch position cannot be changed.

No.		Diagnosis / Remedy	Failure code	Cause: Transmission a: Wear or seizure of F clutch disc or wear of piston seal	Transmission b: Wear or seizure of R clutch disc or wear of piston seal	Transmission c: Wear or seizure of 1st clutch disc or wear of piston seal	Transmission d: Wear or seizure of 2nd clutch disc or wear of piston seal	Transmission e: Wear or seizure of 3rd clutch disc or wear of piston seal	Transmission f: Wear or seizure of 4th clutch disc or wear of piston seal	ECMV g: Defective operation of F clutch ECMV (Fill switch)	ECMV h: Defective operation of R clutch ECMV (Fill switch)	ECMV i: Defective operation of 1st clutch ECMV (Fill switch)	ECMV j: Defective operation of 2nd clutch ECMV (Fill switch)	ECMV k: Defective operation of 3rd clutch ECMV (Fill switch)	ECMV l: Defective operation of 4th clutch ECMV (Fill switch)
		Remedy		x	x	x	x	x	x	x	x	x	x	x	x
1	(1)	The code is not displayed at R1-R4 but is displayed at F1-F4	15SAL1	○						○					
	(2)	When the failure code is 15SAL1 after the diagnosis in (1), the failure code comes not to be displayed when the F fill switch connector (CN-F.SW) is disconnected. When the failure code is 15SALH, the failure code comes not to be displayed when the ECMV is replaced with any one other than F clutch ECMV	15SALH							○					
2	(1)	The code is not displayed at F1-F4 but is displayed at R1-R4	15SBL1		○						○				
	(2)	When the failure code is 15SBL1 after the diagnosis in (1), the failure code comes not to be displayed when the R fill switch connector (CN-R.SW) is disconnected. When the failure code is 15SBLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than R clutch ECMV	15SBLH								○				
3	(1)	The code is not displayed at F2, F3, and F4 but is displayed at F1	15SEL1			○						○			
	(2)	When the failure code is 15SEL1 after the diagnosis in (1), the failure code comes not to be displayed when the 1st fill switch connector (CN-1.SW) is disconnected. When the failure code is 15SELH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 1st clutch ECMV	15SELH									○			
4	(1)	The code is not displayed at F1, F3, and F4 but is displayed at F2	15SFL1				○						○		
	(2)	When the failure code is 15SFL1 after the diagnosis in (1), the failure code comes not to be displayed when the 2nd fill switch connector (CN-2.SW) is disconnected. When the failure code is 15SFLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 2nd clutch ECMV	15SFLH										○		
5	(1)	The code is not displayed at F1, F2, and F4 but is displayed at F3	15SGL1					○						○	
	(2)	When the failure code is 15SGL1 after the diagnosis in (1), the failure code comes not to be displayed when the 3rd fill switch connector (CN-3.SW) is disconnected. When the failure code is 15SGLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 3rd clutch ECMV	15SGLH											○	
6	(1)	The code is not displayed at F1, F2, and F3 but is displayed at F4	15SHL1						○						○
	(2)	When the failure code is 15SHL1 after the diagnosis in (1), the failure code comes not to be displayed when the 4th fill switch connector (CN-4.SW) is disconnected. When the failure code is 15SHLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 4th clutch ECMV	15SHLH												○

H-5 Shocks are large at the times of starting and shifting gear

Ask the operator about the following:

- Did shocks become large suddenly?
  → **Breakage of related equipment**
  Did any abnormal noise occur at the time and where?
- Did shocks become large gradually?
  → **Wear of related equipment, defective seal**

Checks before troubleshooting

- Did any of the following abnormal phenomena occur at the same time: The traveling speed is slow, the braking is weak, the uphill travelling power is weak, the gear is not shifted. → **Execute H-3**

Checks before troubleshooting

- Is any failure code of the electrical system displayed on the machine monitor?
- Are the transmission oil level and the oil type appropriate?
- Haven't the transmission filter and strainer been clogged?
- Is any external oil leak found on the mating faces of pipings and valves around the torque converter and the transmission?
- Isn't the engine speed high at the time of low idling?
- Isn't play of each drive shaft large?

No.	Diagnosis \ Remedy		Cause: Torque converter charging pump			Main relief valve		ECMV		Transmission			Parking brake	Sensor
			a	b	c	d	e	f	g	h	i	j	k	l
			Clogging of strainer	Clogging or air intake on pump suction side	The charging pump is defective	Defective operation of main relief valve	Clogging of last chance filter	Defective operation of relevant ECMV ★	Defect of transmission controller system	Defective seal of relevant clutch piston	Defective return (Release) of relevant clutch piston	Defective seal of relevant clutch shaft	Defective seal of parking brake piston	Defective transmission oil temperature sensor
			C x	△ x	x	△ x	x	*	**	*	*	x	x	**
1	Shocks are large at all gear speeds		○	○	○	○	○		○				○	○
2	Shocks are large at specific gear speeds							○	○	○	○	○		○
3	When the ECMV output (Clutch) oil pressure is measured	The oil pressure is low at all gear speeds	○	○	○	○	○						○	
4		The oil pressure is low at specific gear speeds						○		○		○		
5		The oil pressure is high at all gear speeds				○								

★ Defective operation of relevant ECMV or defective operations of fill switch and solenoid due to bolting wastes of pressure control valve spool.

*: Proceed to the paragraph of “Defective clutch and ECMV specifying method (Check by failure code).”

**: See “Troubleshooting by failure code (Display of code).”

*** Defective clutch and ECMV specifying method**
(Check by failure code)

★ For the checking method of failure code display, see the paragraph of “Special functions of machine monitor.”
★ When replacing the ECMV for diagnosis, remove mud and dust around the ECMV completely and clean it, and then tighten the mounting bolt with the specified torque.
★ For the following diagnoses, start the engine and select the manual mode:

Table of applicable clutches

			Clutch					
			F	R	1st	2nd	3rd	4th
Gear speed	N	In the automatic mode				●		
		In the manual mode			○	○	○	○
	F1		●		●			
	F2		●			●		
	F3		●				●	
	F4		●					●
	R1			●	●			
	R2			●		●		
	R3			●			●	
	R4			●				●

★ When the gear speed is N in the manual mode, the clutch of the gear speed (Marked with ○), to which the gear shift lever is set, is ON.
● Even if the gear shift lever is used when the gear speed is N, the clutch position cannot be changed.

No.		Diagnosis / Remedy	Failure code	Cause: Transmission a: Wear or seizure of F clutch disc or wear of piston seal	Transmission b: Wear or seizure of R clutch disc or wear of piston seal	Transmission c: Wear or seizure of 1st clutch disc or wear of piston seal	Transmission d: Wear or seizure of 2nd clutch disc or wear of piston seal	Transmission e: Wear or seizure of 3rd clutch disc or wear of piston seal	Transmission f: Wear or seizure of 4th clutch disc or wear of piston seal	ECMV g: Defective operation of F clutch ECMV (Fill switch)	ECMV h: Defective operation of R clutch ECMV (Fill switch)	ECMV i: Defective operation of 1st clutch ECMV (Fill switch)	ECMV j: Defective operation of 2nd clutch ECMV (Fill switch)	ECMV k: Defective operation of 3rd clutch ECMV (Fill switch)	ECMV l: Defective operation of 4th clutch ECMV (Fill switch)
				x	x	x	x	x	x	x	x	x	x	x	x
1	(1)	The code is not displayed at R1-R4 but is displayed at F1-F4	15SAL1	○						○					
	(2)	When the failure code is 15SAL1 after the diagnosis in (1), the failure code comes not to be displayed when the F fill switch connector (CN-F.SW) is disconnected. When the failure code is 15SALH, the failure code comes not to be displayed when the ECMV is replaced with any one other than F clutch ECMV	15SALH							○					
2	(1)	The code is not displayed at F1-F4 but is displayed at R1-R4	15SBL1		○						○				
	(2)	When the failure code is 15SBL1 after the diagnosis in (1), the failure code comes not to be displayed when the R fill switch connector (CN-R.SW) is disconnected. When the failure code is 15SBLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than R clutch ECMV	15SBLH								○				
3	(1)	The code is not displayed at F2, F3, and F4 but is displayed at F1	15SEL1			○						○			
	(2)	When the failure code is 15SEL1 after the diagnosis in (1), the failure code comes not to be displayed when the 1st fill switch connector (CN-1.SW) is disconnected. When the failure code is 15SELH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 1st clutch ECMV	15SELH									○			
4	(1)	The code is not displayed at F1, F3, and F4 but is displayed at F2	15SFL1				○						○		
	(2)	When the failure code is 15SFL1 after the diagnosis in (1), the failure code comes not to be displayed when the 2nd fill switch connector (CN-2.SW) is disconnected. When the failure code is 15SFLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 2nd clutch ECMV	15SFLH										○		
5	(1)	The code is not displayed at F1, F2, and F4 but is displayed at F3	15SGL1					○						○	
	(2)	When the failure code is 15SGL1 after the diagnosis in (1), the failure code comes not to be displayed when the 3rd fill switch connector (CN-3.SW) is disconnected. When the failure code is 15SGLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 3rd clutch ECMV	15SGLH											○	
6	(1)	The code is not displayed at F1, F2, and F3 but is displayed at F4	15SHL1						○						○
	(2)	When the failure code is 15SHL1 after the diagnosis in (1), the failure code comes not to be displayed when the 4th fill switch connector (CN-4.SW) is disconnected. When the failure code is 15SHLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 4th clutch ECMV	15SHLH												○

H-6 Time lag is large at the times of starting and shifting gear

Ask the operator about the following:

- Did the time lag become large suddenly?
  → **Breakage of related equipment**
  Did any abnormal noise occur at the time and where?
- Has the time lag become large gradually?
  → **Wear of related equipment, defective seal**

Check of abnormality

- Did any of the following abnormal phenomena occur at the same time: The traveling speed is slow, the braking is weak, the uphill travelling power is weak, the gear is not shifted. → **Execute H-3**

Checks before troubleshooting

- Is any failure code of the electrical system displayed on the machine monitor?
- Are the transmission oil level and the oil type appropriate?
- Haven't the transmission filter and strainer been clogged?
- Is any external oil leak found on the mating faces of pipings and valves around the torque converter and the transmission?

No.	Diagnosis \ Remedy		Cause: Torque converter charging pump — a: Clogging of strainer	b: Clogging or air intake on pump suction side	c: The charging pump is defective	Main relief valve — d: Drop of main relief valve set pressure	e: Clogging of last chance filter	ECMV — f: Defective operation of relevant ECMV	Transmission — g: Defective seal of relevant clutch piston	h: Defective seal of relevant clutch shaft	Parking brake — i: Defective seal of parking brake piston	Sensor — j: Defective operation of transmission oil temperature sensor
			C x	△ x	x	△ x	x	*	*	x	x	**
1	Time lag is large at all gear speeds		○	○	○	○	○				○	○
2	Time lag is large at specific gear speeds							○	○	○		○
3	When the transmission oil temperature is low, any abnormal noise occurs from the charging pump or the transmission filter		○	○								
4	The torque converter oil temperature is heated abnormally high		○	○	○		○					
5	When the ECMV output (Clutch) oil pressure is measured	The oil pressure is low at all gear speeds	○	○	○	○					○	
6		The oil pressure is low at specific gear speeds						○	○	○		

★ Defective operation of relevant ECMV or defective operations of fill switch and solenoid due to bolting wastes of pressure control valve spool.

*: Proceed to the paragraph of “Defective clutch and ECMV specifying method (Check by failure code).”

**: See “Troubleshooting by failure code (Display of code).”

*** Defective clutch and ECMV specifying method**
(Check by failure code)

★ For the checking method of failure code display, see the paragraph of “Special functions of machine monitor.”
★ When replacing the ECMV for diagnosis, remove mud and dust around the ECMV completely and clean it, and then tighten the mounting bolt with the specified torque.
★ For the following diagnoses, start the engine and select the manual mode:

Table of applicable clutches

			Clutch					
			F	R	1st	2nd	3rd	4th
Gear speed	N	In the automatic mode				●		
		In the manual mode			○	○	○	○
	F1		●		●			
	F2		●			●		
	F3		●				●	
	F4		●					●
	R1			●	●			
	R2			●		●		
	R3			●			●	
	R4			●				●

★ When the gear speed is N in the manual mode, the clutch of the gear speed (Marked with ○), to which the gear shift lever is set, is ON.
● Even if the gear shift lever is used when the gear speed is N, the clutch position cannot be changed.

No.		Diagnosis / Remedy	Failure code	Cause: Transmission a: Wear or seizure of F clutch disc or wear of piston seal	b: Wear or seizure of R clutch disc or wear of piston seal	c: Wear or seizure of 1st clutch disc or wear of piston seal	d: Wear or seizure of 2nd clutch disc or wear of piston seal	e: Wear or seizure of 3rd clutch disc or wear of piston seal	f: Wear or seizure of 4th clutch disc or wear of piston seal	ECMV g: Defective operation of F clutch ECMV (Fill switch)	h: Defective operation of R clutch ECMV (Fill switch)	i: Defective operation of 1st clutch ECMV (Fill switch)	j: Defective operation of 2nd clutch ECMV (Fill switch)	k: Defective operation of 3rd clutch ECMV (Fill switch)	l: Defective operation of 4th clutch ECMV (Fill switch)
				x	x	x	x	x	x	x	x	x	x	x	x
1	(1)	The code is not displayed at R1-R4 but is displayed at F1-F4	15SAL1	○						○					
	(2)	When the failure code is 15SAL1 after the diagnosis in (1), the failure code comes not to be displayed when the F fill switch connector (CN-F.SW) is disconnected. When the failure code is 15SALH, the failure code comes not to be displayed when the ECMV is replaced with any one other than F clutch ECMV	15SALH							○					
2	(1)	The code is not displayed at F1-F4 but is displayed at R1-R4	15SBL1		○						○				
	(2)	When the failure code is 15SBL1 after the diagnosis in (1), the failure code comes not to be displayed when the R fill switch connector (CN-R.SW) is disconnected. When the failure code is 15SBLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than R clutch ECMV	15SBLH								○				
3	(1)	The code is not displayed at F2, F3, and F4 but is displayed at F1	15SEL1			○						○			
	(2)	When the failure code is 15SEL1 after the diagnosis in (1), the failure code comes not to be displayed when the 1st fill switch connector (CN-1.SW) is disconnected. When the failure code is 15SELH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 1st clutch ECMV	15SELH									○			
4	(1)	The code is not displayed at F1, F3, and F4 but is displayed at F2	15SFL1				○						○		
	(2)	When the failure code is 15SFL1 after the diagnosis in (1), the failure code comes not to be displayed when the 2nd fill switch connector (CN-2.SW) is disconnected. When the failure code is 15SFLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 2nd clutch ECMV	15SFLH										○		
5	(1)	The code is not displayed at F1, F2, and F4 but is displayed at F3	15SGL1					○						○	
	(2)	When the failure code is 15SGL1 after the diagnosis in (1), the failure code comes not to be displayed when the 3rd fill switch connector (CN-3.SW) is disconnected. When the failure code is 15SGLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 3rd clutch ECMV	15SGLH											○	
6	(1)	The code is not displayed at F1, F2, and F3 but is displayed at F4	15SHL1						○						○
	(2)	When the failure code is 15SHL1 after the diagnosis in (1), the failure code comes not to be displayed when the 4th fill switch connector (CN-4.SW) is disconnected. When the failure code is 15SHLH, the failure code comes not to be displayed when the ECMV is replaced with any one other than the 4th clutch ECMV	15SHLH												○

H-7 Torque converter oil temperature is high

Ask the operator about the following:

- Does the oil temperature rise when the torque converter stalls and does the temperature fall at the time of no load?
  → **Selection of improper gear speed**
  Did any abnormal noise occur at the time and where?
- Does the oil temperature rise only at the time of lifting?
  → **Improvement of operating method**

Check of abnormality

- Measure the torque converter oil temperature to find if the oil temperature is really high.
  → **The torque converter oil temperature gauge is defective**

Checks before troubleshooting

- Are the coolant level in the radiator and the belt tension appropriate?
- Are the oil level in the transmission and the oil type appropriate?
- Haven't the transmission filter and strainer been clogged?

NOTE: When the inspection result was “Engine degradation,” proceed to Troubleshooting of engine (S-mode).

No.	Diagnosis \ Remedy		Cause													
			Torque converter charging pump			Torque converter oil cooler		Torque converter		Main relief valve	Transmission		Others	
			a	b	c	d	e	f	g	h	i	j	k	l
			Clogging of strainer	Clogging or air intake on pump suction side	The charging pump is defective	Clogging of oil cooler and piping (After torque converter outlet)	Breakage of oil cooler and piping (After torque converter outlet)	Oil leak inside torque converter	Internal breakage of torque converter	Drop of main relief valve set pressure	Internal breakage of transmission	Clogging of breather	Defective seal of work equipment and steering system hydraulic pump shaft (Mixing of hydraulic oil in transmission case)	Engine degradation
			C x	△ x	x	△ x	x	△ x	△ x	△ x	△ x	C x	△ x	Note
1	When the transmission oil temperature is low, the charging pump or the transmission filter causes any abnormal noise		○	○										
2	Traveling speed, braking force and uphill travelling power do not occur at all gear speeds		○	○	○	○	○	○	○	○	○		○	○
3	Traveling speed, braking force and uphill travelling power do not occur at specific gear speeds										○			
4	The transmission oil level rises and falls					○	○					○		
5	Metal powders (Aluminum, copper, iron, etc.) are adhered to the transmission filter and the strainer				○				○		○			
6	The engine low idle and high idle speeds are measured to be abnormal								○		○			○
7	When the stall speed of the torque converter is measured, the speed is high		○	○	○		○	○	○	○	○	○		
8	When the ECMV output (Clutch) oil pressure is measured	The oil pressure drops as the oil temperature rises			○									
9		The oil pressure is low at all gear speeds	○	○	○						○	○		
10		The oil pressure is low at specific gear speeds									○			
11		The oil pressure does not become stable as the gauge vibrates	○	○										
12	When the torque converter relief (Inlet) oil pressure is measured, the oil pressure is low. (No. 9 – 11 are normal.)							○	○	○				
13	When the oil pressure at the torque converter outlet is measured, the oil pressure is low. (No. 12 is normal.)						○							

H-8 Steering does not turn [machine with steering wheel]

Ask the operator about the following:

- Did the problem suddenly start? → **Breakage of related equipment**
  Did the machine cause any abnormal noise at the time and where?

Checks before troubleshooting

- Is oil level in hydraulic tank correct? Is the type of oil correct?
- Is the steering shaft broken?
- Is the steering stop valve properly adjusted?
- Has the lock bar been removed from the frame?

No.	Diagnosis \ Remedy		△ x	Defective PTO	Clogging or air intake on pump suction side	Defective steering pump	Defective brake pump	Defective accumulator charge valve	Defective Orbit-roll	Defective stop valve	Defective actuation of demand spool	Defective actuation of steering spool	Defective safety-suction valve	Defect in steering cylinder (defective piston seal)
			Cause	Hydraulic pump				Charge valve	Orbit-roll	Stop valve	Steering valve			Hydraulic cylinder
				a	b	c	d	e	f	g	h	i	j	k
1	Steering does not turn in both directions (left and right)			○	○	○	○	○	○		○	○		○
2	Steering turns only in one direction (left or right)									○			○	
3	Steering is heavy when turned in both directions (left and right)						○	○	○			○		
4	Steering wheel is heavy in one direction (left or right)									○				
5	Work equipment moves					○			○	○	○	○	○	○
6	Work equipment does not move			○	○		○	○						
7	Abnormal noise comes from around PTO			○										
8	Abnormal noise comes from around hydraulic tank				○		○							
9	When steering relief pressure is measured	Oil pressure is low, or there is no pressure in both directions (left and right)		○	○	○	○	○	○		○	○		○
10		Oil pressure is low, or there is no pressure in one direction (left or right)								○			○	
11	When Orbit-roll output pressure is measured, oil pressure is found to be low or there is no oil pressure			○	○		○	○	○					
12	When Orbit-roll basic pressure is measured	Oil pressure is low		○	○		○	○						
13		There is no oil pressure		○	○		○							

★ There is a close connection between the steering circuit and the work equipment circuit, so if any abnormality is left in the steering, check the operation of the work equipment also.

H-9 Steering does not turn [machine with AJSS]

Ask the operator about the following:

- Did the problem suddenly start?
  → **Breakage of related equipment**
  Did the machine cause any abnormal noise at the time and where?

Checks before troubleshooting

- Is oil level in hydraulic tank correct? Is the type of oil correct?
- Is the steering shaft broken?
- Has the lock bar been removed from the frame?
- Is the AJSS followup link properly adjusted?

No.	Diagnosis \ Remedy		Cause: Hydraulic pump a: Defective PTO	Hydraulic pump b: Clogging or air intake on pump suction side	Hydraulic pump c: Defective steering pump	Hydraulic pump d: Defective brake pump	Charge valve e: Defective accumulator charge valve	AJSS EPC solenoid valve f: Clogged line filter	AJSS EPC solenoid valve g: Defective AJSS EPC solenoid valve	Rotary valve h: Defective actuation of rotary valve	Steering valve i: Defective actuation of demand spool	Steering valve j: Defective actuation of steering spool	Steering valve k: Defective safety-suction valve	Hydraulic cylinder l: Defect in steering cylinder (defective piston seal)
	Remedy		△ x	△	△ x	△ x	△ x	C x	x	△ x	△ x	△ x	x	x
1	Steering does not turn in both directions (left and right)		○	○	○	○	○	○	○	○	○	○		○
2	Steering turns only in one direction (left or right)												○	
3	AJSS is heavy when turned in both directions (left and right)					○	○					○		
4	AJSS is heavy in one direction (left or right)													
5	Work equipment moves				○			○	○	○	○	○	○	○
6	Work equipment does not move		○	○		○	○							
7	Abnormal noise comes from around PTO		○											
8	Abnormal noise comes from around hydraulic tank			○		○								
9	When steering relief pressure is measured	Oil pressure is low, or there is no pressure in both directions (left and right)	○	○	○	○	○	○	○	○	○	○		○
10		Oil pressure is low, or there is no pressure in one direction (left or right)											○	
11	When AJSS EPC solenoid valve output pressure is measured, oil pressure is found to be low or there is no oil pressure		○	○		○	○	○	○	○				
12	When AJSS EPC solenoid valve basic pressure is measured	Oil pressure is low	○	○		○	○							
13		There is no oil pressure	○	○		○								

H-10 Turning, response of steering is poor [machine with steering wheel]

Ask the operator about the following:

- Did the problem suddenly start?
  → **Breakage of related equipment**
  Did the machine cause any abnormal noise at the time and where?
- Did the problem gradually appear?
  → **Wear of related parts, defective seal**

Checks before troubleshooting

- Is oil level in hydraulic tank correct? Is the type of oil correct?

No.	Diagnosis \ Remedy		Cause: Hydraulic pump – a: Defective PTO	b: Clogging or air intake on pump suction side	c: Defective brake pump	d: Defective steering pump	e: Defective steering pump servo	Charge valve – f: Defective accumulator charge valve	Orbit-roll – g: Defective Orbit-roll	Stop valve – h: Defective stop valve	Steering valve – i: Defective actuation of demand spool	j: Defective main relief valve	k: Defective steering spool	l: Defective safety-suction valve	Hydraulic cylinder – m: Defect in steering cylinder (defective piston seal)
			△ x	△	△ x	△ x	△ x	△ x	△ x	△ x	△ x	△ x	△ x	x	△ x
1	Turning, response of steering wheel is poor in both directions (left and right)		○	○	○	○	○	○	○		○	○	○		○
2	Turning, response of steering wheel is poor in one direction (left or right)									○				○	
3	Steering wheel is heavy in both directions (left and right)				○			○	○				○		
4	Steering wheel is heavy in one direction (left or right)									○					
5	Work equipment moves					○	○		○	○	○	○	○	○	○
6	Work equipment does not move		○	○	○			○							
7	Abnormal noise comes from around PTO		○												
8	Abnormal noise comes from around hydraulic tank			○		○									
9	When steering relief pressure is measured	Oil pressure is low, or there is no pressure in both directions (left and right)	○	○	○	○	○	○	○		○	○			○
10		Oil pressure is low, or there is no pressure in one direction (left or right)								○				○	
11	When Orbit-roll output pressure is measured, oil pressure is found to be low or there is no oil pressure		○	○	○			○	○						
12	When Orbit-roll basic pressure is measured, oil pressure is found to be low or there is no pressure		○	○	○			○							
13	When steering pump servo assembly is replaced, oil pressure is found to be normal						○								

★ There is a close connection between the steering circuit and the work equipment circuit, so if any abnormality is left in the steering, check the operation of the work equipment also.

H-11 Turning, response of AJSS is poor [machine with AJSS]

Ask the operator about the following:

- Did the problem suddenly start?
  → **Breakage of related equipment**
  Did the machine cause any abnormal noise at the time and where?
- Did the problem gradually appear?
  → **Wear of related parts, defective seal**

Checks before troubleshooting

- Is oil level in hydraulic tank correct? Is the type of oil correct?

No.	Diagnosis \ Remedy		Cause: a Defective PTO	b Clogging or air intake on pump suction side	c Defective brake pump	d Defective steering pump	e Defective steering pump servo	f Defective accumulator charge valve	g Clogged line filter	h Defective AJSS EPC solenoid valve	i Defective rotary valve	j Defective actuation of demand spool	k Defective main relief valve	l Defective actuation of steering spool	m Defective safety-suction valve	n Defect in steering cylinder (defective piston seal)
			Steering pump					Charge valve	AJSS EPC solenoid valve		Rotary valve	Steering valve				Hydraulic cylinder
			△ x	△	△ x	△ x	△ x	△ x	C x	x	△ x	△ x	△ x	△ x	x	△ x
1	Turning, response of steering wheel is poor in both directions (left and right)		○	○	○	○	○	○	○	○	○	○	○	○		○
2	Turning, response of steering wheel is poor in one direction (left or right)														○	
3	Steering wheel is heavy in both directions (left and right)				○			○						○		
4	Work equipment moves					○	○		○	○	○	○	○	○	○	○
5	Work equipment does not move		○	○	○			○								
6	Abnormal noise comes from around PTO		○													
7	Abnormal noise comes from around hydraulic tank			○		○										
8	When steering relief pressure is measured	Oil pressure is low, or there is no pressure in both directions (left and right)	○	○	○	○	○	○	○	○	○	○	○			○
9		Oil pressure is low, or there is no pressure in one direction (left or right)													○	
10	When AJSS EPC solenoid valve output pressure is measured, oil pressure is found to be low or there is no oil pressure		○	○	○			○	○	○	○					
11	When steering pump servo assembly is replaced, oil pressure is found to be normal						○									

★ There is a close connection between the steering circuit and the work equipment circuit, so if any abnormality is left in the steering, check the operation of the work equipment also.

H-12 Steering is heavy [machine with steering wheel]

Check of abnormality

Is the steering difficult to turn? → **See H-8 or H-9**

Measure the operating effort and turning speed, and check the “Standard value table” to see if they are abnormal.

Ask the operator about the following:

- Did the problem suddenly start? → **Breakage of related equipment broken**
- Was there previously any symptom that may lead to heavy steering? → **Wear of related equipment, defective seal**

Checks before troubleshooting

- Is oil level in hydraulic tank correct? Is the type of oil correct?
- Is the tire inflation pressure correct?

No.	Diagnosis \ Remedy		Cause: Hydraulic pump (a)	Charge valve (b)	Orbit-roll (c)	Stop valve (d)	Steering valve (e)	Others (f)
			Defective brake pump	Defective accumulator charge valve	Defective Orbit-roll	Defective stop valve	Defective actuation of steering spool	Defective actuation of steering wheel or steering shaft
			△ x	△ x	△ x	△ x	△ x	△ x
1	Steering is heavy when turned in both directions (left and right)		○	○	○		○	○
2	Steering wheel is heavy in one direction (left or right)					○		
3	Steering is heavy even when joint between steering shaft and Orbit-roll is disconnected							○
4	When steering relief pressure is measured	Oil pressure is low, or there is no pressure in both directions (left and right)	○	○	○		○	
5		Oil pressure is low, or there is no pressure in one direction (left or right)				○		
6	When Orbit-roll output pressure is measured, oil pressure is found to be low		○	○	○			○
7	When Orbit-roll basic pressure is measured	Oil pressure is low	○	○				
8		There is no oil pressure	○					

H-13 When machine turns, it shakes or makes large shocks [machine with steering wheel]

Check of abnormality

- Is the steering difficult to turn? → **See H-8**
- Is there any abnormal noise from around the steering equipment

Checks before troubleshooting

- Is the steering wheel play correct?
- Is there any abnormality in the connection between the steering shaft and the Orbit-roll?
- Is the tire inflation pressure correct?

No.	Diagnosis \ Remedy		Cause: Hydraulic pump a: Defective brake pump	Charge valve b: Defective accumulator charge valve	Orbit-roll c: Defective Orbit-roll	Steering valve: Stop valve d: Defective stop valve	Steering valve: e: Defective actuation of demand spool	Steering valve: f: Defective main relief valve	Steering valve: g: Defective actuation of steering spool	Steering valve: h: Defective safety-suction valve	Cylinder i: Defect in steering cylinder (defective piston seal)
			△ x	△ x	△ x	△ x	△ x	△ x	△	△ x	△ x
1	When machine turns, it shakes or jerks in both directions (left and right)		○	○	○		○	○	○		○
2	When machine turns, it shakes or jerks in both directions (left and right)					○				○	
3	During operations or when traveling (steering is neutral), the machine shakes or jerks								○	○	○
4	Machine jerks or there is excessive shock when steering is operated to end of its stroke					○					
5	Work equipment also jerks		○	○							
6	When steering relief pressure is measured	Oil pressure is unstable in both directions (left and right)	○	○	○		○	○	○		○
7		Oil pressure is unstable in one direction (left or right)				○				○	
8	When Orbit-roll output pressure is measured	Oil pressure is unstable in both directions (left and right)	○	○	○						
9		Oil pressure is unstable in one direction (left or right)				○					
10	When Orbit-roll basic pressure is measured, oil pressure is found to be unstable		○	○							

H-14 When machine turns, it shakes or makes large shocks [machine with AJSS]

Check of abnormality

- Is the steering difficult to turn? → **See H-8**
- Is there any abnormal noise from around the steering equipment

Checks before troubleshooting

- Is the AJSS play correct?
- Is the AJSS followup link properly adjusted?
- Is the tire inflation pressure correct?

No.	Diagnosis \ Remedy		Cause: Defective brake pump (a)	Defective accumulator charge valve (b)	Defective actuation of EPC solenoid valve (c)	Defective actuation of rotary valve (d)	Defective actuation of demand spool (e)	Defective main relief valve (f)	Defective actuation of steering spool (g)	Defective safety-suction valve (h)	Defect in steering cylinder (defective piston seal) (i)
	Hydraulic pump										
	Charge valve										
	AJSS EPC solenoid valve										
	Rotary valve										
	Steering valve										
	Cylinder										
	Remedy		△ x	△ x	x	△ x	△ x	△ x	△	△ x	△ x
1	When machine turns, it shakes or jerks in both directions (left and right)		○	○	○	○	○	○	○		○
2	When machine turns, it shakes or jerks in one directions (left or right)									○	
3	During operations or when traveling (steering is neutral), the machine shakes or jerks								○	○	○
4	Work equipment also jerks		○	○							
5	When steering relief pressure is measured	Oil pressure is unstable in both directions (left and right)	○	○	○	○	○	○	○		○
6		Oil pressure is unstable in one direction (left or right)								○	
7	When Orbit-roll output pressure is measured	Oil pressure is unstable in both directions (left and right)	○	○	○	○					
8		Oil pressure is unstable in one direction (left or right)									
9	When AJSS EPC solenoid valve basic pressure is measured, oil pressure is found to be unstable		○	○							

H-15 Wheel brake does not work or does not work well

Check of abnormality

- Test the effectiveness of the brake referring to “Measuring brake performance” in “Testing and adjusting” to check whether the abnormality actually occurs or is a matter of operator's sense

Ask the operator about the following:

- Has the brake come not to work suddenly?
  → **Breakage of brake**
  Did any abnormal noise occur at the time and where?
- Has the brake come not to work gradually?
  → **Wear of related equipment, defective seal**

Checks before troubleshooting

- Is oil level and type of oil in hydraulic tank correct?
- Is the play of brake pedal appropriate?
- Isn't the oil leaked from brake piping or tube deformed?
- Are the tire air pressure and the tread state appropriate?

		Cause														
		Brake pump			Charge valve	Accumulator	Brake valve		Slack adjuster	Wheel brake				Others	
		a	b	c	d	e	f	g	h	i	j	k	l	m	n
No.	Diagnosis \ Remedy	Defective PTO	Air intake on suction side	Defective brake pump	Defective accumulator charge valve	Gas leakage from accumulator, defective seal of piston	Defective left brake valve	Defective right brake valve	Defective slack adjuster	The brake piston seal is defective	Defective operation of brake piston	Internal breakage of brake	Wear of brake disc	Air in brake circuit	Improper axle oil
		△ x	△	△ x	△ x	x	△ x	△ x	△ x	△ x	△ x	△ x	△ x	△	x
1	The brake does not work only when the left brake pedal is stepped on						○								
2	When the left brake pedal is stepped on, only a little resistance is felt	○	○	○	○		○	○		○				○	
3	When the right brake pedal is stepped on, only a little resistance is felt	○	○	○	○			○		○				○	
4	When the left brake pedal is stepped on, a strong resistance is felt						○								
5	When the right brake pedal is stepped on, a strong resistance is felt							○							
6	To get the specified braking force, an extremely strong leg-power is required					○	○	○	○		○				
7	When the brake works, an abnormal noise occurs from the brake											○	○		○
8	Work equipment and steering wheel does not move	○		○											
9	Work equipment and steering wheel move slowly		○	○	○										
10	Abnormal noise comes from around PTO	○													
11	Abnormal noise comes from around hydraulic tank or brake pump		○	○											
12	Much metal powders are mixed in the oil when it is drained from the axle case												○		
13	When the accumulator charge pressure is measured, the oil pressure is low.		○	○	○										
14	The brake does not work immediately when the engine is stopped					○									
15	The brake works after some time lag								○					○	
16	When brake pressure is measured, the oil pressure is low									○					
17	When brake piston pressure effect is measured, the pressure effect is large					○				○					
18	When wear of brake disc is measured, the amount of wear is large											○	○		
19	Air is discharged when the air is bled from the brake system													○	

H-16 Wheel brake is not released or it drags

Ask the operator about the following:

- Was the brake locked suddenly? → **Breakage of related equipment**
  Did the machine cause any abnormal noise at the time and where?

Checks before troubleshooting

- Has the brake pedal returned completely?
- Isn't the parking brake turned ON?

No.	Diagnosis \ Remedy	Cause: Brake valve a: Defective left brake valve △ x	Cause: Brake valve b: Defective right brake valve △ x	Cause: Slack adjuster c: Defective operation of slack adjuster x	Cause: Wheel brake d: Defective operation of brake piston △ x	Cause: Wheel brake e: Seizure of brake disc plate x
1	The machine does not travel at all	○	○			
2	The machine travels a little			○	○	○
3	When residual pressure in the brake accumulator circuit is released using only the left brake pedal, the brake is released		○			
4	When residual pressure in the brake accumulator circuit is released using only the right brake pedal, the brake is released	○				
5	When air bleeder at wheel is opened, oil leaks out and the brake is released			○		
6	When air bleeder is opened, large amount of oil flows out	○	○			
7	When wear of brake disc is measured and the brake pedal is released, the piston returns					○
8	When wear of brake disc is measured and the brake pedal is released, the piston does not return			○	○	

H-17 Parking brake does not work or does not work well

Ask the operator about the following:

- Has the brake come not to work suddenly? → **Breakage of related equipment**
  Did the machine cause any abnormal noise at the time and where?
- Has the brake come not to work gradually?
  → **Wear of related equipment, defective seal**

Checks before troubleshooting

- Isn't the parking brake emergency release switch turned ON?
- Hasn't the mechanical release of parking brake performed?

No.	Diagnosis / Remedy		Cause: Solenoid a: Defective parking brake solenoid valve	Valve b: Defective parking brake emergency release valve	Parking brake c: Defective parking brake spring	Parking brake d: Defective operation of parking brake piston	Parking brake e: Wear of parking brake disc
			x	△ x	x	△ x	x
1	The parking brake is not applied even if the engine stops				○	○	○
2	When wear of parking brake disc is checked, the disc thickness is lower than Standard value						○
3	When the parking brake inlet pressure is measured	With the parking brake switch ON, there is no oil pressure (Normal)				○	○
4		With the parking brake switch ON, there is a oil pressure	○	○	○		
5	When the parking brake solenoid valve output pressure is measured	With the parking brake switch ON, there is no oil pressure (Normal)		○	○		
6		With the parking brake switch ON, there is a oil pressure	○				

H-18 Parking brake is not released or it drags (including emergency release system)

Check of abnormality

- Is there any abnormality in the power train system?
  → **See H-1, H-4, H-5 and H-6 (Power train hydraulic system)**

No.	Diagnosis / Remedy		Cause: Solenoid a	Valve b	Parking brake c	Parking brake d	Wheel e
			Defective parking brake solenoid valve	Defective parking brake emergency release valve	Defective seal of parking brake piston	Seizure of parking brake disc and plate	Defective operation of wheel brake emergency brake switch
			x	△ x	△ x	x	
1	The parking brake is released when the emergency release switch is turned ON (The parking brake switch does not release the brake)		○	○			
2	The parking brake is released, when “Method of releasing parking brake manually”is executed (The parking brake switch and emergency release switch does not release the brake)		○	○	○		
3	When the parking brake inlet pressure is measured (While operating the parking switch)	Oil pressure is normal			○	○	
4		Oil pressure is low	○	○			
5	When the parking brake output pressure is measured (While operating the emergency release switch)	Oil pressure is normal			○	○	
6		Oil pressure is low	○	○			
7	When the parking brake solenoid valve output pressure is measured, the oil pressure is low		○				
8	When the wheel brake piping oil pressure is measured, the oil pressure is lower than the emergency brake working pressure (3.6 ± 0.49 MPa {37 ± 5 kg/cm^2})						○

★ If any abnormality is left in releasing of the parking brake, check the operation of the power train also, because the power train main relief pressure is used as the parking brake release pressure. (The emergency release circuit uses the wheel brake circuit oil pressure.)

H-19 Lift arm does not rise

Ask the operator about the following:

- Did the lift arm stop suddenly?
  → **Seizure or breakage of each component**
  Did abnormal sound come out when the lift arm stopped?
  (From what part)
- Has the speed lowered?
  → **Wear of parts and fatigue of springs**

Checks before troubleshooting

- Is the oil level in the hydraulic tank proper?
- Is the stroke of the lift arm control lever proper?
- Is the engine speed proper?
- Has the machine monitor displayed any failure code?
  → **See Troubleshooting by failure code (Display of code)**

No.	Diagnosis \ Remedy	Cause									
			Tank – Work equipment pump			Work equipment valve				Bypass valve	Cylinder
		a	b	c	d	e	f	g	h	i	j
		Clogging or air intake on pump suction side	Defective PTO	Defective work equipment pump servo	Defective work equipment pump	Defective operation of main relief valve	Defective operation of unload valve	Defective operation of lift arm load check valve	Internal breakage of valve body (lift arm spool)	Defective operation of spool	Damaged lift arm cylinder piston seal
	C △	△ x	△ x	△ x	△ x	△ x	△ x	x	x	x	
1	Bucket does not move and lift arm does not rise	○	○	○	○	○					
2	Lift arm can raise chassis but does not rise								○		○
3	Bucket moves but lift arm does not rise								○		○
4	Lift arm can rise when not loaded but cannot when loaded	○			○	○	○	○			
5	Work equipment pump is making abnormal sound	○			○						
6	Hydraulic drift of lift arm cylinder is large							○	○	○	○
7	When lift arm and bucket are operated simultaneously, lift arm does not rise								○		
8	When work equipment pump and servo assembly is replaced, lift arm rises normally			○							

H-20 Lift arm speed is low or rising force of lift arm is insufficient

Checks before troubleshooting

- Is the stroke of the lift arm control lever proper?
- Is the engine speed proper?

Check of abnormality

- The troubles of the rising force and rising speed are strongly related to each other. The rising speed lowers first. Measure the lift arm rising speed while it is loaded and check abnormality with the “Standard values table.”

		Cause								
		Tank – Work equipment pump			Work equipment valve					Cylinder
		a	b	c	d	e	f	g	h	i
		Clogging or air intake on pump suction side	Defective work equipment pump servo	Defective work equipment pump	Defective operation of main relief valve	Defective operation of unload valve	Defective operation of ECSS charge valve	Defective operation of lift arm load check valve	Internal wear or breakage of valve body (lift arm spool)	Damaged lift arm cylinder piston seal
No.	Diagnosis \ Remedy	C △	△ x	△ x	A △ x	△ x	△ x	C △ x	x	x
1	Tilting force and speed of bucket are abnormal and rising speed of lift arm is low	○	○	○	○	○	○			
2	Tilting force and speed of bucket are normal and rising speed of lift arm is low							○	○	○
3	After oil temperature rises, rising speed lowers more in step 1			○						
4	Work equipment pump is making abnormal sound	○		○						
5	Hydraulic drift of cylinder is large							○	○	○
6	Relief oil pressure of relief valve of work equipment valve is low				○	○	○		○	○
7	When work equipment pump and servo assembly is replaced, lift arm moves normally		○							

H-21 When rising, lift arm comes to move slowly at specific height

Checks before troubleshooting

- Deformation of lift arm cylinder in appearance

Cause

- Expansion of lift arm cylinder tube or damage inside

★ For other abnormal phenomena during lift arm rise, see “H-20 Lift arm speed is low or rising force of lift arm is insufficient”

H-22 Lift arm cylinder cannot hold down bucket (Bucket floats)

See “H-20 Lift arm speed is low or rising force of lift arm is insufficient.”

Checks before troubleshooting

- Is the stroke of the lift arm control lever appropriate?

Cause

- Defective seat of suction valve on the lift arm cylinder head side of work equipment valve
- Oil leak from lift arm cylinder piston seal

H-23 Hydraulic drifts of lift arm occur often

Ask the operator about the following:

- Have hydraulic drifts come to occur often suddenly? → **Wastes pinched in valve or damage of parts**
- Have hydraulic drifts come to occur often gradually? → **Wear of parts**

Checks before troubleshooting

- Is the lift arm spool at the neutral position? → The spool detent is defective

Check of abnormality

- Check the hydraulic drift of the lift arm with the “Standard values table.”

Cause

- Oil leakage in lift arm cylinder
- Imperfect fitting of suction valve on bottom side
- Imperfect fitting of lift arm spool

H-24 Lift arm wobbles during operation

The bucket and the lift arm moves up and down as the topography goes in digging or leveling with the lift arm control lever in the HOLD position.

Diagnosis and Cause

Check at first the hydraulic drift and if the lift arm cylinder can lift the machine

1. When the hydraulic drift is more than the standard value, see “H-23 Hydraulic drifts of the lift arm occur often.”
2. If the lift arm cylinder can lift the machine, see “H-20 Lift arm speed is low or rising force of lift arm is insufficient.”
3. When the lift arm cylinder comes to enable to lift the machine after the lift arm is operated several times with the normal hydraulic drift and after the lift arm cylinder operates to full stroke
   → **The cause is vacuum generated inside the cylinder**
   ★ Frequent hydraulic drifts → **The suction valve on the lift arm cylinder head side is defective**

H-25 Bucket does not tilt back

Ask the operator about the following:

- Did the bucket stop suddenly?
  → **Seizure or breakage of each component**
  Did abnormal sound come out when the lift arm stopped?
  (From what part)
- Has the speed lowered? → **Wear of parts and fatigue of springs**

Checks before troubleshooting

- Is the oil level in the hydraulic tank proper?
- Is the stroke of the bucket control lever proper?
- Is the engine speed proper?
- Has the machine monitor displayed any failure code?
  → **See Troubleshooting by failure code (Display of code)**

No.	Diagnosis \ Remedy	Cause: Tank – Work equipment pump				Cause: Work equipment valve					Cause: Cylinder
		a	b	c	d	e	f	g	h	i	j
		Clogging or air intake on pump suction side	Defective PTO	Defective work equipment pump servo	Defective work equipment pump	Defective operation of main relief valve	Defective operation of unload valve	Defective operation of bucket bottom safety valve (Suction safety valve)	Defective operation of bucket bottom suction valve (Suction safety valve)	Internal breakage of valve body (lift arm spool)	Damaged bucket cylinder piston seal
		C △	△ x	△ x	△ x	△ x	△ x	△ x	C △ x	x	x
1	Lift arm does not move and bucket does not tilt back	○	○	○	○	○					
2	Bucket can raise chassis but does not tilt back									○	○
3	Lift arm moves but bucket does not tilt back									○	○
4	Bucket can tilt back when not loaded but cannot when used for digging or scooping	○			○	○	○	○	○		
5	Work equipment pump is making abnormal sound	○			○						
6	Hydraulic drift of bucket cylinder is large							○	○	○	○
7	When lift arm and bucket are operated simultaneously, bucket does not tilt back									○	
8	When work equipment pump and servo assembly is replaced, bucket moves normally			○							

H-26 Bucket speed is low or tilting back force is insufficient

Checks before troubleshooting

- Is the stroke of the bucket control lever proper?
- Is the engine speed proper?
- Is the work equipment linkage bushing normal (Is abnormal sound made)?

Check of abnormality

- Check by actual operation that the tilting back force is insufficient.
- Measure the operating speed of the bucket and check it with the “Standard value table.”

No.	Diagnosis \ Remedy	Cause: Tank – Work equipment pump a: Clogging or air intake on pump suction side (C △)	b: Defective work equipment pump servo (△ x)	c: Defective work equipment pump (△ x)	Work equipment valve e: Defective operation and defective adjustment of main relief valve (A △ x)	f: Defective operation of unload valve (△ x)	g: Defective operation of ECSS charge valve (△ x)	h: Defective operation of bucket bottom safety valve (Suction safety valve) (△ x)	i: Defective operation of bucket bottom suction valve (Suction safety valve) (C △ x)	j: Internal breakage of valve body (bucket spool) (x)	Cylinder k: Damaged bucket cylinder piston seal (x)
1	Rising force and speed of lift arm are abnormal and tilting back force and speed of bucket are low	○	○	○	○	○	○				
2	Rising force and speed of lift arm are normal and tilting back force and speed of bucket are low							○	○	○	○
3	After oil temperature rises, tilting back speed lowers more in step 1.			○							
4	Work equipment pump is making abnormal sound	○		○							
5	Hydraulic drift of the cylinder is large							○	○	○	○
6	Relief oil pressure of relief valve of work equipment valve is low				○	○	○	○	○	○	○
7	When work equipment pump and servo assembly is replaced, bucket moves normally		○								

H-27 Bucket comes to operate slowly in the midst of tilting-back

Checks before troubleshooting

- Deformation of bucket cylinder in appearance

Cause

- Expansion of bucket cylinder tube or damage inside
  For other abnormal phenomena during bucket operation, see “H-26 Bucket speed is low or tilt-back force is insufficient.”

H-28 Bucket cylinder cannot hold down bucket

See “H-26. The bucket moves slowly or the tilting-back force is insufficient.”

Checks before troubleshooting

- Is the stroke of the bucket control lever appropriate?

Cause

- Defective seat of safety valve (with suction valve) on the bucket cylinder head side of work equipment valve
- Oil leak from bucket cylinder piston seal

H-29 Hydraulic drifts of bucket occur often

Ask the operator about the following:

- Have hydraulic drifts come to occur often suddenly? → **Wastes pinched in valve or damage of parts**
- Have hydraulic drifts come to occur often gradually? → **Wear of parts**

Checks before troubleshooting

- Is the bucket spool at the neutral position? → The spool detent is defective

Check of abnormality

- Refer to the “Standard value table” and check if the hydraulic drift of the bucket occurs often practically

Cause

- Oil leak in bucket cylinder
- Improper adhesion of safety valve (With suction valve) on the bottom side
- Improper oil tight of bucket spool

H-30 Bucket wobbles during travel with cargo (Work equipment valve is set to “HOLD”)

Cause

- Defective seal of bucket cylinder piston
- Defective operation of safety valve (With suction valve) on bucket cylinder head side. For other abnormal phenomena, refer to diagnoses for relevant abnormal phenomena.

H-31 During operation of machine, engine speed lowers remarkably or engine stalls

Checks before troubleshooting

Is the working equipment main relief pressure normal?

Cause

- Defective work equipment pump servo
- Defective working equipment pump unit
- Defective working equipment pump servo EPC input voltage
- Defective engine system

H-32 Large shocks are made when work equipment starts and stops

Cause

- Defective operation of control valve spool
- Defective working equipment electric lever system
  → **See Troubleshooting by failure code (Display of code)**

H-33 When work equipment circuit is relieved singly, other work equipment moves

Cause

- Pressure is not released properly from main spool of moving equipment → **Replace main spool**

H-34 ECSS does not operate, and pitching bouncing occurs

Ask the operator about the following:
- Did pitching bouncing occur suddenly? → **Breakage of related equipment**
  Did any abnormal noise occur at the time and where?
- Has pitching bouncing occurred gradually? → **Wear of related equipment, defective seal**

Checks before troubleshooting
- Is the state of ECSS switch proper?
- Is the setting of the DIP switch 4 on the back side of the main monitor appropriate?
  (See “Adjusting machine monitor (Speedometer module)” in “Testing and adjusting.”)

No.	Diagnosis \ Remedy	Cause: Defective ECSS solenoid valve (a)	Gas leakage from accumulator, defective seal (b)	Defective operation of work equipment controller (c)	Defective transmission output shaft speed sensor (d)
		Solenoid valve	Accumulator	Controller	Sensor
		a	b	c	d
		x	x	x	A x
1	The ECSS actuation speed (5 km/h) largely fluctuates			○	○
2	The ECSS does not operate under no load		○	○	
3	When the ECSS operates under load, the lift arm lowers the maximum distance (30 cm or more)			○	
4	The ECSS does not operate at all	○	○	○	○

WA600-6 Wheel loader

Form No. SEN00564-00

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Printed in Japan 01-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

40 Troubleshooting

Troubleshooting of engine (S-mode)

Troubleshooting of engine (S-mode) ... 3
Method of using troubleshooting chart ... 3
S-1 Engine does not start easily. ... 6
S-2 Engine does not start ... 8
S-3 Engine does not pick up smoothly ... 12
S-4 Engine stops during operation ... 13
S-5 Engine does not rotate smoothly ... 14
S-6 Engine lacks output (or lacks power) ... 15
S-7 Exhaust smoke is black (Incomplete combustion) ... 16
S-8 Oil is consumed much (or exhaust gas color is blue) ... 18
S-9 Engine oil becomes contaminated quickly ... 19
S-10 Fuel consumption is excessive ... 20
S-11 Coolant contains oil (blows back or reduces) ... 21
S-12 Oil pressure drops ... 22
S-13 Oil level rises (Water, fuel in oil) ... 24
S-14 Coolant temperature rises too high (Overheating) ... 26

S-15 Abnormal noise is made 27
S-16 Vibration is excessive 28

Troubleshooting of engine (S-mode)

Method of using troubleshooting chart

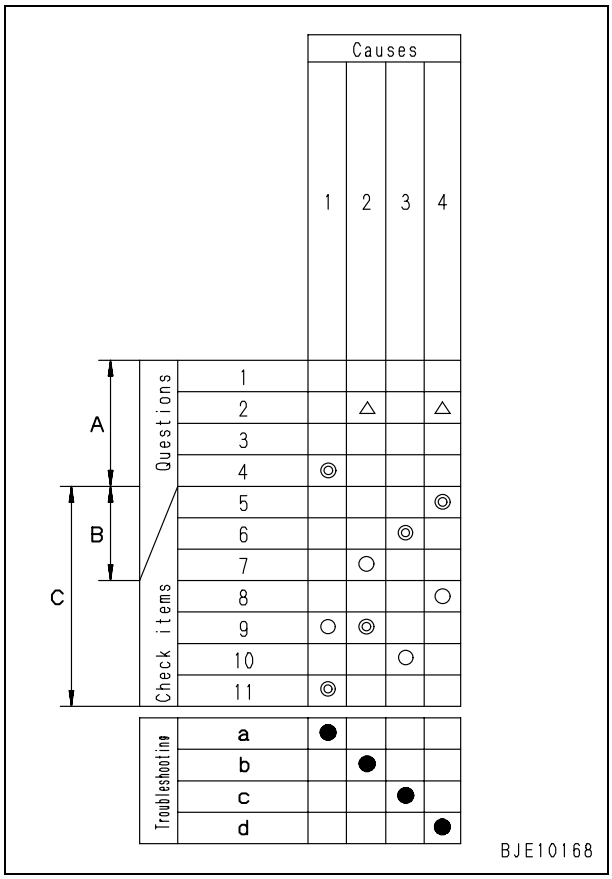
This troubleshooting chart is divided into three sections: questions, check items, and troubleshooting.
The questions and check items are used to pinpoint high probability causes that can be located from the failure symptoms or simple inspection without using troubleshooting tools.
Next, troubleshooting tools or direct inspection are used to check the high probability causes to make final confirmation.

Questions:
Sections **A** + **B** in the right corresponds to the items were answers can be obtained from the user or operator.
A is the basic content. **B** is the items that can be obtained from the user or operator depending on their level.

Check items:
Simple items checked by the serviceman to determine the causes. **C** in the chart to the right corresponds to them.

Causes:
The contents to be determined after asking questions and checking items.
The serviceman determines causes of high probability from **A**, **B**, and **C**.

Troubleshooting:
The content for ultimately verifying whether the determined causes are truly the defective factors by using troubleshooting tools or making direct checking starting with probable causes of higher order.

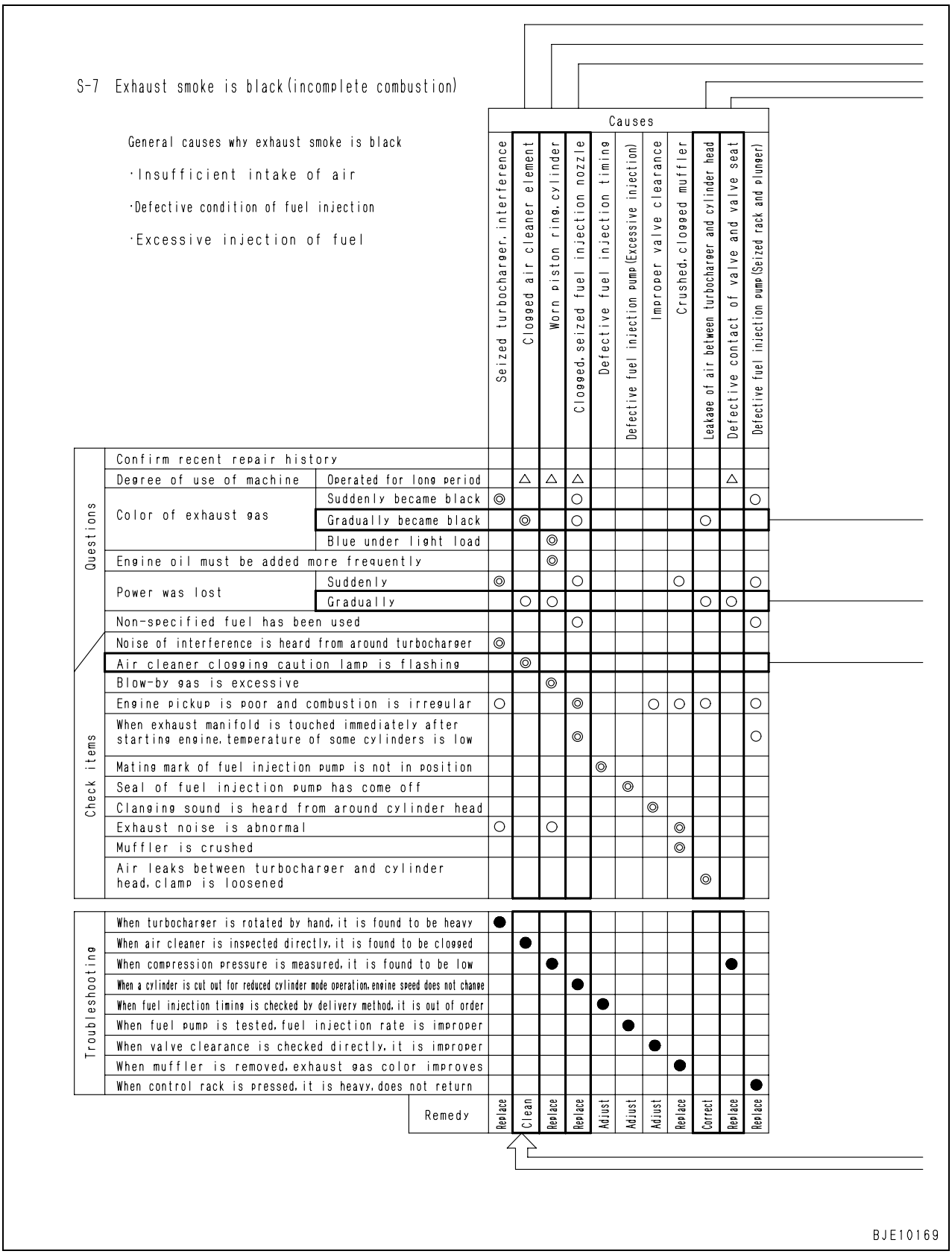


This troubleshooting chart marks the content of the questions and check items with △, ○ or ◎ according to their closer relationship with the causes.

- △: A cause that can be referred to in relation to the question or check item.
- ○: A cause that is related the question or check item.
- ◎: A cause particularly probable among those marked with ○ above.
- ★ Count the priority level of each marking as ◎ > ○ when determining the cause.
  Don't count △ when determining the cause. The item with this marking may be counted, however, if no difference is present than this and the cause cannot be determined.

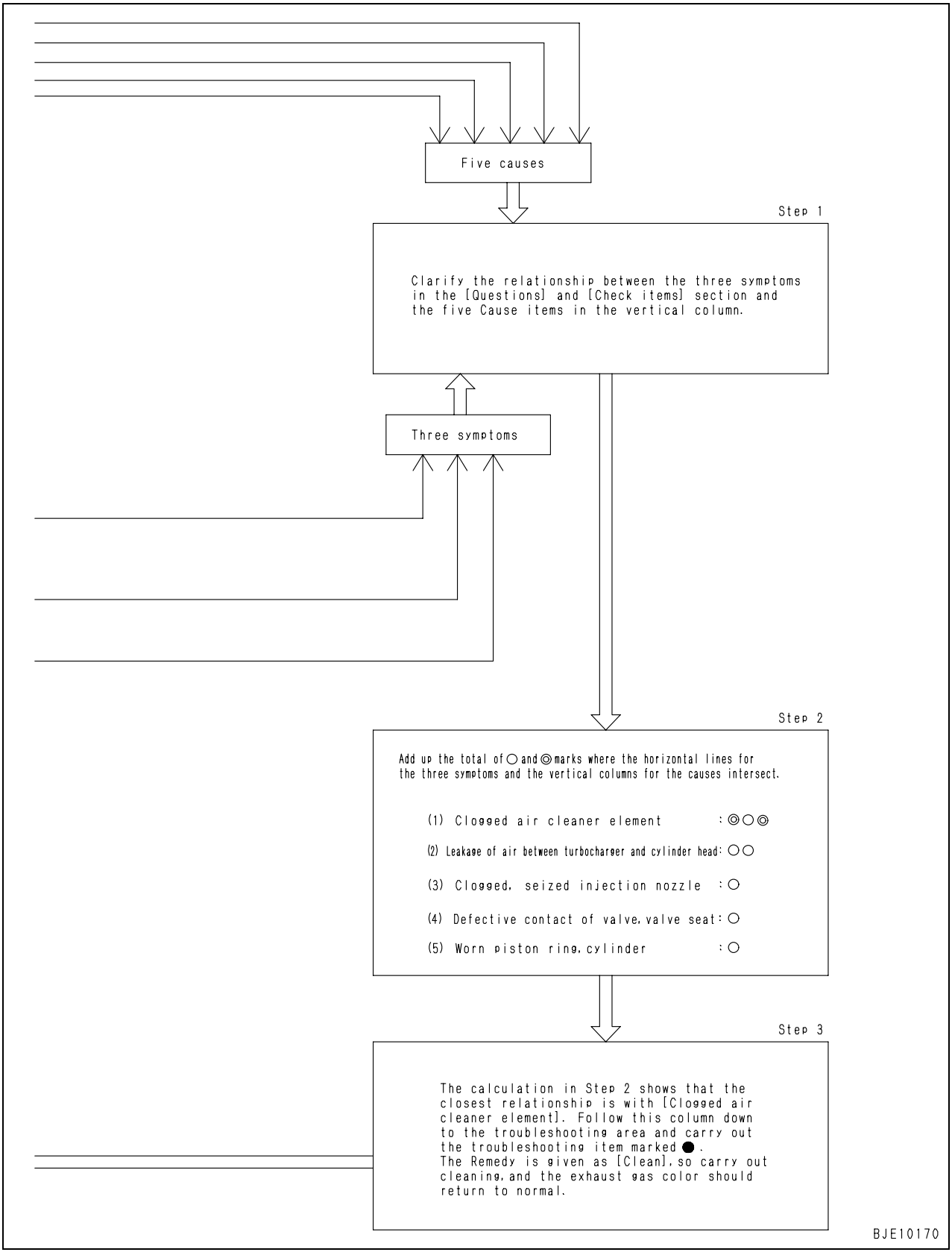
<Example of troubleshooting> Exhaust smoke is black

Let us assume that the questions and item check were conducted when a defect of black exhaust gas is detected. Now suppose that three symptoms have causal relationship with this problem: namely, [Exhaust gas gradually became black], [Power was lost gradually], and [Dust indicator turned red].



If we look from these 3 symptoms to find the causes, we find that there is a relationship with 5 causes.

Procedure for determining the causes from these relationship and leading to the troubleshooting will be explained in step 1 to 3 in the following diagram.



S-1 Engine does not start easily.

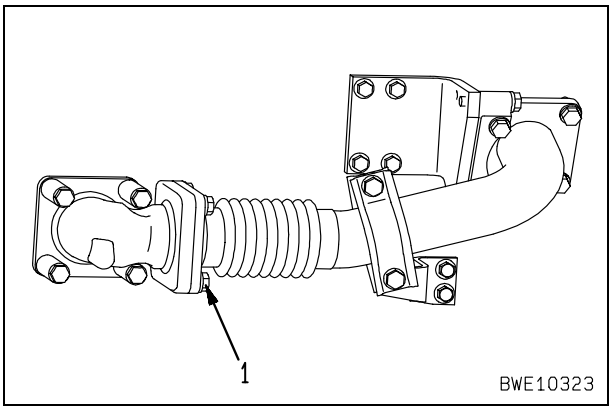
General causes for poor startability include the following

- Electrical system is not normal
- Fuel level is low
- Air intake is in short
- Wrong fuel selection
- Coolant mixing in the exhaust pipe
- ★ Common rail type fuel injection system (CRI) recognizes the fuel injection timing electrically. Therefore, there are cases where the engine does not start before the crankshaft makes two revolutions maximum after starting operation. This is not an abnormal state, however.

			Cause														
			Clogged air cleaner element	Cracked EGR cooler (coolant mixing in the exhaust)	Defective contact of valve, valve seat	Wear of piston ring, cylinder	Clogged air breather hole in fuel tank cap	Leakage, clogging, air in fuel piping	Clogged fuel filter, element	Clogging of feed pump gauze filter	Stuck or seized supply pump plunger	Defective injector	Defective intake air heater system	Defective alternator (regulator)	Defective alternator (generator)	Defective or deteriorated battery
Questions	Confirm recent repair history															
	Degree of use of machine	Operated for long period	△	△					△	△						△
	Ease of starting	Gradually became worse	○	○	◎	◎			○	○						
		Starts when warm											◎			◎
	Non-specified fuel is being used								○	○	○	○				
	Replacement of filters not carried out according to Operation & Maintenance Manual		◎						◎	◎	○	○				
	Engine oil must be added more frequently					◎										
	Preheat monitor does not indicate normal operation during preheating or at low temperature (With monitor installed)												◎			
	Charge level monitor indicates abnormal charging during operation (with monitor installed)													◎	◎	
Check items	Dust indicator lamp is red (with indicator installed)		◎													
	Clogged air breather hole in fuel tank cap						◎									
	Leakage from fuel piping							◎			○					
	No response or heavy resistance felt when operating priming pump							◎	○	○						
	Starting motor cranks engine slowly			○												◎
	When engine is cranked with starting motor,	and air breathing plug is removed from fuel filter, fuel fails to be discharged							◎	◎						
		When spill hose is separated from injector, spill flow drops									◎					
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low											◎				
	Engine does not pick up smoothly, and combustion is irregular				○	○						◎				
	There is hunting from engine (rotation is irregular)						○	◎	○	○						
	Blow-by gas is excessive					◎										
Troubleshooting	Inspect air cleaner directly		●													
	Removing EGR cooler outlet gas piping causes coolant containing antifreeze to flow out (*1)			●												
	When compression pressure is measured, the oil pressure is low.				●	●										
	Air is discharged when air is bled from fuel system							●								
	Inspect fuel filter, strainer directly								●							
	Inspect fuel feed pump gauze filter directly									●						
	Carry out troubleshoot by “Rail Press Very Low Error (*2)”										●					
	Speed of some cylinders does not change when operated in reduced cylinder mode											●				
	Intake air heater mount does not warm up during preheating operation												●			
	Is voltage 26 – 30V between alternator terminal B and terminal E with engine at low idle?	Yes												●		
		No													●	
	Specific gravity of electrolyte and voltage of battery are low															●
		Remedy	Clean	Replace	Correct	Replace	Clean	Correct	Clean	Clean	Replace	Replace	Replace	Replace	Replace	Replace

For *1 and *2, see the next page

*1: EGR cooler inlet gas piping
Loosen 4 mount bolts (1) of gas piping to EGR cooler inlet and check the flowout of coolant.
Condensed water from cooled exhaust gas may come out in small quantity but it poses no problem if colorless and transparent.



*2: Troubleshooting by failure code (Display of code), Code [**CA559**], and Code [**CA2249**]

S-2 Engine does not start

a) Engine does not crank

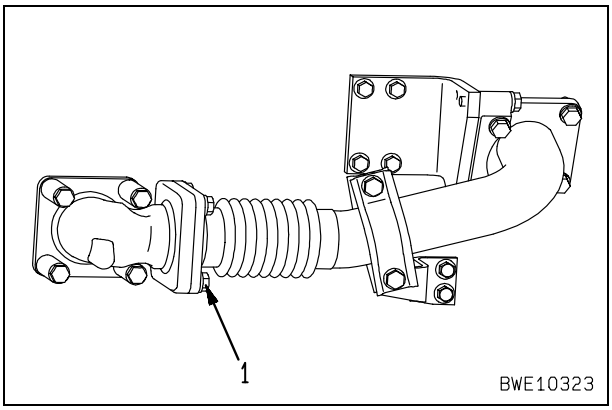
General causes why engine does not turn

- Seizure inside engine:
  See the troubleshooting for “S-4 Engine stops during operations”.
- Coolant mixing inside cylinder causing water hammer
- Electrical system is not normal
- Defective drive unit on applicable machine side:
  Carry out troubleshooting on applicable machine side

			Cause								
			Cracked EGR cooler (coolant mixing in the exhaust)	Damaged flywheel ring gear	Defective or deteriorated battery	Defective battery terminal connection	Defective battery relay	Defective starting switch	Defective starting motor (Safety relay section)	Defective starting motor (Motor section)	Defective wiring of starting circuit
Questions / Check items	Confirm recent repair history										
	Degree of use of machine	Operated for long period	△	△	△						
	Condition of horn when starting switch is turned ON	Does not sound.				○		○			◎
		Horn volume is low			◎						
	Battery electrolyte level is low				◎						
	Battery terminal is loose					◎					
	No operating sound from battery relay when starting switch is turned ON				○		◎				
	When starting switch is turned to START, pinion does not move out				○			○			◎
	When starting switch is set to START, the starting pinion comes out, but	Speed of rotation is low	○		◎						
		Makes grating noise		◎					◎		
		Soon disengages pinion again							◎		
		Makes rattling noise and does not turn	◎		○				○	◎	
Troubleshooting	Removing EGR cooler outlet gas piping causes coolant containing antifreeze to flow out(*1)		●								Carry out troubleshooting on applicable machine side
	Inspect flywheel ring gear directly			●							
	Specific gravity of electrolyte and voltage of battery are low				●						
	Turn the starting switch OFF, connect the cord, then turn starting switch ON and carry out troubleshooting	There is no voltage (20 – 30V) between battery relay terminal B and terminal E					●				
		When terminal B and terminal C of starting switch are connected, engine starts						●			
		When the safety relay outlet terminal B and terminal C are connected, engine starts							●		
		When the safety relay outlet terminal B and terminal C are connected, engine does not start								●	
		Remedy	Replace	Replace	Replace	Correct	Replace	Replace	Replace	Replace	—

For *1, see the next page

*1: EGR cooler inlet gas piping
Loosen 4 mount bolts (1) of gas piping to EGR cooler inlet and check the flowout of coolant.
Condensed water from cooled exhaust gas may come out in small quantity but it poses no problem if colorless and transparent.



b) Engine turns but no exhaust smoke comes out

General causes why engine turns but no exhaust smoke comes out

- Fuel is not being supplied
- Supply of fuel extremely small
- Improper selection of fuel (particularly in winter)

			Cause														
			Improper fuel used	Insufficient fuel in tank	Clogged air breather hole in fuel tank cap	Leakage, clogging, air in fuel piping	Clogged fuel filter element	Clogged feed pump gauze filter	Seizure or abnormal wear of feed pump	Broken supply pump shaft, key	Stuck or seized supply pump plunger	Defective supply pump PCV	Wrong connection of supply pump PCV	Defective operation of overflow valve (not closing)	Defective operation of flow damper	Defective fuel injector
Questions / Check items	Confirm recent repair history																
	Degree of use of machine	Operated for long period				△	△	△									
	Exhaust smoke suddenly stops coming out (when starting again)								◎	○	◎	◎	◎		△	△
	Replacement of filters not carried out according to Operation & Maintenance Manual						◎	◎			△					○
	Fuel tank is found to be empty			◎												
	Clogged air breather hole in fuel tank cap			○	◎											
	Rust and water are detected when fuel tank is drained						○	○	○		○	○				
	When fuel filter is removed, no fuel is inside the fuel filter		◎			◎										
	Leakage from fuel piping					◎										
	When engine is cranked with starting motor,	and the air breathing plug is removed from the fuel filter, fuel fails to discharge		○		○			◎	○						
		When spill hose is separated from injector, spill flow drops				○				◎	◎	◎	◎			○
Troubleshooting	Air is discharged when the air is bled from the fuel system					●										
	Inspect the fuel filter directly						●									
	Inspect the fuel feed pump gauze filter directly							●								
	Inspect feed pump directly								●							
	Carry out troubleshoot by “Rail Press Very Low Error (*1)”									●	●		●			●
	Carry out troubleshoot by “PCV1 Error (:2) or PCV2 Error (*3)”											●				
	Inspect overflow valve directly													●		
	Engine can start when operated in reduced cylinder mode														●	●
		Remedy	Replace	Add	Correct	Correct	Replace	Clean	Replace	Replace	Replace	Replace	Correct	Replace	Replace	Replace

*1: Troubleshooting by failure code (Display of code), Code [**CA559**], and Code [**CA2249**]
*2: Troubleshooting by failure code (Display of code), Code [**CA271**], and Code [**CA272**]
*3: Troubleshooting by failure code (Display of code), Code [**CA273**], and Code [**CA274**]

c) Exhaust smoke comes out but engine does not start (Fuel is being injected)

General causes why exhaust smoke comes out but engine does not start

- Rotating force in short due to defective electrical system
- Supply of fuel small
- Small air intake
- Improper selection of fuel

			Cause													
			Clogged air cleaner element	Wear of valve system (valve, rocker lever, etc.)	Worn piston ring, cylinder liner	Improper fuel used	Clogged air breather hole in fuel tank cap	Leakage, clogging, air in fuel piping	Clogged fuel filter, strainer	Clogged feed pump gauze filter	Stuck or seized supply pump plunger	Clogged injection nozzle, defective spray	Defective or deteriorated battery	Defective coolant temperature sensor or defective wiring harness	Defective intake air heater system
Questions / Check items	Check recent repair history														
	Degree of machine operation	Machine operated for long period			△				△	△		△			
	Suddenly failed to start			◎							◎			○	
	Non-specified fuel is being used										○	○			
	Replacement of filters not carried out according to Operation & Maintenance Manual		◎						◎	◎					
	Engine oil replenishment increasing				◎										
	Preheat monitor not indicating normal operation during preheating or at low temperature (when monitor installed)														◎
	Dust indicator turned red (with indicator installed)		◎												
	Clogged air breather hole in fuel tank cap						○								
	Rust and water are detected when fuel tank is drained								◎	◎					
	When removed, no fuel is inside the fuel filter					◎									
	Leakage from fuel piping							◎							
	Starting motor cranks engine slowly												◎		
	When engine is cranked, abnormal noise is heard from around cylinder head			◎											
	When engine is cranked with starting motor,	Fuel fails to discharge, when bleeding air plug of the fuel filter is removed				○			◎	◎					
		Spill flow drops, when spill hose is separated from injector									◎				
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low											◎			
Troubleshooting	Inspect air cleaner directly		●												
	Inspect valve system directly			●											
	When compression pressure is measured, the oil pressure is low.				●										
	Air is discharged when the air is bled from the fuel system							●							
	Inspect the fuel filter, strainer directly								●						
	Inspect the fuel feed pump gauze filter directly									●					
	Carry out troubleshoot by “Rail Press Very Low Error (*1)”										●				
	Testing a single unit injector indicates defective spraying											●			
	Specific gravity of electrolyte and voltage of battery are low												●		
	Coolant temperature gauge indication is not normal (when the gauge is installed)													●	
	Intake air heater mount does not warm up during preheating operation														●
		Remedy	Clean	Replace	Replace	Replace	Clean	Correct	Clean	Clean	Replace	Clean	Replace	Replace	Replace

*1: Troubleshooting by failure code (Display of code), Code [**CA559**], and Code [**CA2249**]

S-3 Engine does not pick up smoothly

General causes why engine does not pick up smoothly
- Insufficient intake of air
- Insufficient supply of fuel
- Fuel injection condition not normal
- Improper selection of fuel
- Controller in derate control mode
  (Controlling injection capacity (output) due to an error in the electrical system)
- EGR valve is stuck in open state
  (Shortage of air intake due to excessive EGR gas)

			Cause													
			Clogged air cleaner element	Stuck EGR valve	Defective contact of valve and valve seat	Improper valve clearance	Seizure and interference of turbocharger	Worn piston ring, cylinder liner	Clogged air breather hole in fuel tank cap	Leakage, clogging, air in fuel piping	Clogged fuel filter, strainer	Clogged feed pump gauze filter	Stuck or seized supply pump plunger	Defective operation of flow damper (excessive injector leakage)	Clogged injection nozzle, defective spray
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period	△	△	△			△			△	△			
	Engine pick-up suddenly became poor			○			◎		○	○					○
	Non-specified fuel is being used										◎	◎	◎		◎
	Replacement of filters has not been carried out according to Operation & Maintenance Manual		◎								◎	◎			
	Engine oil must be added more frequently							◎							
Check items	Dust indicator is red (with indicator installed)		◎												
	Clogged air breather hole in fuel tank cap								◎						
	Rust and water are detected when fuel tank is drained										◎	◎			
	Leakage from fuel piping									◎					
	No response or heavy resistance felt when operating priming pump									◎	○	○			
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low												○		◎
	Color of exhaust gas	Blue under light load						◎							
		Black	◎		○		◎								◎
	When engine is cranked, abnormal noise is heard from around cylinder head					◎									
	When engine is cranked, abnormal noise is heard from around turbocharger						◎								
	High idle speed under no load is normal, but speed suddenly drops when load is applied								○		◎	◎			
	There is hunting from engine (rotation is irregular)								○		○	◎			○
	Blow-by gas is excessive							◎							
Troubleshooting	Inspect air cleaner directly		●												
	Carry out troubleshoot by “EGR Valve Servo Error (*1)” in E-mode.			●											
	When compression pressure is measured, the oil pressure is low.				●			●							
	Inspect valve clearance directly					●									
	When turbocharger is rotated by hand, it is found to be heavy						●								
	Air is discharged when the air is bled from the fuel system									●					
	Inspect the fuel filter, strainer directly										●				
	Inspect the fuel feed pump gauze filter directly											●			
	Carry out troubleshoot by “Rail Press Very Low Error (*2)”												●		
	Speed of some cylinders does not change when operated in reduced cylinder mode													●	●
		Remedy	Clean	Replace	Replace	Adjust	Replace	Replace	Clean	Correct	Clean	Clean	Replace	Replace	Replace

*1: Troubleshooting by failure code (Display of code), Code [**CA1228**], and Code [**CA1625**]
*2: Troubleshooting by failure code (Display of code), Code [**CA559**], and Code [**CA2249**]

S-4 Engine stops during operation

General causes why engine stops during operations

- Seizure inside engine
- Insufficient supply of fuel
- Overheating
- Defective drive unit on applicable machine side:
  Carry out troubleshooting on applicable machine side.

			Cause														
			Breakage of valve system (valve, rocker lever, etc.)	Broken, seized piston or connecting rod	Broken, seized crankshaft metal	Broken, seized gear train	Insufficient fuel in tank	Clogged air breather hole in fuel tank cap	Leakage, clogging in fuel piping	Clogged fuel filter, strainer	Clogged feed pump gauze filter	Broken, seized feed pump	Broken supply pump shaft, key	Stuck or seized supply pump plunger	Broken auxiliary equipment (pump, compressor, etc.)	Failure of drive units on applicable machine side
Questions	Confirm recent repair history																
	Degree of use of machine	Operated for long period								△	△						
	Condition when engine stopped	Abnormal noise was heard and engine stopped suddenly	◎	◎	◎	◎						○	◎	○	◎	◎
		Engine overheated and stopped		◎	○										○	
		Engine stopped slowly					◎			○	○					
		There was hunting and engine stopped					◎	○		○	○	○				
	Non-specified fuel is being used									○	○	○		○		
	Replacement of filters not carried out according to Operation & Maintenance Manual									◎	◎					
Check items	Fuel level monitor indicates low fuel level (with monitor installed)						◎									
	Fuel tank is found to be empty						◎									
	Clogged air breather hole in fuel tank cap							◎								
	Leakage from fuel piping								◎							
	Rust and water are detected when fuel tank is drained									◎	◎					
	Metal particles are found when oil pan is drained			◎	◎						○	○				
	When engine is cranked manually	Does not turn at all		◎	◎											
		Turns in opposite direction	◎													
		Moves by the amount of gear backlash				◎									◎	
		Supply pump shaft does not turn											◎			
	Engine rotates, but stops when loaded on the machine side															◎
Troubleshooting	Inspect valve system directly		●													Carry out troubleshooting on applicable machine side
	Inspect piston and connecting rod directly.			●												
	Inspect crankshaft metal directly				●											
	Inspect gear train directly					●										
	Inspect fuel filter, strainer directly									●						
	Inspect fuel feed pump gauze filter directly										●					
	Inspect feed pump directly											●				
	Carry out troubleshoot by “Rail Press Very Low Error (*1)”												●	●		
	Engine rotates when auxiliary equipment (pump, compressor) is removed														●	
		Remedy	Replace	Replace	Replace	Replace	Add	Clean	Correct	Clean	Clean	Replace	Replace	Replace	Replace	—

*1: Troubleshooting by failure code (Display of code), Code [**CA559**], and Code [**CA2249**]

S-5 Engine does not rotate smoothly

General causes why engine does not rotate smoothly
- Mixing of air in the fuel system
- Rotation sensor is not normal
  (abnormality where it fails to make error indication)
- EGR valve is not normal
- Bypass valve is not normal

			Cause												
			Low idle speed setting is too low	Defective operation of EGR valve	Defective operation of bypass valve	Insufficient fuel in tank	Clogged air breather hole in fuel tank cap	Leakage, clogging, air in fuel piping	Clogged feed pump gauze filter	Clogged fuel filter, strainer	Defective operation of flow damper (excessive injector leakage)	Clogged fuel injector, defective injection	Defective Ne speed sensor or defective wiring harness	Defective Bkup speed sensor or defective wiring harness
Questions	Confirm recent repair history													
	Degree of use of machine	Operated for long period		△	△				△	△				
	Condition of hunting	Occurs at a certain speed range	○	○	○								○	○
		Occurs at low idle	◎					○	○	○	○	○	○	○
		Occurs even when speed is raised		○	○		○						○	○
		Occurs on slope				◎							○	○
	Replacement of filters not carried out according to Operation & Maintenance Manual								◎	◎				
Check item	Fuel tank is found to be empty					◎								
	Clogged air breather hole in fuel tank cap						◎							
	Rust and water are detected when fuel tank is drained								○	○				
	Leakage from fuel pipe							◎						
Troubleshooting	Carry out troubleshoot by “EGR Valve Servo Error (*1)”			●										
	Carry out troubleshoot by “Bypass Valve Servo Error (*2)”				●									
	Air is discharged when the air is bled from the fuel system							●						
	Inspect the fuel feed pump gauze filter directly								●					
	Inspect the fuel filter, strainer directly									●				
	Speed of some cylinders does not change when operated in reduced cylinder mode										●	●		
	Carry out troubleshoot by “Eng Ne Speed Sensor Error (*3)”												●	
	Carry out troubleshoot by “Eng Ne Speed Sensor Error (*4)”													●
		Remedy	Correct	Replace	Replace	Add	Clean	Correct	Replace	Replace	Replace	Replace	Correct or replace	Correct or replace

*1: Troubleshooting by failure code (Display of code), Code [**CA1228**], and Code [**CA1625**]
*2: Troubleshooting by failure code (Display of code), Code [**CA1628**], and Code [**CA1629**]
*3: Troubleshooting by failure code (Display of code), Code [**CA689**]
*4: Troubleshooting by failure code (Display of code), Code [**CA778**]

S-6 Engine lacks output (or lacks power)

General causes why engine lacks output

- Insufficient intake of air
- Insufficient supply of fuel
- Fuel injection condition not normal
- Improper selection of fuel
- Overheating
  See the troubleshooting for “S-14 Coolant Temperature Too High (Overheat)”
- Controller in derate control mode
  (Controlling injection capacity (output) due to an error in the electrical system)

			Cause																
			Clogged air cleaner element	Air leakage from air intake pipe	Seizure or interference of turbocharger	Defective contact of valve and valve seat	Improper valve clearance	Worn piston ring, cylinder liner	Clogged air breather hole in fuel tank cap	Leakage, clogging in fuel piping	Clogged fuel filter, strainer	Clogged feed pump gauze filter	Stuck or seized supply pump plunger	Clogged fuel injector, defective injection	Defective drive of injector (signal or solenoid)	Defective mounting of charge pressure sensor (air leak)	Defective charge pressure sensor or defective wiring harness	Defective fuel temperature sensor or defective wiring harness
Questions	Confirm recent repair history																		
	Degree of use of machine	Operated for long period	△			△		△			△	△							
	Power was lost	Suddenly		○											○	○	○		
		Gradually	○			○		○			○	○		○		○			
	Non-specified fuel is being used										○	○							
	Replacement of filters not carried out according to Operation & Maintenance Manual		◎																
	Engine oil must be added more frequently					○	○	○											
Check items	Dust indicator is red (with indicator installed)		◎																
	Clogged air breather hole in fuel tank cap								◎										
	Leakage from fuel piping									◎									
	Output reduces after a break																		◎
	Color of exhaust gas	Black	◎	◎															
		Blue under light load			◎														
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low													◎					
	When engine is cranked, interfering noise is heard from around turbocharger			◎															
	When engine is cranked, abnormal noise is heard from around cylinder head						◎												
	High idle speed of engine is low														○				
	High idle speed under no load is normal, but speed suddenly drops when load is applied										◎	◎	○						
	Engine does not pick up smoothly, and combustion is irregular			◎					○	○				◎					
	There is hunting from engine (rotation is irregular)								○	○	○	○							
	Blow-by gas is excessive				◎														
Troubleshooting	Inspect air cleaner directly		●																
	Inspect intake air piping directly			●															
	When boost pressure is measured, the oil pressure is low		●	●	●														
	When compression pressure is measured, the oil pressure is low					●		●											
	Inspect valve clearance directly						●												
	Inspect fuel filter, strainer directly										●								
	Inspect fuel feed pump gauze filter directly											●							
	Carry out troubleshoot by “Rail Press Very Low Error (*1)”												●						
	Speed of some cylinders does not change when operated in reduced cylinder mode													●	●				
	Check the mount of boost pressure sensor directly															●			
	Carry out troubleshoot by “Chg Air Press Sensor Error (*2)”																●		
	Carry out troubleshoot by “Fuel Temp Press Sensor Error (*3)”																		●
		Remedy	Clean	Correct	Replace	Replace	Adjust	Replace	Clean	Correct	Replace	Clean	Replace	Replace	Replace	Correct	Replace	Replace

For *1, *2 and *3, see the next page

*1: Troubleshooting by failure code (Display of code), Code [**CA559**], and Code [**CA2249**]
*2: Troubleshooting by failure code (Display of code), Code [**CA122**], and Code [**CA123**]
*3: Troubleshooting by failure code (Display of code), Code [**CA263**], and Code [**CA265**]

S-7 Exhaust smoke is black (Incomplete combustion)

General causes why exhaust smoke is black

- Insufficient intake of air
- Insufficient supply of fuel
- Fuel injection condition not normal
- Improper selection of fuel
- Overheating
  See the troubleshooting for “S-14 Coolant Temperature Too High (Overheat)”
- Controller in derate control mode
  (Controlling injection capacity (output) due to an error in the electrical system)
- EGR valve is stuck in open state
  (Shortage of air intake due to excessive EGR gas)

			Cause															
			Clogged air cleaner element	Seizure or interference of turbocharger	Stuck EGR valve	Defective contact of valve or valve seat	Improper valve clearance	Air leakage between turbocharger and cylinder head	Crushed, clogged muffler	Worn piston ring, cylinder liner	Stuck or seized supply pump plunger	Clogged, seized injector	Abnormal wear of injector	Clogged fuel spill piping (on the cylinder head side)	Improper injection timing	Improper injection pressure	Defective coolant temperature sensor or defective wiring harness
Questions	Confirm recent repair history																	
	Degree of use of machine	Operated for long period	△		△	△				△		△						
	Color of exhaust gas	Suddenly became black		◎	○						○	○						
		Gradually became black	◎					○				○	○					
		Blue under light load								◎								
	Non-specified fuel is being used										○	○						
	Engine oil must be added more frequently									◎								
	Power was lost	Suddenly		◎					○		○	○						
		Gradually	○			○		○		○								
Check items	Dust indicator is red (with indicator installed)		◎															
	Muffler is crushed								◎									
	Leakage of air between turbocharger and cylinder head, loose clamp							◎										
	Operated in low-temperature mode during normal temperature														○	○		○
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low										○	◎						
	When engine is cranked, abnormal noise is heard from around turbocharger		◎															
	When engine is cranked, abnormal noise is heard from around cylinder head						◎											
	Torque converter stall or high pump relief speed (excessive fuel injection)												○	○				
	Exhaust noise is abnormal		○						◎			○						
	Engine does not pick up smoothly, and combustion is irregular		○	○		○	○	○		○	◎							
	Blow-by gas is excessive									◎								
	Spill flow is excessive when spill hose is separated from injector												◎					
Troubleshooting	Inspect air cleaner directly		●															
	When turbocharger is rotated by hand, it is found to be heavy			●														
	Carry out troubleshoot by “EGR Valve Servo Error (*1)”				●													
	When compression pressure is measured, the oil pressure is low.					●				●								
	Inspect valve clearance directly						●											
	When muffler is removed, exhaust color returns to normal								●									
	Carry out troubleshoot by “Rail Press Very Low Error (*2)”										●		●					
	Speed of some cylinders does not change when operated in reduced cylinder mode											●						
	Inspect fuel spill piping (on the cylinder head side) directly													●				
	Carry out troubleshoot by “Coolant Temp Sensor Error (*3)”																	●
		Remedy	Clean	Replace	Replace	Replace	Adjust	Correct	Replace	Replace	Replace	Replace	Replace	Correct	Replace	Replace	Replace	Replace

For *1, *2 and *3, see the next page

*1: Troubleshooting by failure code (Display of code), Code [**CA1228**], and Code [**CA1625**]
*2: Troubleshooting by failure code (Display of code), Code [**CA559**], and Code [**CA2249**]
*3: Troubleshooting by failure code (Display of code), Code [**CA144**], and Code [**CA145**]

S-8 Oil is consumed much (or exhaust gas color is blue)

General causes why oil consumption is excessive
- Abnormal oil combustion
- Extended operation for long hours in low or high idle (continuous no load operation for 20 minutes and longer inhibited)
- Oil leakage to outside
- Wear of lubricating system

			Cause															
			Dust sucked in from intake system	Worn or damaged valve (stem, guide, and seal)	Turbocharger: Worn seal at turbine end	Turbocharger: Wear of seal at blower end	Oil leakage from EGR valve stem	Clogged breather or breather hose	Broken piston ring	Worn piston ring, cylinder liner	Worn, damaged rear seal surface	Broken oil cooler	Leakage from oil cooler	Leakage from oil filter	Leakage from oil piping	Leakage from oil drain plug	Leakage from oil pan, cylinder head, etc.
Questions	Confirm recent repair history																	
	Degree of use of machine	Operated for long period		△	△	△	△			△								
	Oil consumption suddenly increased								◎			○						
	Engine oil must be added more frequently						○			◎		○						
	Engine oil becomes contaminated quickly							○	○	◎								
Check items	Outside of engine is dirty with oil												◎	◎	◎	◎	◎	
	Pipe clamps for intake system are loose		◎															
	Inside of turbocharger air intake outlet pipe is contaminated with oil					◎												
	Inside of turbocharger exhaust outlet pipe is contaminated with oil			○	◎													
	There is oil in the coolant											◎						
	Oil level in clutch or damper chambers on applicable machine side increasing										◎							
	Color of exhaust gas blue under light load						○		◎	◎								
	Amount of blow-by gas	Excessive		○		○			◎	◎								
		None						◎										
Troubleshooting	When intake manifold is removed, dust is found inside		●															
	When intake manifold is removed, inside is contaminated abnormally			●														
	Excessive play of turbocharger shaft				●	●												
	When EGR valve is removed, exhaust port is contaminated with oil						●											
	Inspect breather, breather hose directly							●										
	When compression pressure is measured, the oil pressure is low.								●	●								
	Inspect rear oil seal directly										●							
	Pressure-tightness test of oil cooler shows there is leakage											●	●					
	There is external leakage of oil from engine													●	●	●	●	
		Remedy	Correct	Correct	Replace	Replace	Replace	Clean	Replace	Replace	Correct	Replace	Replace	Correct	Correct	Correct	Correct	

S-9 Engine oil becomes contaminated quickly

General causes why oil becomes contaminated quickly
- Entry of exhaust gas due to internal wear
- Clogging of lubrication route
- Improper fuel is being used
- Improper oil is being used
- Operated under excessive load

			Cause										
			Defective seal at turbocharger turbine end	Worn EGR valve guide	Worn valve, valve guide	Worn piston ring, cylinder liner	Clogged breather, breather hose	Clogged oil cooler	Clogged oil filter	Defective oil filter safety valve	Clogged lubricating drain tube of turbocharger	Exhaust smoke is black
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period	△	△	△	△						
	Non-specified fuel is being used								○			
	Engine oil must be added more frequently			○		◎						
	Oil filter clogging monitor indicates clogging when the oil temperature rises (with the monitor installed)								◎	○		
Check item	Metal particles are found when oil is drained in oil filter				○	○			◎			
	Inside of exhaust pipe is contaminated with oil				◎							
	Engine oil temperature rises quickly							◎				
	Color of exhaust gas	Blue under light load				◎						
		Black										◎
	Amount of blow-by gas	Excessive	○		○	◎					○	
		None					◎					
Troubleshooting	Excessive play of turbocharger shaft		●									(See S-7)
	When EGR valve is removed, exhaust port is contaminated with oil			●								
	When compression pressure is measured, the oil pressure is low.				●	●						
	Inspect breather, breather tube directly						●					
	Inspect oil cooler directly							●				
	Inspect oil filter directly								●			
	There is catching or breakage to the oil filter safety valve spring									●		
	Inspect turbocharger lubricating drain tube directly										●	
		Remedy	Replace	Replace	Replace	Replace	Clean	Clean	Replace	Replace	Clean	—

S-10 Fuel consumption is excessive

General causes why fuel consumption is excessive
- Leakage of fuel
- Fuel injection condition (fuel pressure and injection timing) not normal
- Excessive fuel injection

			Cause								
			Leakage of fuel inside head cover	Fuel leakage from fuel filter, piping, etc.	Defective feed pump oil seal	Defective supply pump plunger	Defective common rail fuel pressure	Defective injector spray	Defective injector operation	Defective coolant temperature sensor or defective wiring harness
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period			△	△		△		
	Condition of fuel consumption	More than for other machines of same model					○		○	○
		Gradually increased				○		○		
		Suddenly increased	○	○						
Check items	Fuel leakage to outside			◎						
	There is irregular combustion							◎		
	Oil increasing, smelling of diesel oil		◎		◎					
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low							◎		
	Low idle speed is too high								○	
	Torque converter stall or hydraulic pump relief speed is high								○	
	Color of exhaust gas	Black					○	○		○
		White	○							
Troubleshooting	Remove head cover and inspect directly		●							
	Inspect feed pump oil seal directly				●					
	Carry out troubleshoot by “Rail Press Very Low Error (*1)”					●				
	Speed of some cylinders does not change when operated in reduced cylinder mode							●		
	Spill flow is excessive when spill hose is separated from injector								●	
	Carry out troubleshoot by “Coolant Temp Sensor Error (*2)”									●
		Remedy	Correct	Correct	Replace	Replace	Correct	Replace	Replace	Correct

*1: Troubleshooting by failure code (Display of code), Code [**CA559**], and Code [**CA2249**]
*2: Troubleshooting by failure code (Display of code), Code [**CA144**], and Code [**CA145**]

S-11 Coolant contains oil (blows back or reduces)

General causes why oil in coolant
- Internal leakage of lubricating system
- Internal leakage of cooling system

			Cause					
			Broken cylinder head, head gasket	Internal cracks in cylinder block	Hole drilled by damages or pitching of cylinder liner O-ring	Insufficient protrusion of cylinder liner	Broken oil cooler core, O-ring	Broken hydraulic oil cooler, power train oil cooler
Questions / Check item	Confirm recent repair history							
	Degree of use of machine	Operated for long period			△		△	
	Oil level	Suddenly increased	○				○	○
		Gradually increased		○	○			
	Hard water is being used as coolant				○		○	
	Oil level has risen, oil is milky			○	○		◎	
	Excessive air bubbles inside radiator, coolant spurts back		◎			◎		
	Hydraulic oil or power train oil on applicable machine side is milky							◎
	When hydraulic oil or power train oil on applicable machine side is drained, water is discharged							◎
Trouble-shooting	Pressure-tightness test of cylinder head shows there is leakage		●					Carry out troubleshooting on applicable machine side
	Inspect cylinder block, liner directly			●	●			
	Inspect cylinder liner directly.					●		
	Pressure-tightness test of cylinder head shows there is leakage						●	
		Remedy	Replace	Replace	Replace	Replace	Replace	|

S-12 Oil pressure drops

General causes why oil pressure drops
- Leakage, clogging, wear of lubrication system
- Hydraulic control is not normal
- Wrong fuel selection (viscosity not appropriate)
- Oil deteriorated by overheating

			Cause													
			Wear of metal journal	Lack of oil in oil pan	Water, fuel in oil	Clogged strainer inside oil pan	Clogging or breakage of pipe inside oil pan	Defective oil pump	Defective oil pump relief valve	Clogged oil filter	Leakage, crushing or clogging of hydraulic pipe	Defective EGR oil pump	Leakage from EGR hydraulic piping	Defective hydraulic sensor or defective wiring harness
Questions	Confirm recent repair history													
	Degree of use of machine	Operated for long period	△					△		△		△		
	Oil pressure monitor indicates low pressure level (with monitor installed)								○	◎				
	Non-specified fuel is being used		○							○				
	Replacement of filters not carried out according to Operation & Maintenance Manual									◎				
Check items	Oil pressure monitor (With monitor installed)	Indicates a drop of hydraulic pressure during low idle	◎						○			○		
		Indicates a drop of oil pressure during low and high idle		○		◎	◎	◎	○			○	○	
		Indicates a drop of oil pressure on a slope		◎										
		Indicates a drop of oil pressure occasionally							◎					○
	Oil level monitor indicates low level (with monitor installed)			◎										
	Oil pan oil level is in short			◎										
	Leakage or crushing with external hydraulic pipe										◎		◎	
	Oil is cloudy white or smells of diesel oil				◎									
	Metal particles are found when oil pan is drained		◎											
	Metal particles are found when oil is drained from oil filter		◎					○				○		
Troubleshooting	Metal particles are detected in oil filter		●		See S-13									
	Inspect oil pan strainer, pipe directly					●	●							
	Oil pump rotation is heavy, there is play							●						
	Oil pump relief valve, spring is fatigued or damaged								●					
	Inspect oil filter directly									●				
	Relief valve of EGR oil pump is damaged or has oil leak											●		
	Inspect EGR hydraulic piping directly												●	
	Carry out troubleshoot by “Eng Oil Press Sensor Error (*1)”													●
		Remedy	Replace	Add	—	Clean	Clean	Replace	Adjust	Replace	Correct	Replace	Replace	Replace

*1: Troubleshooting by failure code (Display of code), Code [**CA135**], and Code [**CA141**]

S-13 Oil level rises (Water, fuel in oil)

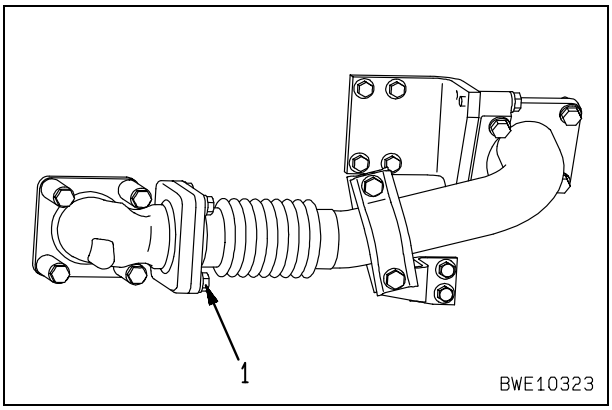
General causes why oil level rises
- Coolant mixing in the oil (oil turns cloudy)
- Fuel in oil (smells diluted diesel fuel)

★ If oil mixes with the coolant, carry out troubleshooting by S-11 Coolant contains oil

			Cause									
			Cracked EGR cooler (mixing of coolant)	Broken cylinder head, head gasket	Leakage of fuel inside head cover	Internal cracks in cylinder block	Hole drilled by damages or pitching of cylinder liner O-ring	Worn, damaged rear seal surface	Broken oil cooler core, O-ring	Clogging of water pump drain hole (breather hole) or defective seal	Defect inside supply pump	Defective seal of auxiliary equipment (pump or compressor)
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period					△	△		△		△
	Fuel must be added more frequently				◎						◎	
	Coolant must be added more frequently		○	○								
Check items	There is oil in the coolant			○		○	○		◎			
	Engine oil smells of diesel fuel				◎						◎	
	Oil is milky		○	○								
	After starting engine, drops of water come from muffler		○	○								
	Leave radiator cap open. When engine is run at idle, an abnormal number of bubbles appear or water spurts back			◎			○					
	Exhaust gas is white				○							
	Clogged water pump drain hole (breather hole)									◎		
	Water comes out when water pump drain hole (breather hole) is cleaned									◎		
	Oil level in clutch or damper chambers on applicable machine side decreasing							◎				
	Hydraulic tank oil level is decreasing on applicable machine side											◎
Troubleshooting	Removing EGR cooler inlet gas piping causes coolant containing antifreeze to flow out (*1)		●									
	When compression pressure is measured, the oil pressure is low			●								
	Remove head cover and inspect directly				●							
	Inspect cylinder block, liner directly					●	●					
	Inspect rear oil seal directly							●				
	Pressure-tightness test of cylinder head shows there is leakage								●			
	Remove water pump and inspect directly									●		
	Remove supply pump and inspect directly										●	
	Inspect the seal of auxiliary machine directly											●
		Remedy	Replace	Replace	Correct	Replace	Replace	Correct	Replace	Replace	Replace	Replace

For *1, see the next page

*1: EGR cooler inlet gas piping
Loosen 4 mounting bolts (1) of gas piping to EGR cooler inlet and check the flowout of coolant.
Condensed water from cooled exhaust gas may come out in small quantity but it poses no problem if colorless and transparent.



S-14 Coolant temperature rises too high (Overheating)

General causes why coolant temperature becomes too high

- Lack of cooling air (deformation, damages of fan)
- Drop in heat dissipation efficiency
- Defect in the coolant circulation system
- Power train oil temperature on applicable machine side is rising:
  Carry out troubleshoot on applicable machine side

			Cause													
			Water leakage to outside EGR cooler	Broken cylinder head, head gasket	Hole drilled by damages or pitching of cylinder liner O-ring	Clogged, broken oil cooler	Lack of coolant	Broken water pump	Defective operation of thermostat	Clogged, crushed radiator fins	Clogged radiator core	Defective radiator cap (pressure valve)	Slipping of fan belt, wear of fan pulley	Defective coolant temperature gauge	Rise of power train oil temperature
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period	△	△	△					△	△				
	Condition of overheating	Suddenly increased	○				○	◎					○		
		Always tends to overheat							○	◎	◎		○		
	Coolant temperature gauge (when installed)	Rises quickly					○		◎						
		Does not go down from red range												◎	
Check items	Radiator coolant level monitor indicates low level (with monitor installed)		○				◎								
	Engine oil level has risen, oil is cloudy white				◎	○									
	Fan belt tension is low												◎		
	Cloudy white oil is floating on coolant					◎									
	Excessive air bubbles inside radiator, coolant spurts back			◎											
	When light bulb is held behind radiator, no light passes through									◎					
	Radiator shroud and inside of underguard on applicable machine side are clogged with dirt or mud									◎			◎		
	Coolant leakage from cracks in the radiator hose or loose clamps						◎								
	Coolant flows out from radiator overflow hose											◎			
	Fan belt whines under sudden load												◎		
	Power train oil temperature gauge on applicable machine side enters red range faster than engine coolant temperature gauge (when oil temperature and coolant temperature gauge are installed)														◎
Troubleshooting	Inspect coolant leakage from EGR cooler directly		●												Carry out troubleshooting on applicable machine side
	When compression pressure is measured, the oil pressure is low.			●											
	Inspect cylinder liner directly				●										
	Inspect oil cooler directly					●									
	Temperature difference between top and bottom radiator tanks is excessive							●							
	When function test is carried out on thermostat, it does not open even at cracking temperature								●						
	Temperature difference between top and bottom radiator tanks is slight									●					
	Inspect radiator core directly										●				
	When function test is carried out on the radiator cap, cracking pressure is low											●			
	Inspect fan belt, pulley directly												●		
	When coolant temperature is measured, it is found to be normal													●	
		Remedy	Replace	Replace	Replace	Replace	Add	Replace	Replace	Correct	Correct	Replace	Correct	Replace	—

S-15 Abnormal noise is made

General causes why abnormal noise is made
- Abnormality due to defective parts
- Abnormal combustion
- Air sucked in from intake system

★ Judge if noise is from inside or outside before proceeding with troubleshooting

★ When engine is not fully warmed up, engine noise rises slightly because of operation in the low temperature mode. This is not abnormal, however.

★ When engine is accelerated, it enters acceleration mode, where engine noise remains slightly higher for about 5 seconds maximum. This is not abnormal, however.

			Cause													
			Air leakage between turbocharger and cylinder head	Seizure or interference of turbocharger	Cracks or gas leakage from EGR gas piping	Breakage of valve system (valve, rocker lever, etc.)	Defect inside muffler (dividing board out of position)	Improper valve clearance	Excessive wear of piston ring, cylinder liner	Improper gear train backlash	Missing, seized gear train bushing	Deformed fan, loose fan belt or interference	Clogged, seized injector	Dirt caught in the injector	Defective fuel injection timing (abnormal low coolant temperature sensor)
Questions	Confirm recent repair history															
	Degree of use of machine	Operated for long period							△							
	Condition of abnormal noise	Gradually increased						○	○			○				
		Suddenly increased		○	○	○					○					
	Non-specified fuel is being used												○			
	Engine oil must be added more frequently								◎							
Check items	Metal particles are found when oil is drained in oil filter					○			◎		◎					
	Leakage of air between turbocharger and cylinder head		◎													
	When engine is cranked, abnormal noise is heard from around turbocharger			◎												
	When engine is cranked, abnormal noise is heard from around EGR gas piping				◎											
	When engine is cranked, abnormal noise is heard from around cylinder head					◎		◎								
	When engine is cranked, abnormal noise is heard from around muffler						◎									
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low												◎	○		
	Color of exhaust gas	Blue under light load							◎							
		Black	○	◎				○								
	Engine pickup is poor and combustion is abnormal												◎			
	Abnormal noise is loud when accelerating engine							○		○		○	○			
	Blow-by gas is excessive								◎							
Troubleshooting	When turbocharger is rotated by hand, it is found to be heavy			●												
	Inspect EGR gas piping directly				●											
	Inspect valve system directly					●										
	When muffler is removed, abnormal noise disappears						●									
	Inspect valve clearance directly							●								
	When compression pressure is measured, the oil pressure is low.								●							
	Inspect gear train directly									●	●					
	Inspect fan and fan belt directly											●				
	Speed of some cylinders does not change when operated in reduced cylinder mode												●	●		
	Abnormal noise is emitted only when starting engine													●		
	Check by the monitoring function															●
		Remedy	Replace	Replace	Replace	Correct	Replace	Adjust	Replace	Replace	Replace	Correct	Replace	Correct	Correct	

S-16 Vibration is excessive

General causes why vibration is excessive
- Defective parts (abnormal wear, breakage, etc.)
- Alignment with applicable machine side is not normal
- Abnormal combustion

★ If there is abnormal noise together with the vibration, carry out trouble-shooting also for “S-15 Abnormal noise is made”.

			Cause								
			Stuck valve system (valve, rocker lever, etc.)	Worn main metal, connecting rod metal	Improper gear train backlash	Worn camshaft bushing	Loose engine mounting bolts, broken cushion	Center of engine and equipment of applicable machine side	Wear of front support spigot joint portion	Broken part inside output shaft damper on applicable machine side
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period		△		△	△		△	
	Condition of vibration	Suddenly increased	○							○
		Gradually increased		○		○	○		○	
Check items	Non-specified fuel is being used			○		○				
	Metal particles are found when oil is drained in oil filter			◎		◎				
	Metal particles are found when oil pan is drained			◎		◎				
	Oil pressure is low at low idle			○		○				
	Vibration occurs at mid-range speed						○			○
	Vibration follows engine speed				○		○	○	○	○
	Exhaust smoke color is black		◎							
Troubleshooting	Inspect valve system directly		●							
	Inspect main metal, connecting rod metal directly			●						
	Inspect gear train directly				●					
	Inspect camshaft bushing directly					●				
	Inspect engine mount bolt, cushion directly.						●			
	When face runout and radial runout are inspected, they are found to be incorrect							●		
	Inspect front support spigot directly								●	
	Inspect inside of output shaft or damper directly									●
		Remedy	Replace	Replace	Replace	Replace	Replace	Adjust	Replace	Replace

WA600-6 Wheel loader

Form No. SEN00565-00

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Printed in Japan 01-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

General information on disassembly and assembly

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Sketches of special tools 11

General information on disassembly and assembly

How to read this manual

1. Removal and installation of assemblies

Special tools

- As to the special tools needed for removal and installation, symbols such **A1···X1** are attached in the table along with respective part numbers, part names and quantity.
- In addition to the above, the list of special tools contains the following information.

1) Necessity
   - ■: Special tools that cannot be substituted and should always be used (installed).
   - ●: Special tools that will be useful if available and are substitutable with commercially available tools.
2) Distinction of new and existing special tools
   - N: Tools newly developed for this model. They respectively have a new part number.
   - R: Tools with upgraded part numbers. They are remodeled from already available tools for other models.
   - Blank: Tools already available for other models. They can be used without any modification.
3) Circle mark (○) in sketch column:
   - A circle mark means that a sketch of the special tool is presented in the section of Sketches of special tools.
   - Part No. of special tools starting with 79*T means that they are locally made parts and as such not interchangeable with those made by Komatsu in Japan, e.g. 79*T-***-****.

Removal

- The “Removal” section contains procedures, precautions and the amount of oil or coolant to be drained.
- As to the multi purpose tools used in removal, the numbers such [1], [2]··· are given. Their part numbers, part names and quantity are not described.
- Various symbols used in the “Removal” section are explained and listed below.

⚠ : **Precautions related to safety in execution of work.**

★ : This mark gives guidance or precautions when doing the procedure.

[*1] : This mark shows that there are instructions or precautions for installing parts.

This mark shows oil or coolant to be drained.

: Weight of part or component

Installation

- Except where otherwise instructed, installation of parts is done in the reverse order of removal.
- Instructions and precautions for installing parts are shown with [*1] mark in the “Removal” section, identifying which step the instructions are intended for.
- As to the multi purpose tools used in installation, the numbers such [1], [2]··· are given. Their part numbers, part names and quantity are not described.
- Marks shown in the “Installation” section stand for the following.

⚠ : **Precautions related to safety in execution of work.**

★ : This mark gives guidance or precautions when doing the procedure.

: Type of coating material

: Tightening torque

: Quantity of oil or coolant to be added

Sketches of special tools

- Various special tools are illustrated for the convenience of local manufacture.

2. Disassembly and assembly of assemblies

special tools

- As to the special tools needed for disassembly and assembly, symbols such **A1···X1** are attached along with respective part numbers, part names and quantity.
- In addition to the above, the list of special tools contains the following information.

1) Necessity
   - ■: Special tools that cannot be substituted and should always be used (installed).
   - ●: Special tools that will be useful if available and are substitutable with commercially available tools.
2) Distinction of new and existing special tools
   - N: Tools newly developed for this model. They respectively have a new part number.
   - R: Tools with upgraded part numbers. They are remodeled from already available tools for other models.
   - Blank: Tools already available for other models. They can be used without any modification.
3) Circle mark (○) in sketch column:
   - A circle mark means that a sketch of the special tool is presented in the section of Sketches of special tools.
   - Part No. of special tools starting with 79*T means that they are locally made parts and as such not interchangeable with those made by Komatsu in Japan, e.g. 79*T-***-****.

Disassembly

- In “Disassembly” section, the work procedures, precautions and know-how for carrying out those procedures, and quantity of the oil and coolant drained are described.
- As to the multi purpose tools used in disassembly, the numbers such [1], [2]··· are given. Their part numbers, part names and quantity are not described.
- Various symbols used in the “Disassembly” section are explained and listed below.

⚠ : **Precautions related to safety in execution of work.**

★ : This mark gives guidance or precautions when doing the procedure.

This mark shows oil or coolant to be drained.

Assembly

- In “Assembly” section, the work procedures, precautions and know-how for carrying out those procedures, and quantity of the oil and coolant added are described.
- As to the multi purpose tools used in assembly, the numbers such [1], [2]··· are given. Their part numbers, part names and quantity are not described.
- Various symbols used in “Assembly” section are explained and listed below.

⚠ : **Precautions related to safety in execution of work**

★ : This mark gives guidance or precautions when doing the procedure.

: Type of coating material

: Tightening torque

: Quantity of oil or coolant to be added

Sketches of special tools

- Various special tools are illustrated for the convenience of local manufacture.

Coating materials list

★ The recommended coating materials such as adhesives, gasket sealants, and greases used for disassembly and assembly are listed below.
★ For coating materials not listed below, use the equivalent of products shown in this manual.

Category	Komatsu code	Part No.	Q'ty	Container	Main features and applications
Adhesive	LT-1A	790-129-9030	150 g	Tube	• Used to prevent falling off of rubber gaskets, rubber cushions, and cork plugs.
	LT-1B	790-129-9050	20 g (2 pcs.)	Polyethylene container	• Used for plastic (except polyethylene, polypropylene, tetrafluoroethylene and vinyl chloride), rubber, metal, and non-metal parts which require immediate and strong adhesion.
	LT-2	09940-00030	50 g	Polyethylene container	• Features: Resistant to heat and chemicals. • Used to fix and seal bolts and plugs.
	LT-3	790-129-9060 Set of adhesive and hardener	Adhesive: 1 kg Hardener: 500 g	Can	• Used to stick and seal metal, glass, and plastics.
	LT-4	790-129-9040	250 g	Polyethylene container	• Used to seal plugs for drilled holes.
	Holtz MH 705	790-129-9120	75 g	Tube	• Heat-resistant sealant used to repair engines.
	Three Bond 1735	790-129-9140	50 g	Polyethylene container	• Quick-setting adhesive. • Setting time: Within 5 sec. to 3 min. • Used mainly to stick metals, rubbers, plastics, and woods.
	Aron-alpha 201	790-129-9130	2 g	Polyethylene container	• Quick-setting adhesive. • Quick-hardening type. (max. strength is obtained after 30 minutes of application) • Used mainly to stick rubbers, plastics, and metals.
	Loctite 648-50	79A-129-9110	50 cc	Polyethylene container	• Features: Resistant to heat and chemicals. • Used for fitted portions of high temperatures.
Gasket sealant	LG-1	790-129-9010	200 g	Tube	• Used to stick or seal gaskets and packings of power train case, etc.
	LG-5	790-129-9080	1 kg	Polyethylene container	• Used to seal various threaded portions, pipe joints, and flanges. • Used to seal tapered plugs, elbows, and nipples of hydraulic pipes.
	LG-6	790-129-9020	200 g	Tube	• Features: Silicon-based heat and cold-resistant sealant. • Used to seal flanged surfaces and threaded portions. • Used to seal oil pan, final drive case, etc.
	LG-7	790-129-9070	1 kg	Tube	• Features: Silicon-based quick-hardening sealant. • Used to seal flywheel housing, intake manifold, oil pan, thermostat housing, etc.
	Three Bond 1211	790-129-9090	100 g	Tube	• Gasket sealant used to repair engine.
	Three Bond 1207B	419-15-18131	100 g	Tube	• Features: Silicon-based, heat-resistant, vibration-resistant and impact-resistant sealant. • Used to seal transfer case, etc.

Category	Komatsu code	Part No.	Q'ty	Container	Main features and applications
Molybdenum disulfide lubricant	LM-G	09940-00051	60 g	Can	• Used to lubricate sliding portions (for preventing squeaking)
	LM-P	09940-00040	200 g	Tube	• Used to prevent scuffing and seizure of press-fitted portions, shrink-fitted portions, and threaded portions. • Used to lubricate linkages, bearings, etc.
Grease	G2-LI G0-LI(*) *: For cold districts	SYG2-400LI SYG2-350LI SYG2-400LI-A SYG2-160LI SYGA-160CNLI SYG0-400LI-A(*) SYG0-16CNLI(*)	Various	Various	• General purpose type.
	G2-CA	SYG2-400CA SYG2-350CA SYG2-400CA-A SYG2-160CA SYGA-160CNCA	Various	Various	• Used for bearings used at normal temperature under light load in contact with water or steam.
	Molybdenum disulfide lubricant LM-G (G2-M)	SYG2-400M SYG2-400M-A SYGA-16CNM	400 g × 10 400 g × 20 16 kg	Bellows-type Can	• Used for parts under heavy load. Caution: • Do not use this grease for ball bearings such as swing circle bearing. • Apply this grease to work equipment pins only when installing but do not use it after then.
	Hyper white grease G2-T, G0-T(*) *: For cold districts	SYG2-400T-A SYG2-16CNT SYG0-400T-A (*) SYG0-16CNT (*)	400 g 16 kg	Bellows-type Can	• Seizure resistance and heat resistance higher than molybdenum disulfide grease. • Not conspicuous on machine since its color is white.
	Bio grease G2-B, G2-BT(*) *For use at high temperature under high load	SYG2-400B SYGA-16CNB SYG2-400BT (*) SYGA-16CNBT (*)	400 g 16 kg	Bellows-type Can	• Since this grease is decomposed by natural bacteria in short period, its impacts on microorganisms, animals, and plants are minimized.
Primer	SUNSTAR PAINT PRIMER 580 SUPER	417-926-3910	20 ml	Glass container	Adhesive for cab glass: • Used as primer for cab side. (Using limit: 4 months after date of manufacture)
	SUNSTAR GLASS PRIMER 580 SUPER		20 ml	Glass container	Adhesive for cab glass: • Used as primer for glass side. (Using limit: 4 months after date of manufacture)
	SUNSTAR PAINT PRIMER 435-95	22M-54-27230	20 ml	Glass container	Adhesive for cab glass: • Used as primer for painted surface on cab side. (Using limit: 4 months after date of manufacture)
	SUNSTAR GLASS PRIMER 435-41	22M-54-27240	150 ml	Steal can	Adhesive for cab glass: • Used as primer for black ceramic-coated surface on glass side and for hard polycarbonate-coated surface. (Using limit: 4 months after date of manufacture)
	SUNSTAR SASH PRIMER GP-402	22M-54-27250	20 ml	Glass container	Adhesive for cab glass: • Used as primer for sash (processing of Alumite surface) (Using limit: 4 months after date of manufacture)

Category	Komatsu code	Part No.	Q'ty	Container	Main features and applications	
Adhesive	SUNSTAR PENGUINE SEAL 580 SUPER “S” or “W”	417-926-3910	320 ml	Polyethylene container	Adhesive for cab glass	• “S” is used for high-temperature season (April – October) and “W” for low-temperature season (October – April) as adhesive for glass. (Using limit: 4 months after date of manufacture)
	Sika Ltd., Japan, Sikaflex 256HV	20Y-54-39850	310 ml	Polyethylene container		• Used as adhesive for glass. (Using limit: 6 months after date of manufacture)
	SUNSTAR PENGUINE SUPER 560	22M-54-27210	320 ml	Ecocart (Special container)		• Used as adhesive for glass. (Using limit: 6 months after date of manufacture)
Caulking material	SUNSTAR PENGUINE SEAL No. 2505	417-926-3920	320 ml	Polyethylene container		• Used to seal joint of glasses. (Using limit: 4 months after date of manufacture)
	SEKISUI SILICON SEALANT	20Y-54-55130	333 ml	Polyethylene container		• Used to seal front window. (Using limit: 6 months after date of manufacture)
	GE TOSHIBA SILICON TOSSEAL 381	22M-54-27220	333 ml	Cartridge		• Used to seal joint of glasses Translucent white seal (Using limit: 12 months after date of manufacture)

Special tool list

★ Tool part number 79○T-○○○-○○○○ indicates an interchangeable part (locally produced)
★ Necessity : ■····· Special tools which cannot be substituted and should be always installed (used)
: ●····· Special tools which are very useful if available. They can be substituted with commercially available tools.
★ Distinction of new and existing special tools.
: N····· Tools with new part numbers. They are newly developed for this model.
: R····· Tools with upgraded part numbers. They are remodeled from already available tools for other models.
: Blank····· Tools already available for other models and usable without any modification.
★ Circle (○) in sketch column: A circle mark means that a sketch of the special tool is presented in the section of Sketches of special tools.

Work item	Symbol		Part number	Part name	Essentiality	Quantity	New•Remodel	Illustration	Nature of work, remarks
Removal of fuel injector and cylinder head assembly	A	1	795-799-5410	Adapter	■	1			Removal and installation of fuel injector assembly
			795-799-5420	Remover	■	1			
		2	795T-675-1110	Socket	●	1	N	○	Removal and installation of high-pressure pipings
Engine rear seal and front seal		3	795-931-1100	Seal puller	●	1			Removal of engine front and rear seals
Engine front seal		4	795-621-1140	Push tool	■	1			Press fitting of oil seal
			795T-621-1170	Push tool	■	1	N	○	Press fitting of dust seal
			795-902-1460	Bolt	■	3			Press fitting of oil seal and dust seal
			01582-02218	Nut	■	3			
Engine rear seal		5	795T-621-1160	Push tool	■	1	N	○	Press fitting of engine rear seal
			01050-32235	Bolt	■	5			
Assembly of damper assembly		6	793-612-1120	Push tool	■	1			Press fitting of bearing
		7	793T-612-1310	Push tool	●	1	N	○	Press fitting of oil seal
Cylinder head assembly		8	790-331-1120	Wrench (angle)	●	1			Angle tightening of bolt
Disassembly and assembly of torque converter assembly	C		792-900-1350	Wrench	■	1			Removal and installation of turbine shaft nut
	D		793-613-1210	Wrench	■	1			Removal and installation of stator shaft nut
	E		793-615-1110	Wrench assembly	■	1			Measurment of rotation torque of input shaft
			01306-10616	Bolt	■	1			
Disassembly and assembly of transmission and transfer assembly	F		799-301-1500	Oil leak tester	■	1			Operation check of clutch piston
Disassembly and assembly of transfer assembly	G	1	793-615-1130	Spline wrench	■	1			Measurment of rotation torque of intermediate shaft
		2	796-730-2300	Wrench assembly	■	1			Measurment of rotation torque of input shaft

Work item	Symbol		Part number	Part name	Essentiality	Quantity	New•Remodel	Illustration	Nature of work, remarks
Disassembly and assembly of differential assembly	H	1	790-501-5200	Unit repair stand	■	1			
			790-901-4110	Bracket	■	1			
		2	793T-622-1810	Plate	■	1	N	○	
		3	792-103-0901	Wrench	■	1			Bearing preload adjustment
		4	793T-622-1180	Push tool	■	1		○	Press fitting of differential case bearing
		5	793T-622-1840	Push tool	■	1	N	○	Press fitting of pinion shaft main bearing inner race
		6	790-201-2460	Plate	■	1			Press fitting of main bearing outer race
			790-201-2690	Plate	■	1			
		7	790-101-5621	Plate	■	1			Press fitting of sub-bearing outer race
			790-101-5421	Grip	■	1			
			01010-81240	Bolt	■	1			
		8	790-201-2860	Spacer	■	1			Press fitting of sub-bearing inner race
		9	792-525-1000	Micrometer	■	1			Bearing preload adjustment
			792-525-1220	Adapter	■	1			
		10	793T-622-1820	Push tool	■	1	N	○	Press fitting of differential cage oil seal
		11	793T-622-1830	Push tool	■	1	N	○	Press fitting of differential cage dust seal
			790-101-5221	Grip	■	1			
			01010-81240	Bolt	■	1			
Removal and installation of center support assembly		12	793T-620-1410	Centering tool	■	1	N	○	Centering of transmission – center support
Disassembly and assembly of rear brake assembly	J	1	793T-622-1910	Fixture	■	3	N	○	Removal and installation of wheel hub
		2	792-520-2110	Installer	■	1			Installation of floating seal
			792-530-1600	Push tool	■	1			
		3	792T-422-1220	Plate	■	1		○	Press fitting of oil seal
			790-101-5421	Grip	■	1			
			01010-81240	Bolt	■	1			

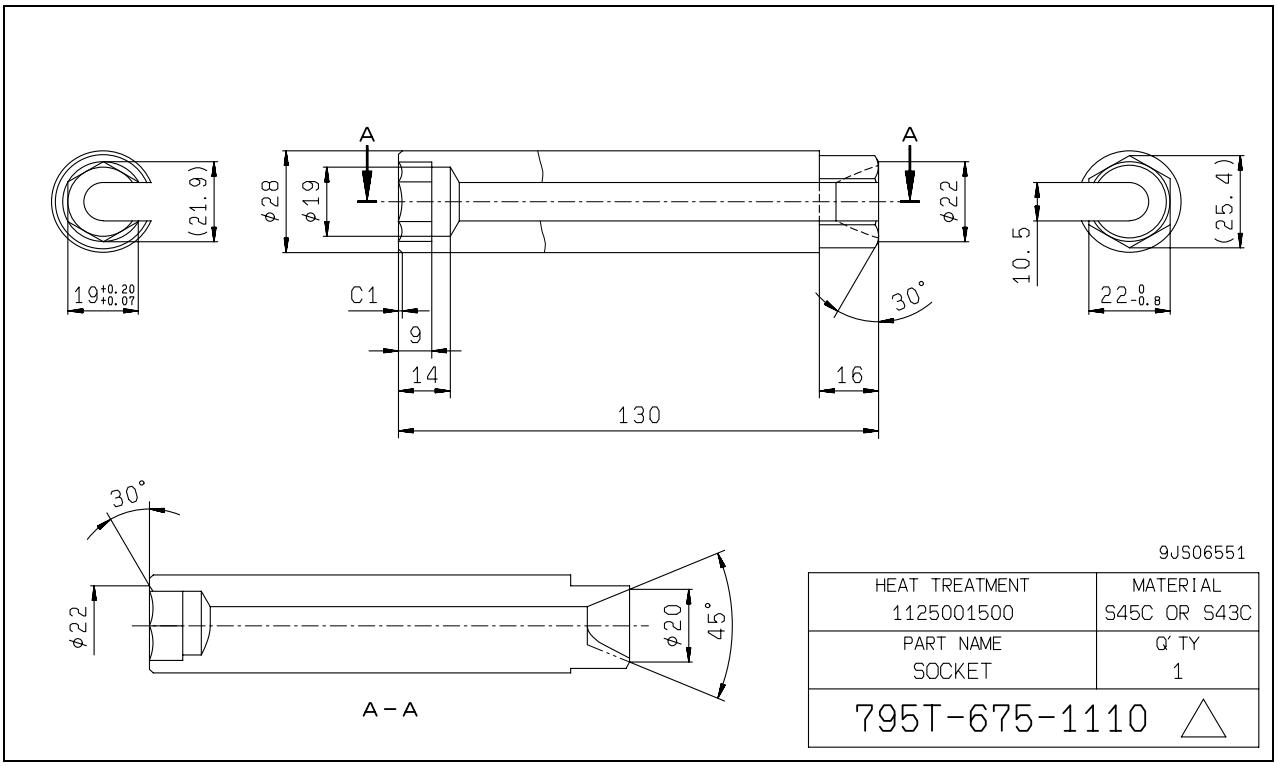
Work item	Symbol		Part number	Part name	Essentiality	Quantity	New•Remodel	Illustration	Nature of work, remarks
Installation of center hinge bearing	K	1	790-101-2300	Push tool	■	1			Installation of lower center hinge bearing
			790-101-2310	• Block		1			
			790-101-2320	• Screw		1			
			790-101-2330	• Nut		2			
			790-101-2340	• Washer		1			
			790-101-2350	• Leg		2			
			790-101-2360	• Plate		4			
			790-101-2410	• Joint		2			
			02215-11622	• Nut		2			
			793-520-2640	Push tool	■	1			
			790-438-1030	Guide	■	1			
			790-438-1050	Bar	■	2			
			790-101-2102	Puller (294 kN {30 ton})	■	1			
			790-101-1102	Pump	■	1			
		2	790-101-2300	Push tool	■	1			Installation of upper center hinge bearing
			790-101-2310	• Block		1			
			790-101-2330	• Nut		1			
			790-101-2340	• Washer		1			
			790-101-2350	• Leg		2			
			790-101-2360	• Plate		4			
			790-101-2410	• Joint		2			
			02215-11622	• Nut		2			
			790-438-1050	Bar	■	2			
			01580-12016	Nut	■	2			
			790-438-1010	Push tool	■	1			
			790-438-1020	Guide	■	1			
			790-438-1040	Screw	■	1			
			790-101-2102	Puller	■	1			
			790-101-1102	Pump	■	1			
Steering valve assembly	T	1	793T-664-1110	Bracket	■	1	N	○	Removal and installation of steering valve assembly
Control valve assembly		2	796-946-1310	Guide	■	1			Replacement of pressure compensation valve seal
			(For 723-46-40100)						
		3	796-946-1320	Guide	■	1			
			(For 723-46-40100)						
		4	796-946-1330	Sleeve	■	1			
			(For 723-46-40100)						

Work item	Symbol		Part number	Part name	Essentiality	Quantity	New•Remodel	Illustration	Nature of work, remarks
Hydraulic cylinder assembly	U	1	790-502-1003	Cylinder repair stand	●	1			Disassembly and assembly of hydraulic cylinder assembly
			790-101-1102	Pump	●	1			
		2	790-102-4300	Wrench assembly	■	1			Removal and installation of piston assembly
			790-102-4310	Pin	■	2			
		3	790-720-1000	Expander	●	1			Installation of piston ring
		4	796-720-1690	Ring (For lift arm)	●	1			
			07281-02169	Clamp	●	1			
			796-720-1720	Ring (For bucket)	●	1			
			07281-02429	Clamp	●	1			
			796-720-1660	Ring (For steering)	●	1			
			07281-01159	Clamp	●	1			
		5	790-201-1702	Push tool kit	■	1			Press fitting of bushing
			790-201-1881	• Push tool (For lift arm and bucket)		1			
			790-201-1821	• Push tool (For steering)		1			
			790-101-5021	• Grip		1			
			01010-50816	• Bolt		1			
		6	790-201-1500	Push tool kit	●	1			Press fitting of dust seal
			790-101-5021	• Grip		1			
			01010-50816	• Bolt		1			
			790-201-1690	Plate (For lift arm and bucket)	●	1			
			790-201-1630	Plate (For steering)	●	1			
Air conditioner assembly	X	1	799-703-1200	Service tool kit	■	1			Charging of air conditioner gas
			799-703-1100	Vacuum pump (100 V)	■	1			
			799-703-1111	Vacuum pump (220 V)	■	1			
			799-703-1121	Vacuum pump (240 V)	■	1			
			799-703-1401	Gas leak detector	■	1			
Operator cab glass (stuck glass)		2	793-498-1210	Lifter (Suction cup)	■	2			Installation of operator cab glass (stuck glass)
		3	20Y-54-13180	Stopper rubber	■	2			

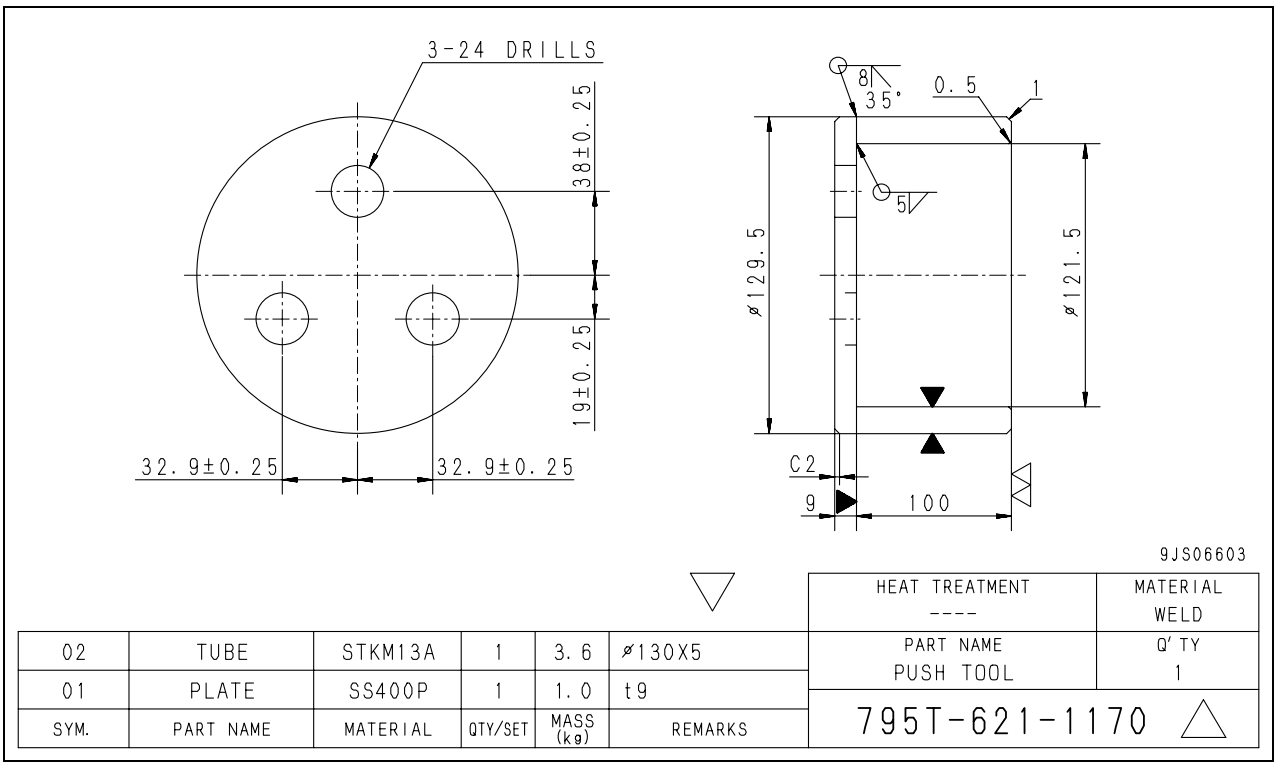
Sketches of special tools

Note) Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

A2 socket



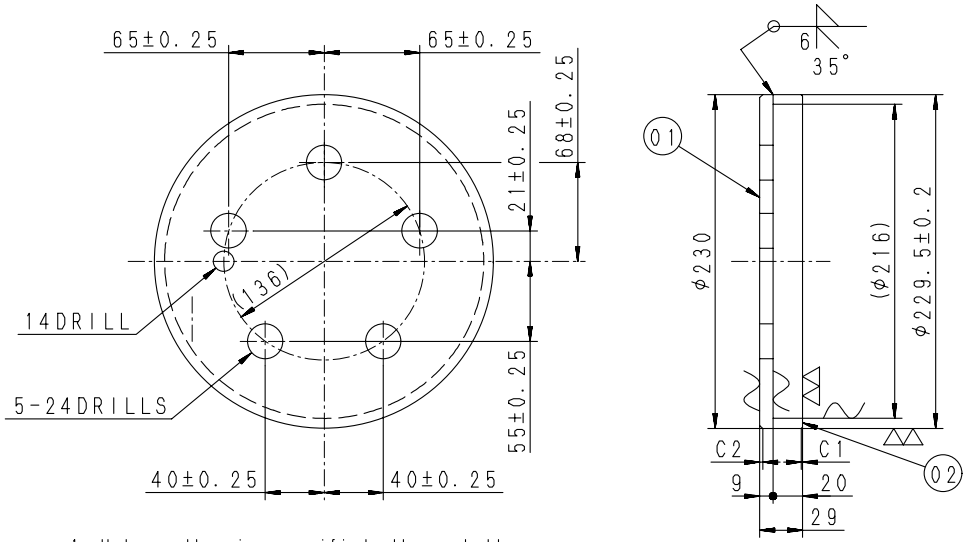
A4 push tool (For dust seal)



SYM.	PART NAME	MATERIAL	QTY/SET	MASS (kg)	REMARKS
02	TUBE	STKM13A	1	3.6	φ130X5
01	PLATE	SS400P	1	1.0	t9

Note) Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

A5 push tool



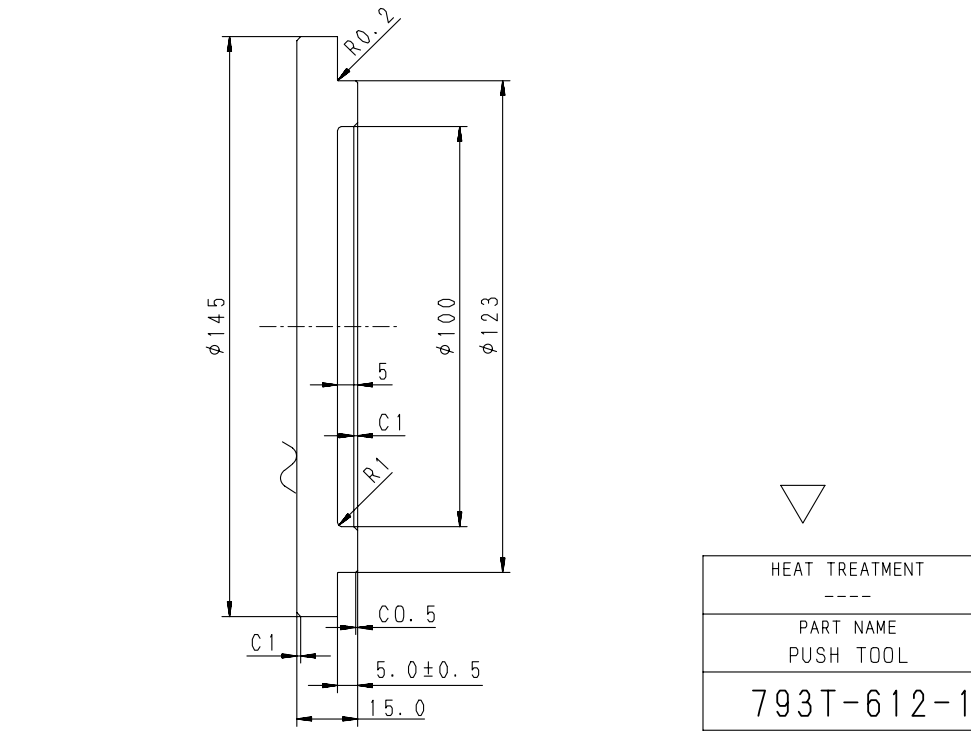
9JS06552

1. Unless otherwise specified, there shall be no burrs or flushes at the corner.

SYM.	PART NAME	MATERIAL	QTY/SET	MASS (kg)	REMARKS
02	TUBE	STKM13A	1	0.57	φ232Xt8
01	PLATE	SS400P	1	2.77	t9

HEAT TREATMENT	MATERIAL
----	----
PART NAME	Q'TY
PUSH TOOL	1
795T-621-1160 △	

A7 push tool (For oil seal)

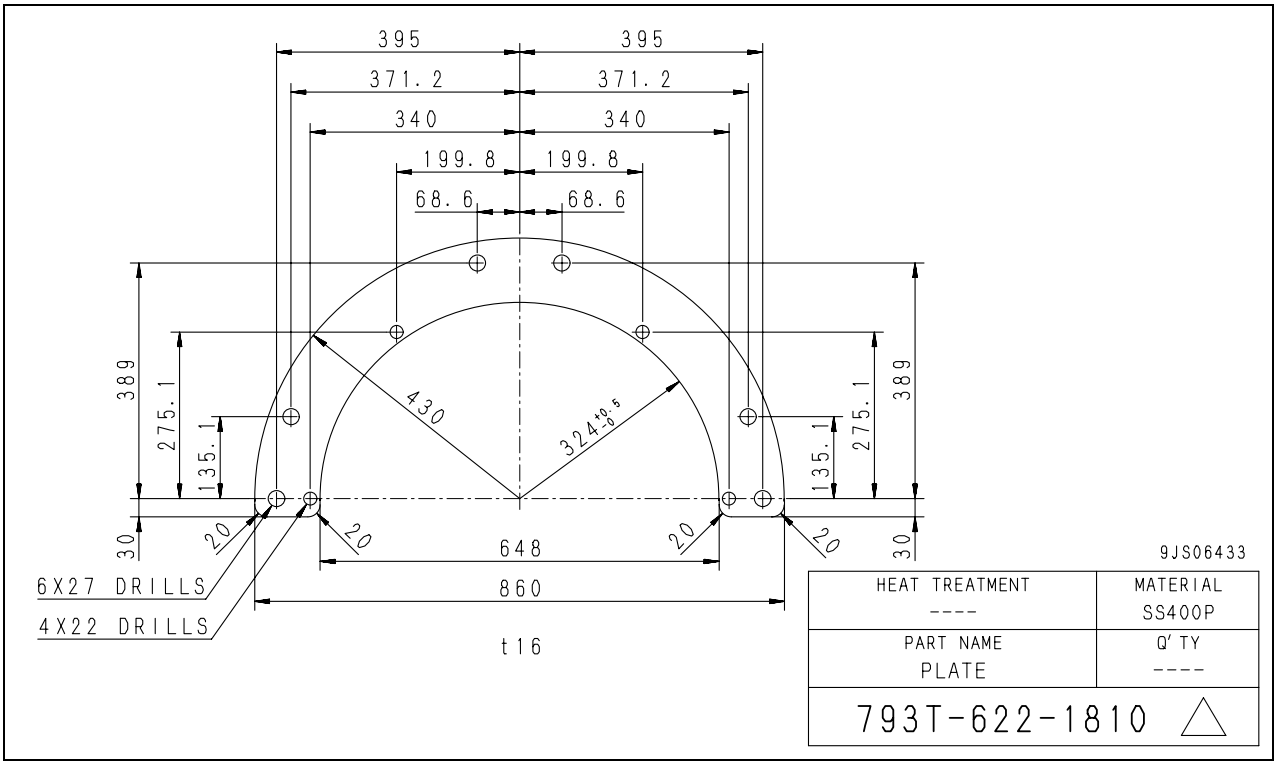


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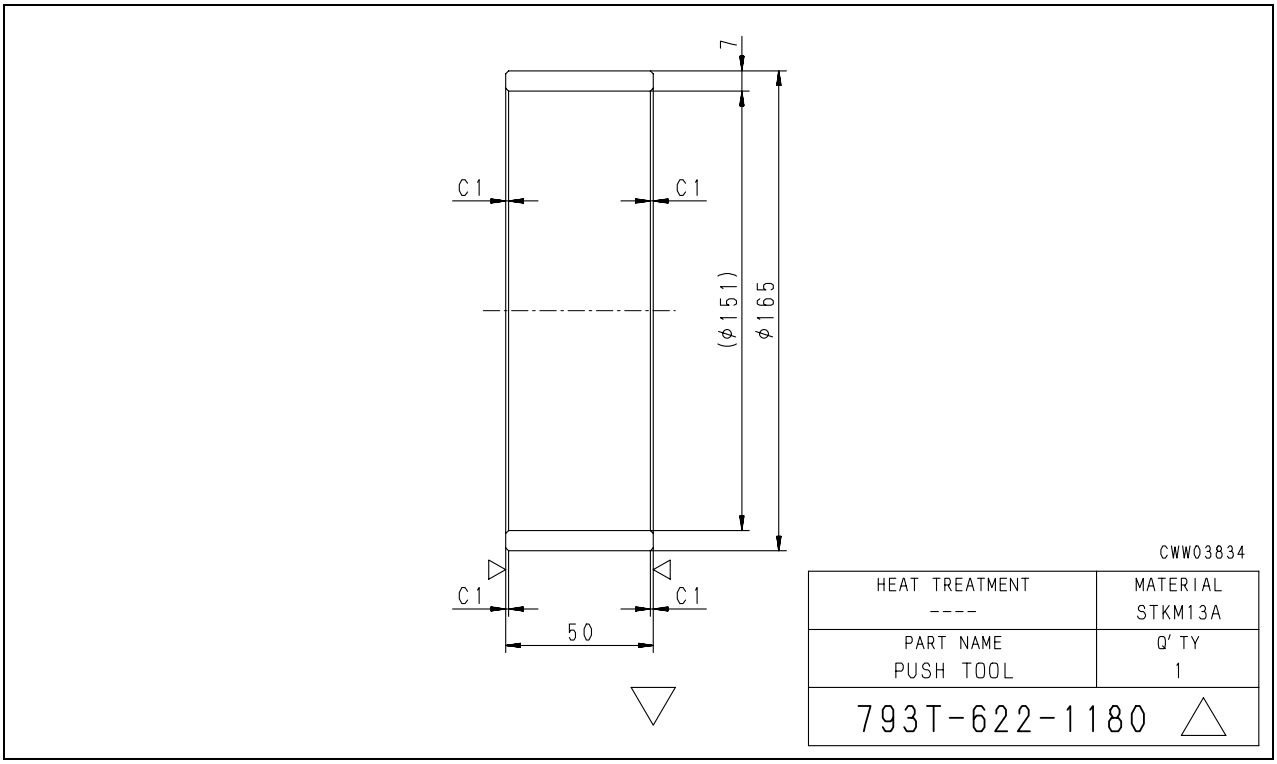
HEAT TREATMENT	MATERIAL
----	SS400P
PART NAME	Q'TY
PUSH TOOL	1
793T-612-1310 △	

Note) Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

H2 plate

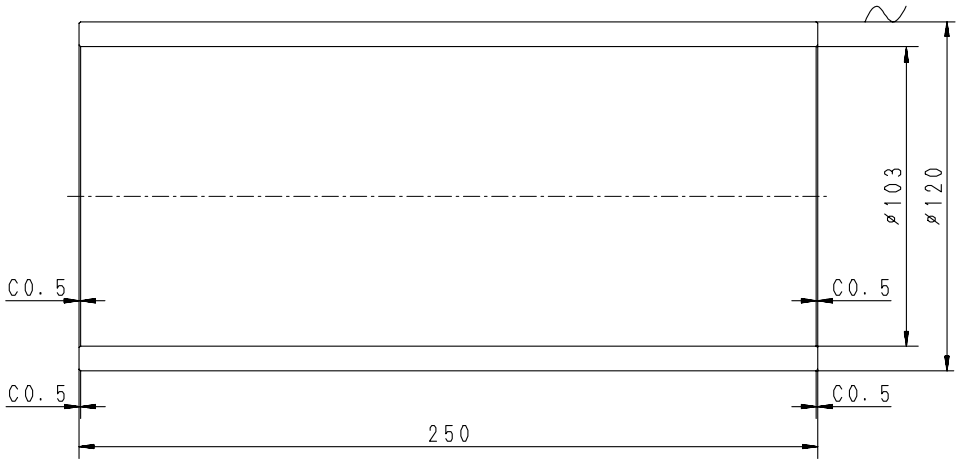


H4 push tool



Note) Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

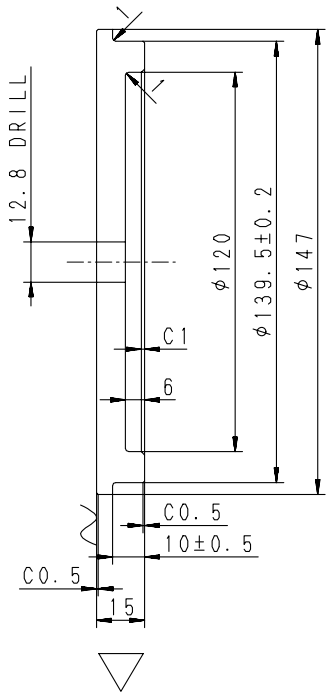
H5 push tool



9JS06434

HEAT TREATMENT	MATERIAL
----	STKM13A
PART NAME	Q'TY
PUSH TOOL	----
793T-622-1840 △	

H10 push tool

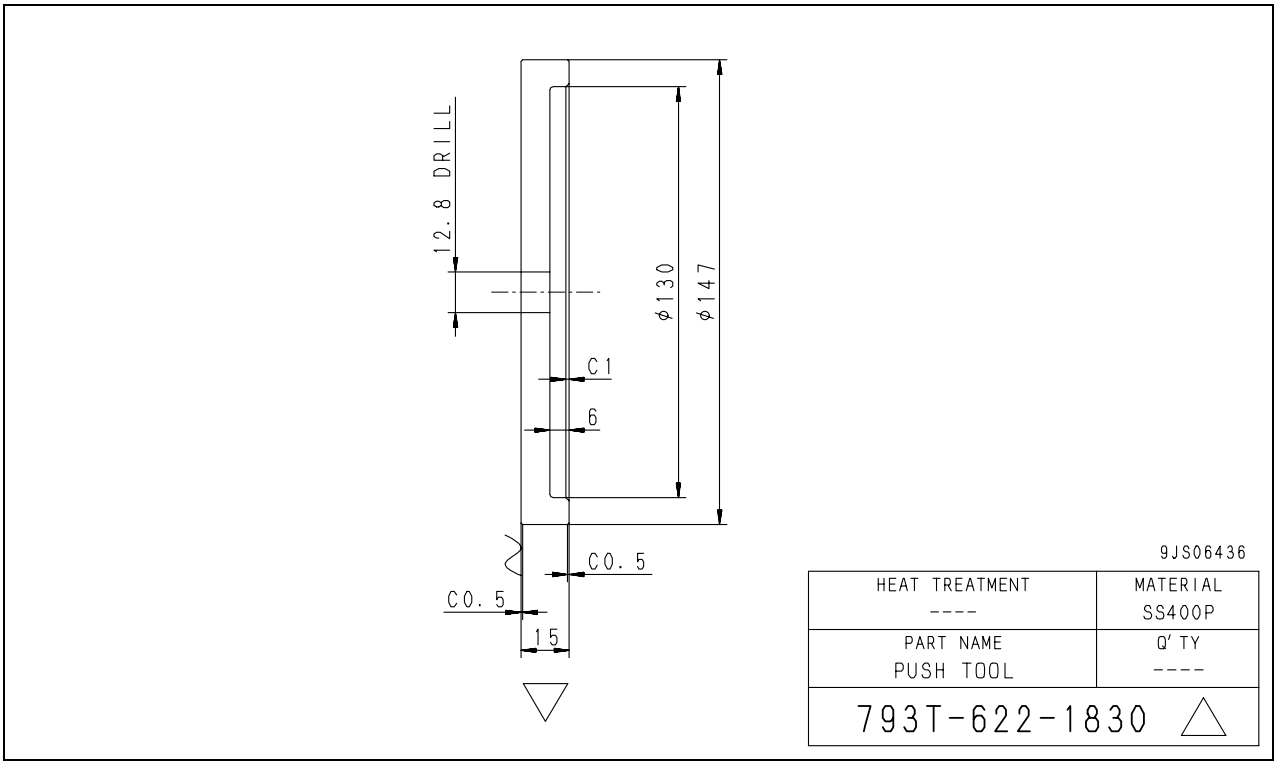


9JS06435

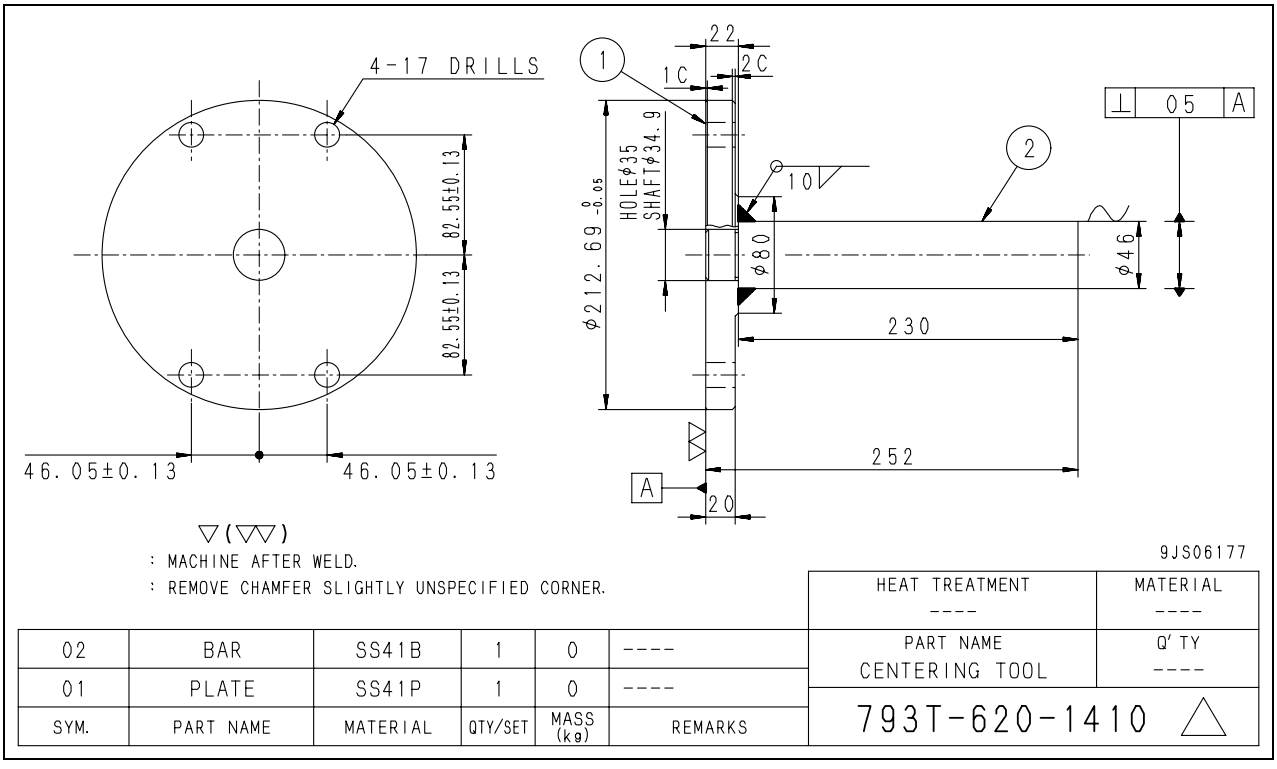
HEAT TREATMENT	MATERIAL
----	SS400P
PART NAME	Q'TY
PUSH TOOL	----
793T-622-1820 △	

Note) Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

H11 push tool



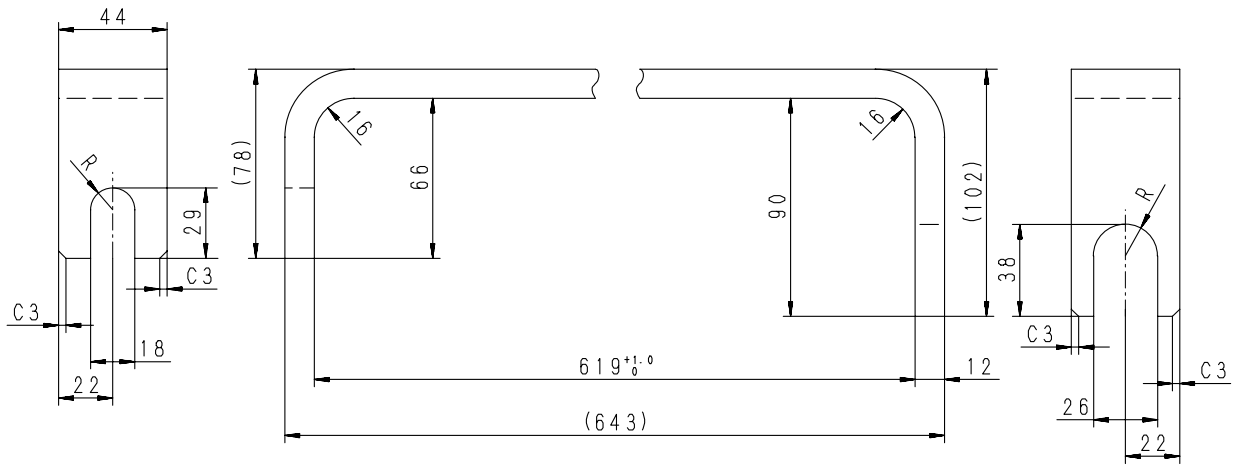
H12 centering tool



SYM.	PART NAME	MATERIAL	QTY/SET	MASS (kg)	REMARKS
02	BAR	SS41B	1	0	----
01	PLATE	SS41P	1	0	----

Note) Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

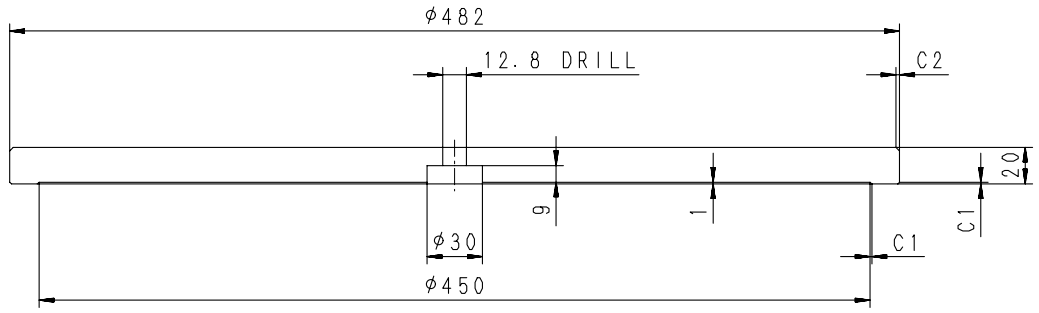
J1 fixture



9JS06437

HEAT TREATMENT	MATERIAL
----	SS400F
PART NAME	Q'TY
FIXTURE	----
793T-622-1910 △	

J3 plate



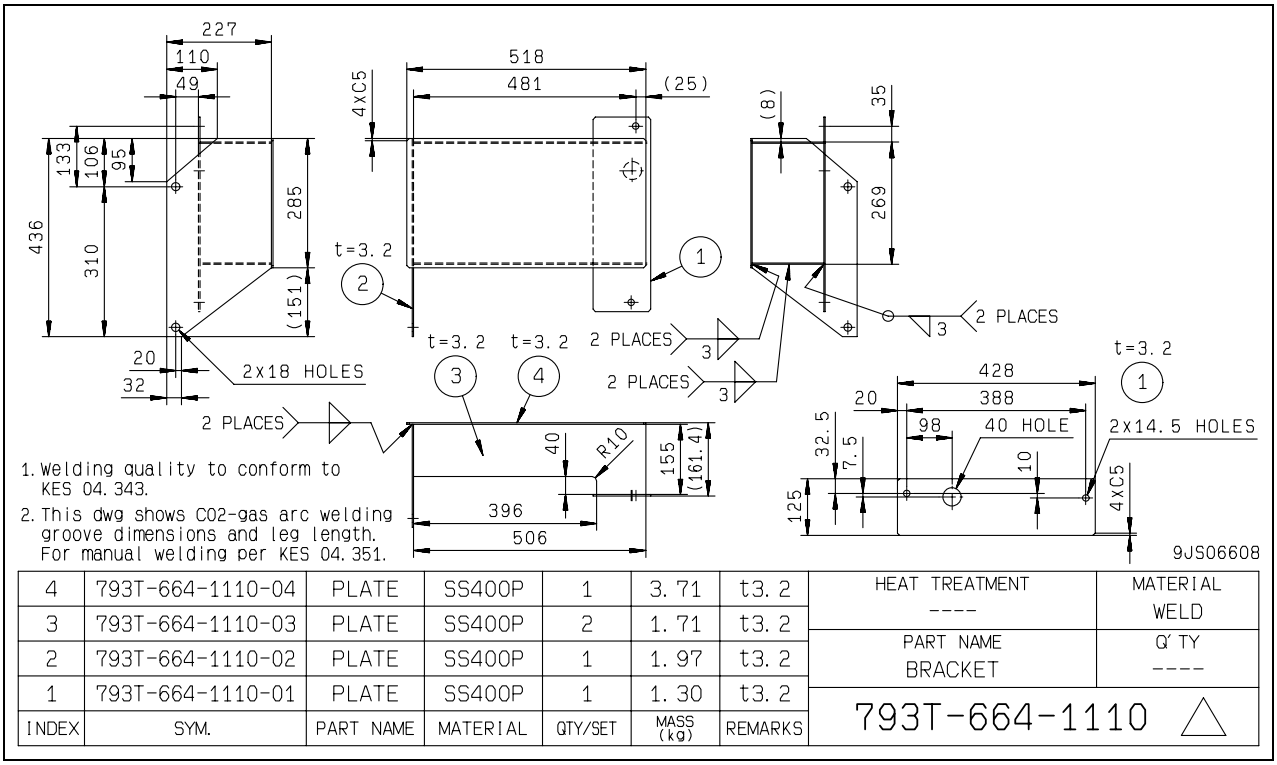
CWH10650

HEAT TREATMENT	MATERIAL
----	SS400P
PART NAME	Q'TY
PLATE	----
792T-422-1220 △	

▽

Note) Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

T1 bracket



INDEX	SYM.	PART NAME	MATERIAL	QTY/SET	MASS (kg)	REMARKS
4	793T-664-1110-04	PLATE	SS400P	1	3.71	t3.2
3	793T-664-1110-03	PLATE	SS400P	2	1.71	t3.2
2	793T-664-1110-02	PLATE	SS400P	1	1.97	t3.2
1	793T-664-1110-01	PLATE	SS400P	1	1.30	t3.2

HEAT TREATMENT	MATERIAL
----	WELD
PART NAME	Q'TY
BRACKET	----
793T-664-1110 △	

WA600-6 Wheel loader

Form No. SEN01156-01

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Printed in Japan 10-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

Engine and cooling system, Part 1

Engine and cooling system, Part 1 2
Removal and installation of engine assembly 2
Removal and installation of radiator assembly 6
Removal and installation of air aftercooler 11
Removal and installation of cooling fan and fan motor assembly 12
Removal and installation of damper assembly 14
Disassembly and assembly of damper assembly 16
Removal and installation of fuel tank assembly 20
Removal and installation of engine hood assembly 22
Removal and installation of bulkhead assembly 24

Engine and cooling system, Part 1

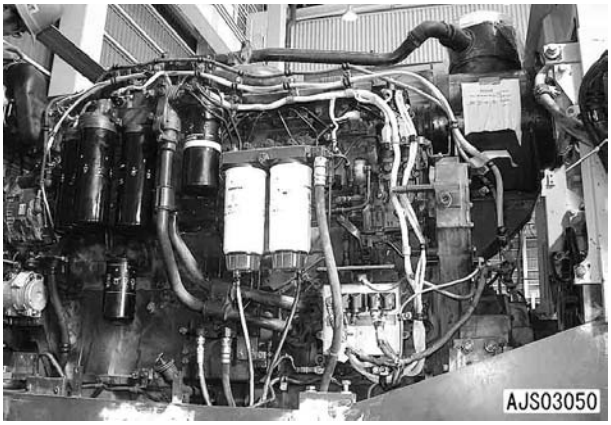
Removal and installation of engine assembly

Removal

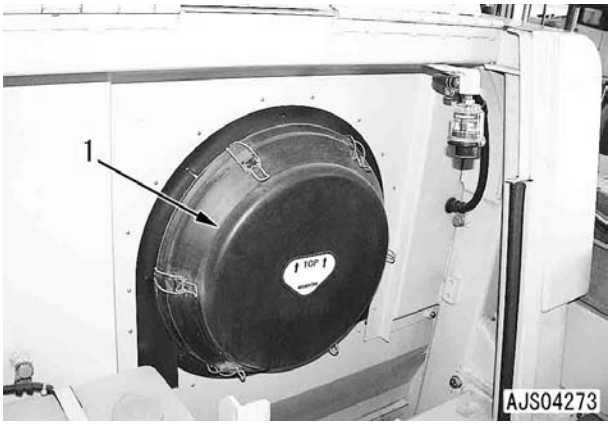
⚠ Stop the machine on level ground and set the frame lock bar.
⚠ Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.
⚠ Disconnect the negative terminal (–) of the battery before starting with the work.

1. Remove the radiator assembly, referring to “Removal and installation of radiator assembly”.

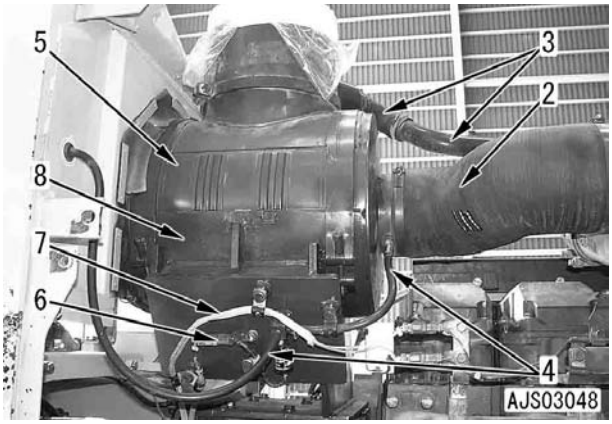
- Overall view of machine right side

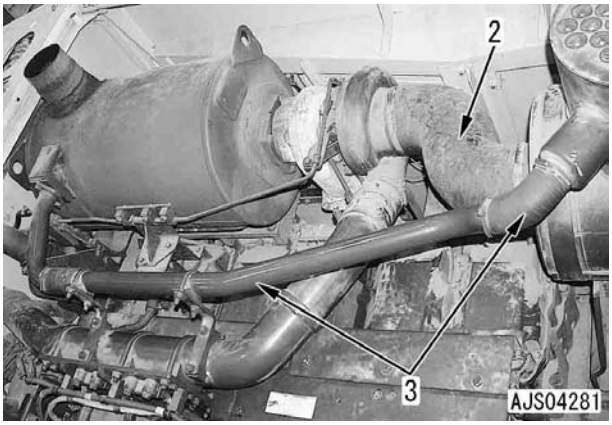


2. Open the bulkhead cover to remove cover (1) of the air cleaner.

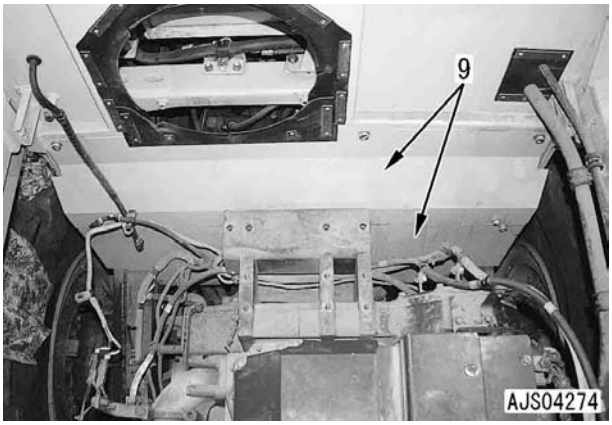


3. Remove air hose (2). [*1]
4. Remove komaclone hose and tube assembly (3). [*2]
5. Disconnect dust indicator hoses (4).
6. Remove air cleaner (5). [*3]
7. Disconnect connector E15 (6).
8. Disconnect wiring harness (7).
9. Remove air cleaner bracket (8).

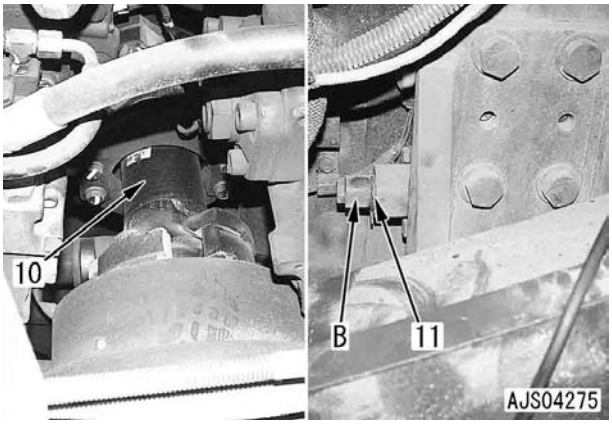




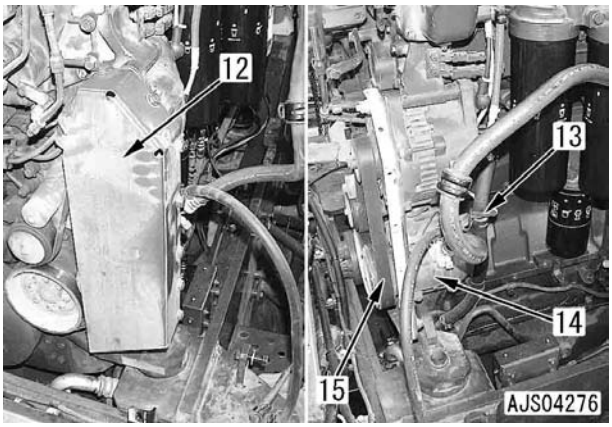
10. Remove bracket and heat insulation cover (9) assembly.



11. Disconnect drive shaft (10). [*4]
    ★ Remove the bottom mounting bolt as shown below.
    1) Pull pin (11) out of a location near the engine mount, which is situated in the front right side, and then push in forcing screw (B).
    2) Turn forcing screw (B) for deburring and then remove the bottom mounting bolt of the drive shaft.



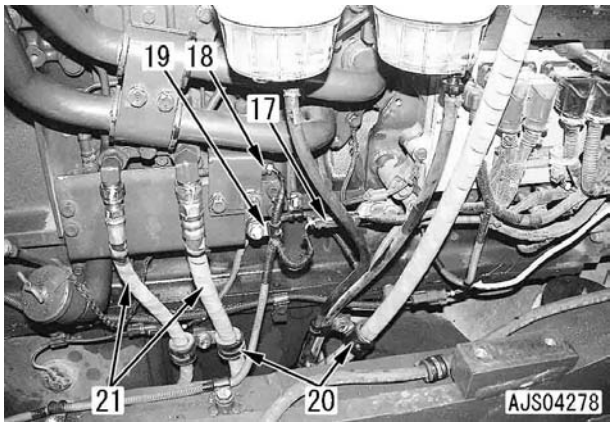
12. Remove cover (12).
13. Disconnect connector E16 (13).
14. Loosen the adjustment bolt of air conditioner compressor (14) and then remove air conditioner compressor belt (15). [*5]
15. Remove air conditioner compressor (14).
    ★ Don't disconnect the air conditioner hose.



16. Disconnect fuel supply hose (16).

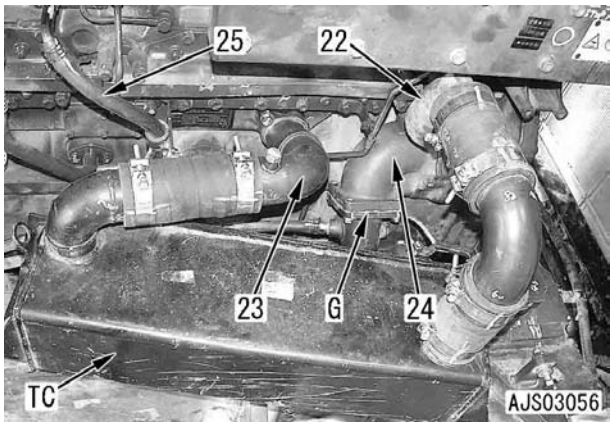


17. Disconnect connector EP1 (17) and EP2 (18).
18. Disconnect clamps (19) and (20).
19. Disconnect 2 fuel hoses (21).

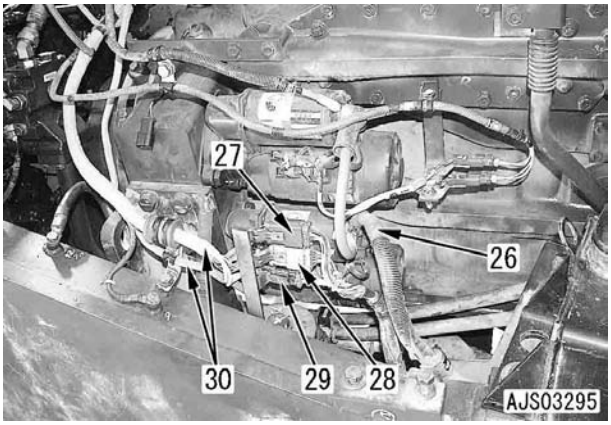


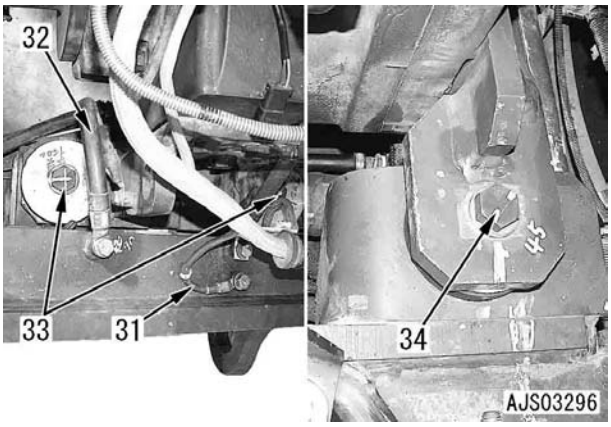
● Left side

20. Disconnect torque converter cooler (TC) coolant tubes (22) and (23).
    ★ Connection: O-ring
21. Disconnect coolant tube (24).
    ★ Replacement of gasket (G)
22. Disconnect heater hose (25).

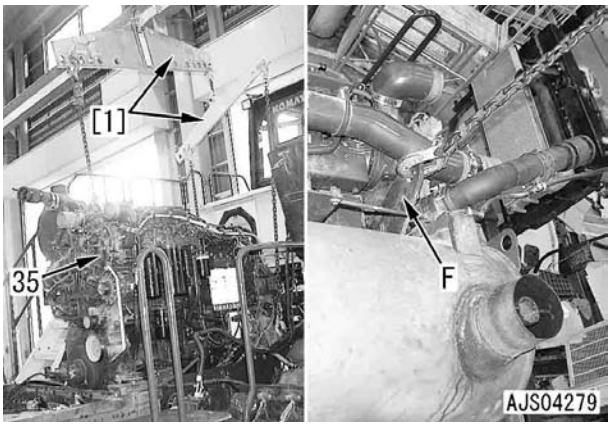


23. Disconnect starting motor terminal (26).
24. Disconnect connector ER1 (27).
25. Disconnect connector ER2 (28).
26. Disconnect connector ER3 (29).
27. Disconnect wiring harness (30).
28. Disconnect grounding wire ER06 (31).
29. Disconnect engine grounding wire (32).
30. Remove engine mount bolts (33) and (34). [*6]

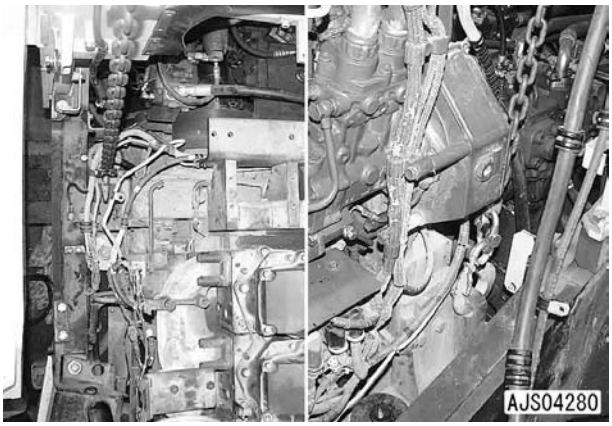




31. Lift and remove engine assembly (35), using T-shaped lifting tool [1].
    ★ F: Rear side lifting hook



★ Front right side and left side lifting hooks are provided in the bottom.



Installation

- Carry out installation in the reverse order to removal.

[*1]
Air hose clamp:
8.8 ± 0.5 Nm {0.9 ± 0.05 kgm}

[*2]
Komaclone tube assembly hose clamp:
5.9 ± 0.49 Nm {0.6 ± 0.05 kgm}

[*3]
Air cleaner band:
12.7 – 17.6 Nm {1.3 – 1.8 kgm}

[*4]
Drive shaft assembly mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}

[*5]
★ Adjust the air conditioner compressor belt tension, referring to “Adjusting air conditioner compressor belt tension” in Testing and adjusting.

[*6]
Engine mount bolt:
824 – 1030 Nm (84 – 105 kgm)
Target: 927 Nm (94.5 kgm)

- **Refilling with coolant**
  Add coolant through the coolant filler to the specified level. Run the engine to increase coolant temperature and then confirm the coolant level again.

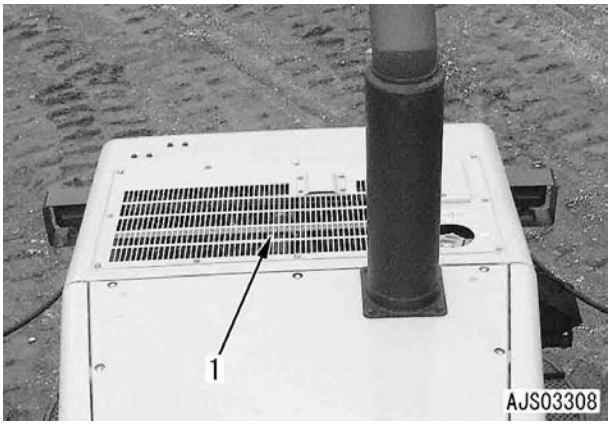
  Coolant: **160 ℓ**

Removal and installation of radiator assembly

Removal

- ⚠ **Park the machine on flat ground and set the safety bar to the frame.**
- ⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- ⚠ **Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**

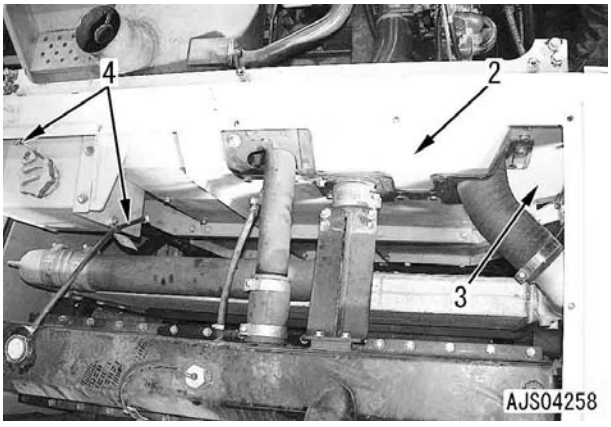
1. Remove cover (1).



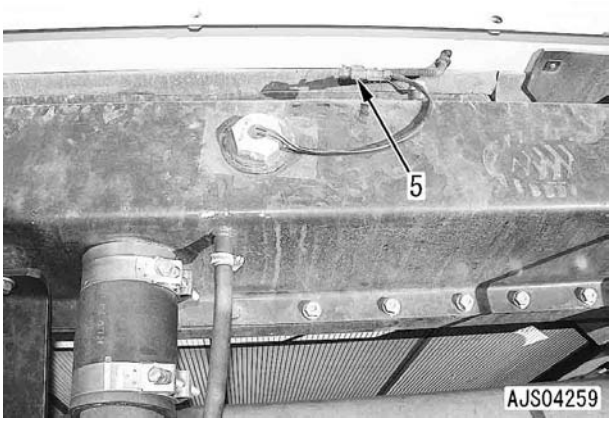
2. Drain the engine coolant.
   Coolant: **160 ℓ**

3. Remove the engine hood and covers, referring to “Removal and installation of engine hood assembly”.

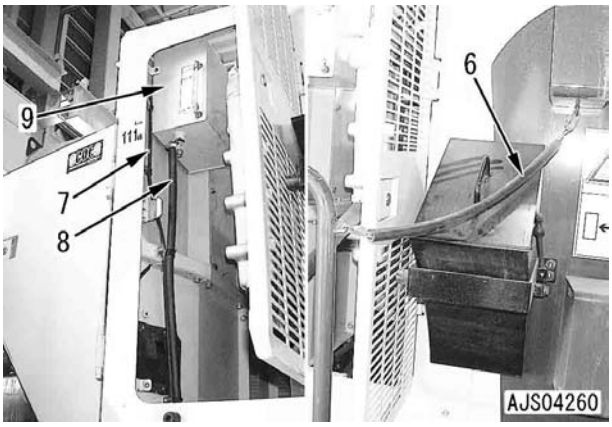
4. Remove cover (2).
5. Disconnect cover (3).
6. Disconnect 2 hoses (4) from the reservoir tank.



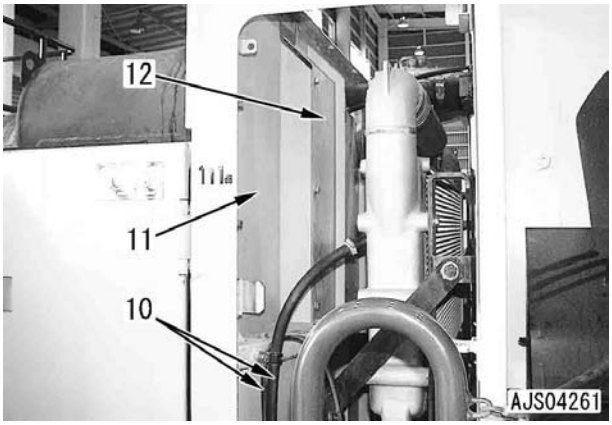
7. Disconnect connector G05 (5) and disconnect the clip of the wiring harness.



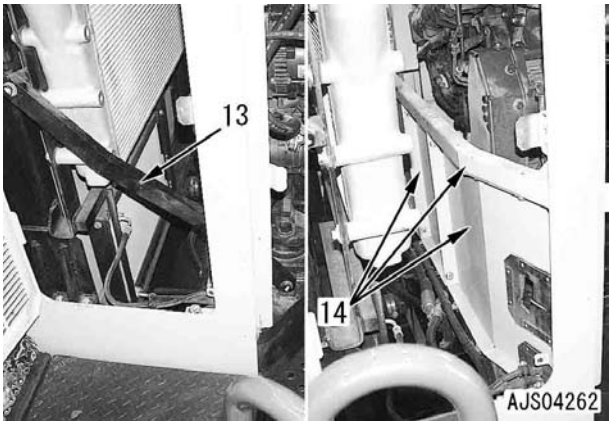
8. Disconnect right and left chains (6).
9. Disconnect hoses (7) and (8).
10. Remove reservoir tank (9).



11. Disconnect hose (10).
12. Remove covers (11) and (12).
    ★ Take care in this operation not to damage the aftercooler core.



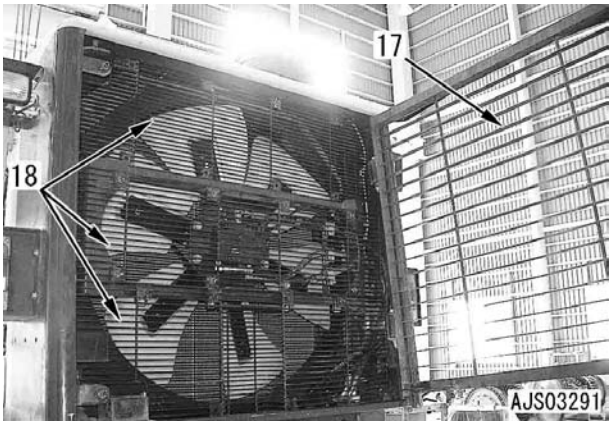
13. Remove right and left side bars (13).
14. Remove cover and frame assembly (14).
    ★ Take care in this operation not to damage the aftercooler core.



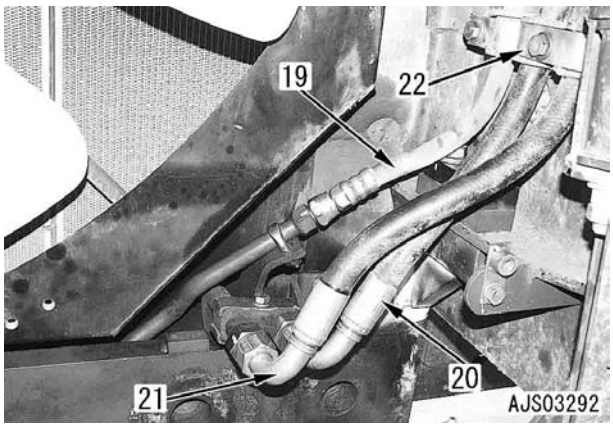
15. Disconnect air conditioner hose clamps (15) from radiator guard (16).



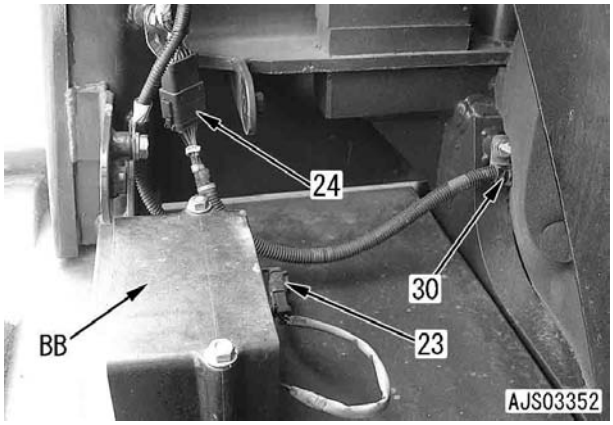
16. Open radiator grille (17) and remove 3 fan guards (18).



17. Disconnect fan drain hose (19), fan inlet hose (20) and fan outlet hose (21).
18. Remove clamp (22).



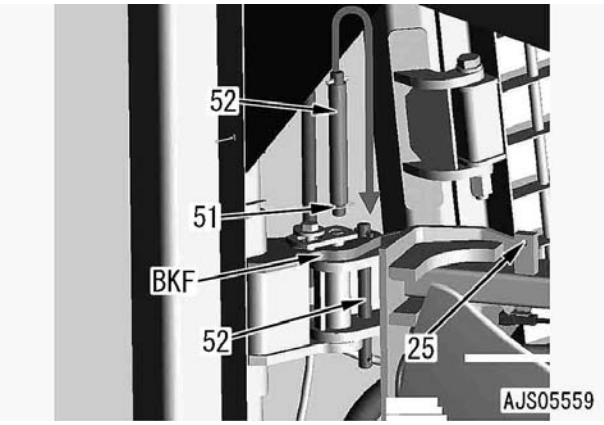
19. Disconnect connectors G06 (23) and GR1 (24) situated in the rear left side of the radiator.
20. Disconnect clamp (30).
    ★ BB: Back buzzer



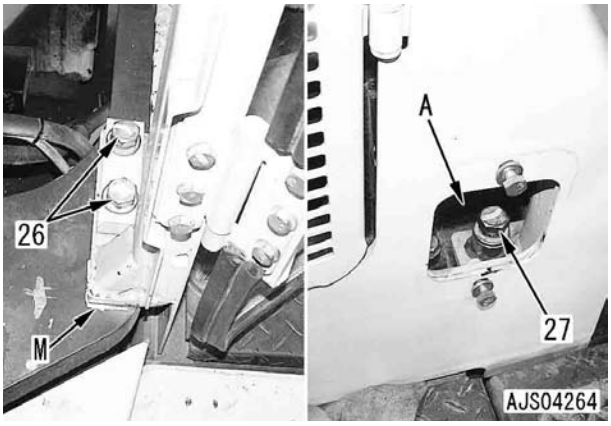
21. Remove 3 mounting bolts and then open fan motor and support assembly (25). [*1]



22. Fix fan motor and support assembly (25) in the manner shown below.
    1) Remove pin (51) from the hinged portion of fan motor and support assembly (25).
    2) Remove lock pin (52) and then fix the assembly to the bracket (BKT) using lock pin (52).



23. Remove right and left mounting bolts (26).
    ★ Leave a counter mark (M) to the position.
24. Remove the cover of section (A) and remove right and left mounting bolts (27).
    ★ The mounting bolt is provided in the rear side of the radiator, too.

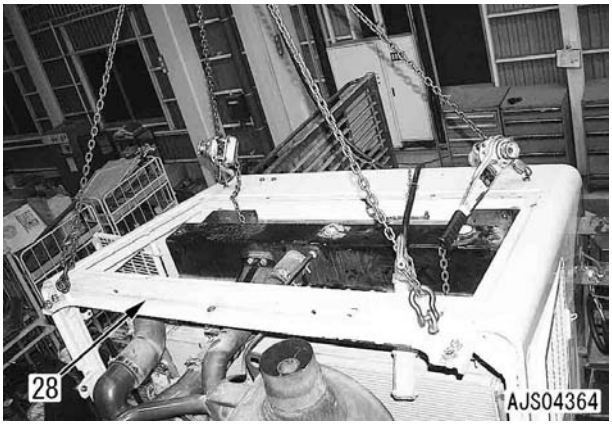


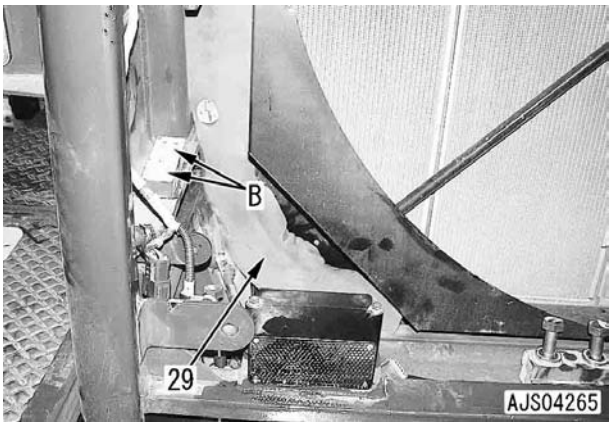
25. Lift and float the radiator guard and fan assembly (28).
    ★ (B): The mounting bolt position in the rear side of the radiator.

    Radiator guard and fan assembly:

    650 kg

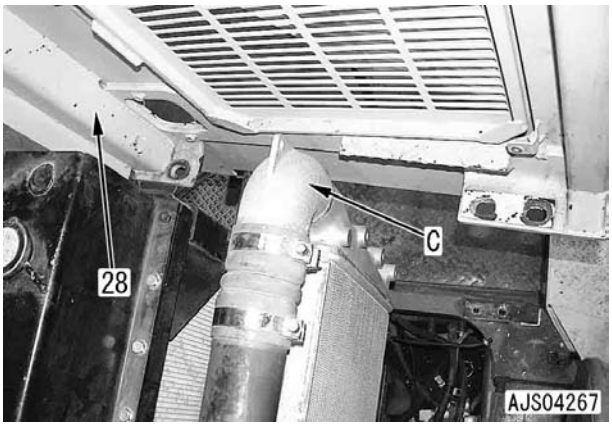
26. Disconnect sponge (29).



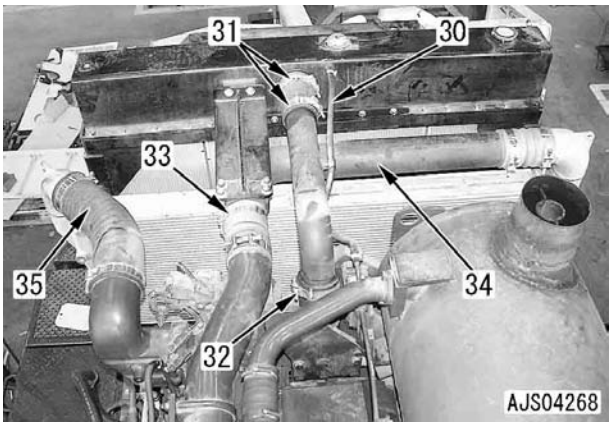


27. Lift radiator guard and fan assembly (28) slowly.
28. Take out radiator guard and fan assembly (28) while avoiding contact against tube (C) of the aftercooler.

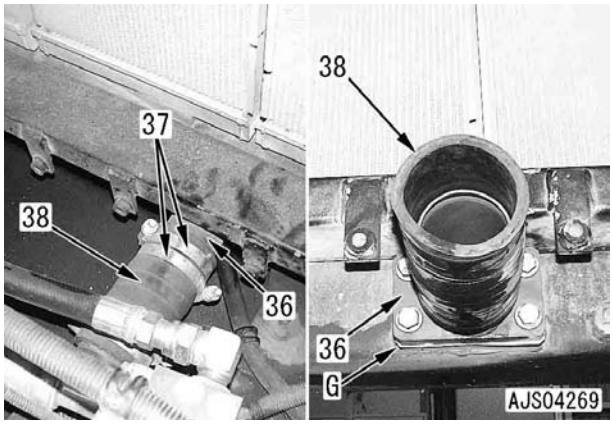




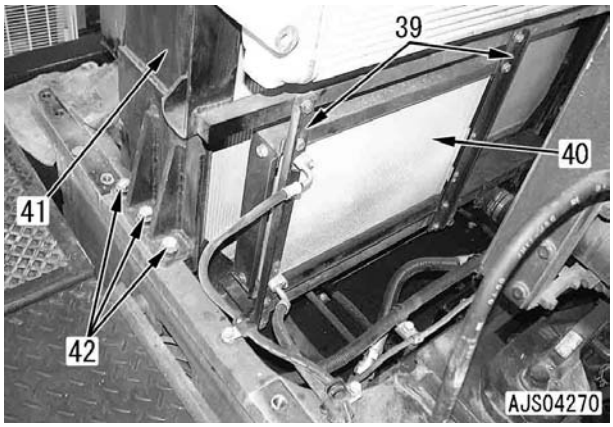
29. Disconnect aeration hose (30).
30. Loosen radiator hose clamps (31) and (32). [*2]
31. Loosen air hose clamp (33). [*3]
32. Disconnect air tube (34).
33. Remove air hose (35). [*4]



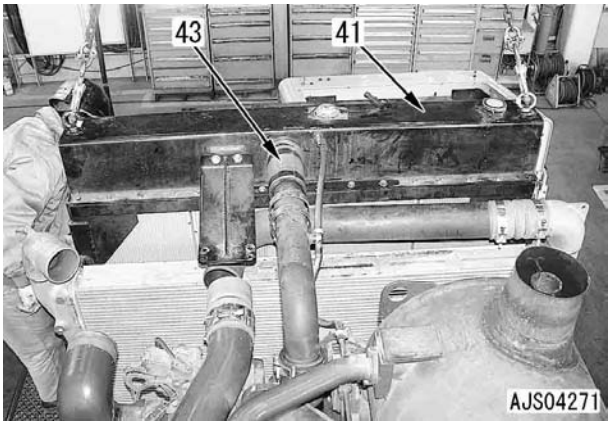
34. Disconnect connectors (36) from the radiator outlet.
    ★ Replacement of gasket (G)
    ★ When disconnecting the outlet at the connection with radiator hose (38) (it takes more than an hour)
    1) Loosen right and left side clamps (37) and then push radiator hose (38) all the way in the radiator. [*5]
       ★ Hose (38) is disconnected later (as the radiator assembly is lifted up).

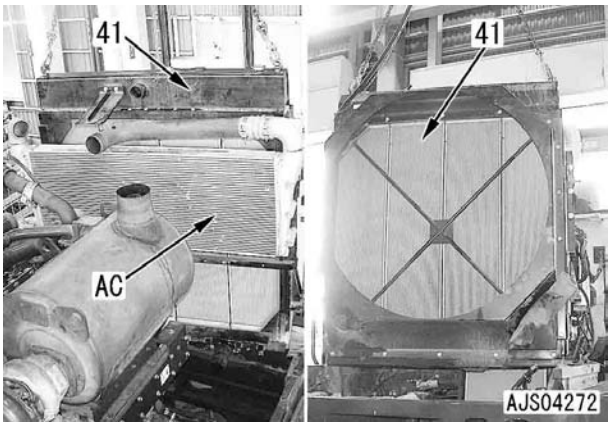


35. Disconnect air conditioner assembly (40) directing bracket (39) outward.
    ★ Remove the air conditioner hose clamp prior to the above operation.
36. Lift radiator assembly (41) temporarily and remove right and left side mounting bolts (42). [*6]
37. Disconnect hose (38) (noted in the foregoing) while the radiator assembly being lifted up.



38. Float radiator assembly (41).
    Radiator assembly: **450 kg**
39. Disconnect radiator hose (43).
40. Take out radiator assembly (41).
    ★ AC: Aftercooler
    ★ Take care in this operation not to damage the core.

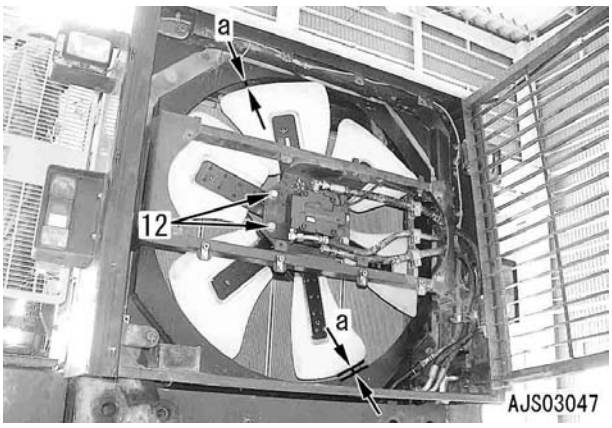




Installation

- Carry out installation in the reverse order to removal.

[*1]
Fan motor and support assembly mounting bolt:
245 – 309 Nm {25 – 31.5 kgm}
Make sure that clearance (a) between the shroud and fan is uniform (Standard clearance: **6 mm**). When not uniform, loosen mounting bolts (12) to adjust the clearance.
Mounting bolt (12):
490 – 608 Nm {50 – 62 kgm}



[*2]
Radiator hose clamp:
10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}

[*3]
Air hose clamp:
10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}

[*4]
Air hose clamp:
10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}

[*5]
Radiator hose clamp:
10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}

[*6]
Radiator assembly (28) mounting bolt:
245 – 309 Nm {25 – 31.5 kgm}

- **Refilling with coolant**
  Add coolant through the coolant filler to the specified level. Run the engine to increase coolant temperature and then confirm the coolant level again.
  Coolant: **160 ℓ**

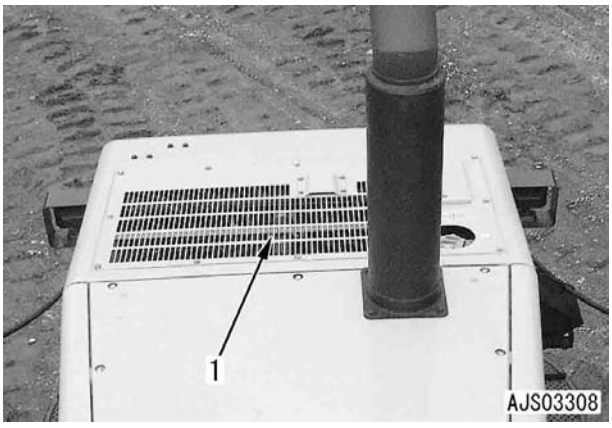
Removal and installation of air aftercooler

Removal

⚠ **Park the machine on flat ground and set the safety bar to the frame.**

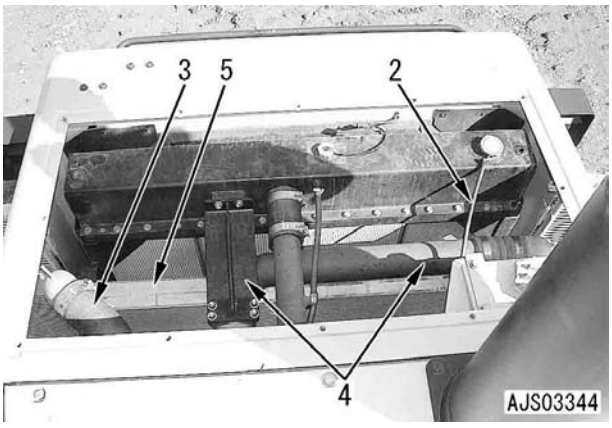
⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**

1. Remove cover (1).



2. Disconnect reservoir tank hose (2).
3. Disconnect air hose (3). [*1]
4. Remove air tube and bracket assembly (4). [*2]
5. Lift air aftercooler assembly (5) temporarily.

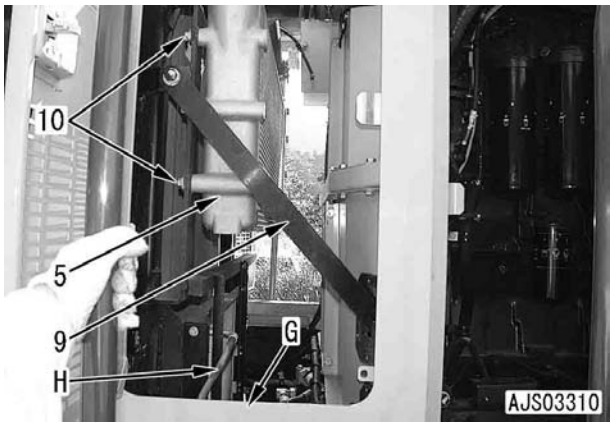
   Air aftercooler assembly: **45 kg**



6. Push up fender (6).
   ★ Fender: If equipped
7. Open doors (7) and (8).



8. Remove bar (9).
9. Remove mounting bolt (10).
10. Slowly take out air aftercooler assembly (5) through the side face while using care not to damage air conditioner hose (H).
    ★ Take care in this operation not to damage the core.
    ★ Take care in this operation not to damage the radiator guard (G).



Installation

- Carry out installation in the reverse order to removal.

[*1], [*2]

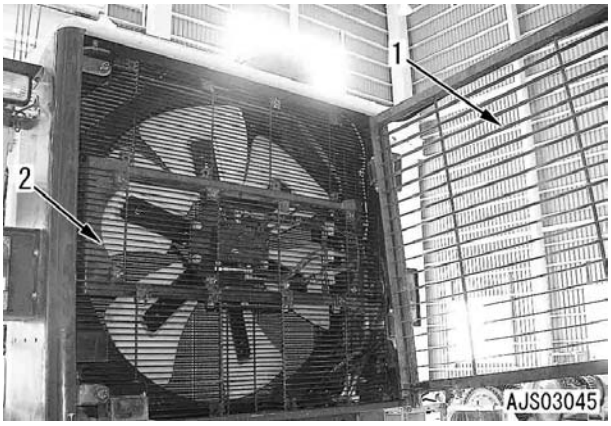
Air hose clamp:
10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}

Removal and installation of cooling fan and fan motor assembly

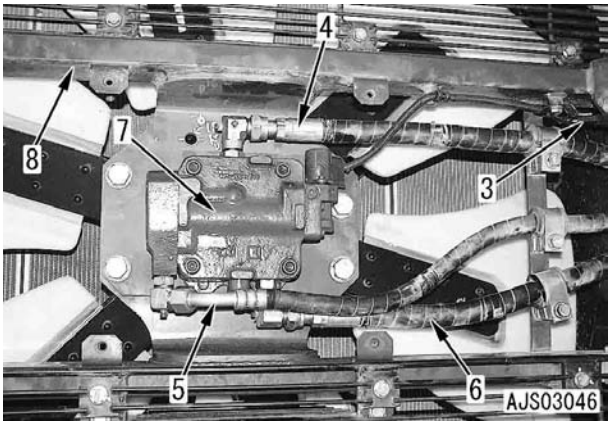
Removal

- ⚠ **Stop the machine on level ground and set the frame lock bar.**
- ⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- ⚠ **Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**

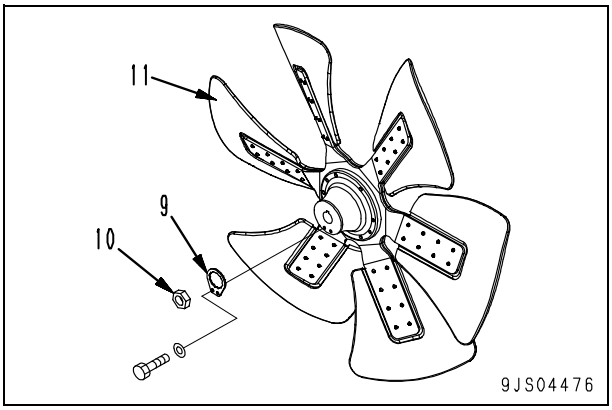
1. Open grille (1) to take out fan guard (2).



2. Disconnect connector G07 (3).
   - ★ Disconnect the wiring harness clamp.
3. Disconnect IN port hose (4), Dr port hose (5) and OUT port hose (6) from fan motor assembly (7).
   - ★ Prepare an oil pan and a detent plug since the above operation allows oil to flow out.
4. Disconnect the top and bottom fan guards from radiator guard.
5. Remove 3 mounting bolts and then open fan motor and support assembly (8). [*1]
   - ★ Fix it using the lock pin.



6. Remove lock plate (9). [*2]
7. Remove fan mounting nut (10) to remove cooling fan (11). [*3]



8. Remove 4 mounting bolts to remove fan motor assembly (7) (noted in the foregoing). [*4]

Installation

- Carry out installation in the reverse order to removal.

[*1]

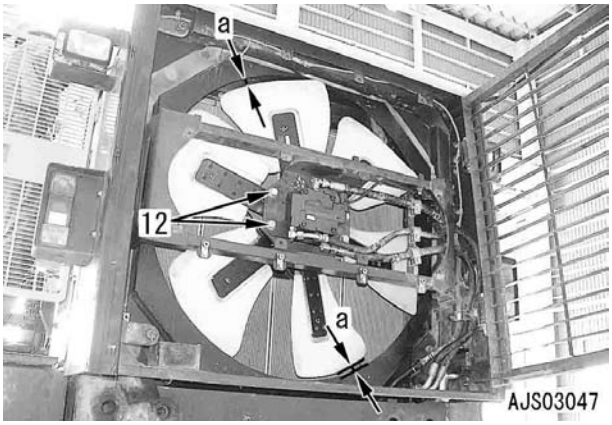
⇦ Fan motor and support assembly (8) mounting bolt:

245 – 309 Nm {25 – 31.5 kgm}

Make sure that clearance (a) between the shroud and fan is uniform (Standard clearance: **6 mm**). When not uniform, loosen mounting bolts (12) to adjust the clearance.

⇦ Mounting bolt (12):

490 – 608 Nm {50 – 62 kgm}



[*2]

It is not allowed to turn the hole alignment side on lock plate (9) to the loosening side.

[*3]

⇦ Mounting nut:

441 – 539 Nm {45.0 – 55.0 kgm}

- **Refilling with oil (Hydraulic oil tank)**
  Add oil through oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

Removal and installation of damper assembly

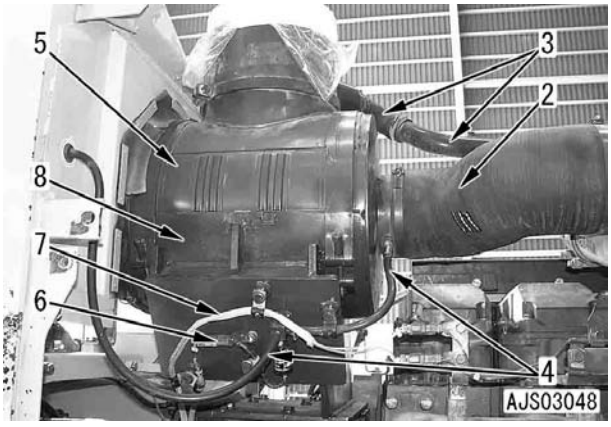
Removal

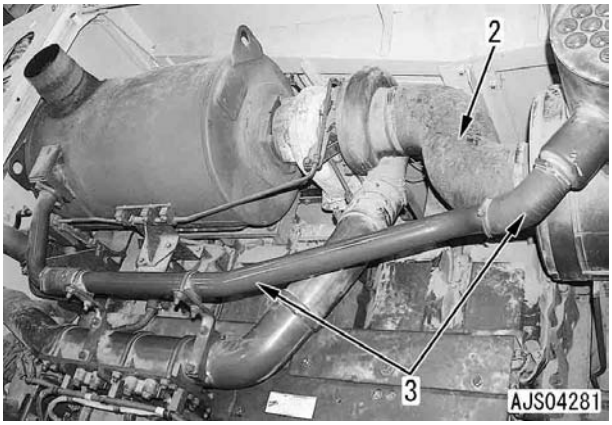
- ⚠ **Stop the machine on level ground and set the frame lock bar.**
- ⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- ⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Remove the engine hood and covers, referring to “Removal and installation of engine hood assembly”.
2. Open the bulkhead cover to remove cover (1) of the air cleaner.

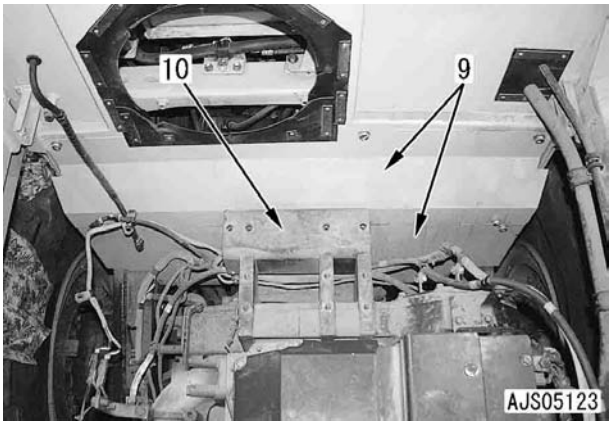


3. Remove air hose (2). [*1]
4. Remove komaclone hose and tube assembly (3). [*2]
5. Disconnect dust indicator hoses (4).
6. Remove air cleaner (5). [*3]
7. Disconnect connector E15 (6).
8. Disconnect wiring harness (7).
9. Remove air cleaner bracket (8).



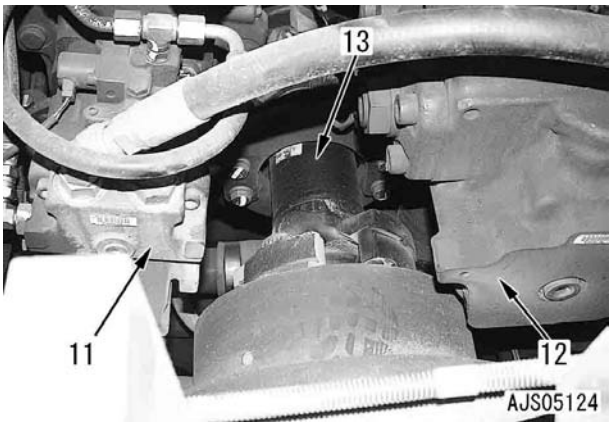


10. Remove bracket (10) and heat insulation cover (9) assembly.
11. Remove bracket (10).

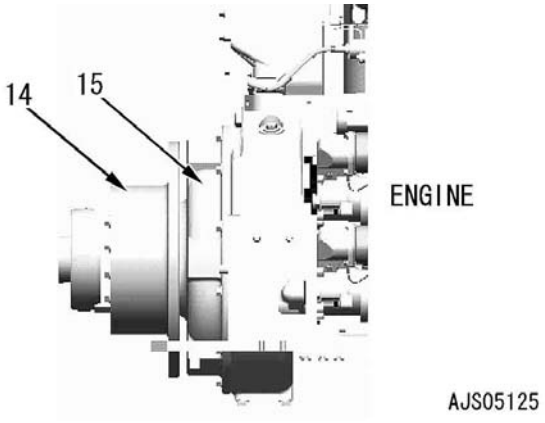


12. Referencing “Removal and installation of hydraulic pump assembly”:
    1) Remove steering and fan pump assembly (11) and work equipment hydraulic pump assembly (12).
    2) Remove drive shaft (13). [*4]

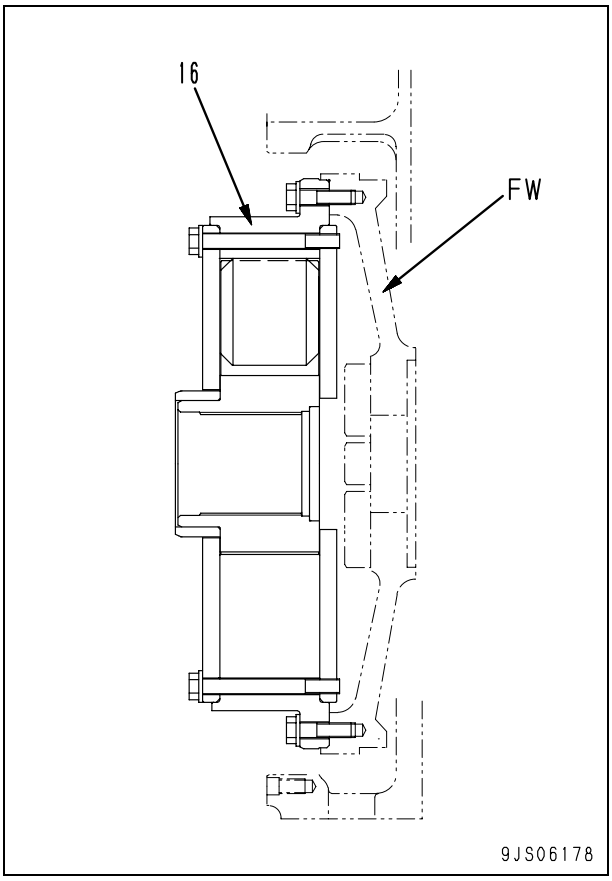
    Drive shaft: **30 kg**



13. Lift and remove damper flywheel assembly (14). [*5]
    Damper flywheel assembly: **45 kg**
14. Lift and remove damper cover and shaft assembly (15). [*6]
    Damper cover and shaft assembly: **70 kg**



15. Lift and remove damper body assembly (16) from the flywheel (FW). [*7]
    Damper body assembly: **80 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]
Air hose clamp:
8.8 ± 0.5 Nm {0.9 ± 0.05 kgm}

[*2]
Komaclone tube assembly hose clamp:
5.9 ± 0.49 Nm {0.6 ± 0.05 kgm}

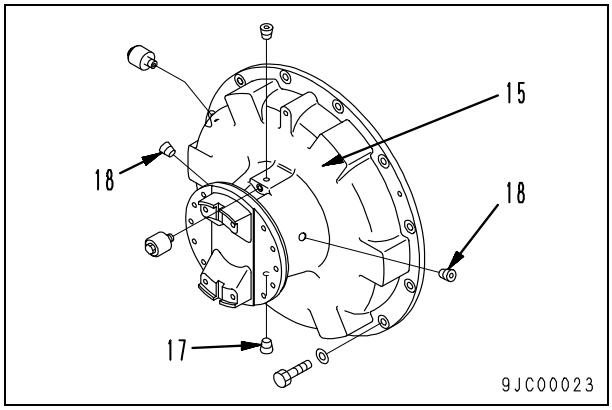
[*3]
Air cleaner band:
12.7 – 17.6 Nm {1.3 – 1.8 kgm}

[*4]
Drive shaft assembly mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}

[*5]
Damper flywheel mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}

[*6]
Mating face: **Gasket sealant (LG-1)**
Damper cover and shaft assembly (15) mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}

1. Remove plug (17) situated at the bottom of the machine and plug (18) situated on the side face, and then fill ENS grease through plug hole (17) until the grease level comes to the bottom of plug (18).
   ENS grease:
   427-12-11871 (GREASE) (250 ± 30 mℓ)
2. Install plugs (17) and (18).
   Plug: **5.9 – 11.8 Nm {0.6 – 1.2 kgm}**



[*7]
Damper body assembly mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}

Disassembly and assembly of damper assembly

Special tools

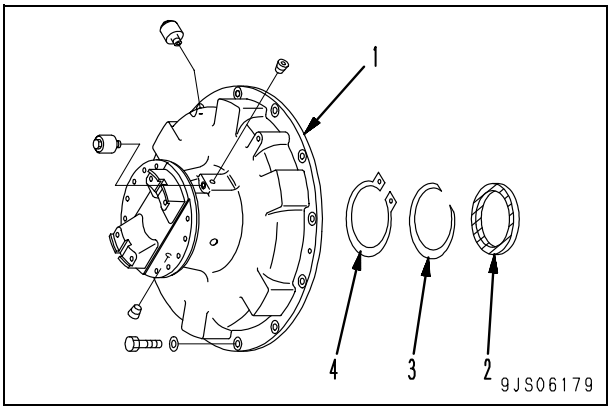
Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	6	793-612-1120	Push tool	■	1		
	7	793T-612-1310	Push tool	●	1	N	○

★ ENS grease:
427-12-11871 (GREASE) (contained in 2-kg can) should be used.
★ Before using ENS grease, make sure other greases are completely cleaned off. It is prohibited to mix ENS grease with other greases.

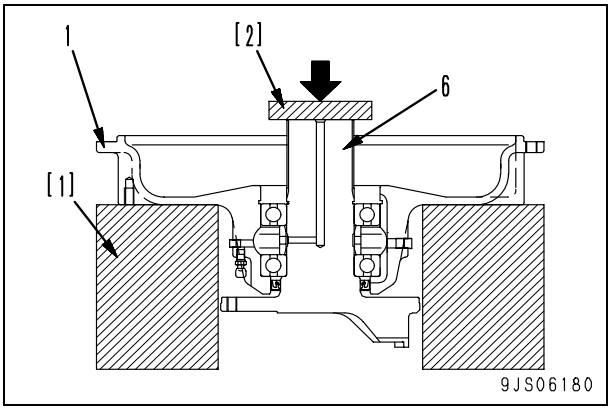
Disassembly

Damper cover and shaft assembly (1)

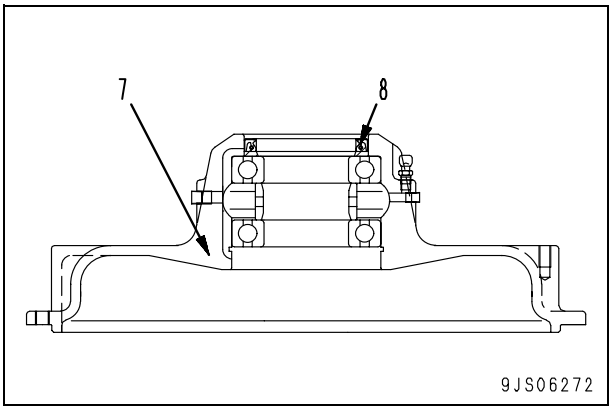
1. Remove oil seal (2) from damper cover and shaft assembly (1).
2. Remove snap rings (3) and (4).



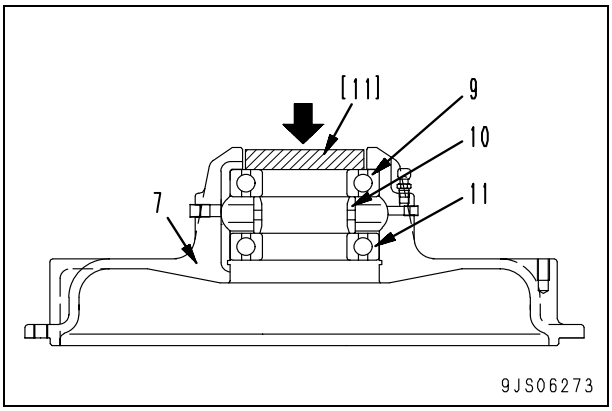
3. Using blocks [1] and push tool [2], remove shaft (6) from damper cover and shaft assembly (1).
   ★ Cover the floor with wood chips so that the shaft may not be damaged should it fall off.



4. Invert cover (7) to remove oil seal (8).

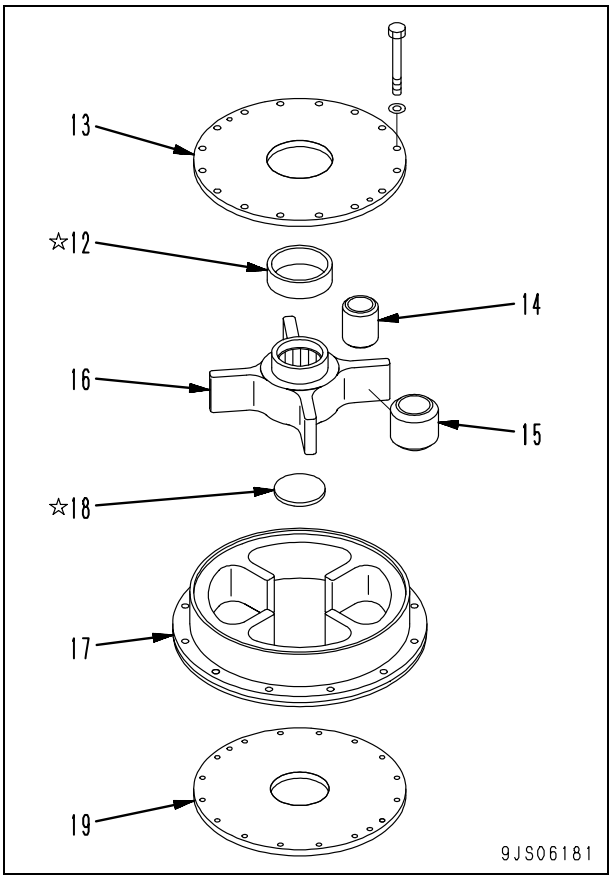


5. Using push tool [11], remove bearing (9), spacer (10) and bearing (11) from cover (7).



Damper body assembly

6. Remove the flange mounting bolt and then remove flange (13), 4 small rubbers (14), 4 large rubbers (15), inner body assembly (16), outer body (17) and flange (19), in this order.
   ★ Don't remove spacer (12) and plug (18) from inner body (16). They must be handled as integral part of inner body assembly.



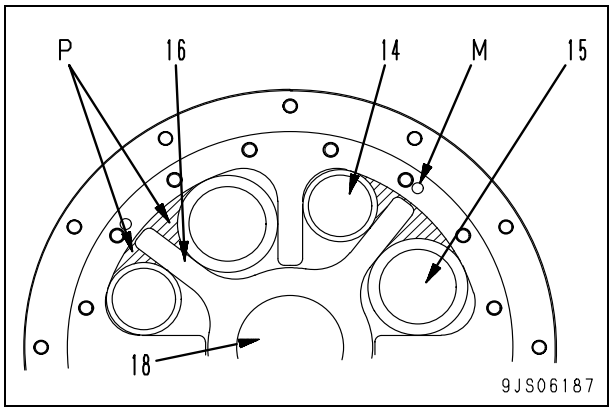
Assembly

Damper body assembly

★ See the figure to the left.

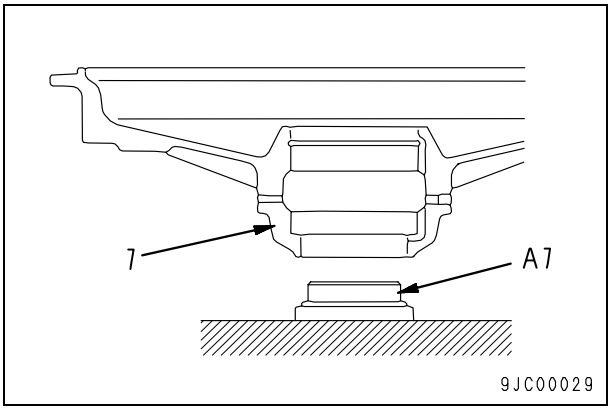
1. Set outer body (17) to flange (19) aligning the mounting bolt hole.
   Mating face: **Gasket sealant (LG-1)**
2. Set inner body assembly (16) aligning the lever tip of inner body assembly (16) to the mark (M) on outer body (17).
   ★ The mark (M) is provided at 4 points on the circumference on the both sides of the outer body.
3. Assemble 4 small rubbers (14) and 4 large rubbers (15) to the positions indicated on the figure.
   Before assembling the rubbers, apply the entire face of the rubbers, outer periphery of inner body and inner periphery of outer body with ENS grease (G2-U-S).
   After assembling the rubbers, fill each of 4 clearances (P) between the rubbers and inner body with **100 mℓ** of ENS grease.
4. Install flange (13).
   Mating face: **Gasket sealant (LG-1)**
   Mounting bolt:
   98 – 123 Nm {10 – 12.5 kgm}
   Fill the top face (shaft insertion portion) of spacer (18) with **30 mℓ** of **ENS grease**.

● View from cover (13).

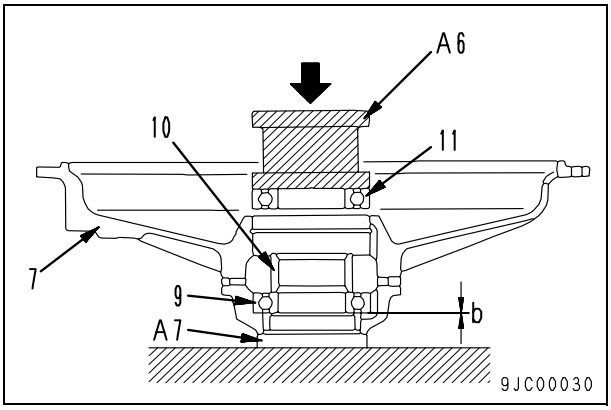


Damper cover and shaft assembly

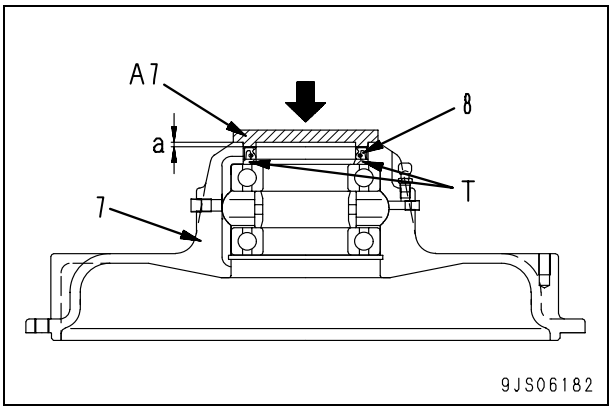
5. Set tool **A7** on the press bench and then set damper cover (7) on tool **A7**.
   ★ Use care in this operation not to incline the damper cover.



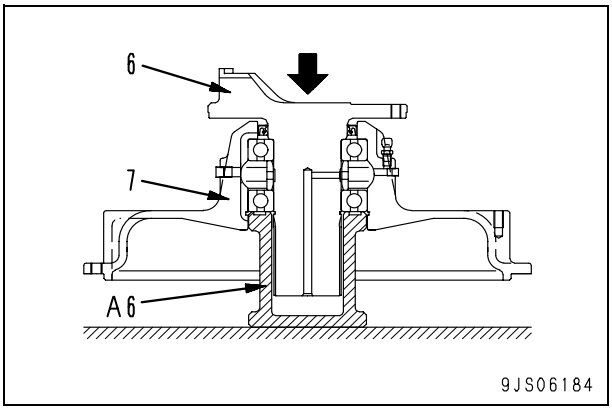
6. Apply adhesive to the outer periphery of bearing (9).
   Outer periphery of bearing: **Locktite No. 648**
7. Using push tools **A6 and A7**, press fit bearing (9) to damper cover (7).
   ★ Overall length: **150 mm**
   Ball of bearing (9): **To be filled with ENS grease**
8. Using push tools **A6 and A7**, press fit bearing (9) to damper cover (7).
   ★ Using the clearance gauge, make sure the clearance is within the standard value.
   Clearance (b): **0 – 0.6 mm**
9. Install spacer (10) aligning it to the bearing inner diameter.
10. In the same way, press fit bearing (11) to damper cover (7).
    ★ When press fitting bearing (11), make sure that inner diameter of spacer (10) and bearing (11) is aligned.
    ★ Press fit bearings one by one.



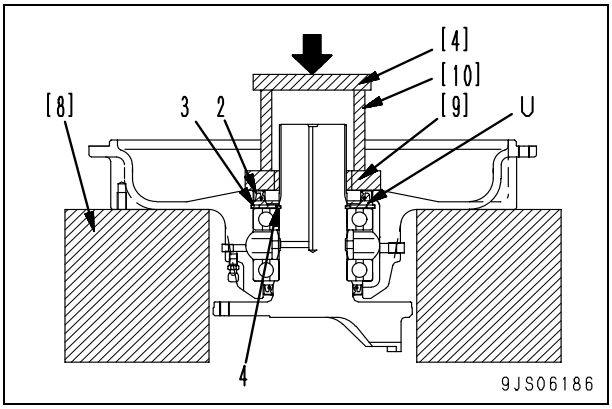
11. Invert damper cover (7).
12. Using push tool **A7**, press fit oil seal (8) to cover (7).
    ★ Overall length: **125 mm**
    Seal lip surface: **ENS grease**
    ★ Seal driven depth: (a) **= 5 ± 0.5 mm**
    Space between bearing and oil seal (indicated as T): **ENS grease** (**20 mℓ**)



13. Press fit shaft (6) from the top of cover (7) setting push tool **A6** at the bottom.
    Inner periphery of bearing: **Loctite No. 648**
    Spline of shaft: Molybdenum disulfide-based desiccating and lubricating agent (**LM-P**)
    Sumico Lubricant Low Coll Dry Spray or equivalent
    ★ Leave the spline as is for 2 to 3 minutes after applying the above agent.
    ★ Before press fitting, remove foreign substances deposited on the outside of the shaft and inside of the bearing.



14. Invert the damper cover and shaft assembly and install snap rings (3) and (4).
    - Ball of bearing (11): **To be filled with ENS grease**
    - Space between bearing and oil seal (indicated as U): **ENS grease** (**60 mℓ**)
15. Using push tools [4], [8], [9] and [10], press fit oil seal (2).
    - ★ Oil seal driven depth: **± 0.5 mm** from the damper cover end face
    - Oil seal lip surface: **ENS grease**

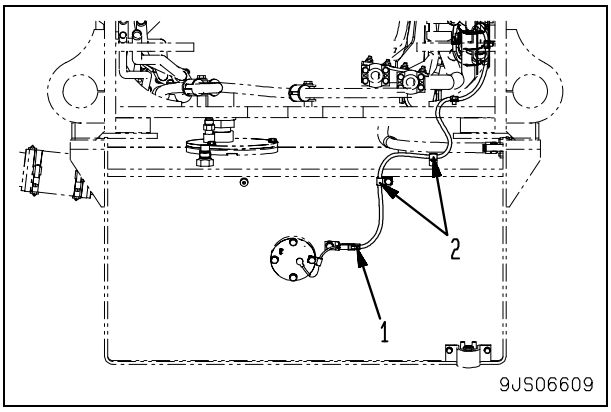


Removal and installation of fuel tank assembly

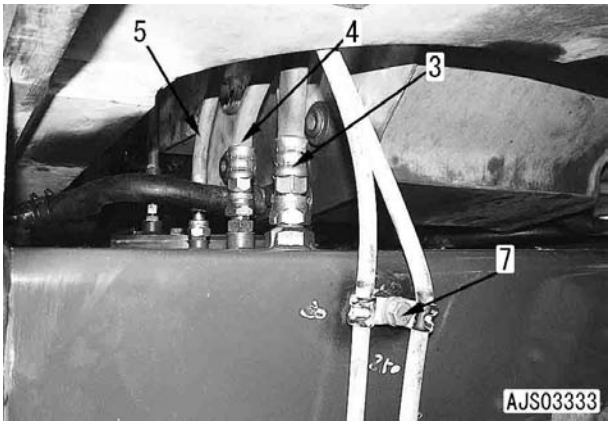
Removal

- ⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- ⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**
- ⚠ **Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**

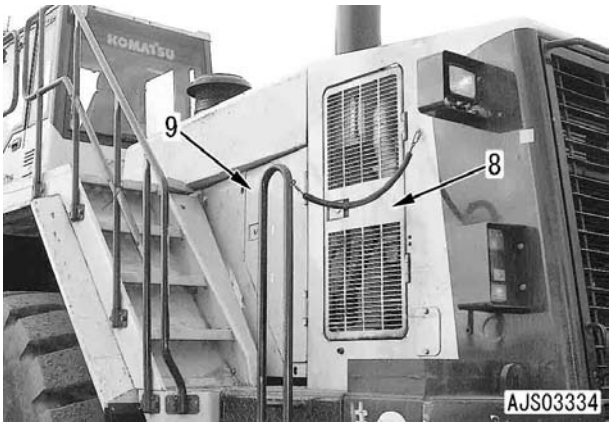
1. Drain fuel from the tank.
   Fuel tank: **133 ℓ** (When filled up)
2. Drain the engine coolant.
   Coolant: **Approx. 32 ℓ**
3. Disconnect wiring connector R16 (1) situated in the front side of the fuel tank.
4. Disconnect clamp (2).



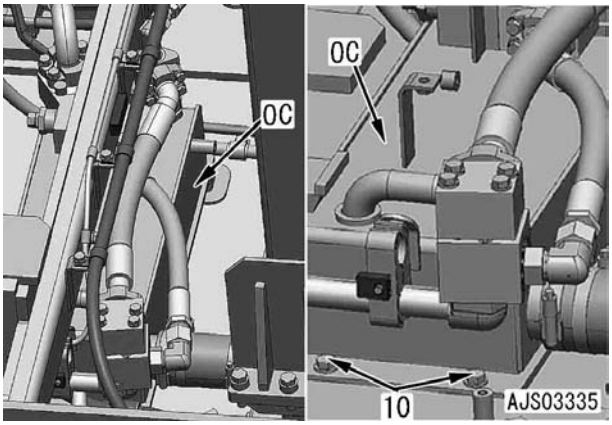
5. Disconnect fuel supply hose (3) and fuel return hoses (4) and (5) in the upper right of the fuel tank.
   ★ Before disconnecting, attach them a tag or equivalent to make the later position identification easier.
6. Disconnect hose clamp (7).



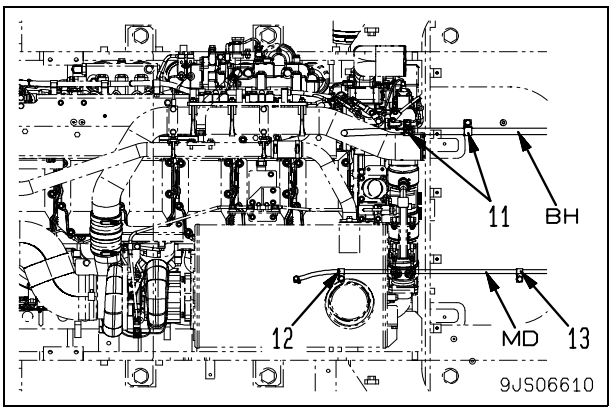
7. Open right and left covers (8) as well as cover (9).



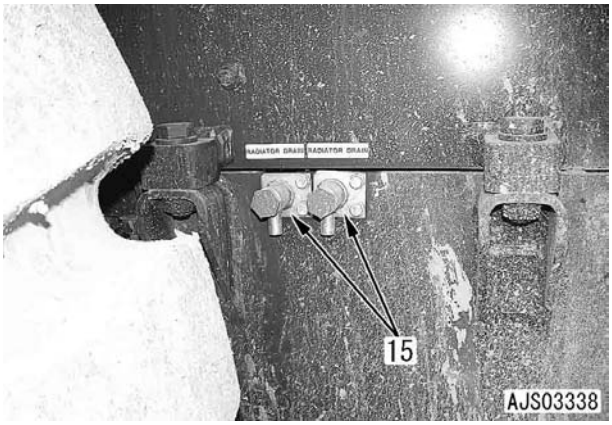
8. Remove right and left oil cooler (OC) mounting bolts (10).
   ★ Don't disconnect the oil hose and coolant hose from the oil cooler (OC).



9. Disconnect clamp (11) of the blow-by hose (BH).
10. Disconnect clamps (12) and (13) of the muffler drain hose (MD).

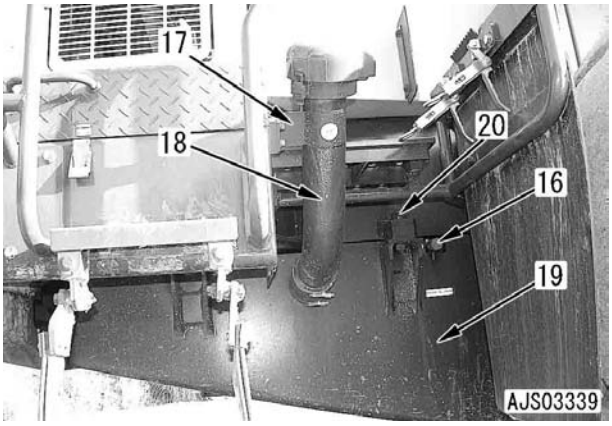


11. Disconnect radiator drain (15).



12. Disconnect engine drain (16).
13. Disconnect bracket (17).
14. Remove oil filler port (18).
15. Lift fuel tank (19) temporarily.
16. Remove 6 right and left mounting bolts (20). [*1]
    ★ Shims are provided for 6 right and left mounting bolts (20). Confirm their numbers and positions. [*2]
17. Lift and remove fuel tank (13).

    Fuel tank assembly: **430 kg** (Fuel not included)



Installation

- Carry out installation in the reverse order to removal.

[*1]

Fuel tank mounting bolt
1,520 – 1,910 Nm {155 – 195 kgm}
Target: **1,720 Nm {175 kgm}**

[*2]

★ Adjust the shim so that the clearance on the fuel tank mounting surface may become 0.5 mm or less.

- **Refilling with oil (Hydraulic oil tank)**
  Fill oil from the oil filler.

Removal and installation of engine hood assembly

Removal

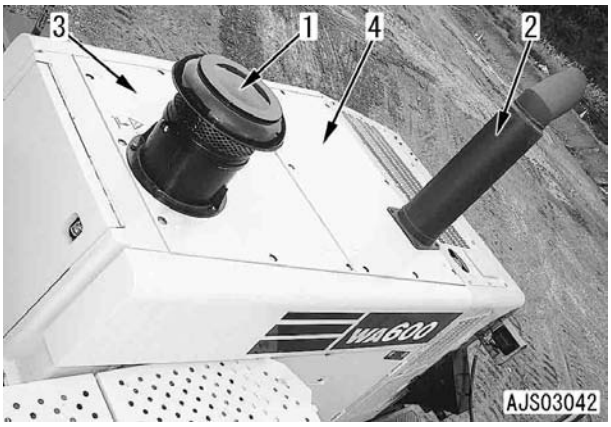
⚠ **Stop the machine on level ground and set the frame lock bar.**

⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**

1. Remove pre-cleaner (1) and muffler (2).
2. Remove hoods (3) and (4).
   ★ A tapped hole for lifting is provided in the four corners.

   Hood (3): **35 kg**

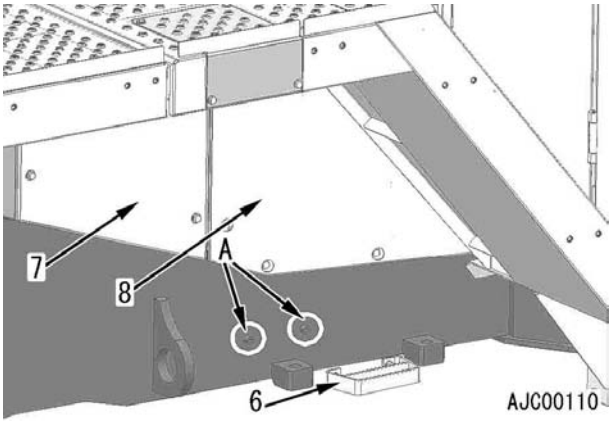
   Hood (4): **45 kg**



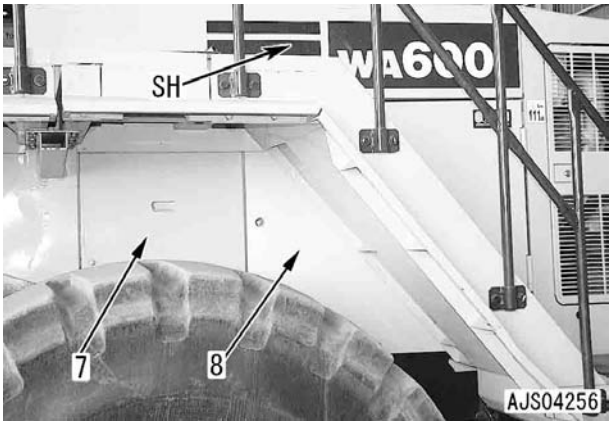
3. Remove cover (5).

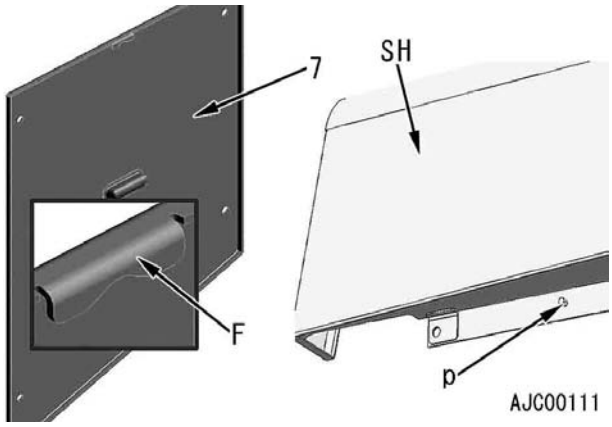


4. Remove step (6) on the right side of the machine body and then install it on boss (A) of the left side.
   ★ Use it as the step when removing covers (7) and (8).



5. Remove covers (7) and (8).
   ★ Hook (F) is provided at the top of the rear side of cover (7). The pin (P) situated at the bottom of the side hood (SH) protect cover (7) from falling off as the mounting bolt is removed.





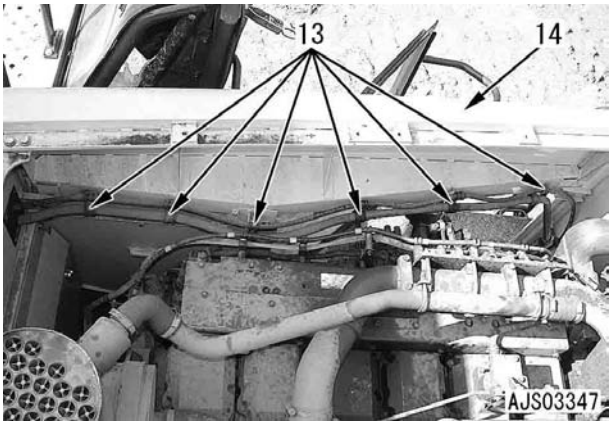
6. Push up fender (10).
   ★ Fender (10): If equipped
7. Remove engine right side door (11).

   Engine right side door: **45 kg**

8. Remove cover (12).
   ★ Just like cover (7), cover (12) is also protected from falling off as the bolt is removed.



9. Disconnect air conditioner hose clamps (13) from right side hood (14).



10. Remove stay (15).
11. Lift and remove side hood (16).

    Side hood (one side): **55 kg**

    ★ Remove the right side, too.



Installation

- Carry out installation in the reverse order to removal.

Removal and installation of bulkhead assembly

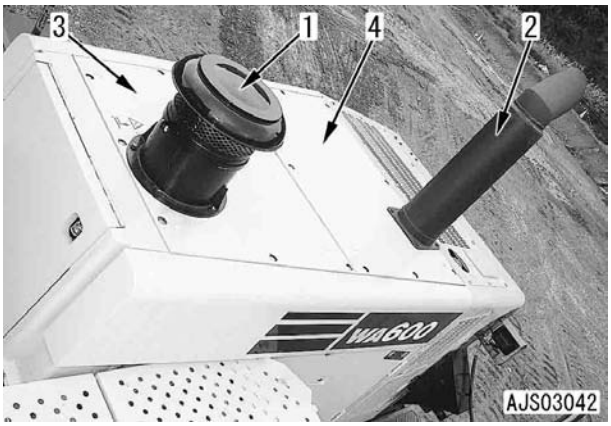
Special tools

Sym-bol	Part number	Part name	Necessity	Q'ty	New/Remodel	Sketch
X1	799-703-1200	Service tool kit	■	1		
	799-703-1100	Vacuum pump (100 V)	■	1		
	799-703-1111	Vacuum pump (220 V)	■	1		
	799-703-1121	Vacuum pump (240 V)	■	1		
	799-703-1401	Gas leak detector	■	1		

Removal

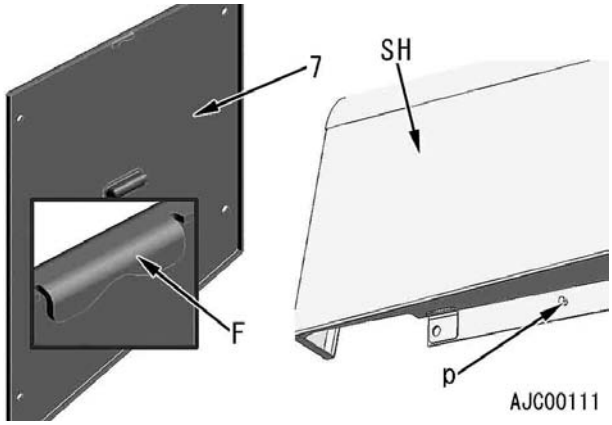
- ⚠ **Stop the machine on level ground and set the frame lock bar.**
- ⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- ⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**
- ⚠ **Collect the air conditioner gas (R134a).**

1. Remove pre-cleaner (1) and muffler (2).
2. Remove hoods (3) and (4).
   - ★ A tapped hole for lifting is provided in the four corners.
   - Hood (3): **35 kg**
   - Hood (4): **45 kg**

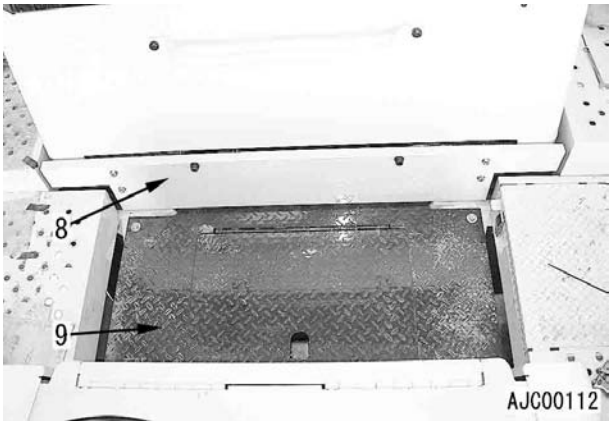


3. Push up fender (5).
4. Lift and remove handrail and step assembly (6).
5. Remove cover (7).
   - ★ Hook (F) is provided at the top of the rear side of cover (7). The pin (P) situated at the bottom of the side hood (SH) protects cover (7) from falling off as the mounting bolt is removed.

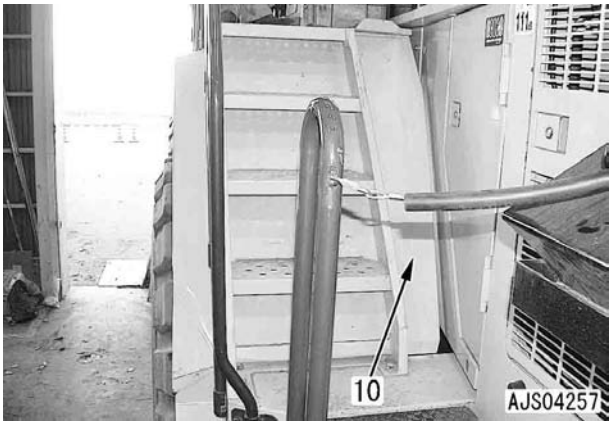




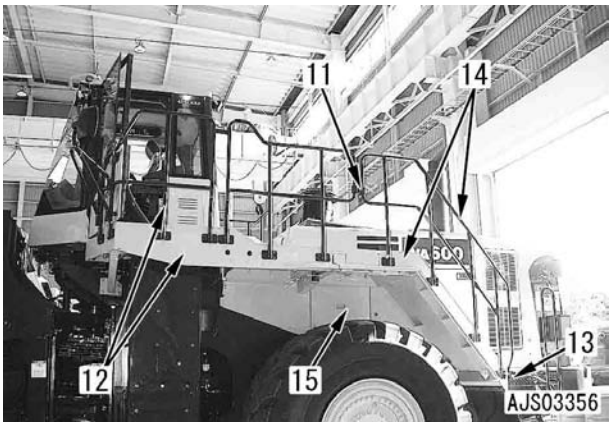
6. Remove cover (8).
7. Remove step (9).

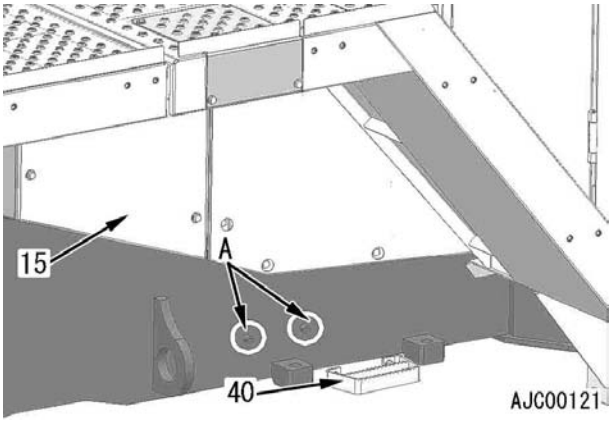


8. Remove cover (10).

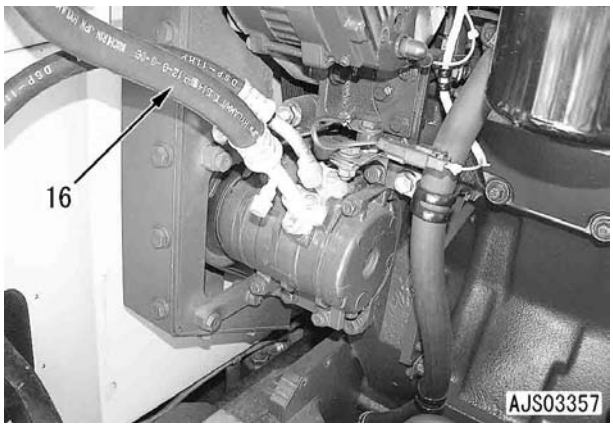


9. Remove clamp (11).
10. Lift and remove handrail and step assembly (12).
11. Remove handrail mounting bolt (13).
12. Lift and remove handrail and ladder assembly (14).
13. Remove step (40) on the right side of the machine body and then install it on boss (A) of the left side.
    ★ Use it as the step when removing cover (15).
14. Remove cover (15).
    ★ Just like cover (7), cover (15) is also protected from falling off as the bolt is removed.





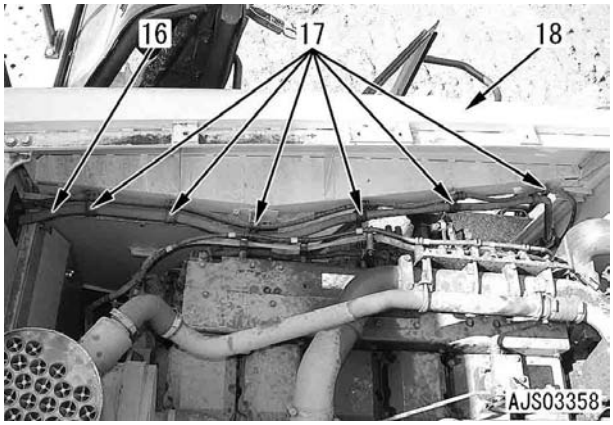
15. Open the engine right side door.
16. Disconnect air conditioner hose (16). [*1]
    ★ The hose with larger diameter



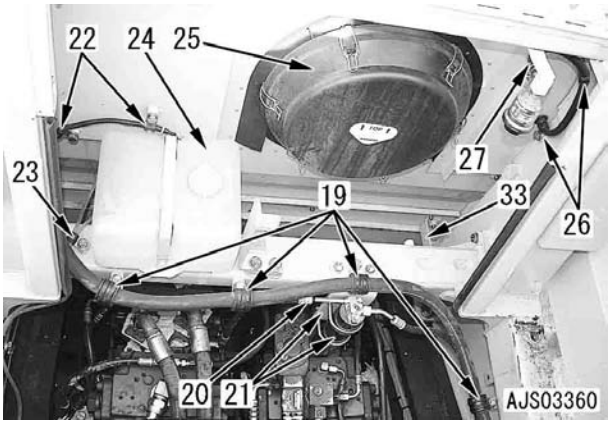
17. Disconnect air conditioner hose clamps (17) from right side hood (18).
18. Lift and remove right side hood (18).
    ★ Remove the left side, too.

    Side hood (one side): **55 kg**

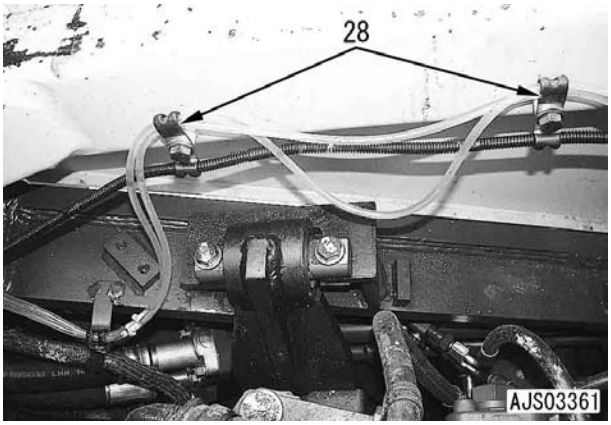
    ★ Haul in air conditioner hose (16) on the engine side to the cab side.



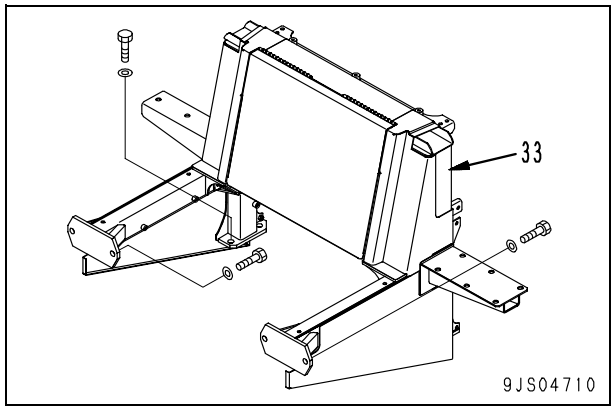
19. Disconnect air conditioner hose clamps (19).
20. Disconnect air conditioner hose (20).
21. Disconnect receiver dryer and bracket assembly (21) from the bulkhead assembly.
22. Disconnect clamps (22) and (23).
23. Disconnect washer tank (24).
    - ★ Disconnect connectors BL1 and BL3 from the back.
    - ★ Haul in air conditioner hose (20) from the engine side.
24. Remove air cleaner cover (25).
25. Disconnect hose clamps (26).
26. Disconnect dust indicator hose (27).
27. Remove right and left brackets (33).



28. Disconnect clamps (28).



29. Lift and remove bulkhead assembly (33). [*2]
    Bulkhead assembly: **220 kg**



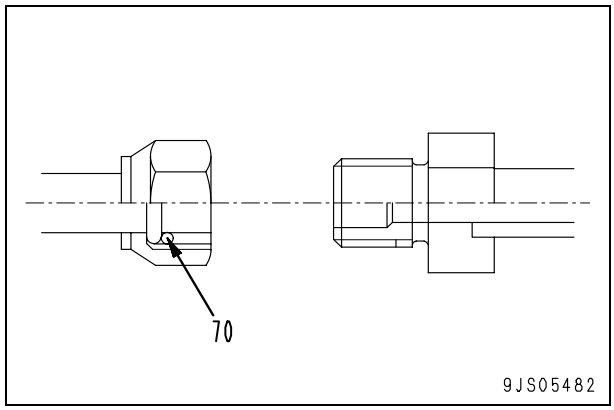
Installation

- Carry out installation in the reverse order to removal

[*1]

- ★ When installing the air conditioner circuit hoses, use care so that dirt, water, may not enter.
- ★ Before tightening, make sure O-ring (70) is provided in the air conditioner hose piping connection.
- ★ Check that there is no defect or deterioration on the O-ring.
- ★ When connecting the refrigerant piping, coat the O-ring with compressor oil **for new refrigerant (R134a) (Denso: ND-OIL8, Zexel: ZXL100PG (PAG 46 or equivalent))**.

Mounting bolt: **8 – 12 Nm {0.8 – 1.2 kgm}**



[*2]

Bulkhead assembly mounting bolt:
455 – 565 Nm {46.5 – 58 kgm}

- **Filling of air conditioning gas**
  By using tool **X1**, fill the air conditioner gas **(R134a)** inside the air conditioner circuit.
  - ★ Filling quantity: **850 ± 50 g**

WA600-6 Wheel loader

Form No. SEN01157-00

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Printed in Japan 06-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

Engine and cooling system, Part 2

Engine and cooling system, Part 2 2
Removal and installation of fuel supply pump assembly 2
Removal and installation of cylinder head assembly 8
Removal and installation of fuel injector assembly 24
Removal and installation of engine front seal 28
Removal and installation of engine rear seal 31

Engine and cooling system, Part 2

Removal and installation of fuel supply pump assembly

Removal

⚠ **Stop the machine on level ground and set the frame lock bar.**

⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**

⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

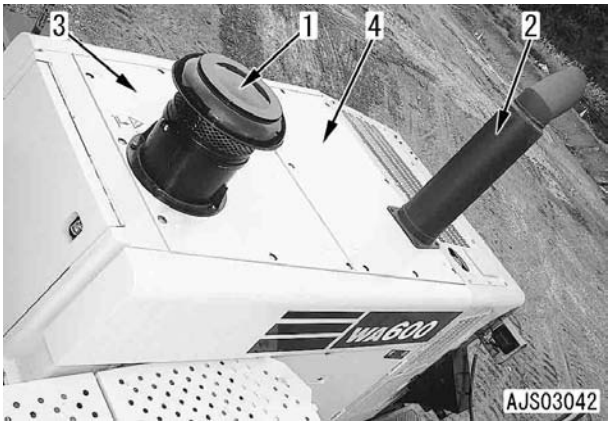
★ The work of aligning 1TOP and 6TOP is not necessary.

★ The special tool for pulling the gear out is not necessary.

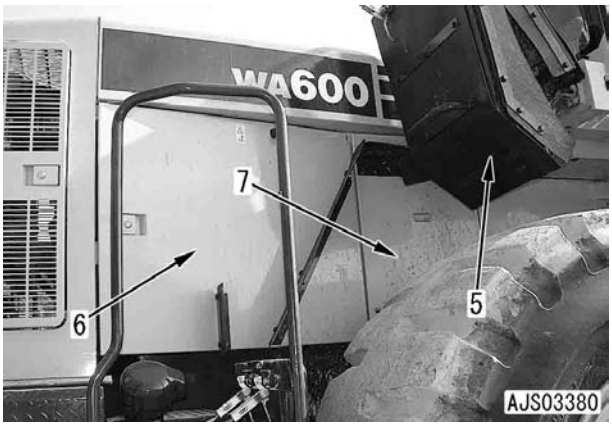
1. Remove pre-cleaner (1) and muffler (2).
2. Remove hoods (3) and (4).
   ★ A tapped hole for lifting is provided in the four corners.

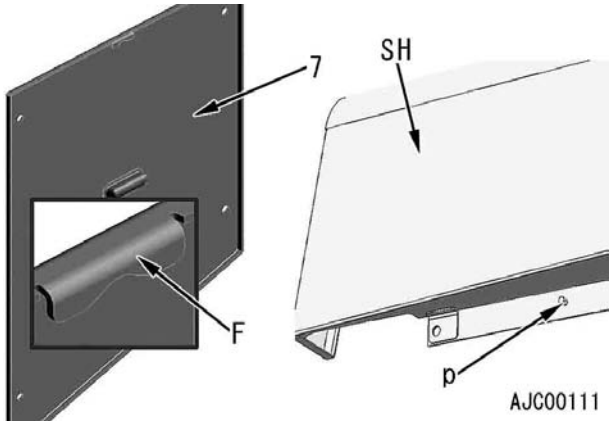
   Hood (3): **35 kg**

   Hood (4): **45 kg**

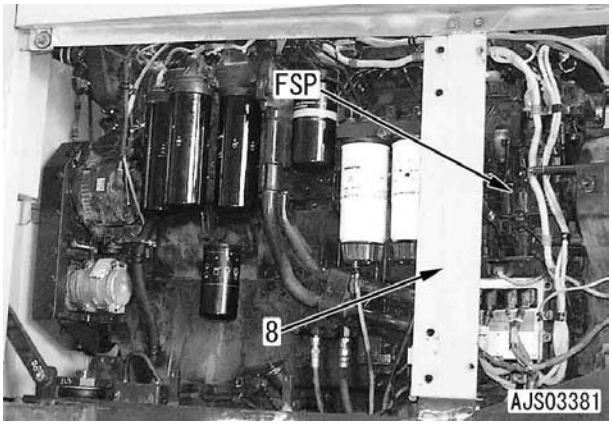


3. Push up fender (5).
4. Remove door (6).
5. Remove cover (7).
   ★ Hook (F) is provided at the top of the rear side of cover (7). The pin (P) situated at the bottom of the side hood (SH) protect cover (7) from falling off as the mounting bolt is removed.

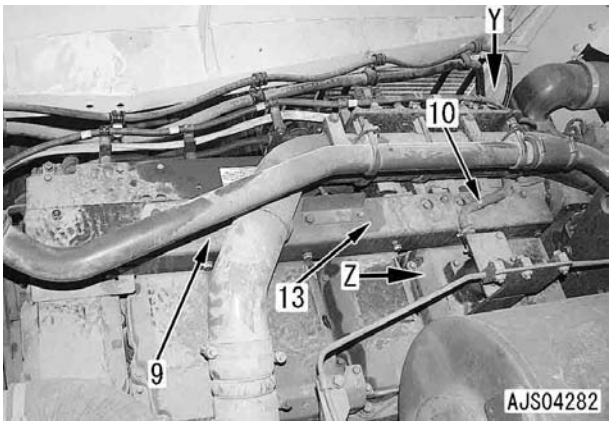




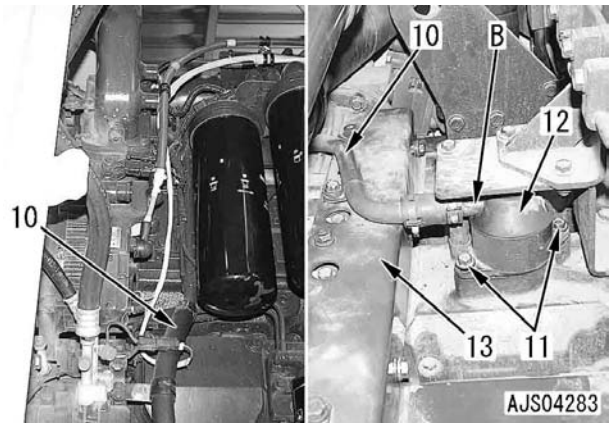
6. Remove stay (8).
   ★ FSP: Fuel supply pump



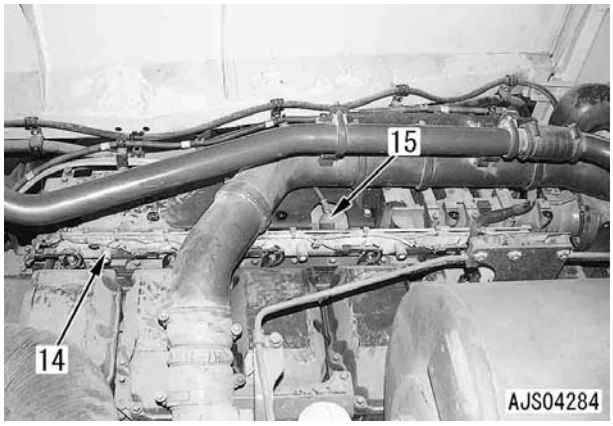
7. Remove wiring harness cover (9).
   ★ Use care so that the washer may not fall off.
8. Disconnect the clamp of blow-by tube (10).
9. Remove mounting bolt (11) and then lift breather (12) slightly.
10. Remove wiring harness cover (13).
    ★ Use care so that the washer may not fall off.
    ★ Care must be exercised in removing cover (13). Removing cover (13) forcibly without slightly lifting breather (12) may generate cracks in (B) portion since breather (12) is made of plastics.
    ★ An O-ring instead of a gasket is provided in breather (12) installation position.



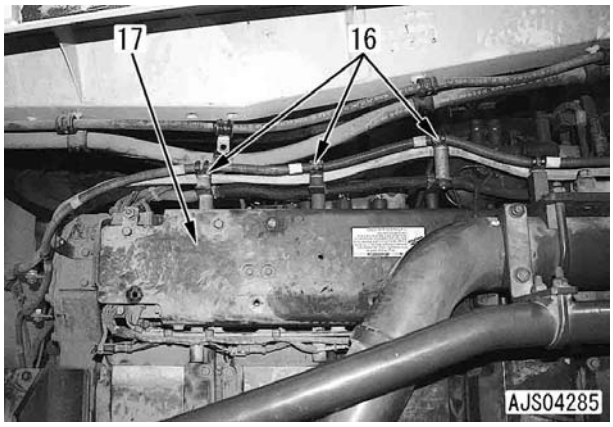
· Y View · Z View



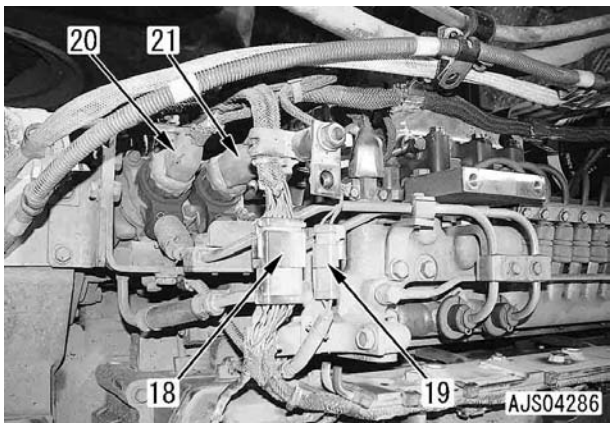
11. Remove bracket (14).
    ★ 5 mounting bolts
12. Disconnect connector PFUEL (15).



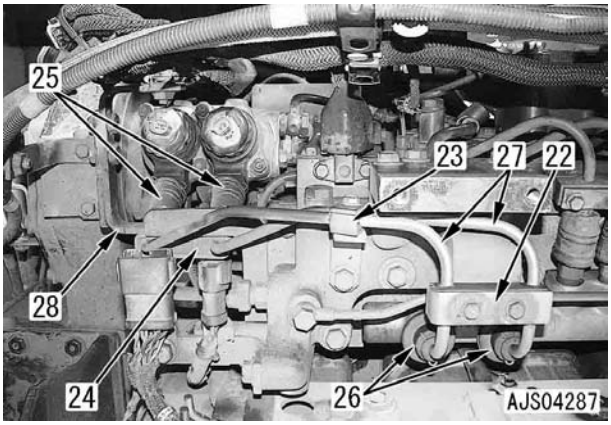
13. Disconnect clamps (16).
14. Remove high-pressure piping cover (17).



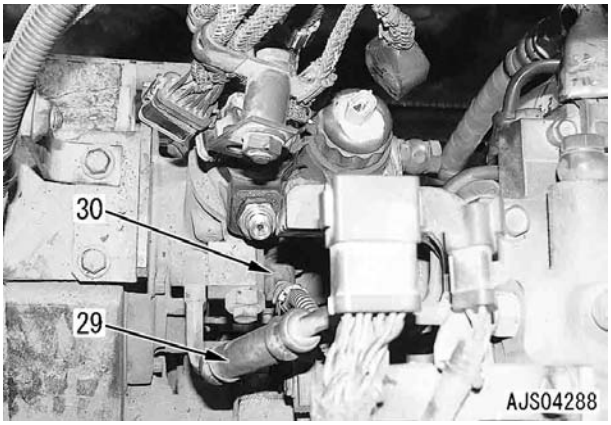
15. Disconnect connectors INJ (18) and G (19).
16. Disconnect connectors PCV1 (20) and PCV2 (21).



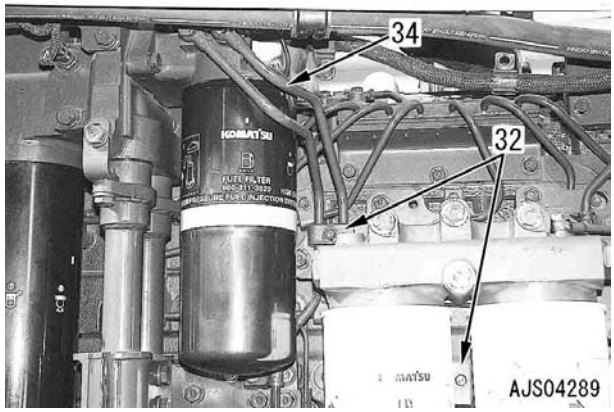
17. Remove clamps (22) to (24).
18. Remove covers (25) and (26).
19. Remove tube (27).
    ★ Before removing the tube, clean adjacent sections thoroughly so that foreign substances may not enter the supply pump and common rail.
20. Remove bracket (28).

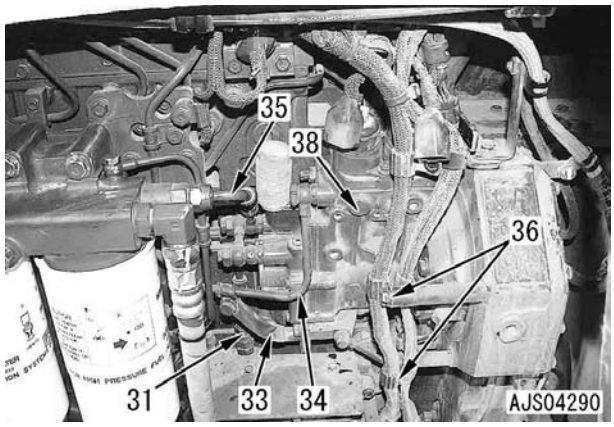


21. Remove tube (29). [*1]
22. Disconnect connector G (30).

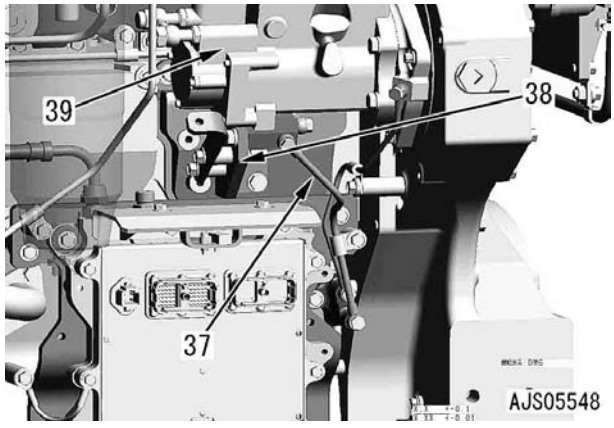


23. Disconnect tube (31). [*2]
    ★ Prepare an oil pan since oil flows out during this operation.
24. Remove clamp (32).
25. Disconnect bracket (33) and remove tube (34). [*3]
    ★ Another clamp is provided.
26. Remove tube (35). [*4]
27. Disconnect clamps (36).

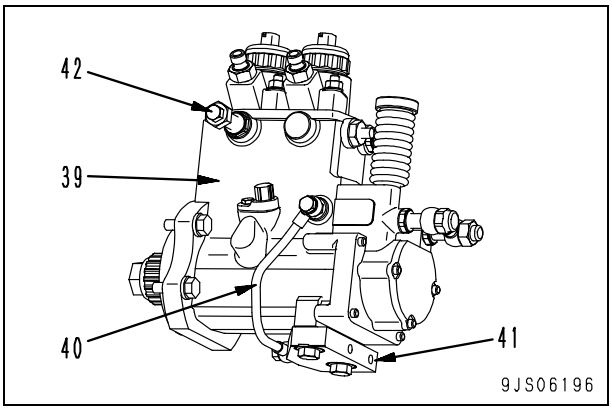




28. Remove tube (37).
29. Remove bracket (38).
30. Remove fuel supply pump assembly (39).



31. Remove the followings from fuel supply pump assembly (39).
    1) Oil tube (40)
    2) Plate (41)
    3) Overflow pipe adapter (42)

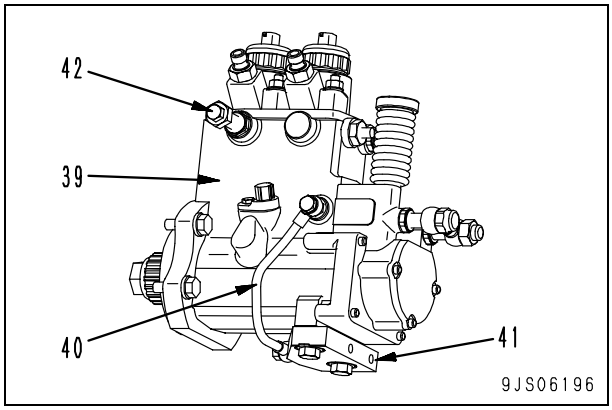


Installation

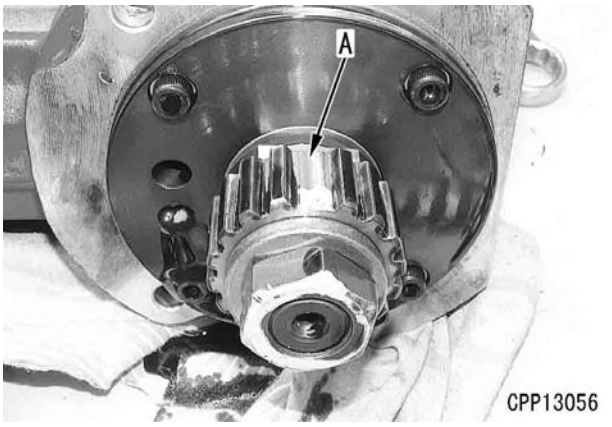
1. Install the followings to fuel supply pump assembly (39).
    1) Plate (41)
    2) Oil tube (40)
    3) Overflow pipe adapter (42)

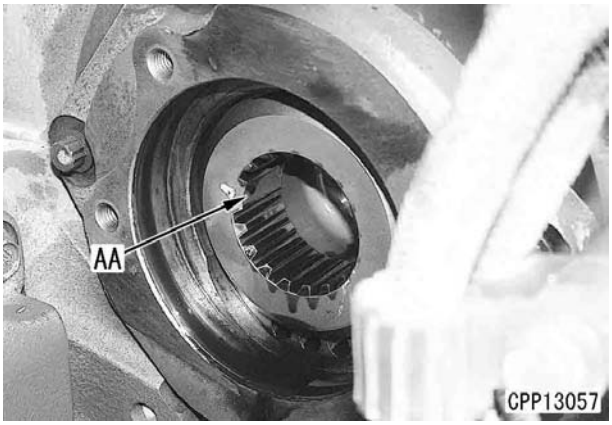
    Plate (41) mounting bolt:
    19.6 – 29.4 Nm {2.0 – 3.0 kgm}

    Oil tube (40) joint bolt:
    Top: **7.9 – 12.7 Nm {0.8 – 1.3 kgm}**
    Bottom: **9.8 – 12.7 Nm {1.0 – 1.3 kgm}**

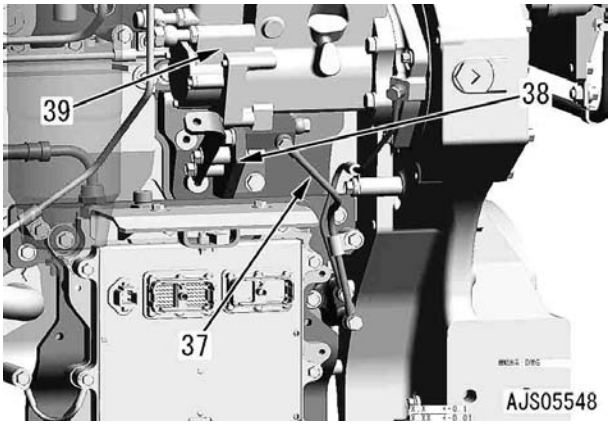


2. Assemble the fuel supply pump assembly by aligning (A) and (AA) at the position where a spline tooth is missing.





3. Install fuel supply pump assembly (39).
   - Fuel supply pump mounting bolt:
     59 – 74 Nm {6 – 7.5 kgm}
   - Bracket (38) mounting bolt:
     58.8 – 73.5 Nm {6.0 – 7.5 kgm}
4. Install oil tube (37).
   - Oil tube (37) joint bolt:
     9.8 – 12.7 Nm {1.0 – 1.3 kgm}

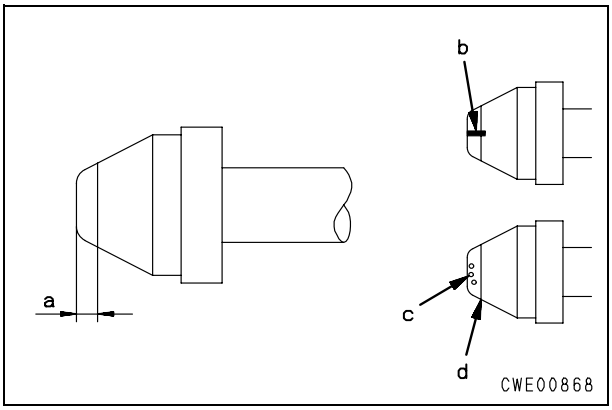


High-pressure piping

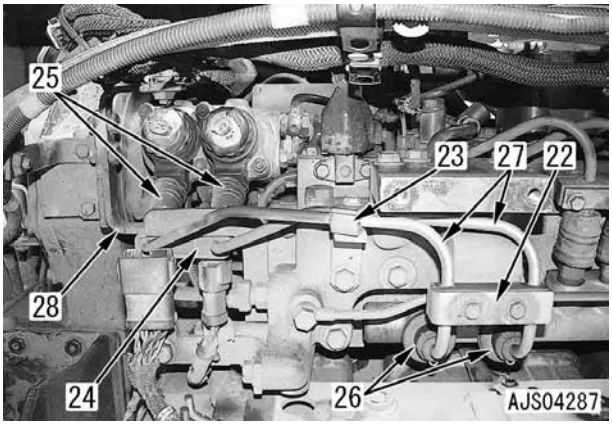
⚠ **When handing the high-pressure pipe and clamp, pay attention the following.**
- It is strictly prohibited to bend the high-pressure piping to use it again or using it in other locations.
- Install the specified clamp securely in the specified position with the specified torque.
- Don't apply lubricant and the like to the high-pressure piping sleeve nut and the threaded portion of the mating side.

★ **Axial force in the tightening can be excessive, potentially damaging the high-pressure piping.**

⚠ **Before installing the high-pressure piping, check it for the following defects. If there is any of these defects, it can cause fuel leakage. Accordingly, replace the high-pressure piping.**
- Check the taper seal of the connecting part (Part (a): Part of 2 mm from the end) for visible lengthwise slit (b) and dent (c).
- Check part (d) (end of the taper seal: Part at 2 mm from the end) for stepped-type wear (fatigue) which your nail can feel.



5. Tighten high-pressure piping (27) temporarily.
6. Tighten clamps (22) to (24) temporarily.
7. Tighten high-pressure piping (27) permanently.
   - High-pressure piping sleeve nut:
     39.2 – 44.1 Nm {4.0 – 4.5 kgm}
8. Tighten clamps (22) to (24) permanently.
   - Clamping bolt:
     9.8 ± 1.0 Nm {1 ± 0.1 kgm}
9. Tighten bracket (28) permanently.
10. Install covers (25) and (26).



- Carry out the succeeding installation in the reverse order of removal.

[*1]
Tube (29)
Joint bolt (Overflow valve):
14.8 – 19.6 Nm {1.51 – 1.99 kgm}
joint bolt (Supply pump side):
24.5 – 34.3 Nm {2.5 – 3.5 kgm}
Sleeve nut (Fuel block side):
54 – 93 Nm {5.5 – 9.5 kgm}

[*2]
Tube (31)
joint bolt (Supply pump side):
14.8 – 19.6 Nm {1.51 – 1.99 kgm}
Tube (31) sleeve nut:
84 – 132 Nm {8.5 – 13.5 kgm}

[*3]
Tube (34) joint bolt:
24.5 – 34.3 Nm {2.5 – 3.5 kgm}

[*4]
Tube (35) joint bolt (Supply pump side):
14.8 – 19.6 Nm {1.51 – 1.99 kgm}
Tube (35) sleeve nut:
84 – 132 Nm {8.5 – 13.5 kgm}

⚠ **Make sure that a clearance of 10 mm minimum is provided between the high-pressure piping and adjacent wiring harness. If not, secure the clearance by adjusting the wiring harness position.**

- **Bleeding air**
  Bleed air from the fuel system, referring to “Bleeding air from fuel system” in Testing and adjusting.

Removal and installation of cylinder head assembly

Special tools

Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	1	795-799-5410	Adapter	■	1	N	
		795-799-5420	Remover	■	1	N	
	2	795T-675-1110	Socket	●	1	N	○
	8	790-331-1120	Wrench (angle)	●	1		

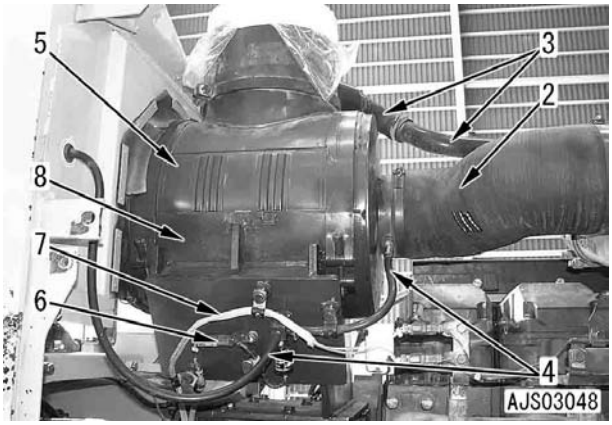
Removal

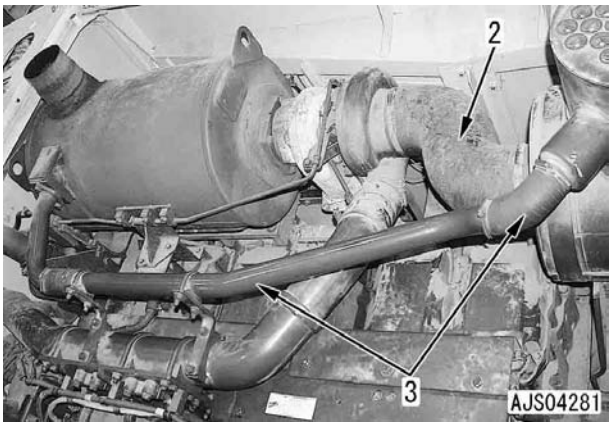
⚠ Stop the machine on level ground and set the frame lock bar.
⚠ Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.
⚠ Disconnect the negative terminal (–) of the battery before starting with the work.

1. Drain the engine coolant.
   Coolant: **160 ℓ**
2. Remove the engine hood and covers, referring to “Removal and installation of engine hood assembly”.
3. Open the bulkhead cover to remove cover (1) of the air cleaner.

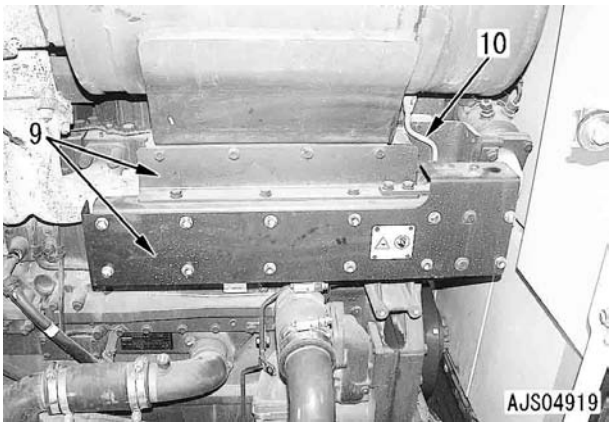


4. Remove air hose (2). [*1]
5. Remove komaclone hose and tube assembly (3). [*2]
6. Disconnect dust indicator hoses (4).
7. Remove air cleaner (5). [*3]
8. Disconnect connector E15 (6).
9. Disconnect wiring harness (7).
10. Remove air cleaner bracket (8).

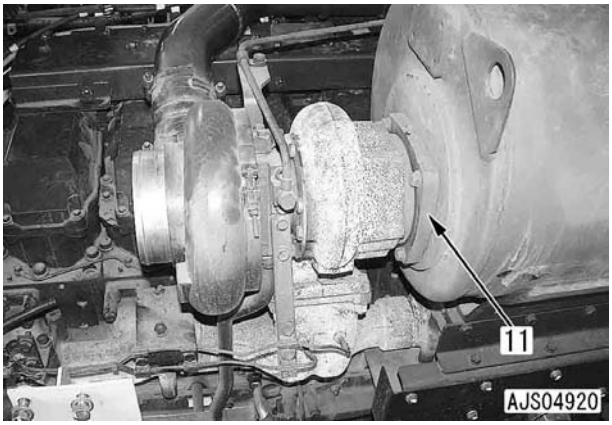




11. Remove bracket and heat insulation cover (9) assembly.
12. Disconnect muffler drain tube (10).

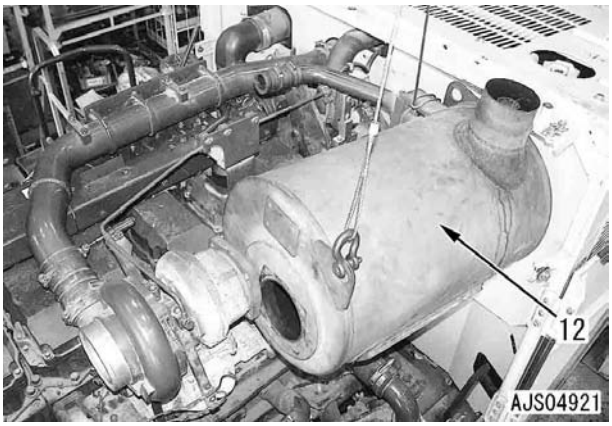


13. Remove flange (11).

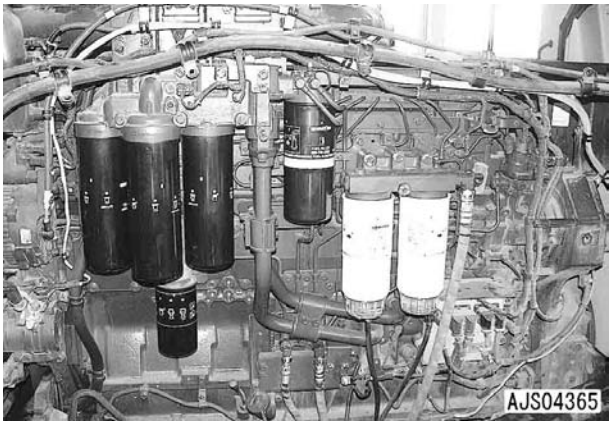


14. Lift and remove muffler (12).

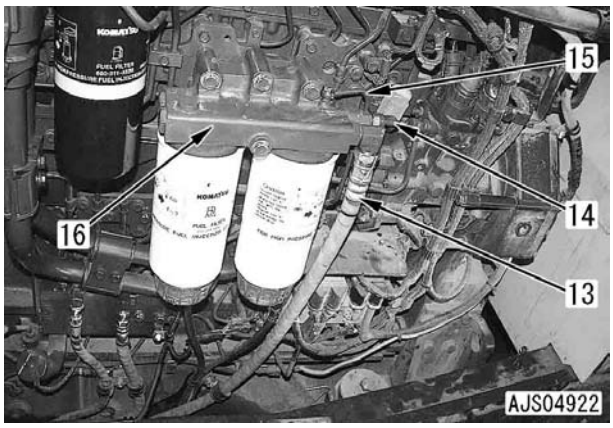
Muffler assembly: **100 kg**



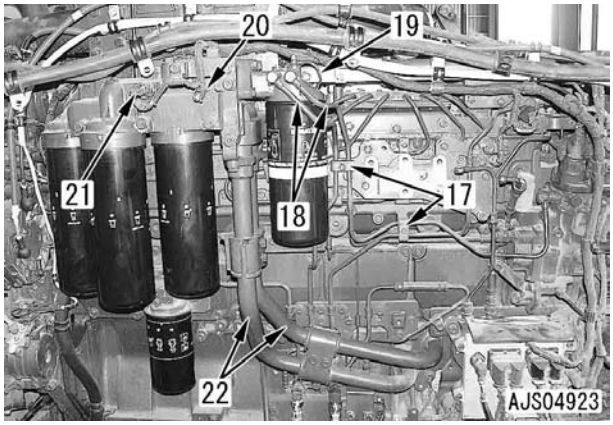
- Overall view of right side

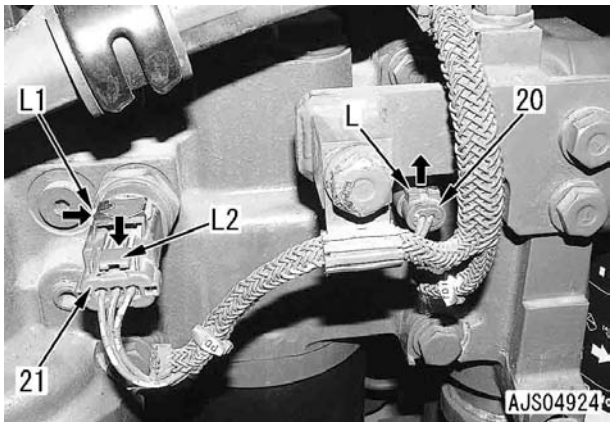


15. Disconnect fuel hose (13).
16. Disconnect tubes (14) and (15). [*4]
17. Remove filter assembly (16).

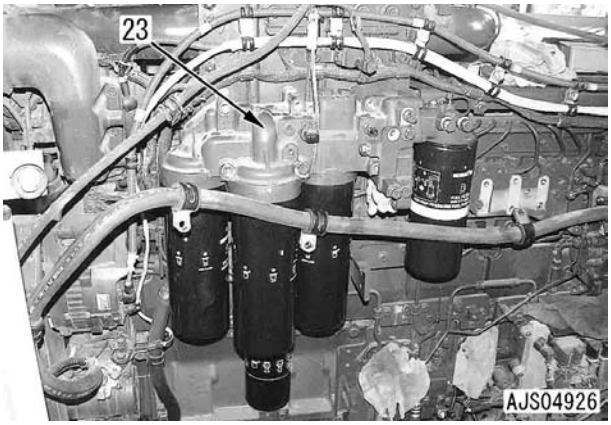


18. Remove fuel tube clamps (17).
19. Remove fuel tube (18). [*5]
20. Disconnect fuel tube (19).
21. Disconnect connectors TOIL (20) and POIL (21) in the following manner.
    1) Pull out connector TOIL (20) by driving lock (L) upward.
    2) When disconnecting connector POIL (21), slide lock (L1) rightward.
    3) Pull out connector POIL (21) while pushing lock (L2).
22. Remove tube assembly (22).

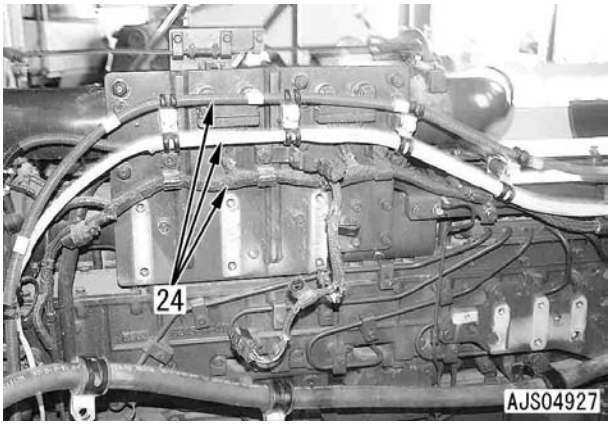




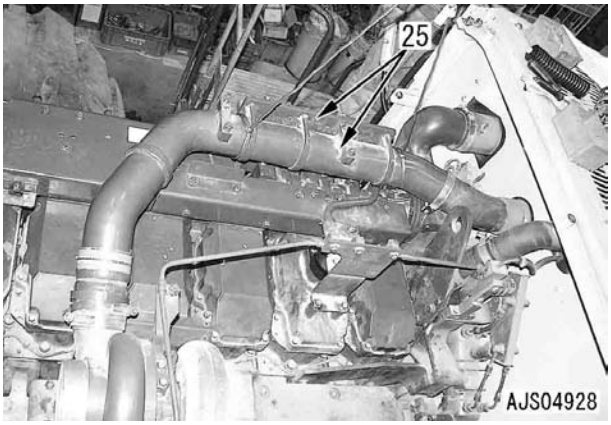
23. Lift and remove filter assembly (23).



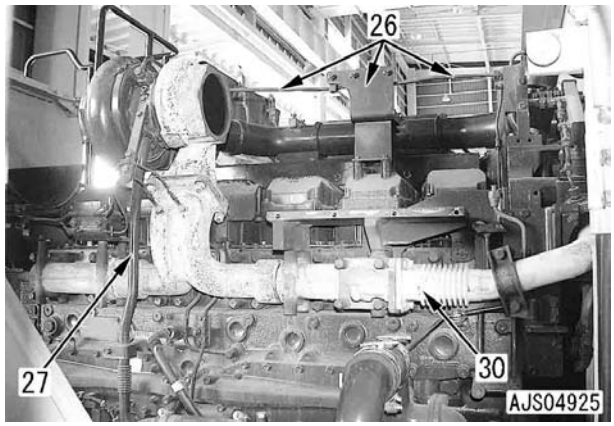
24. Disconnect wiring harness (24).

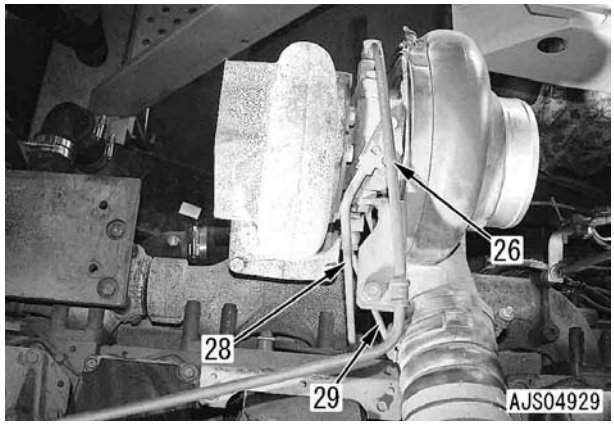


25. Lift and remove air tube and bracket assembly (25). [*6]

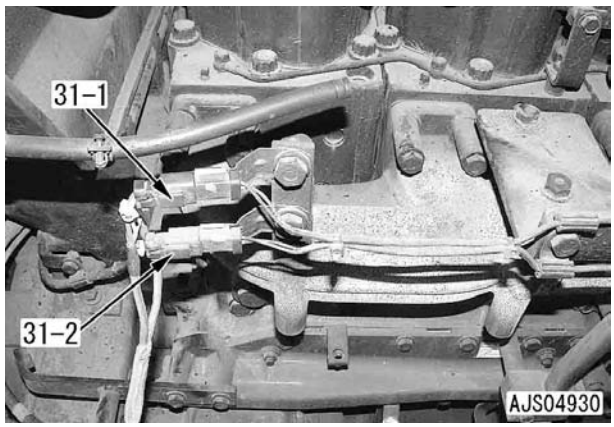


26. Remove turbocharger coolant tube assembly (26). [*7]
27. Remove turbocharger lubrication tubes (27) and (28).
28. Remove turbocharger coolant tube (29).
29. Disconnect exhaust tube (30).

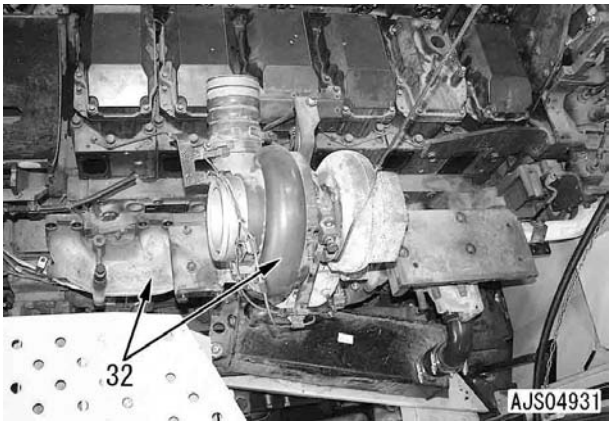




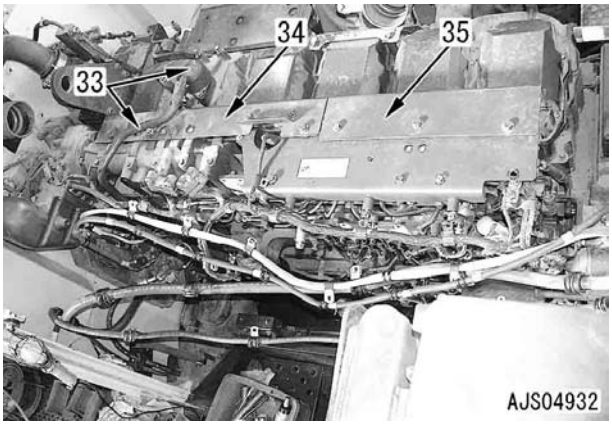
30. Disconnect connectors V30 (31-1) and V29 (31-2).
    ★ Push the lock when disconnecting them.



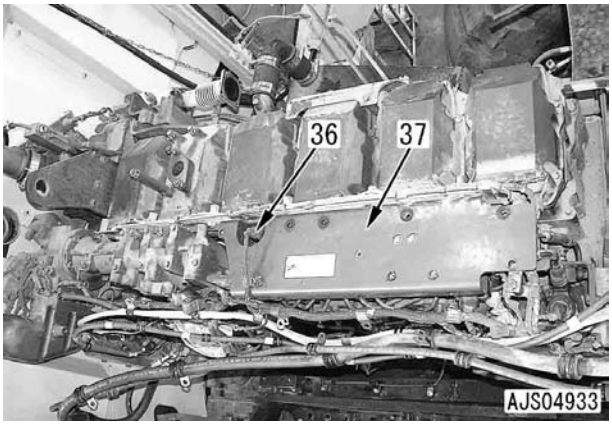
31. Lift and remove turbocharger and exhaust manifold assembly (32). [*8]
    Turbocharger and exhaust manifold assembly: **120 kg**



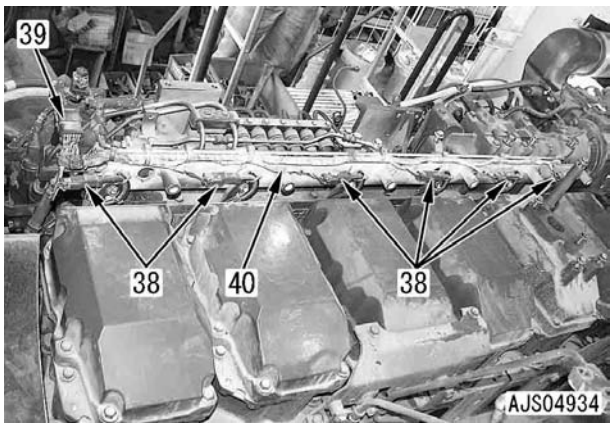
32. Remove breather and tube assembly (33).
33. Remove wiring harness covers (34) and (35).



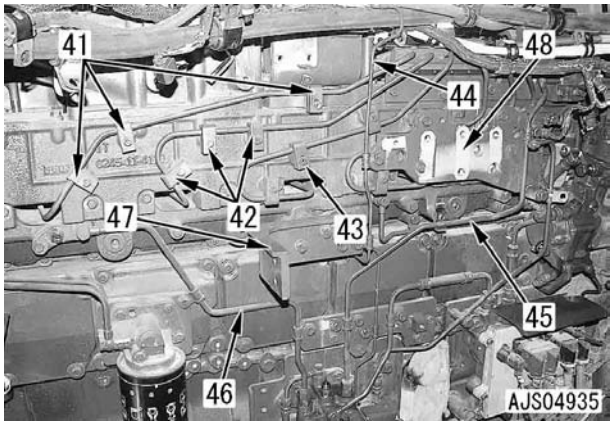
34. Disconnect connector (36).
35. Remove high-pressure piping cover (37).



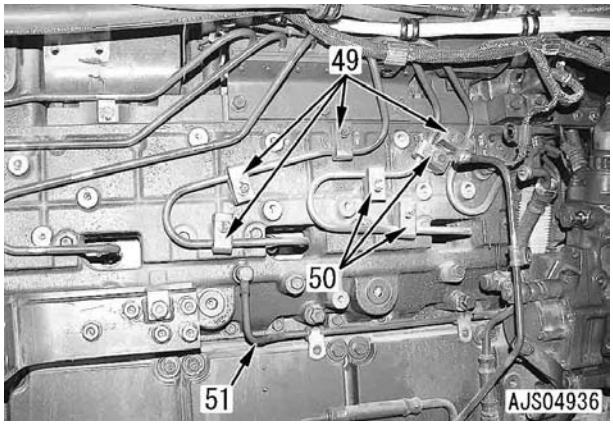
36. Disconnect 6 injector connectors (38).
37. Disconnect connector CN6 (39).
38. Remove wiring harness bracket (40).



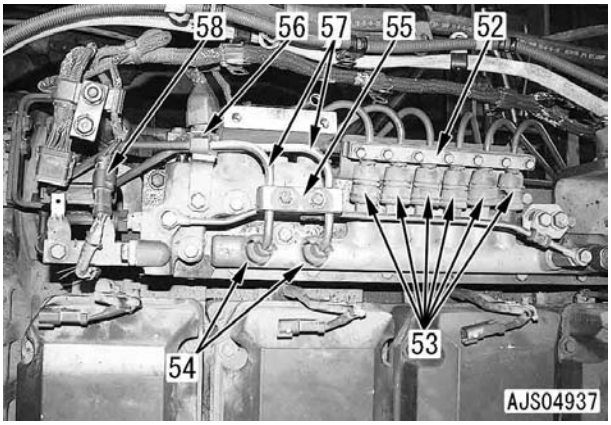
39. Disconnect high-pressure piping clamps (41) to (43).
40. Remove tubes (44) to (46). [*9]
41. Remove brackets (47) and (48).



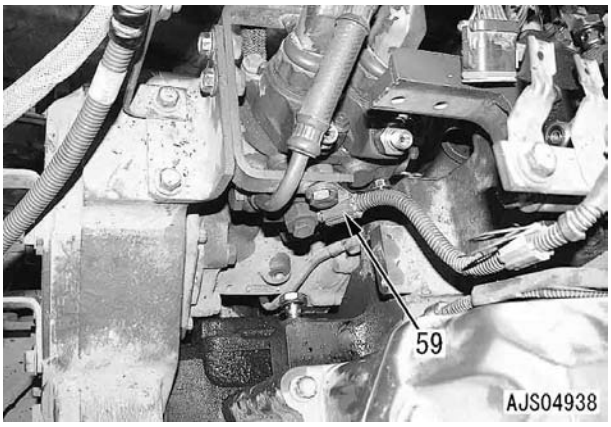
42. Disconnect high-pressure piping clamps (49) and (50).
43. Remove fuel tube (51). [*10]



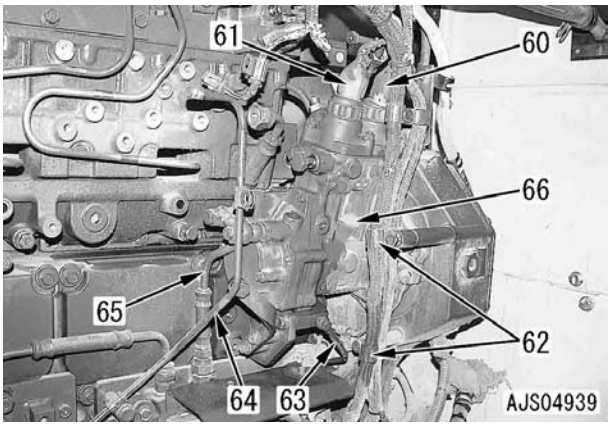
44. Remove clamp (52).
45. Remove covers (53) and (54).
46. Loosen clamps (55) and (56).
47. Remove high-pressure piping tube assembly (57).
48. Disconnect connector (58).



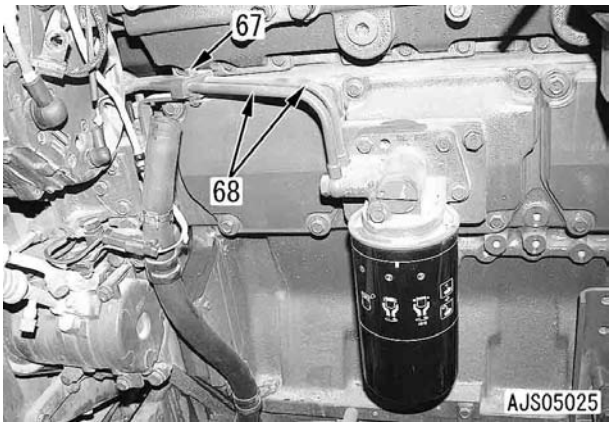
49. Disconnect wiring harness clamp (59) from rear side of the fuel supply pump.
50. Disconnect the connector from the bottom of clamp (59).



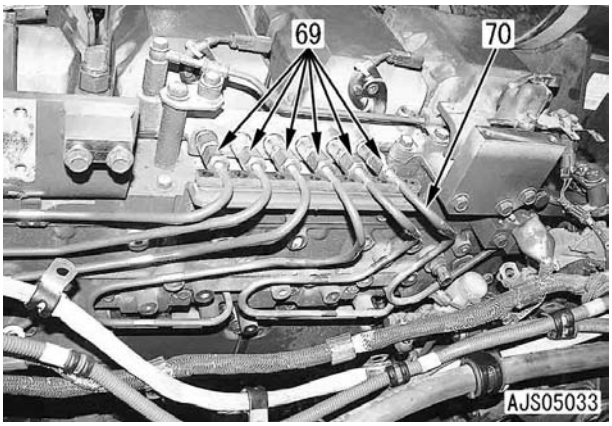
51. Disconnect connectors PCV1 (60) and PCV2 (61).
52. Disconnect wiring harness clamp (62).
53. Remove tubes (63) to (65).
54. Remove fuel supply pump assembly (66).



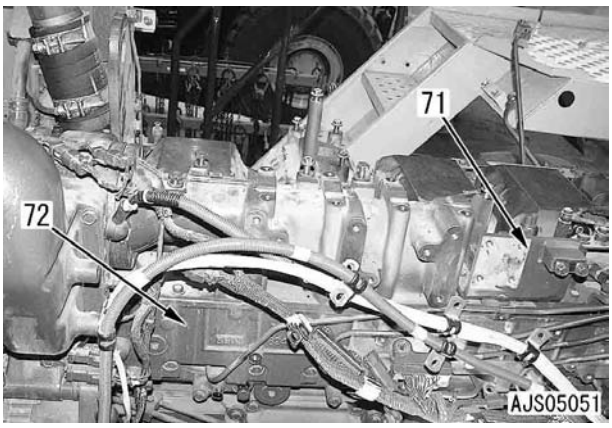
55. Disconnect clamps (67).
56. Disconnect tube (68). [*12]

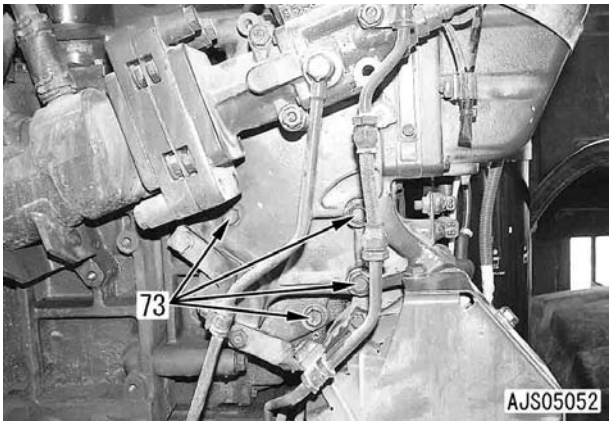


57. Disconnect sleeve (69).
58. Remove high-pressure piping (70).

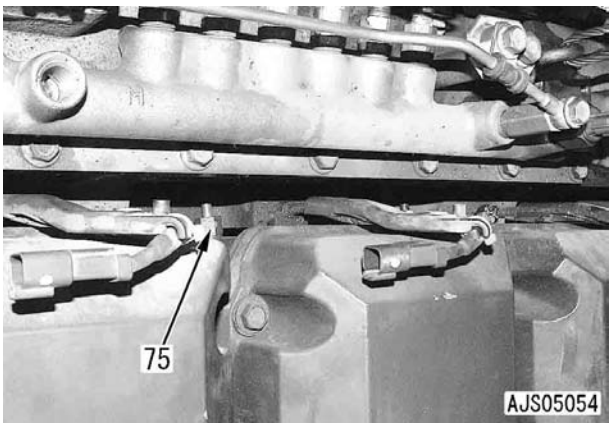


59. Remove bracket (71).
60. Remove 4 mounting bolts (73) from the radiator side of intake manifold assembly (72).

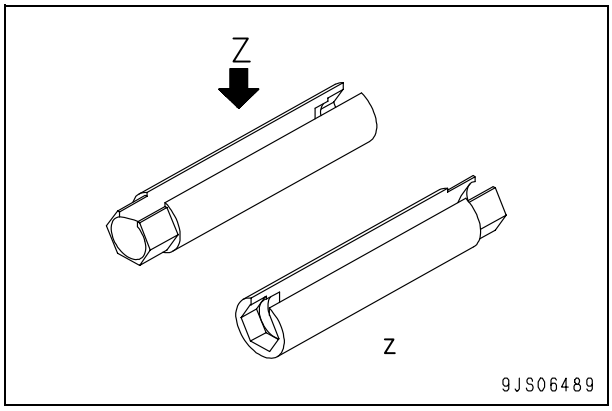




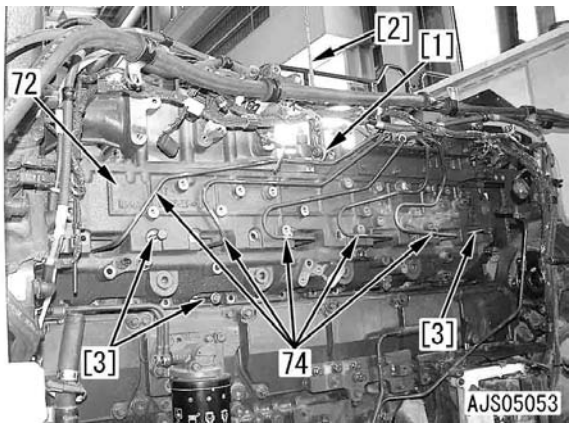
61. Disconnect sleeve nut (75) on the high-pressure piping injector side.
    ★ Tool **A2** allows implementing this work from the side face rather than from the top.



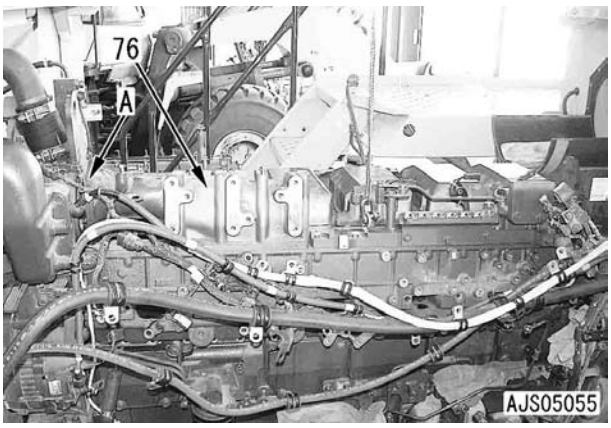
★ Tool **A2**



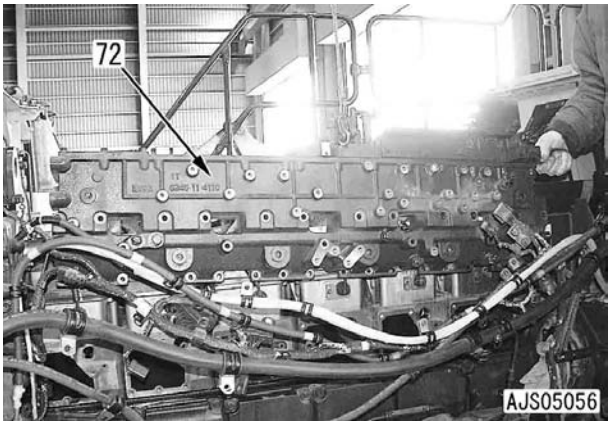
62. Remove high-pressure piping (74).
63. Lift air intake manifold assembly (72) temporarily.
    ★ Using eyebolt [1] and lifting tool [2], lift the assembly temporarily on to the mounting bolt hole of bracket (71) (noted in the foregoing).
64. Remove the mounting bolts of air intake manifold assembly (72).
65. Install guide bolts [3].
    ★ Use the filter mounting bolt as the guide bolt.
    ★ The convexed tube bites into the inner face of the diffuser. Thus, care must be exercised in using the guide bolt to avoid damaging the tube. (See the following section)
66. Remove all mounting bolts of air intake manifold assembly (72).



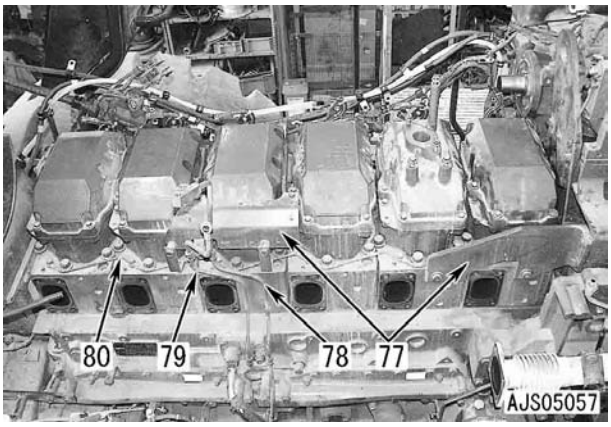
67. Remove diffuser (76).
    ★ Take care a convexed tube bites into the inner face of the diffuser (indicated as A).



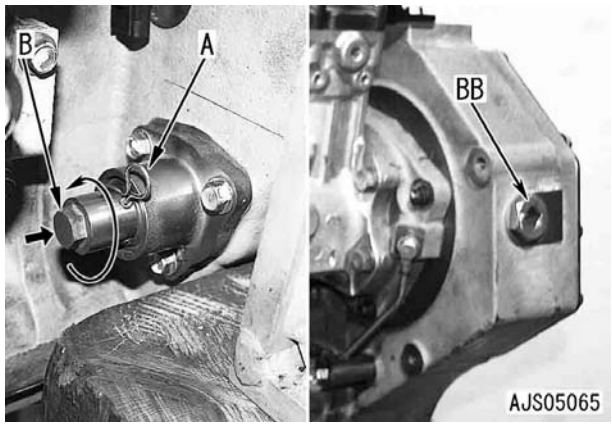
68. Lift and remove air intake manifold assembly (72).
    Air intake manifold assembly: **110 kg**



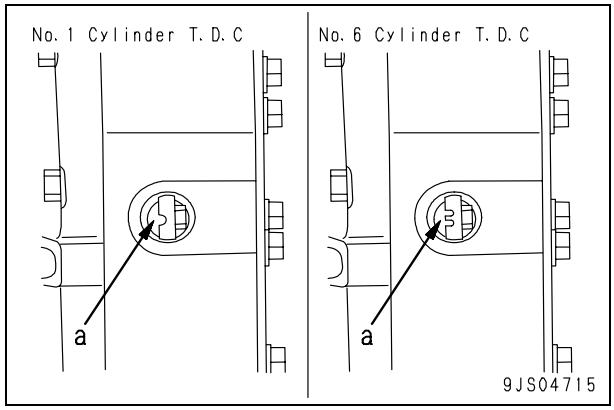
69. Remove bracket (77).
70. Remove turbocharger lubrication tube (78) and coolant tube (79).
71. Remove air vent tube (80).



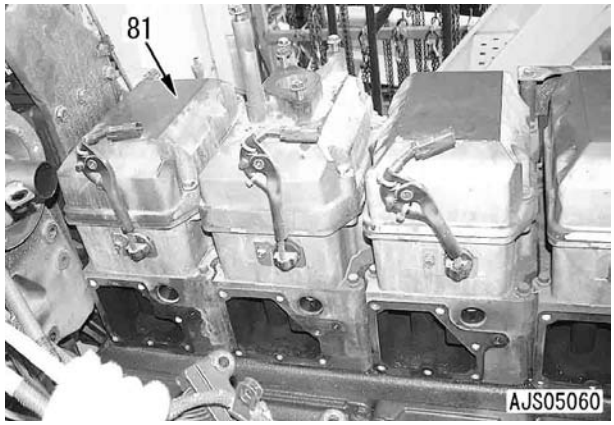
72. Pull out pin (A) and then push in bolt (B).
73. Barring using bolt (B) and then align **1.6 TOP**. (Confirm the result after removing plug (BB).)
    ★ For above operation, see “Testing and adjusting valve clearance” in Testing and adjusting.



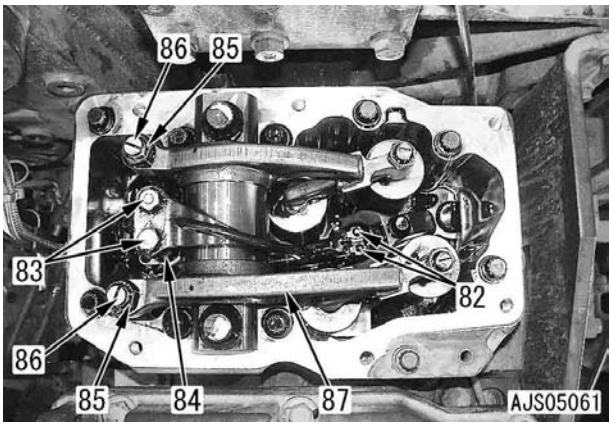
- (a): shows the notch of flywheel housing.



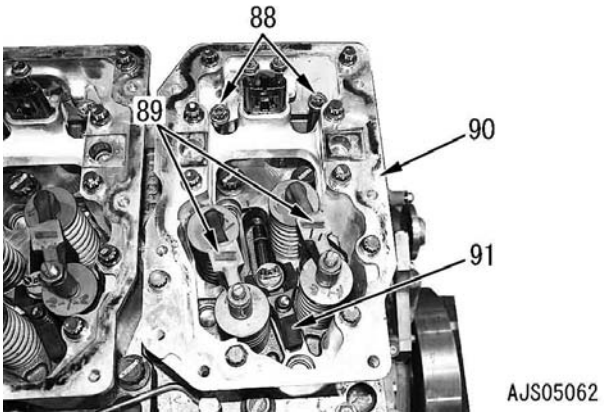
74. Remove cylinder head cover (81).
    ★ Referencing play of the rocker arm, confirm which is currently selected No.1 TOP or No.6 TOP.



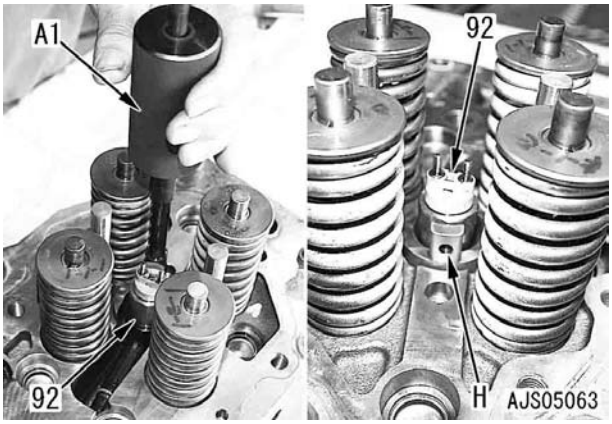
75. Disconnect terminal mounting nuts (82).
76. Remove wiring harness assembly mounting bolts (83) and spacer (84).
77. Loosen locknut (85) and then loosen adjustment screw (86).
78. Remove rocker arm assembly (87).



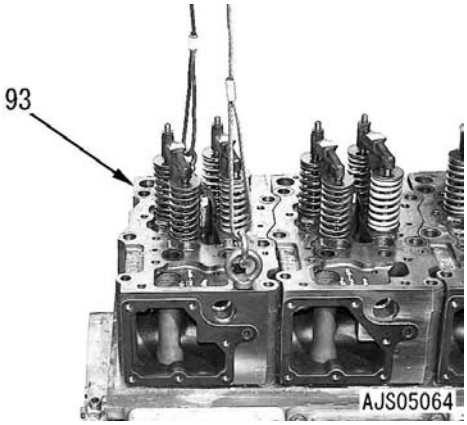
79. Remove plush rod (88).
80. Remove crosshead assembly (89).
81. Remove rocker housing (90).
82. Remove fuel injector holder (91).



83. Using tool **A1**, remove fuel injector assembly (92).
    - ★ Remove the assembly by hitching tip of tool **A1** on hole (H) of the fuel injector.
    - ★ Do not grip the solenoid valve at the top of the injector to pull off the injector with pliers.



84. Lift and remove cylinder head assembly (93).
    Cylinder head assembly: **50 kg**
85. Remove the cylinder head gasket.



Installation

Cylinder head assembly

1. Install the cylinder head gasket.
2. Lift and install cylinder head assembly (93).

   Cylinder head assembly: **50 kg**

   ★ Check the punch mark on the mounting bolt head. If 5 marks are punched, replace it with a new one without using it.

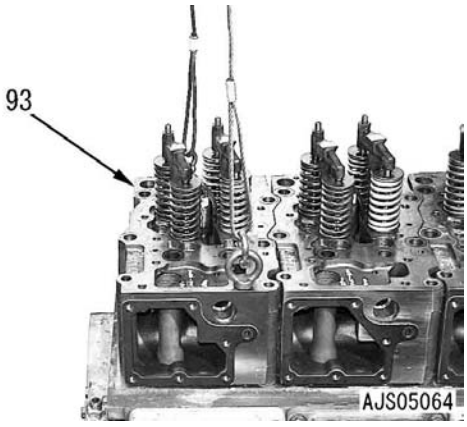
   ★ Tighten the mounting bolts in the following order.

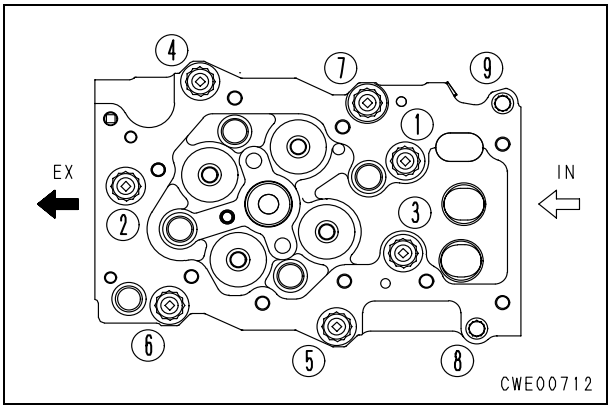
   Cylinder head assembly mounting bolt: **Molybdenum disulfide grease (LM-P)**

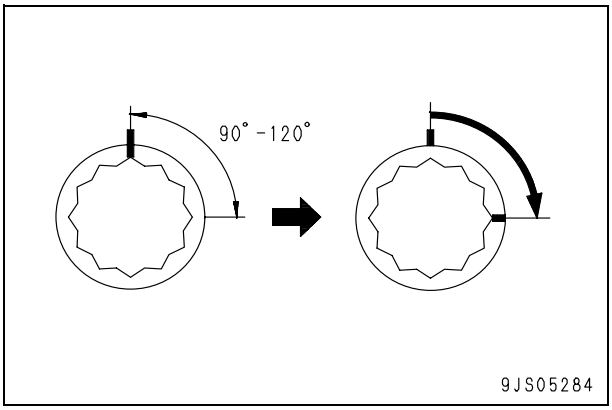
   Cylinder head mounting bolts (1 – 7):
   1st time: 245 ± 9.8 Nm {25 ± 1 kgm}
   2nd time: 382.5 ± 9.8 Nm {39 ± 1 kgm}
   3rd time: 90 – 120° retightening

   ★ For retightening, use tool **A8** (see Special tool list). When not using tool **A8**, apply a marking to the cylinder head and bolt with a felt pen and then retighten the bolt by 90° – 120° (target is 120°).

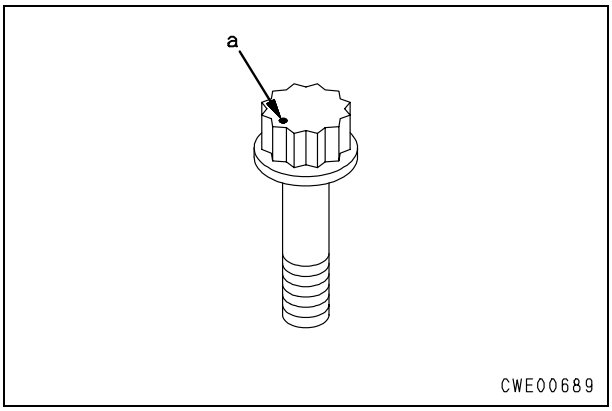
   Cylinder head assembly mounting bolts (8 and 9):
   93.2 – 103 kgm {9.5 – 10.5 kgm}







★ After tightening the main bolt, apply a punch mark (a) on its head (this mark shall not be applied to a new bolt).

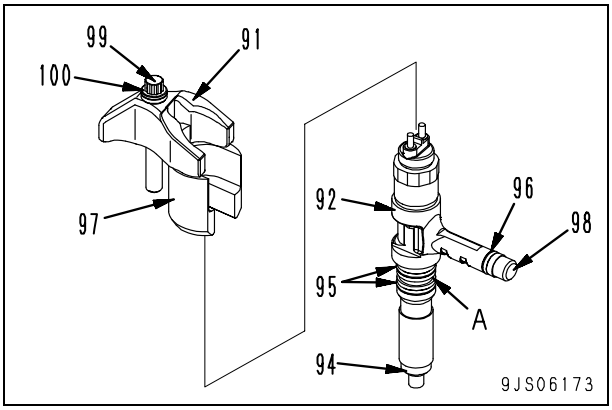


Fuel injector

★ Make sure that inside of the injector hole is free from dusts.

O-ring: **Engine oil (EO30)**

3. Assemble gasket (94) and O-rings (95) and (96) to fuel injector (92).
   ★ Use care not to install O-ring (95) in groove (A) at the center.
4. Insert fuel injector (92) to adapter (97) and injector holder (91).
5. Attach spherical washer (100) to bolt (99) and then tighten injector holder (91) temporarily.
   Spherical washer: **Engine oil (EO30)**

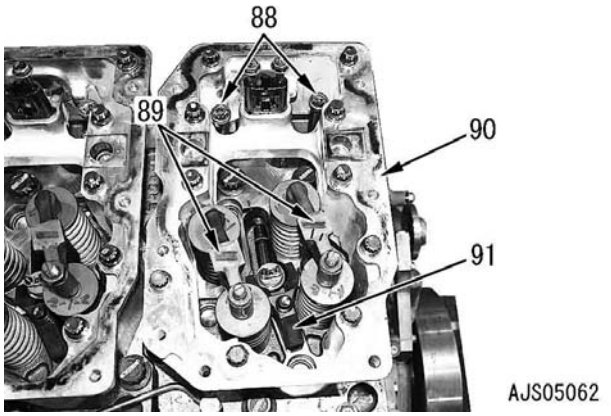


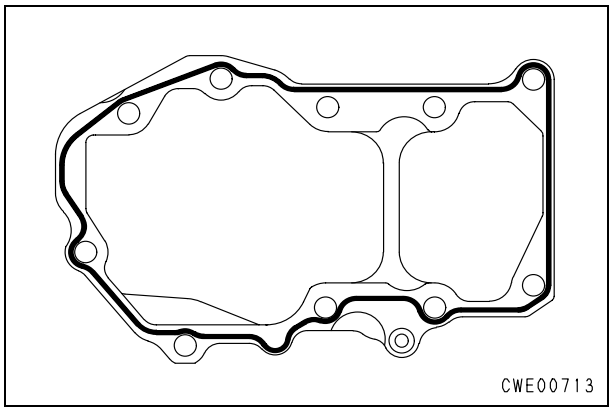
   ★ Tightening of injector holder (91) is done permanently after installing the intake manifold and tightening the high-pressure piping temporarily.

6. Install push rod (88).
   ★ Check that the push rod end is securely placed in the cam follower socket.

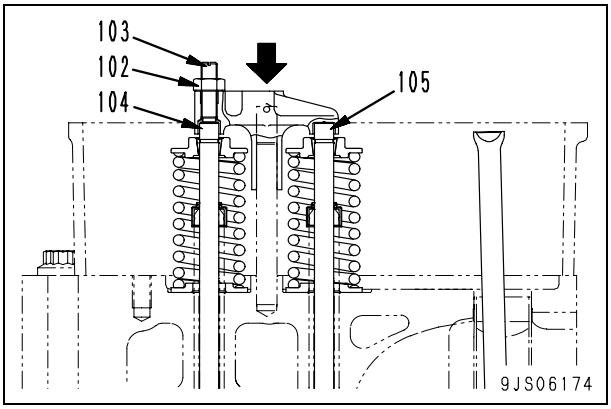
7. Apply gasket sealant and then install rocker housing (90).
   Rocker housing: **Gasket sealant (LG-7)**
   ★ Diameter of the gasket sealant line shall be 2 to 3 mm and it should be applied along the housing groove as shown below.
   Rocker housing mounting bolt:
   78.4 – 93.2 Nm {8.0 – 9.5 kgm}

8. Install crosshead (89).



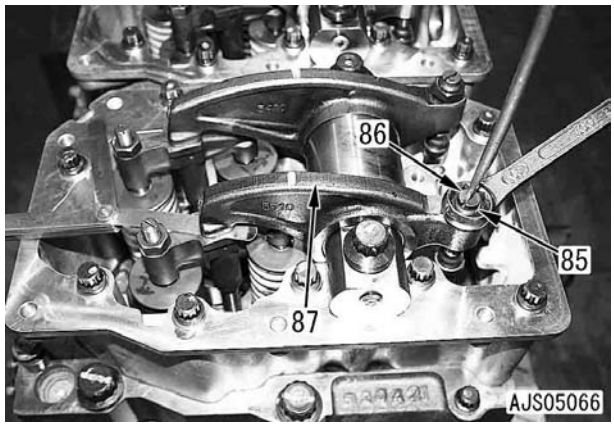


9. Adjust the crosshead in the following procedure.
   1) Loosen locknut (102) and then loosen adjustment screw (103) to a position where it does not contact with valve stem (104).
   2) Maintain the contact with valve stem (105) on the push rod side by pressing the contact surface against the rocker arm using a finger.
   3) Tighten adjustment screw (103) to confirm the position where adjustment screw (103) is contacted against valve stem (104).
   4) Drive in adjustment screw (103) further by 20 – 30° from the contacting position against valve stem (104).
   5) Tighten locknut (102) while suppressing move of adjustment screw (103).
      Locknut:
      53.0 – 64.7 Nm {5.4 – 6.6 kgm}



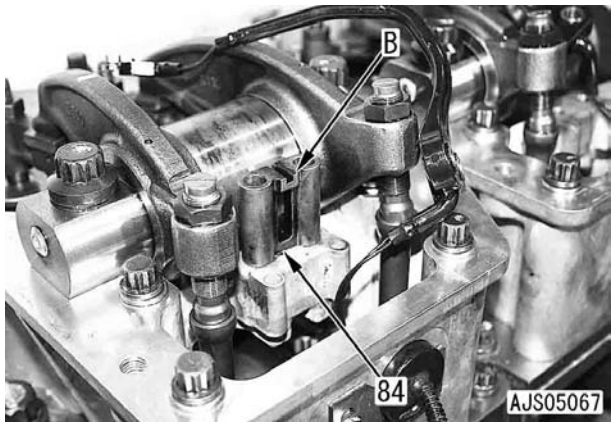
Rocker arm assembly

10. Install rocker arm assembly (87).
   ★ Insert respective rocker arm at a position where the riveted side of the shaft faces the front side of the engine.
   ★ When installing, direct the wider seat of the shaft to the rocker arm housing.
   ★ Make sure that the ball of adjustment screw (86) is securely fitted to the push rod socket.
   ★ When tightening the mounting bolt, make sure adjustment screw (86) is not pushing the push rod.
      Threaded portion and seat of rocker arm assembly mounting bolt:
      Engine oil (EO30)
      Rocker arm assembly mounting bolt:
      235.2 – 254.8 Nm {24 – 26 kgm}
   ★ Adjust valve clearance, referring to “Testing and adjusting valve clearance” in Testing and adjusting.
      Locknut (85):
      57.8 – 77.4 Nm {5.9 – 7.9 kgm}
   ★ After tightening the locknut, check the valve clearance again.

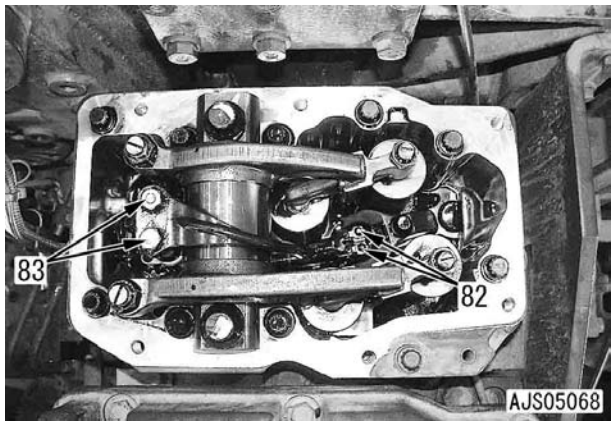


Injector wiring harness

11. Install spacer (84).
   ★ When installing the spacer, direct its projection (B) toward the outside.



12. Install terminal mounting nut (82) and wiring harness fixing bolt (83).
   ★ Tighten the terminal mounting nuts alternately.
      Terminal mounting nut:
      2 ± 0.2 Nm {0.2 ± 0.02 kgm}



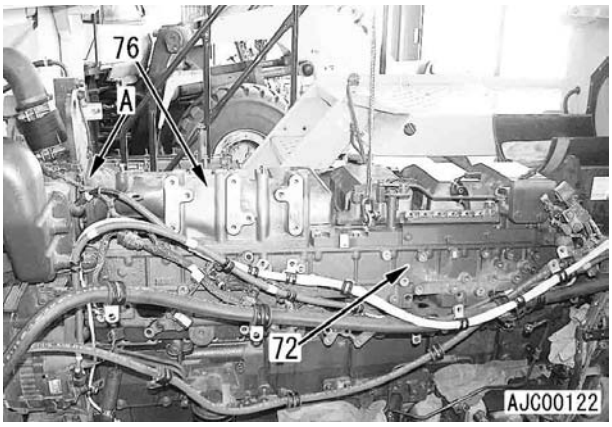
Air intake manifold assembly

13. Place diffuser (76) on air lifted intake manifold assembly (72) being lifted.

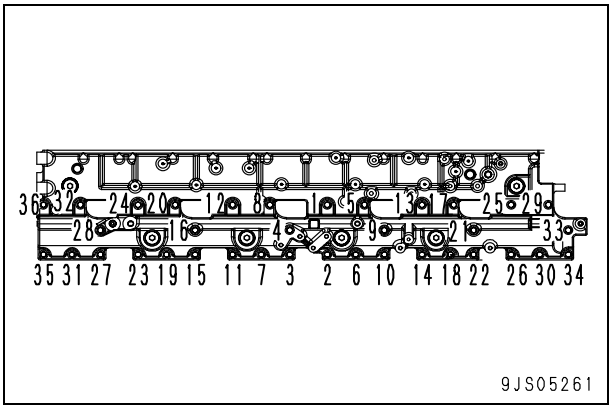
    Air intake manifold and diffuser assembly:

    135kg

    ★ Pay attention to biting of the tube into (A) portion.



14. Install air intake manifold assembly (72).
    ★ Tighten the mounting bolts in the order indicated in the figure (clockwise starting at the center).



High-pressure piping

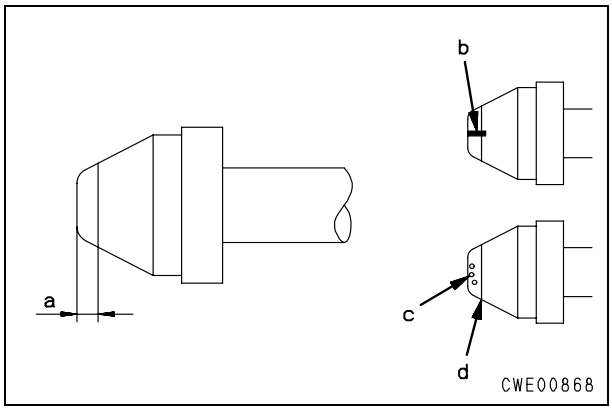
⚠ **When handing the high-pressure pipe and clamp, pay attention the following.**

- It is strictly prohibited to bend the high-pressure piping to use it again or using it in other locations.
- Install the specified clamp securely in the specified position with the specified torque.
- Don't apply lubricant and the like to the high-pressure piping sleeve nut and the threaded portion of the mating side.

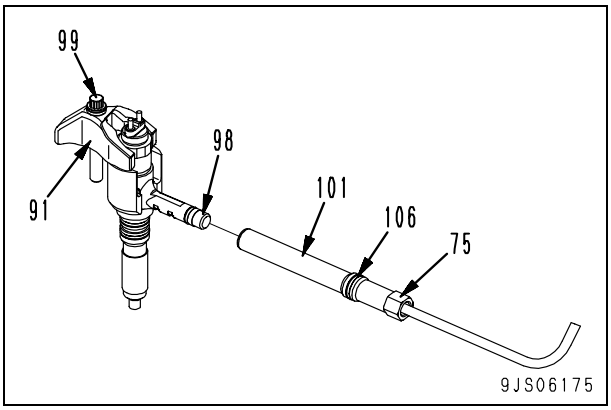
★ **Axial force in the tightening can be excessive, potentially damaging the high-pressure piping.**

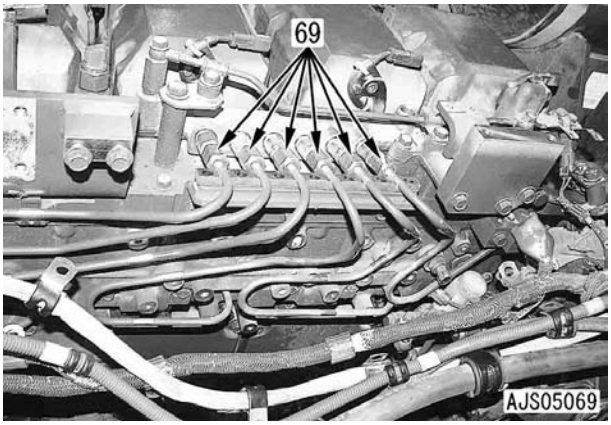
⚠ **Before installing the high-pressure piping, check it for the following defects. If there is any of these defects, it can cause fuel leakage. Accordingly, replace the high-pressure piping.**

- Check the taper seal of the connecting part (Part (a): Part of 2 mm from the end) for visible lengthwise slit (b) and dent (c).
- Check part (d) (end of the taper seal: Part at 2 mm from the end) for stepped-type wear (fatigue) which your nail can feel.

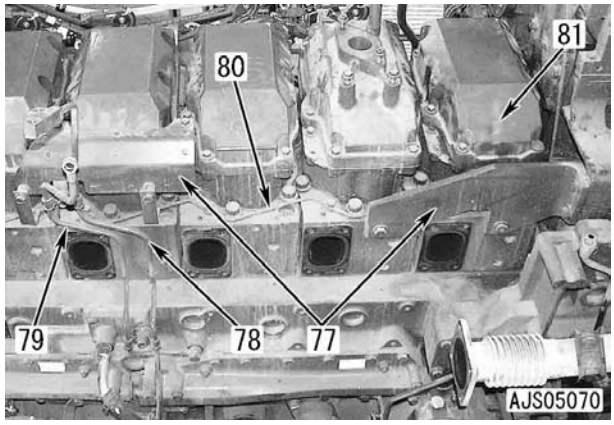


15. Install O-ring (106) to high-pressure piping sleeve (101).
    - O-ring: **Engine oil (EO30)**
16. Tighten sleeve nut (75) temporarily aligning it connector (98) of the injector.
    - ★ When it is difficult to hitch sleeve nut to the threaded portion, turn the spanner while pushing sleeve nut (75) end toward the injector by use of a short bar and the like.
17. Tighten the common rail side sleeve nut (69) temporarily, too.
18. Tighten injector holder (91) permanently.
    - Injector holder mounting bolt: **58.9 – 73.5 Nm {6.0 – 7.5 kgm}**
19. Tighten high-pressure piping sleeve nuts (69) and (75) permanently using the spanner type torque wrench.
    - Sleeve nut: **39.2 – 44.1 Nm {4 – 4.5 kgm}**
    - ★ After finishing the work, check that O-ring (106) is not projected from the end of the sleeve nut (75).



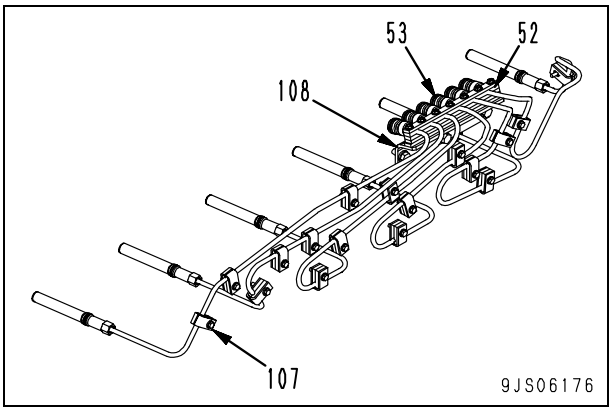


20. Install cylinder head cover (81).
    - ★ A different tightening torque is employed for No. 2 cylinder mounting bolt alone.
    - Cylinder head cover mounting bolt:
      No.1, 3, 4, 5 and 6 cylinders:
      9.8 ± 1.0 Nm {1.0 ± 0.1 kgm}
      No. 2 cylinder:
      58.8 – 73.5Nm {6 – 7.5 kgm}
21. Install air vent tube (80).
    - Air bleeding tube joint bolt (Cylinder head side):
      9.8 – 12.7 Nm {1.0 – 1.3 kgm}
22. Install turbocharger coolant tube (79) and lubrication tube (78).
23. Install bracket (77).



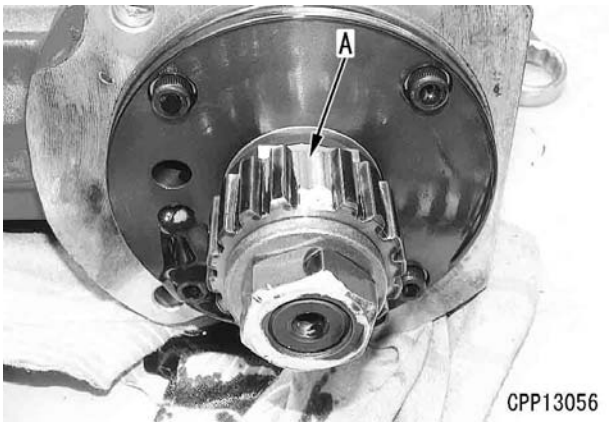
High-pressure piping clamp

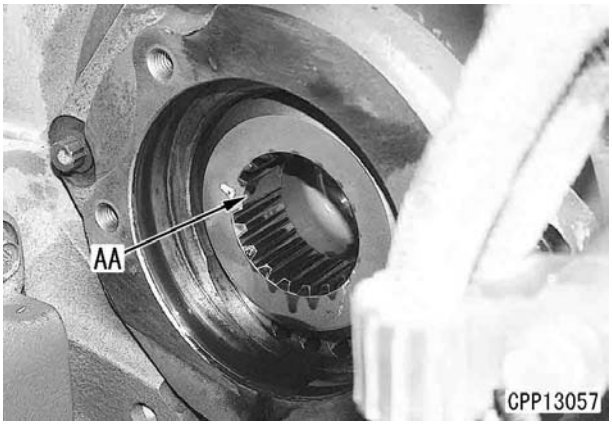
24. Install the clamp on the high-pressure pipe in the following procedure.
    1) Manually tighten 17 high-pressure piping clamps (107) temporarily in the position indicated in the figure.
    2) Manually tighten common rail slide clamp bracket (108) and clamp (52) temporarily and then tighten clamp (52).
       Common rail side clamp bolt:
       9.8 ± 1.0 Nm {1 ± 0.1 kgm}
    3) Tighten common rail side clamp bracket (108) to the specified torque.
    4) Tighten high-pressure piping clamp (107).
       High-pressure piping side clamp bolt:
       11.8 – 14.7 Nm {1.2 – 1.5 kgm}
    5) Install cover (53) on the common rail side sleeve nut.
       ★ When installing it, direct the slit downward.



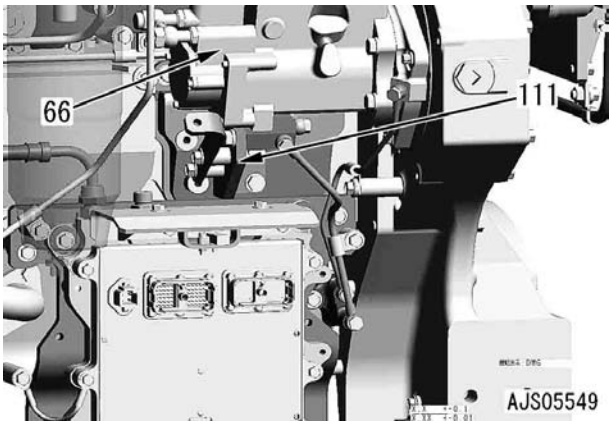
Fuel supply pump

25. Install the fuel supply pump assembly by aligning (A) and (AA) at the position where a spline tooth is missing.





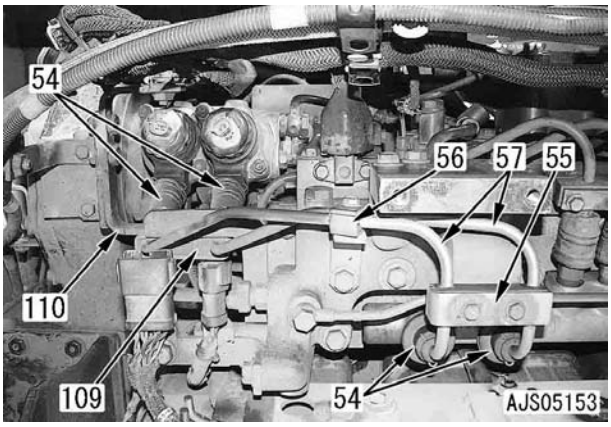
Fuel supply pump (66) mounting bolt:
59 – 74 Nm {6 – 7.5 kgm}
Bottom bracket (111) mounting bolt:
58.8 – 73.5 Nm {6.0 – 7.5 kgm}



High-pressure piping

⚠ Handle the high-pressure piping and clamp in the same way as the piping between the fuel injector and common rail (noted in the foregoing) is handled.

26. Tighten high-pressure piping (57) temporarily.
27. Tighten clamps (55), (56) and (109) temporarily.
28. Tighten bracket (110) temporarily.
29. Tighten high-pressure piping (57) permanently.
    High-pressure piping sleeve nut:
    39.2 – 44.1 Nm {4.0 – 4.5 kgm}
30. Tighten clamps (55), (56) and (109) permanently.
    Clamping bolt:
    9.8 ± 1.0 Nm {1 ± 0.1 kgm}
31. Tighten bracket (110) permanently.
32. Install cover (54).



- Carry out the succeeding installation in the reverse order of removal.

[*1]
Air hose clamp:
8.8 ± 0.5 Nm {0.9 ± 0.05 kgm}

[*2]
Komaclone tube assembly hose clamp:
5.9 ± 0.49 Nm {0.6 ± 0.05 kgm}

[*3]
Air cleaner band:
12.7 – 17.6 Nm {1.3 – 1.8 kgm}

[*4]
Tube (15) joint bolt:
19.6 – 29.4 Nm {2.0 – 3.0 kgm}
Tube (14) joint bolt:
14.8 – 19.6 Nm {1.51 – 1.99 kgm}
Tube (14) sleeve nut:
84 – 132 Nm {8.5 – 13.5 kgm}

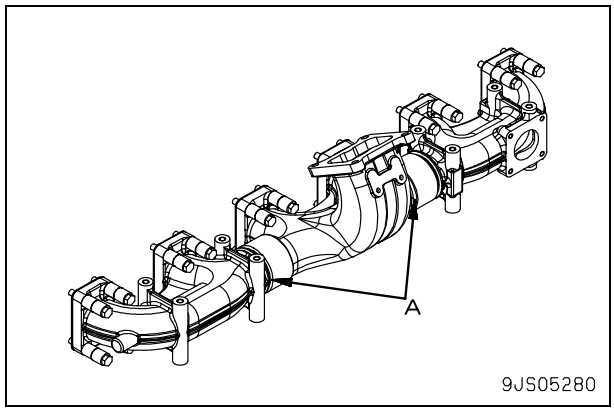
[*5]
Tube (18) joint bolt:
24.5 – 34.3 Nm {2.5 – 3.5 kgm}
Tube (18) (Supply pump side):
14.8 – 19.6 Nm {1.51 – 1.99 kgm}

[*6]
Air hose clamp:
9.8 ± 1.0 Nm {1.0 ± 0.1 kgm}

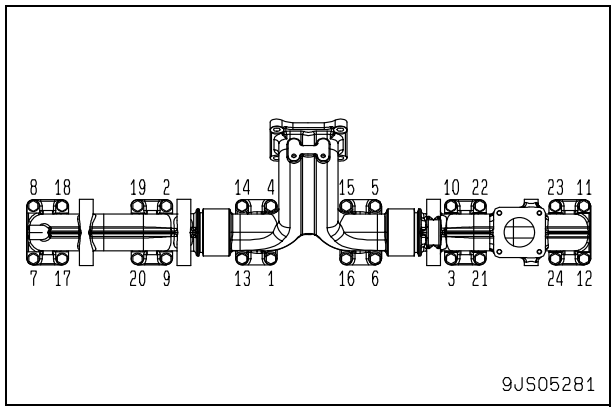
[*7]
Coolant tube assembly (26) joint bolt:
24.5 – 34.3 Nm {2.5 – 3.5 kgm}

[*8]
Exhaust manifold assembly

1. When the exhaust manifold assembly was disassembled, apply connection (A) (2 locations) with the adhesive (heat resistant sealing agent) before assembling it.
   Exhaust manifold connection:
   Liquid adhesive (Holtz MH 705)



★ Tighten the mounting bolts in the following order.
Exhaust manifold mounting bolt:
Seizure prevention compound (LC-G)
Exhaust manifold mounting bolt:
1st time: 39.2 – 58.8 Nm {4.0 – 6.0 kgm}
2nd time:
98.1 – 122.6 Nm {10 – 12.5 kgm}



Reference

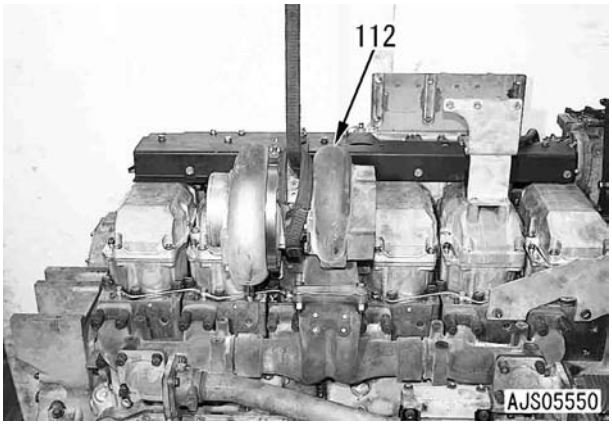
Installation of turbocharger assembly

1. Lift and install turbocharger assembly (112).

Turbocharger assembly: **55 kg**

Turbocharger mounting bolt and nut:
Seizure prevention compound (LC-G)

Turbocharger mounting bolt and nut:
78.5 – 88.3 Nm {8.0 – 9.0 kgm}



[*9]

Oil tube (44) joint bolt:
7.8 – 9.8 Nm {0.8 – 1.0 kgm}

Tubes (45) and (46) sleeve nut:
54 – 93 Nm {5.5 – 9.5 kgm}

Tube (46) joint bolt:
24.5 – 34.3 Nm {2.5 – 3.5 kgm}

[*10]

Tube (51) joint bolt:
19.6 – 29.4 Nm {2.0 – 3.0 kgm}

[*11]

Oil tube (63) joint bolt (Supply pump side):
7.9 – 12.7 Nm {0.8 – 1.3 kgm}

Oil tube (63) joint bolt (Block side):
9.8 – 12.7 Nm {1.0 – 1.3 kgm}

Tube (65) joint bolt (Supply pump side):
14.8 – 19.6 Nm {1.51 – 1.99 kgm}

Tubes (64) (bottom) and (65) sleeve nut:
84 – 132 Nm {8.5 – 13.5 kgm}

[*12]

Tube (68) joint bolt (Corrosion resistor side):
24.5 – 34.3 Nm {2.5 – 3.5 kgm}

⚠ **Make sure that a clearance of 10 mm minimum is provided between the high-pressure piping and adjacent wiring harness. If not, secure the clearance by adjusting the wiring harness position.**

- **Bleeding air**
  Bleed air from the fuel system, referring to “Bleeding air from fuel system” in Testing and adjusting.

Removal and installation of fuel injector assembly

Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	1	795-799-5410	Adapter	■	1	N	
		795-799-5420	Remover	■	1	N	
	2	795T-675-1110	Socket	●	1	N	○

Removal

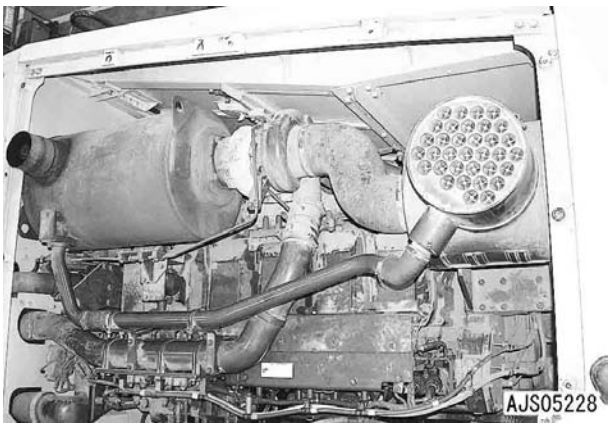
⚠ **Stop the machine on level ground and set the frame lock bar.**

⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**

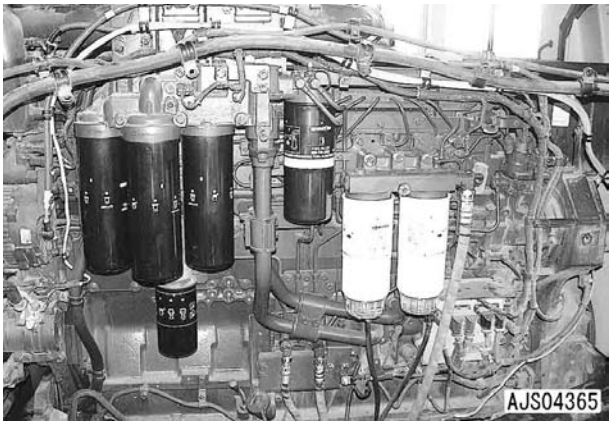
⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Remove the engine hood and covers, referring to “Removal and installation of engine hood assembly.”

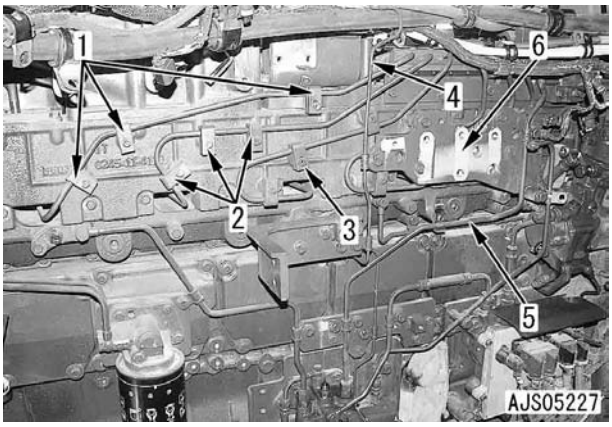
2. Remove the filter, air tube, injector wiring harness brackets, referring to “Removal and installation of cylinder head assembly.”
   - Overall view of top surface



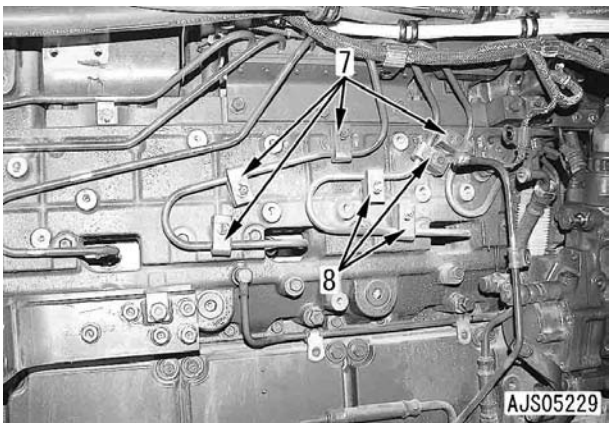
- Overall view of right side



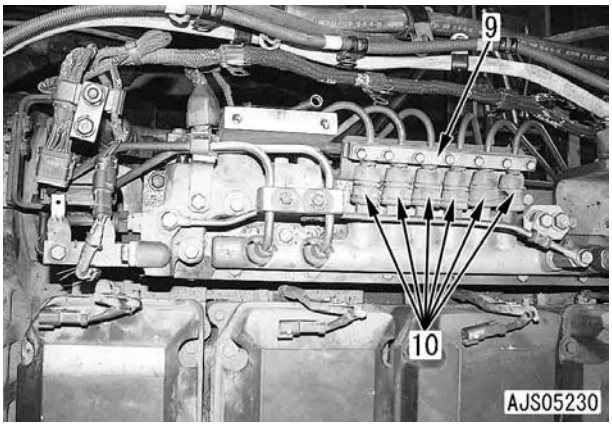
3. Disconnect high-pressure piping clamps (1) to (3).
4. Remove tubes (4) and (5). [*1]
5. Remove bracket (6).



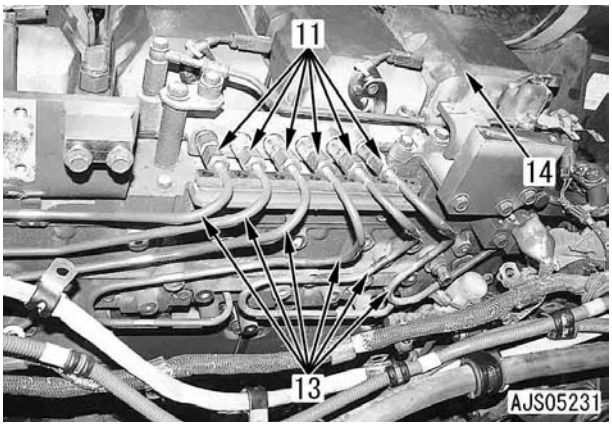
6. Disconnect high-pressure piping clamps (7) and (8).
   ★ A clamp is provided on the fuel supply pump side.

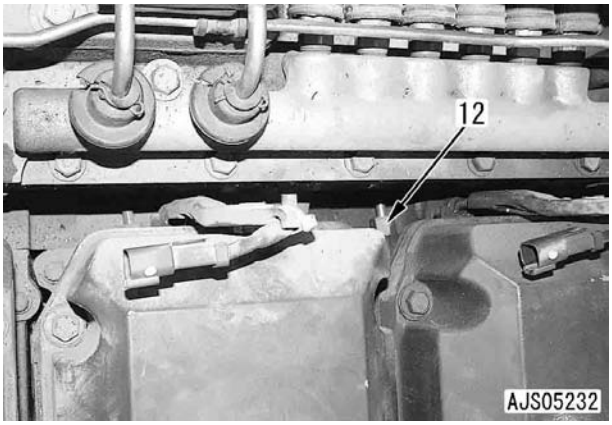


7. Remove clamp (9).
8. Remove cover (10).



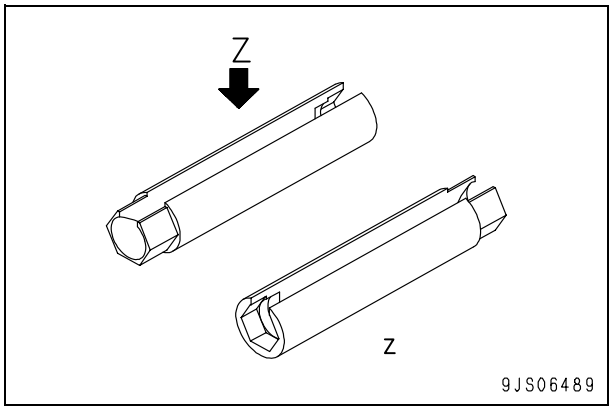
9. Disconnect 6 sleeves (11) and (12).
10. Remove high-pressure pipings (13).
11. Remove cylinder head cover (14).



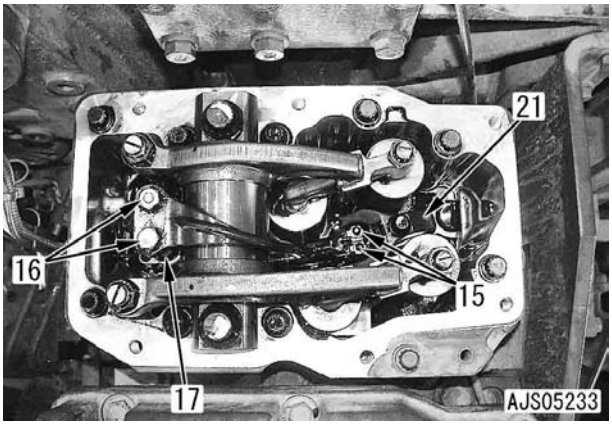


★ When tool **A2** is not available, disconnect sleeve (12) through the top.

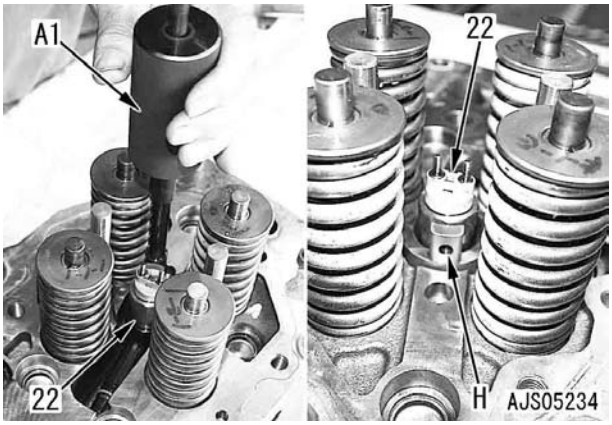
- Tool **A2**



12. Disconnect terminal mounting nuts (15).
    ★ Loosen the nuts alternately.
13. Remove wiring harness assembly mounting bolts (16) and spacer (17).
14. Remove fuel injector holder (21).



15. Using tool **A1**, remove fuel injector assembly (22).
    ★ Remove the assembly by hitching tip of tool **A1** on hole (H) of the fuel injector.
    ★ Do not grip the solenoid valve at the top of the injector to pull off the injector with pliers.



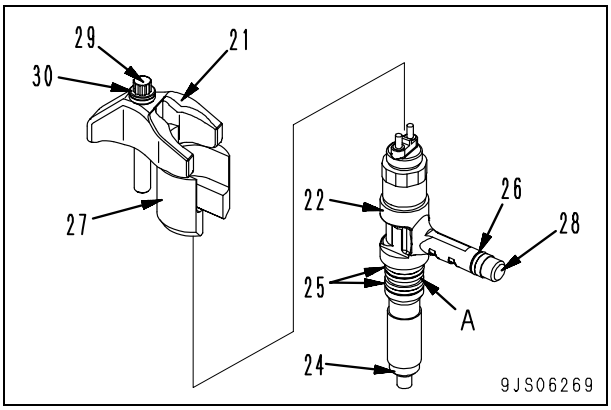
Installation

Fuel injector

★ Check that the inside of the injector sleeve is free from dirt.

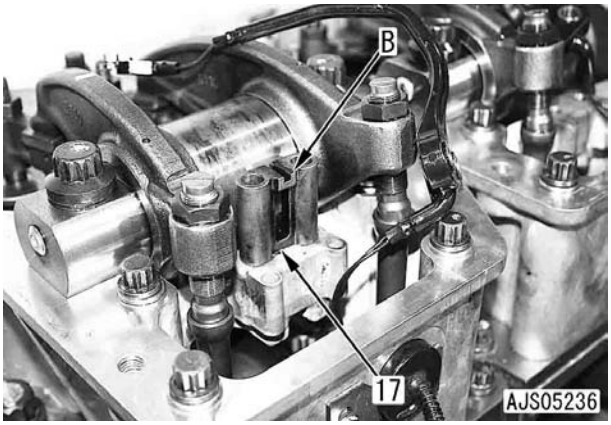
O-ring: **Engine oil (EO30)**

1. Assemble gasket (24) and O-rings (25) and (26) to fuel injector (22).
   ★ Use care not to install O-ring (25) in groove (A) at the center.
2. Insert fuel injector (22) to adapter (27) and injector holder (21).
3. Attach spherical washer (30) to bolt (29) and then tighten injector holder (31) temporarily.
   Spherical washer: **Engine oil (EO30)**
   ★ Tightening of injector holder (21) permanently after tightening the high-pressure piping temporarily.



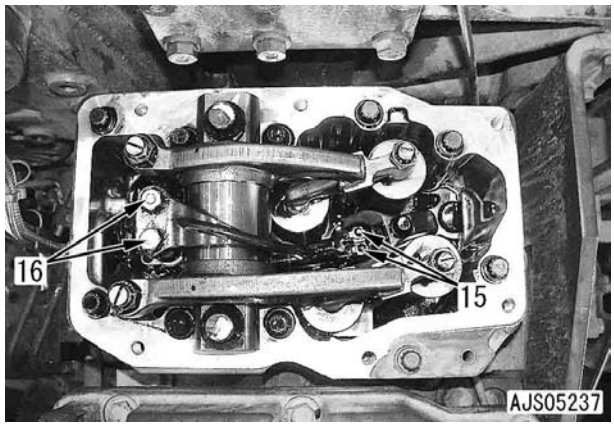
Injector wiring harness

4. Install spacer (17).
   ★ When installing the spacer, direct its projection (B) toward the outside.



5. Install terminal mounting nut (15) and wiring harness fixing bolt (16).
   ★ Tighten the terminal mounting nuts alternately.

   Terminal mounting nut:
   2 ± 0.2 Nm {0.2 ± 0.02 kgm}



High-pressure piping

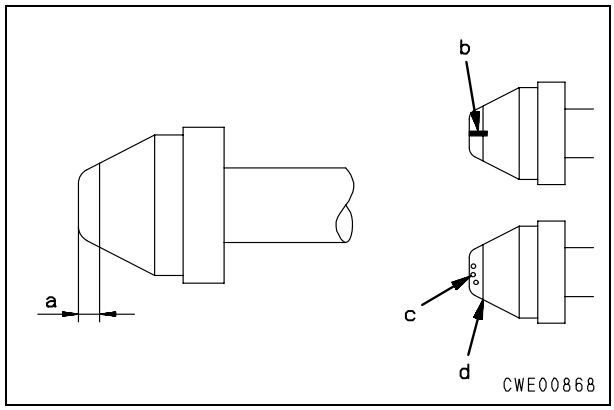
⚠ **When handing the high-pressure pipe and clamp, pay attention the following.**

- It is strictly prohibited to bend the high-pressure piping to use it again or using it in other locations.
- Install the specified clamp securely in the specified position with the specified torque.
- Don't apply lubricant and the like to the high-pressure piping sleeve nut and the threaded portion of the mating side.

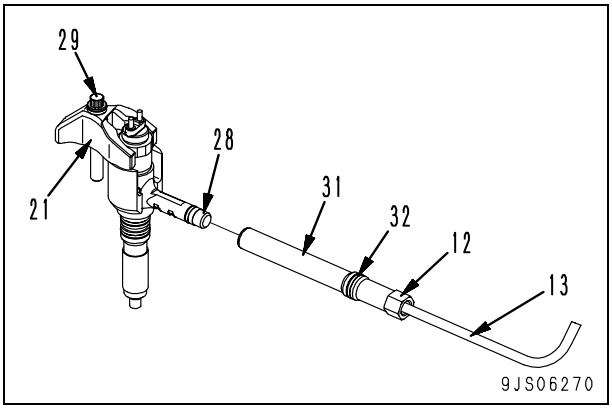
★ **Axial force in the tightening can be excessive, potentially damaging the high-pressure piping.**

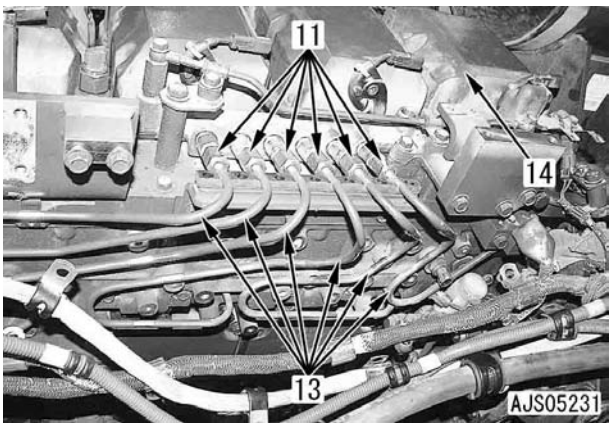
⚠ **Before installing the high-pressure piping, check it for the following defects. If there is any of these defects, it can cause fuel leakage. Accordingly, replace the high-pressure piping.**

- Check the taper seal of the connecting part (Part (a): Part of 2 mm from the end) for visible lengthwise slit (b) and dent (c).
- Check part (d) (end of the taper seal: Part at 2 mm from the end) for stepped-type wear (fatigue) which your nail can feel.



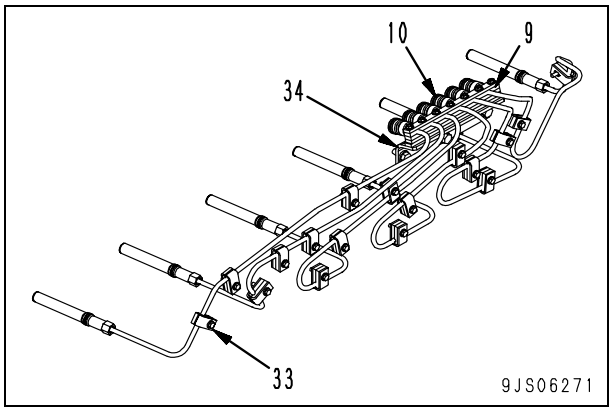
6. Install O-ring (32) to sleeve (31) of high-pressure piping (13).
   O-ring: **Engine oil (EO30)**
7. Tighten sleeve nut (12) temporarily aligning it connector (28) of the injector.
   ★ When it is difficult to hitch sleeve nut (12) to the threaded portion, turn the spanner while pushing sleeve nut (12) end toward the injector using a short bar and the like.
8. Tighten the common rail side sleeve nut (11) temporarily, too.
9. Tighten injector holder (21) permanently.
   Injector holder mounting bolt:
   58.9 – 73.5 Nm {6.0 – 7.5 kgm}
10. Tighten high-pressure piping sleeve nuts (11) and (12) permanently using the spanner type torque wrench.
    Sleeve nut: **39.2 – 44.1 Nm {4 – 4.5 kgm}**
    ★ After finishing the work, check that O-ring (32) is not projected from the end of the sleeve nut (12).
11. Install cylinder head cover (14).
    ★ A different tightening torque is employed for No. 2 cylinder mounting bolt alone.
    Cylinder head cover mounting bolt:
    No.1, 3, 4, 5 and 6 cylinders:
    9.8 ± 1.0 Nm {1.0 ± 0.1 kgm}
    No. 2 cylinder:
    58.8 – 73.5 Nm {6 – 7.5 kgm}





High-pressure piping clamp

12. Install the clamp on the high-pressure pipe in the following procedure.
    1) Manually tighten 17 high-pressure piping clamps (33) temporarily in the position indicated in the figure.
    2) Manually tighten common rail slide clamp bracket (34) and clamp (9) temporarily and then tighten clamp (9).
       Common rail side clamp bolt:
       9.8 ± 1.0 Nm {1 ± 0.1 kgm}
    3) Tighten common rail side clamp bracket (34) to the specified torque.
    4) Tighten high-pressure piping clamp (33).
       High-pressure piping side clamp bolt:
       11.8 – 14.7 Nm {1.2 – 1.5 kgm}
    5) Install cover (10) on the common rail side sleeve nut.
       ★ When installing it, direct the slit downward.



- Carry out the succeeding installation in the reverse order of removal.

[*1]
Oil tube (4) joint bolt:
7.8 – 9.8 Nm {0.8 – 1.0 kgm}
Tube (5) sleeve nut:
24.5 – 34.3 Nm {2.5 – 3.5 kgm}

★ Reference the precautions in “Removal and installation of cylinder head” for the installation.

⚠ **Make sure that a clearance of 10 mm minimum is provided between the high-pressure piping and adjacent wiring harness. If not, secure the clearance by adjusting the wiring harness position.**

- **Bleeding air**
  Bleed air from the fuel system, referring to “Bleeding air from fuel system” in Testing and adjusting.

Removal and installation of engine front seal

Special tools

Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	3	795-931-1100	Seal puller assembly	■	1		
	4	795-621-1140	Push tool	■	1		
		795T-621-1170	Push tool (For dust seal)	■	1	N	○
		• 795-902-1460	• Bolt	■	3		
		• 01582-02218	• Nut	■	3		

Removal

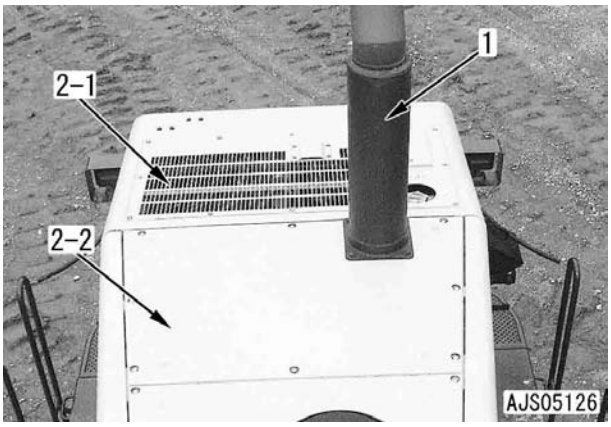
⚠ Stop the machine on level ground and set the frame lock bar.

⚠ Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.

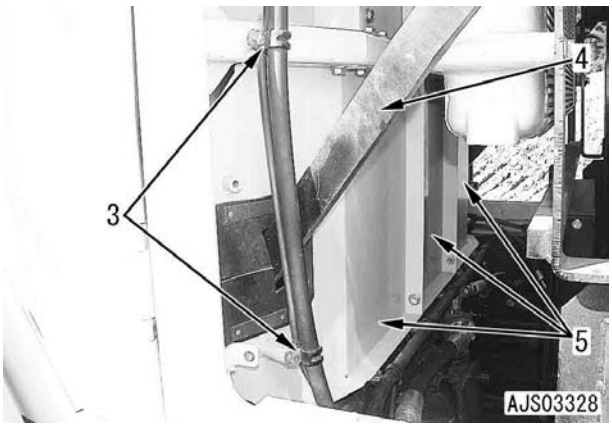
1. Remove muffler (1).
2. Remove cover (2-1).
3. Sling hood (2-2) to remove.

   Hood (2-2): **45 kg**

   ★ A tapped hole for lifting is provided in the four corners of the engine hood.

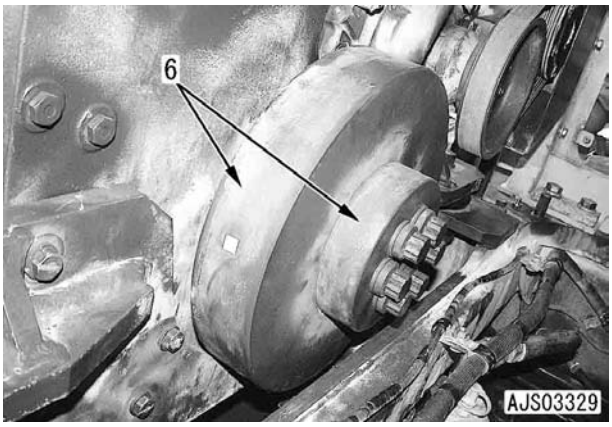


4. Disconnect hose clamps (3).
5. Remove bar (4).
6. Remove 3 covers (5).

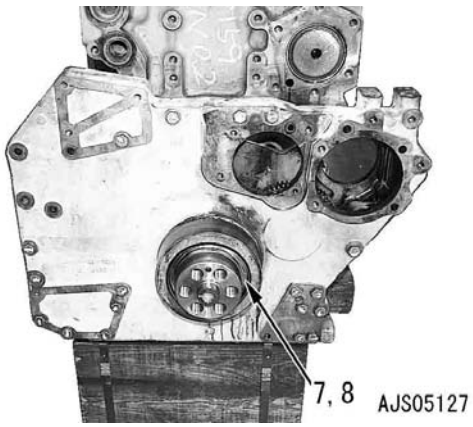


7. Lift pulley and damper assembly (6) temporarily.
8. Lift and remove pulley and damper assembly (6). [*1]

   Pulley and damper assembly (6): **50 kg**

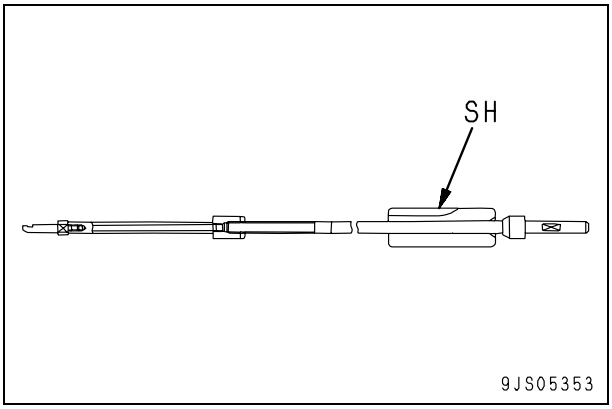


9. Remove dust seal (7).
10. Remove front seal (8) in the following procedure.

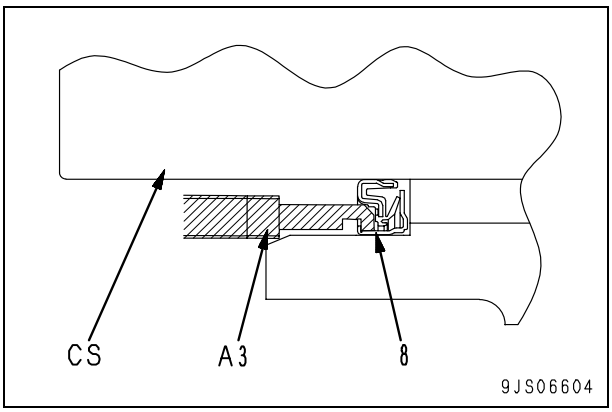


1) Replace the tip of tool **A3** with the hook type one.
2) Hitch the hook to the hoop of front seal (8).
3) Remove the seal using impacts of the slide hammer (SH).

- Tool **A3**

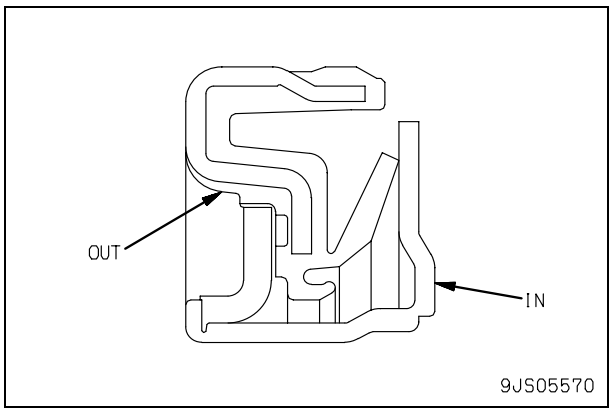


★ CS: Crankshaft

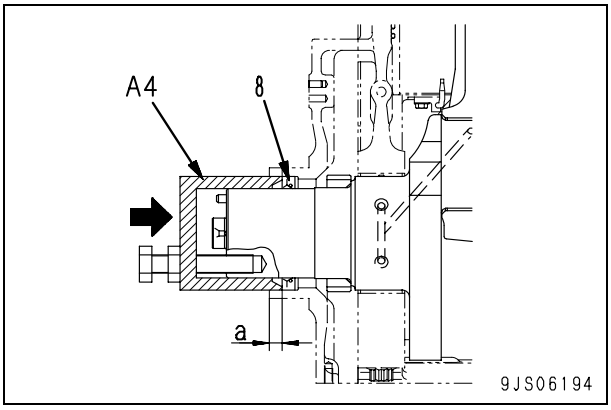


Installation

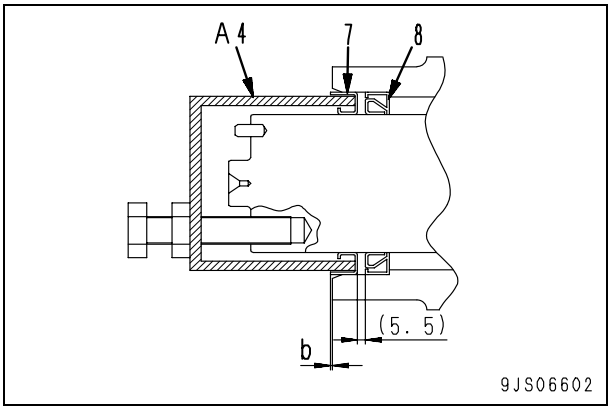
1. Clean, degrease and then dry the contact surface between the front cover and front seal.
2. Using a clean cloth, remove foreign matter deposited the crankshaft flange.
   ★ Clean foreign matter deposited on the seal lip surface (surface around the crank shaft) and then degrease and dry the surface.
   ★ Check the crankshaft end face corner and lip siding surface for scratches due to the housing, burrs or rusts.
3. Install front oil seal (8) according to the following procedure.
   ★ Before installing the seal, check that the end corners and lip sliding surfaces of the crankshaft are free from flaw, burr, and rust of the housing.
   ★ When installing the seal, do not apply oil or grease to the shaft and seal lip. Wipe off the oil from the shaft.
   1) Install the oil seal directing its side stamped with IN toward the inside of the engine.
      ★ Pay attention to the assembling direction.
      ★ The OUT stamped side is directed toward the outside of the engine.



2) Using tool **A4**, press fit oil seal (8) to the front case in such that dimension (a) in the figure is met.
★ Oil seal press fitting dimension (a):
18.5 mm (when measured from the front cover end face)



3) Using tool **A4** (for dust seal), press fit dust seal (7) to the front case in such that dimension (b) in the figure is met.
★ Dust seal press fitting dimension (b):
2 mm (Projection out of the front cover end face)



- Carry out the succeeding installation in the reverse order of removal.

[*1]
Pulley and damper mounting bolt:
1st time: 53.9 – 93.1 Nm {5.5 – 9.5 kgm}
2nd time: 225.4 – 264.6 Nm {23 – 27 kgm}
3rd time: 617.4 – 656.6 Nm {63 – 67 kgm}

Removal and installation of engine rear seal

Special tools

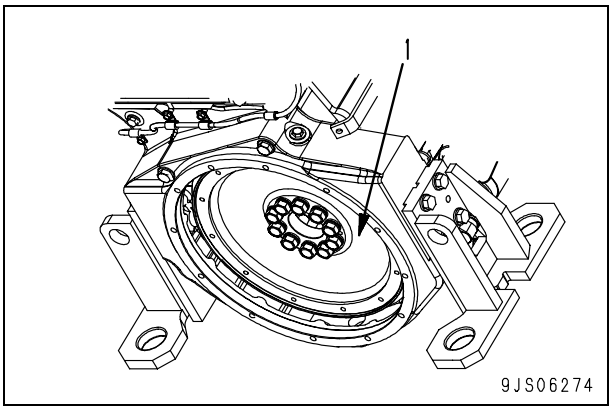
Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	3	795-931-1100	Seal puller assembly	■	1		
	5	795T-621-1160	Push tool	■	1	N	○
		• 01050-32235	• Bolt	■	5		

Removal

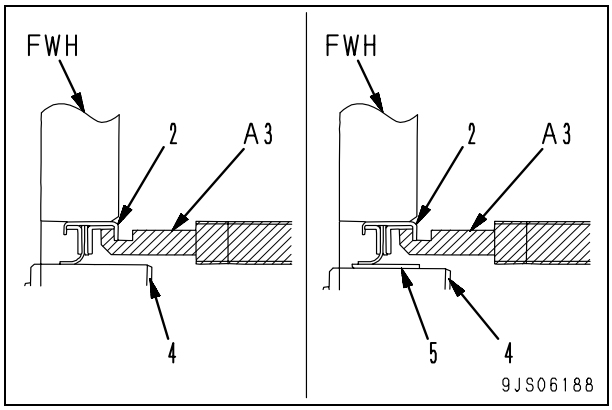
⚠ **Stop the machine on level ground and set the frame lock bar.**
⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Remove the damper assembly, referring to "Removal and installation of damper assembly."

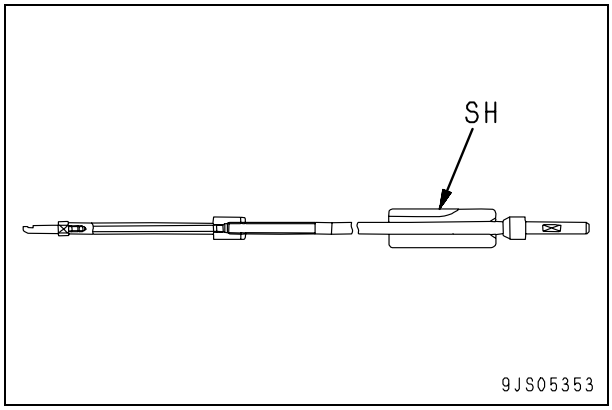
2. Lift and remove flywheel (1). [*1]
   Flywheel assembly: **40 kg**



3. Remove rear seal (2).
   ★ Take care in the removal not to damage the seal installation position on the flywheel housing and the seal contact surface on the crankshaft.
   ★ Before removing, slightly drive the seal in once to free it from fixation.
   ★ When rear seal (2) is fixed too hard to the flywheel housing (FWH), remove the following procedure.
   1) Replace the tip of tool **A3** with the hook type one.
   2) Hitch the hook to the hoop of seal (2).
   3) Remove the seal using impacts of the slide hammer (SH).
   ★ When the sleeve is attached, cut sleeve (5) using a gad and hammer to remove it.
   ★ Take care not to damage crankshaft (4).



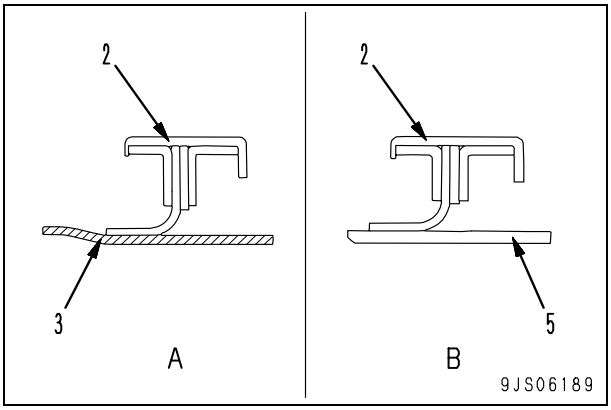
- Tool **A3**



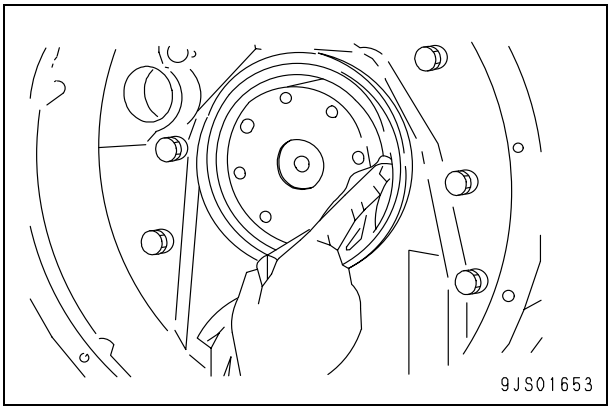
Installation

Rear seal (2)

★ Check the Teflon seal (Laydown lip seal) by checking the wear of the shaft and replace it with the “Standard seal” or “Sleeved seal”.
★ When wear on the shaft is not serious and only makes it look lustrous (depth of wear is 10 μm or less when checked with finger cushion) and no scratch is recognized, assemble the standard seal (A). When the above is not applicable, assemble sleeved seal (B).
★ (3): Shows the plastic inside cylinder doubling the assembly guide.
★ (5): Shows the sleeve.
★ Don't remove assembly guide (3) from rear seal (2) until the assembly is complete.
★ Handle rear seal (2) and sleeve (5) as an integral part. Don't try to separate them.

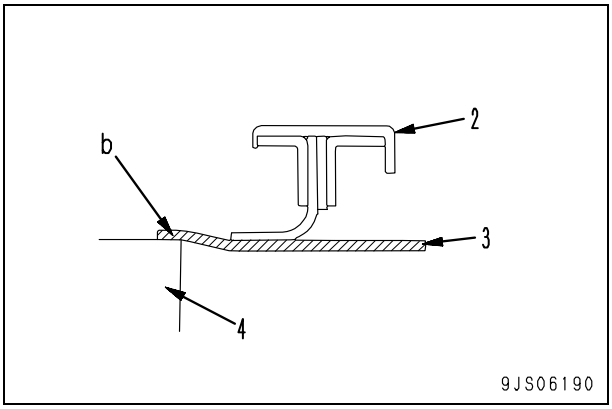


★ Clean, degrease and then dry the contact surface between the rear seal and flywheel housing.
★ Clean foreign matter deposited on the seal lip surface (surface around the crank shaft) and then degrease and dry the surface.
★ Check the crankshaft end face corner and lip siding surface for scratches due to the housing, burrs or rusts.

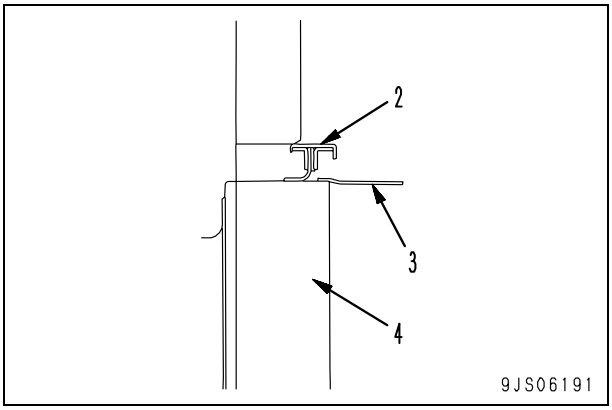


● **Procedure for installing standard seal**

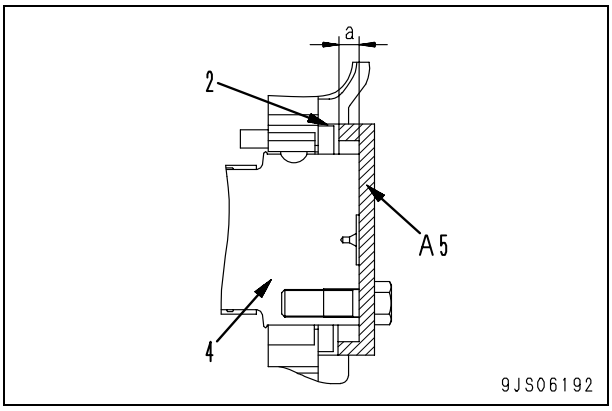
★ Don't apply gear or oil to the seal lip surface.
1) Contact larger inner diameter side (b) of plastic inside cylinder (3) of rear seal (2) against the end face of crank shaft (4).
★ Take care not to mistake the direction of the plastic inside cylinder.



2) Applying equal force to both hands, push in the hoop of rear seal (2).
3) After pushing in rear seal (2), remove plastic inside cylinder (3).
★ When removing the inside cylinder, take care not to damage the seal lip.



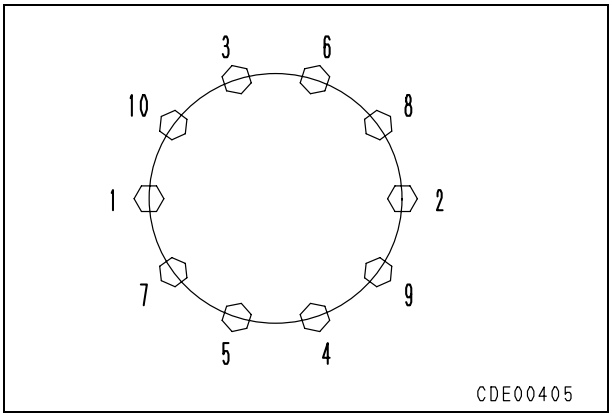
4) Tighten the bolts evenly to press fit rear seal (2) until the end of tool **A5** reaches the end of crankshaft (4).
   ★ Oil seal press fitting dimension (when measured from the shaft end face)
   (a): 20 mm
   ★ After press fitting the rear seal, remove the red sealant layer from its periphery.

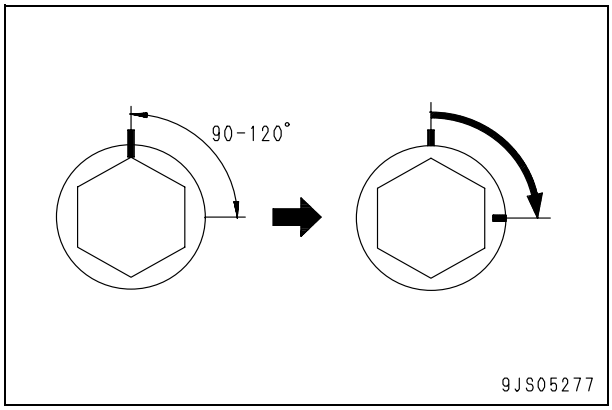


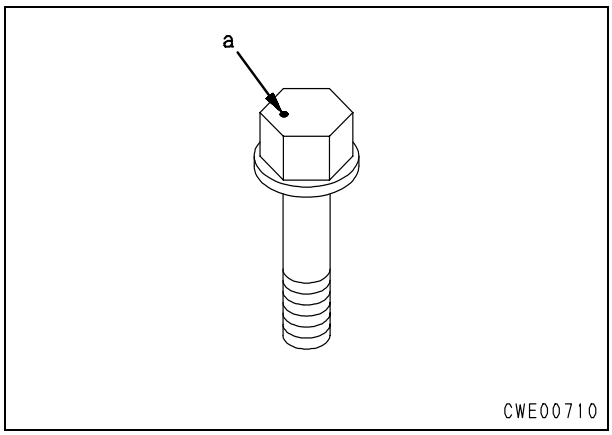
- Carry out the succeeding installation in the reverse order of removal.

[*1]
Flywheel assembly

★ Check the punch mark on the mounting bolt head. If 5 marks are punched, replace it with a new one without using it.
★ In order to prevent the flywheel from rotating, fix the space between the flywheel and flywheel housing using the bolt hole.
★ Tighten the mounting bolts in the following order.
   Flywheel assembly mounting bolt:
   Engine oil (EO30)
   Flywheel assembly mounting bolt:
   1st time : 196.1 ± 19.6 Nm {20 ± 2 kgm}
   2nd time : 460.9 ± 19.6 Nm {47 ± 2 kgm}
   3rd time : 90 – 120° retightening
★ After tightening the bolt, make a punch mark (a) on its head. (When a new bolt is used, do not make a punch mark on its head.)



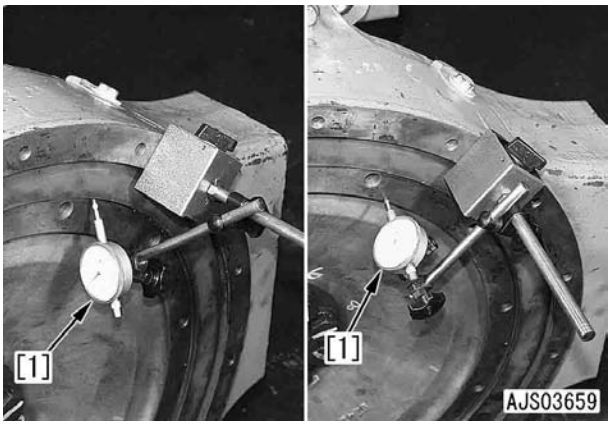




- Measure radial runout or facial runout of the flywheel using dial gauge [1].
  - ★ Standard radial and facial runout:

Measuring items	Tolerance (mm)
Radial runout	0.13
Facial runout	0.0005 × Diameter of measuring point

  - ★ When the measured value is out of the standard, determine the cause by disassembling the flywheel again.



WA600-6 Wheel loader

Form No. SEN01158-00

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Printed in Japan 06-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

Power train, Part 1

Power train, Part 1 2
Removal and installation of parking brake assembly 2
Removal and installation of torque converter and transmission assembly 4

Power train, Part 1

Removal and installation of parking brake assembly

Removal

- **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- **Set the frame lock bar.**
- **Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**
- **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Remove the drain plug to drain oil from the transmission case.

   Transmission case: Approx. **83 ℓ**

- Rear side

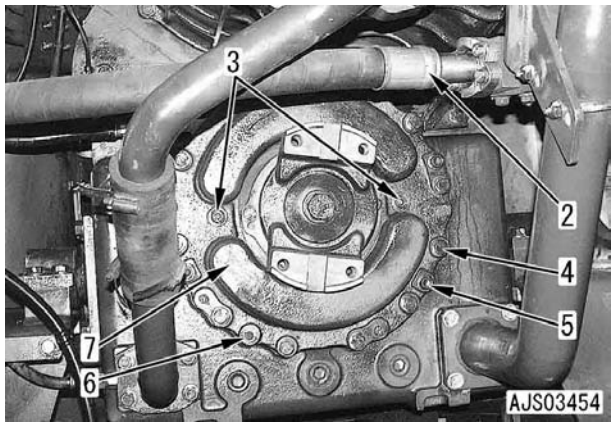
2. Remove drive shaft (1) connected to rear differential. [*1]

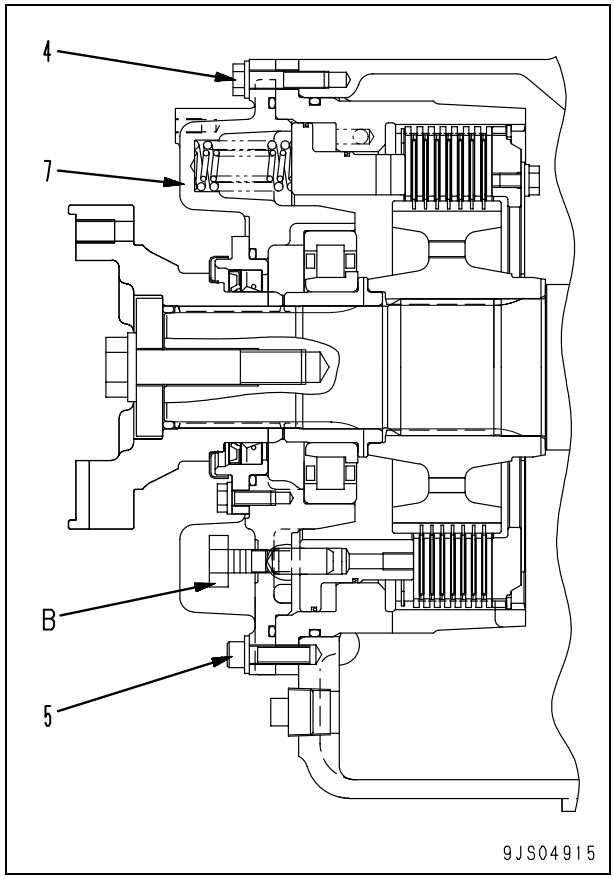
   Drive shaft: **65 kg**



3. Disconnect hose (2).
4. Remove plug (3) and then screw in the prepared parking brake release bolt (B) (**M12 × 1.75, L = 70 mm minimum**) until it is uniformly stopped.
5. Remove 12 mounting bolt (4). [*1]
6. Remove 4 mounting bolt (5).
7. Remove top and bottom plugs (6) and then remove parking brake assembly (7), using the forcing screw.

   Parking brake assembly:**120 kg**





Installation

- Installation is done in the reverse order of removal.

[*1]
Mounting bolt:
98 – 123 Nm {10.0 – 12.5 kgm}

- **Refilling with oil**
  Tighten the drain plug and then feed power line oil (**TO30**) from the oil filler.
  Transmission case: Approx. **83 ℓ**

- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, “Bleeding air from various parts”.

Removal and installation of torque converter and transmission assembly

Removal

- ⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- ⚠ **Set the frame lock bar.**
- ⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Drain the oil from the hydraulic tank.

   Hydraulic tank: **approx. 443 ℓ**

2. Remove the floor frame assembly, referring to “Removal and installation of floor frame assembly.“

3. Remove the work equipment pump assembly, steering and fan pump assembly, referring to “Removal and installation of hydraulic pump assembly.”

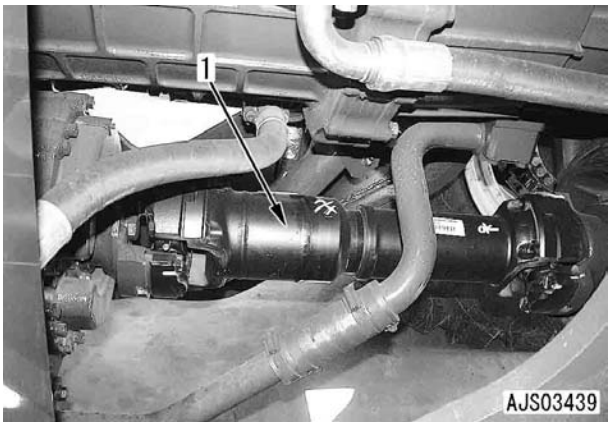
4. Remove the drain plug to drain oil from the transmission case.

   Transmission case: Approx. **83 ℓ**

- Drive shaft

5. Remove drive shaft (1) connected to rear differential. [*1]

   Drive shaft: **65 kg**

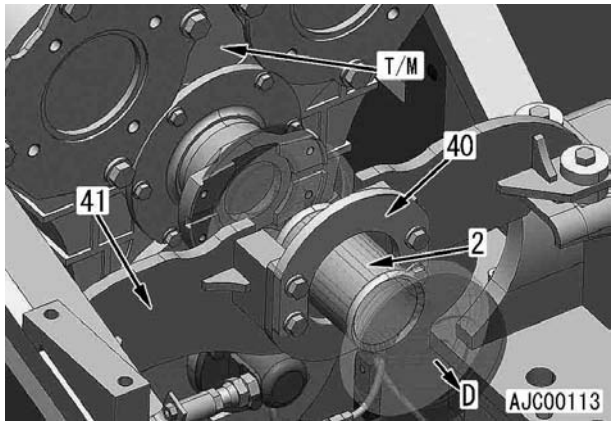


6. Remove guard (40).
7. Remove drive shaft (2) connected to the damper (D). [*2]

   Drive shaft: **30 kg**

8. Remove guard (41).

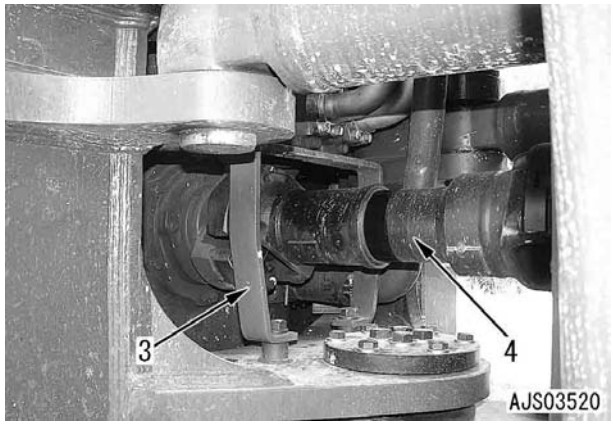
   ★ T/M: Transmission





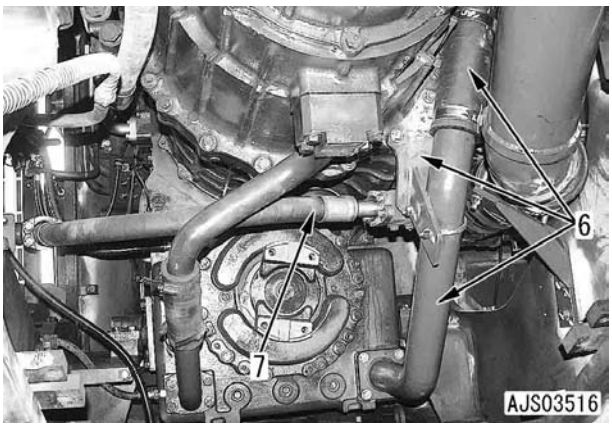
9. Remove guard (3).
10. Remove front drive shaft (4). [*3]

    Drive shaft: **65 kg**

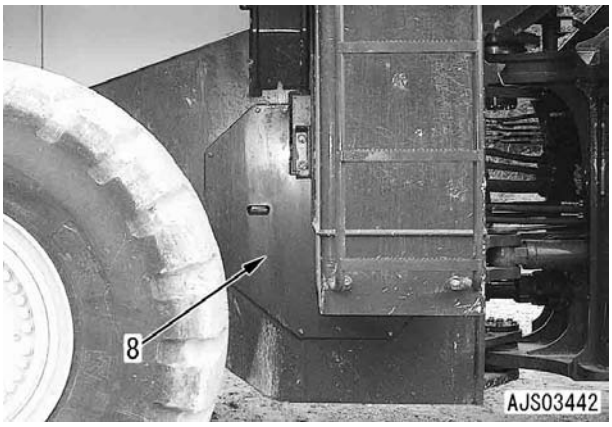


- Rear side

11. Remove tube, bracket and hose assembly (6).
12. Remove hose (7).

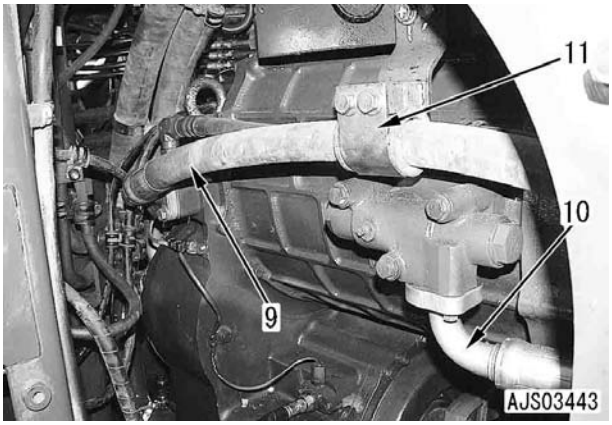


13. Remove right and left transmission side covers (8).

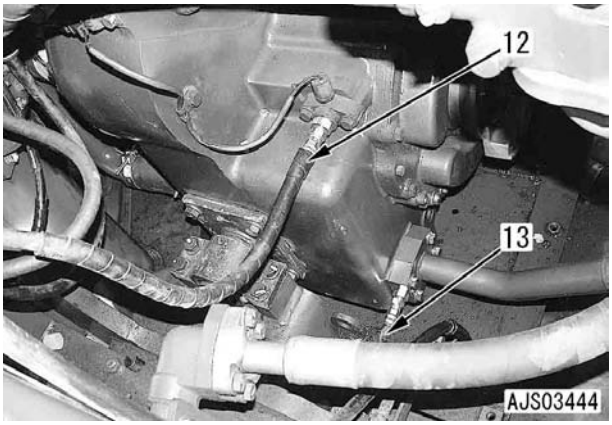


- Left side

14. Disconnect torque converter cooler hoses (9) and (10).
15. Disconnect clamp (11).

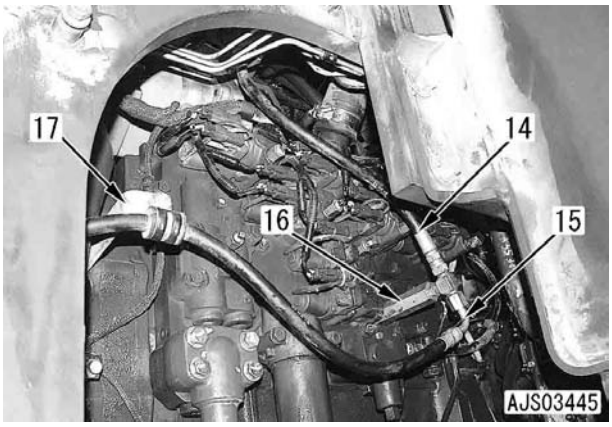


16. Disconnect hoses (12) and (13).



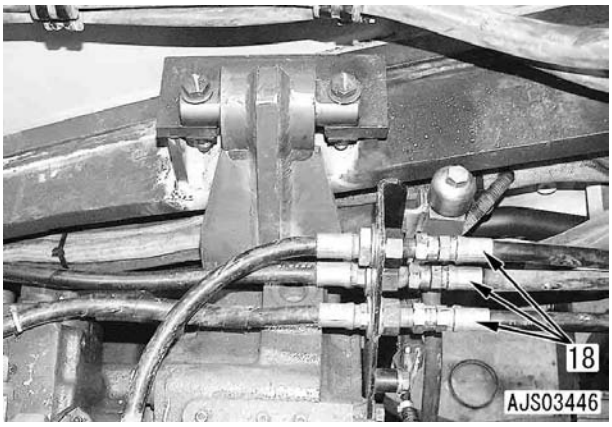
- Right side

17. Disconnect hoses (14) and (15).
18. Disconnect connector (16).
19. Disconnect bracket (17).

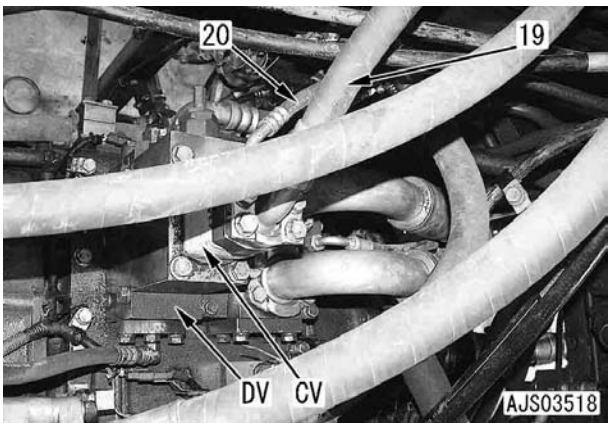


- Top side

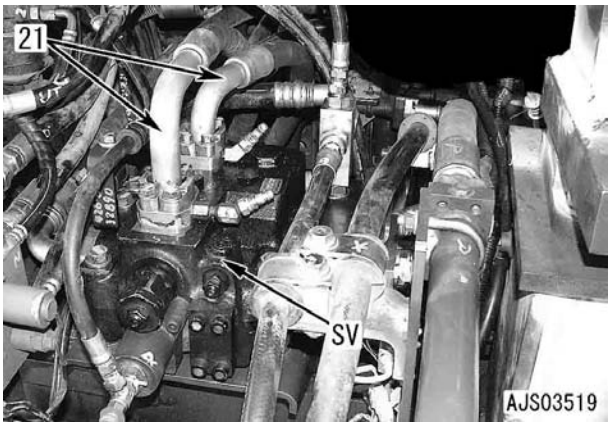
20. Disconnect 3 hoses (18).



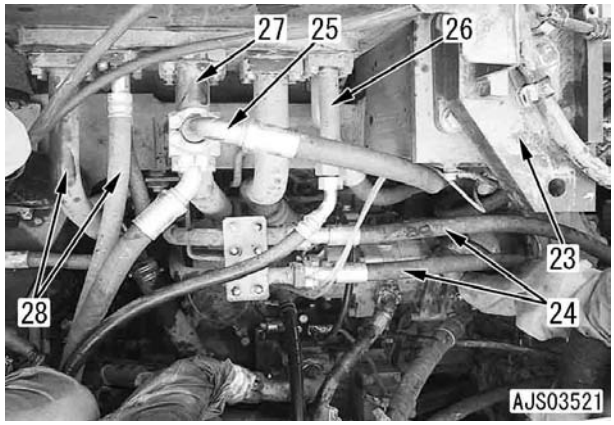
21. Disconnect hoses (19) and (20) from the check valve (CV).
    ★ DV: Diverter valve



22. Remove 2 blowout hoses (21) from the steering valve (SV).



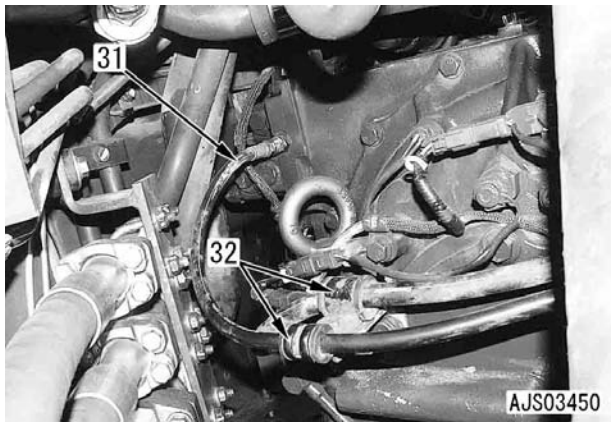
23. Remove right and left brackets (23).
24. Disconnect the hoses and tubes from the hydraulic tank.
    (24): 2 oil cooler hoses
    (25): Oil cooler return hose
    (26) Top: Steering drain tube
    (26) Bottom: Pump drain hose
    (27): Oil cooler and steering return tube
    (28): 2 emergency steering return hoses and suction tube



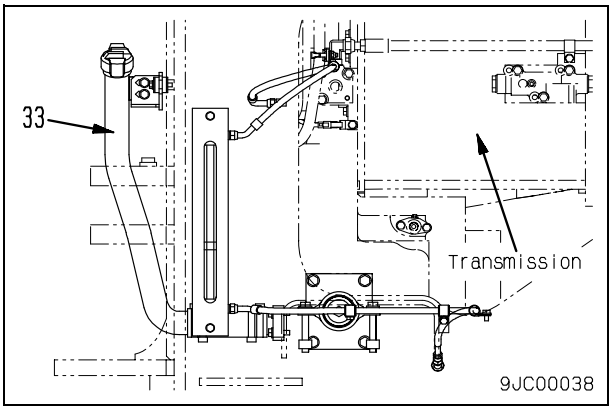
25. Disconnect 2 tubes (29) from the hydraulic tank.
26. Remove tube assembly (30).



● Front side
27. Disconnect parking brake hose (31).
28. Disconnect clamps (32).

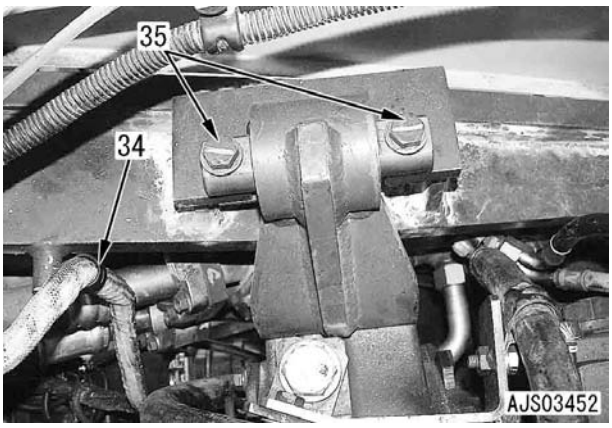


29. Disconnect filler (33).
    ★ Fasten filler (33) to the emergency steering hose by use of a string.

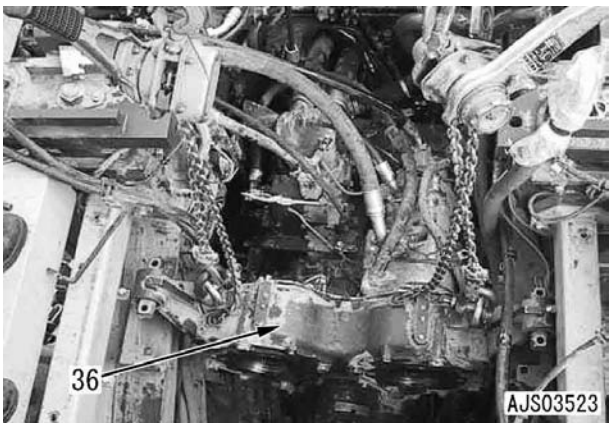


- Top side

30. Disconnect clamp (34).
31. Remove mounting bolt (35). [*4]
    ★ Check the number of the shims in advance.

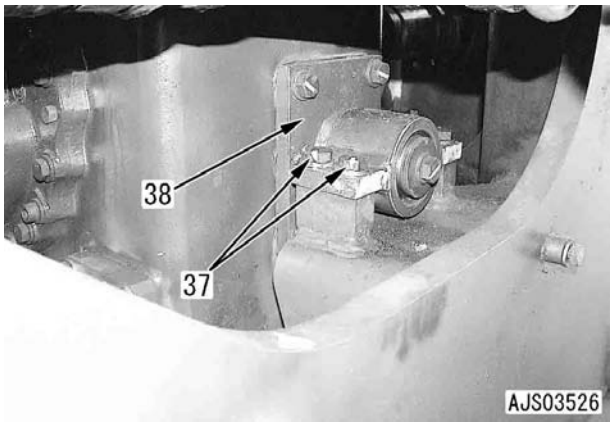


32. Lift air torque converter and transmission assembly (36) temporarily.



- Bottom right and left sides

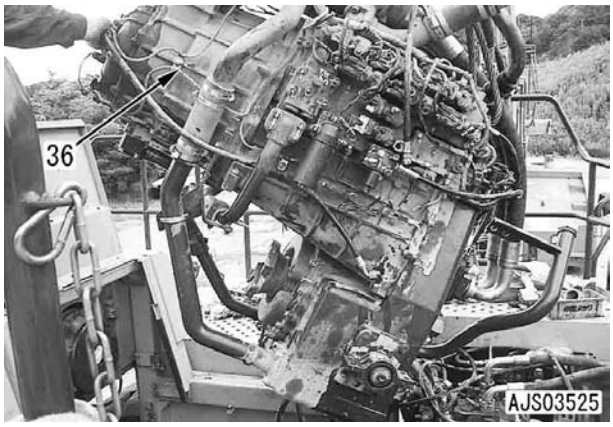
33. Remove mounting bolt (37). [*5]
34. Remove right and left brackets (38). [*6]
    ★ Above is needed since the opposite side bracket interferes with the suction tube as the assembly is lifted.



35. Lift and remove torque converter and transmission assembly (36).

    Torque converter and transmission assembly: **2,000 kg**

    ★ Incline the rear side approx. 30° when lifting.



Installation

- Installation is done in the reverse order of removal.

[*1]
Drive shaft mounting bolt:
245 – 309 Nm {25.0 – 31.5 kgm}
Mounting bolt: **490 – 608 Nm {50 – 62 kgm}**

[*2]
Mounting bolt of drive shaft between dampers:
98 – 123 Nm {10.0 – 12.5 kgm}

[*3]
Drive shaft mounting bolt:
245 – 309 Nm {25.0 – 31.5 kgm}

[*4]
Top side mounting bolt:
157 – 196 Nm {16.0 – 20.0 kgm}

[*5], [*6]
Mounting bolt at bottom right and left side:
245 – 309 Nm {25.0 – 31.5 kgm}

- **Refilling with oil**
  Tighten the drain plug and then feed power line oil (**TO30**) from the oil filler.

  Transmission case: Approx. **83 ℓ**

- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

  Hydraulic tank: **approx. 443 ℓ**

- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, “Bleeding air of various parts.”

WA600-6 Wheel loader

Form No. SEN01160-00

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Printed in Japan 06-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

Power train, Part 2

Power train, Part 2 2
Disassembly and assembly of torque converter assembly 2
Disassembly and assembly of transmission assembly 29
Disassembly and assembly of transfer assembly 56
Disassembly and assembly of parking brake assembly 71

Power train, Part 2

Disassembly and assembly of torque converter assembly

Special tools

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
C	792-900-1350	Wrench	■	1		
D	793-613-1210	Wrench	■	1		
E	793-615-1110	Wrench assembly	■	1		
	01306-10616	Bolt	■	1		

Disassembly

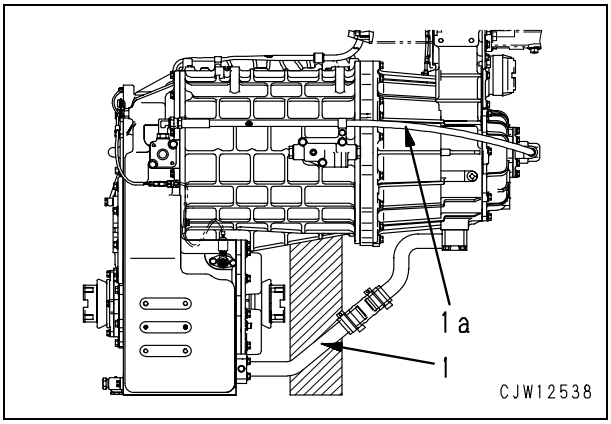
1. Preparation work

1) Set the transmission and torque converter assembly on the block.

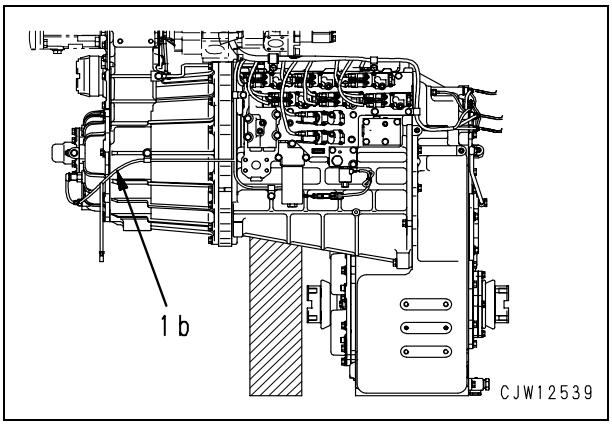
Transmission and torque converter assembly: **1,800 kg**

2) Remove oil tube (1) between the torque converter and transfer.

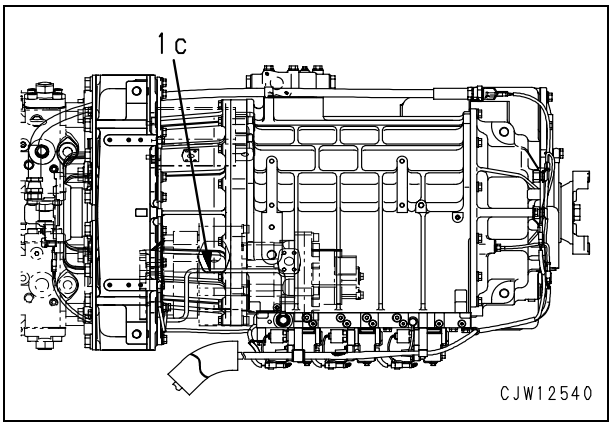
3) Remove modulated clutch lubrication hose (1a).



4) Disconnect torque converter speed sensor wiring harness (1b).



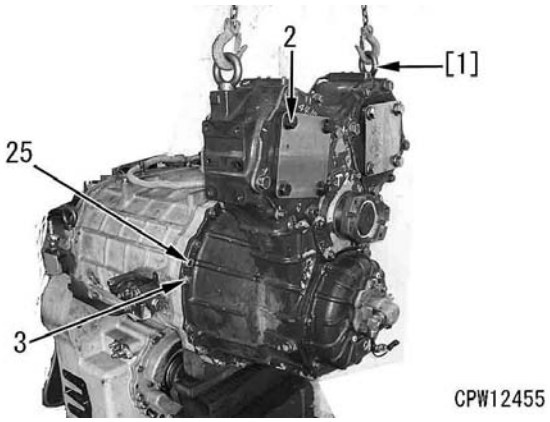
5) Remove torque converter PTO lubrication tube (1c).



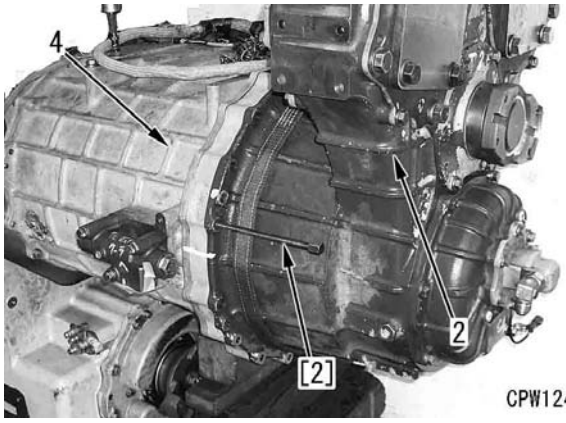
6) Using sling [1], sling torque converter and PTO assembly (2).

7) Remove 16 mounting bolts (3).

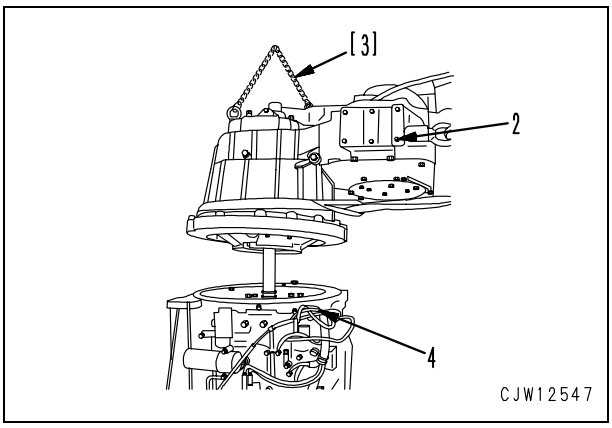
★ Do not remove 2 sub-assembly bolts (25).



8) Using forcing screws [2] (M12, P = 1.75 mm), disconnect torque converter and PTO assembly (2) from transmission assembly (4).

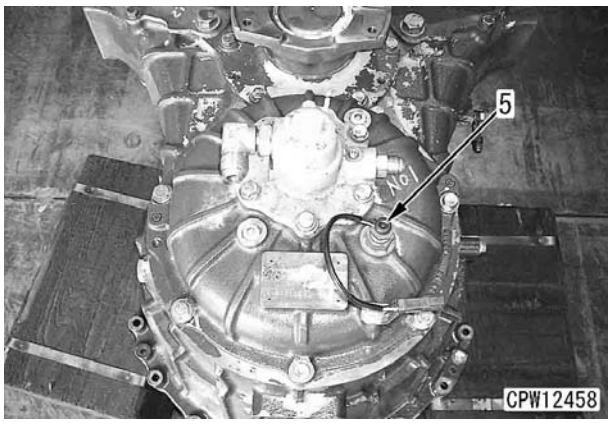


9) Using sling [3], remove torque converter and PTO assembly (2) from transmission assembly (4).



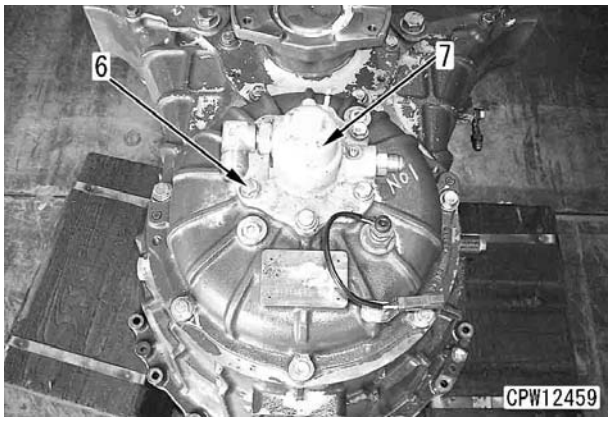
Torque converter and PTO assembly: **490 kg**

10) Remove modulated clutch speed sensor (5).



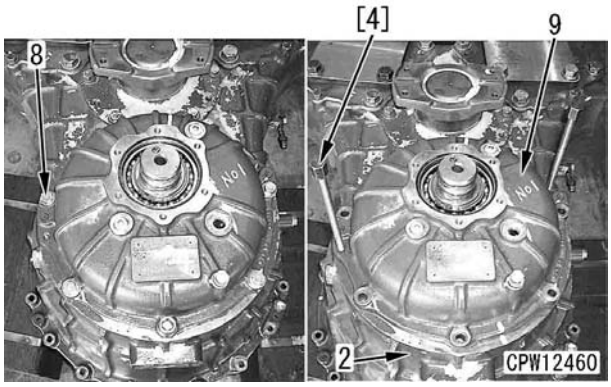
2. Seal cage

Remove mounting bolts (6) and seal cage (7).

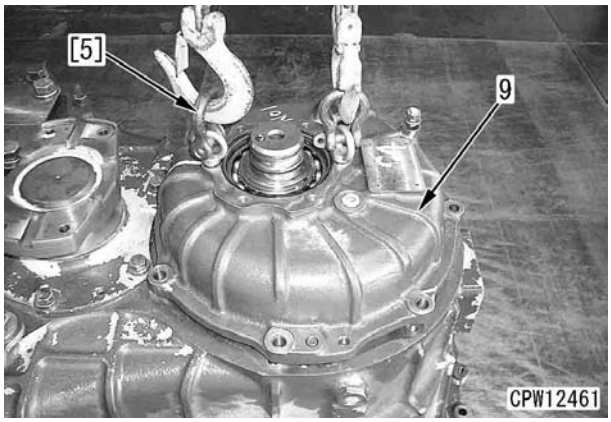


3. Modulated clutch assembly

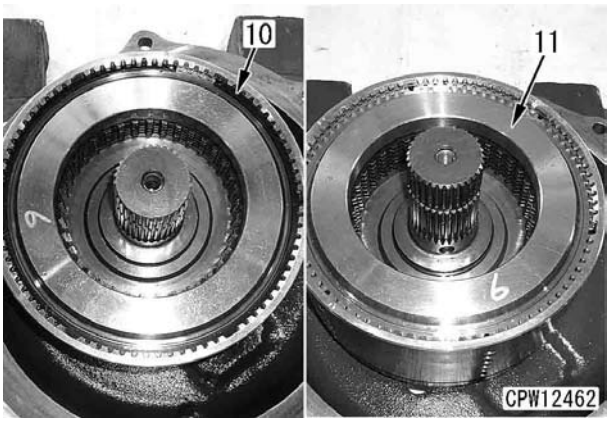
1) 1) Remove 7 mounting bolts (8).
2) Using forcing screws [4] (M12, P = 1.75 mm), disconnect modulated clutch assembly (9) from torque converter and PTO assembly (2).



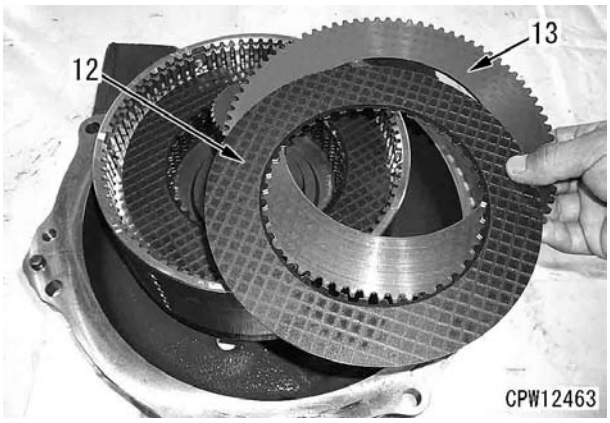
3) Using sling [5] (M10, P = 1.5 mm), remove modulated clutch assembly (9).



4) Disassemble modulated clutch assembly according to the following procedure.
   1] Remove snap ring (10).
   2] Remove plate (11).



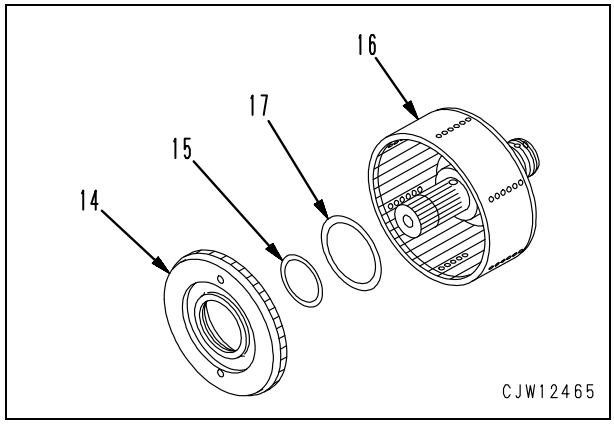
   3] Remove 7 discs (12) and 8 plates (13) alternately.



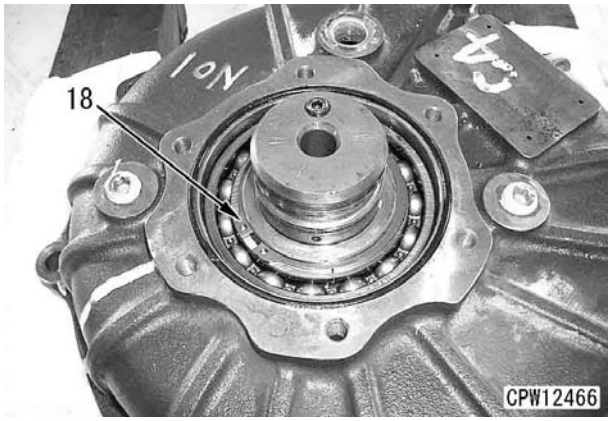
   4] Using eyebolts (M12, P = 1.75 mm), remove piston (14).



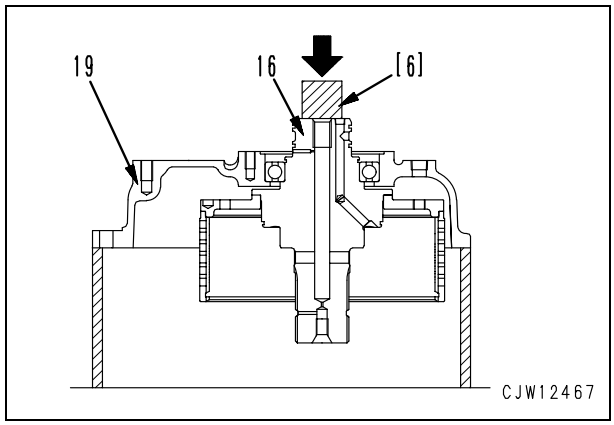
   5] Remove seal ring (15) from piston (14) and remove seal ring (17) from clutch outer drum shaft (16).



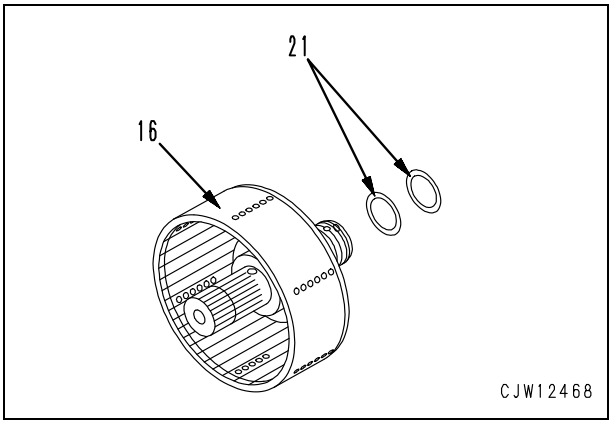
   6] Reverse the case and remove snap ring (18).



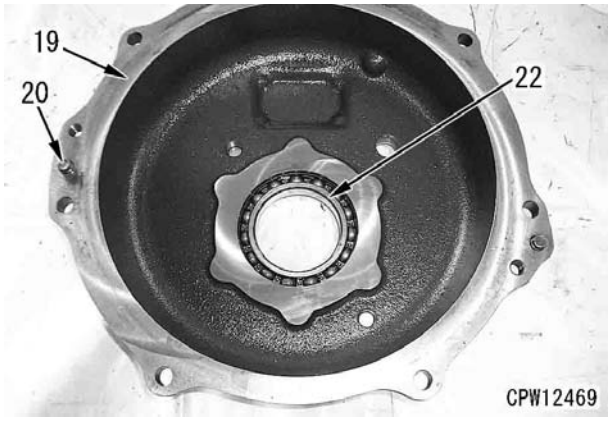
   7] Support case (19) and push out clutch outer drum shaft (16) with push tool [6] (Outside diameter: 60 mm).



8] Remove seal rings (21) from clutch outer drum shaft (16).

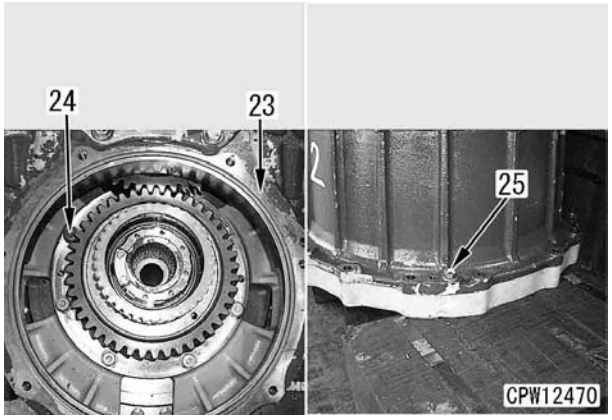


9] Remove bearing (22) from cover (19).
10] Remove 2 dowel pins (20).

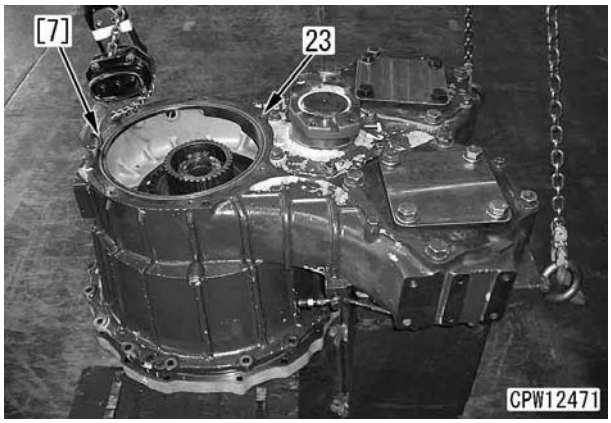


4. Torque converter case

1) Remove 6 mounting bolts (24) from the inside of torque converter case (23).
2) Remove 2 sub-assembly bolts (25).

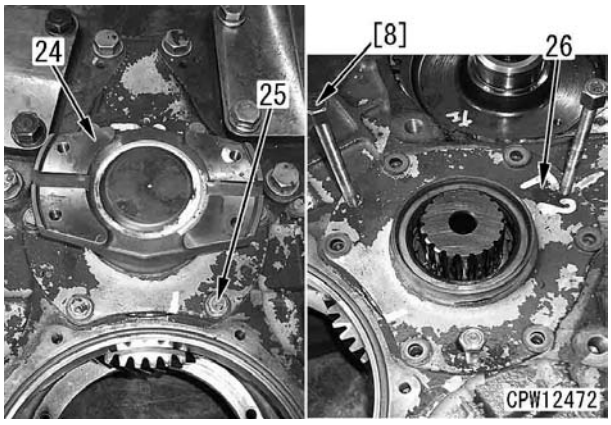


3) Using sling [7], remove torque converter case (23).

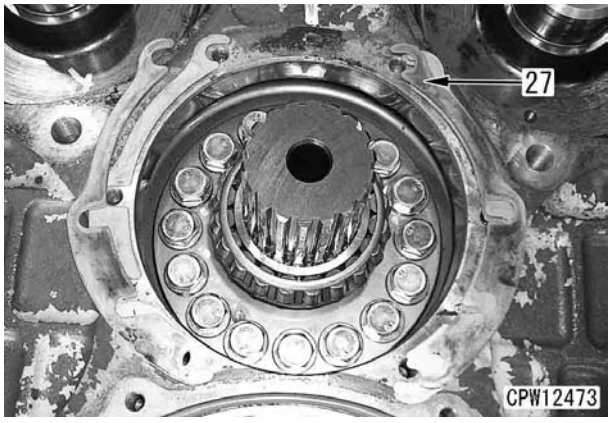


5. Coupling and drive gear

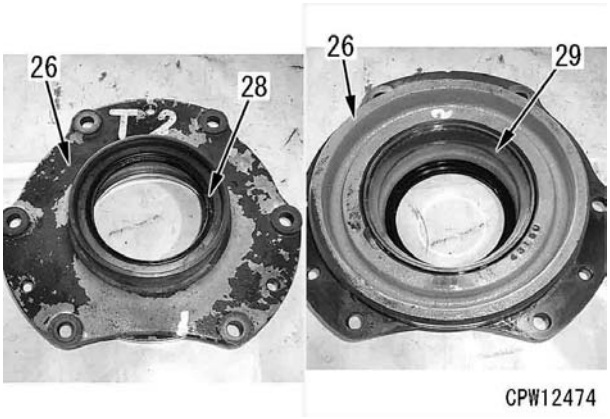
1) Remove coupling (24).
2) Remove 6 mounting bolts (25).
3) Using forcing screws [8] (M12, P = 1.75 mm), remove cage (26).



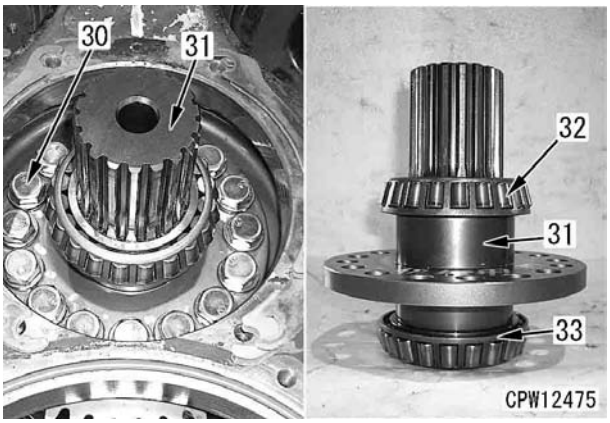
4) Remove shim (27).
★ Check the quantity and thickness of the shim.



5) Remove oil seal (28) from cage (26).
6) Remove outer race (29) from cage (26)



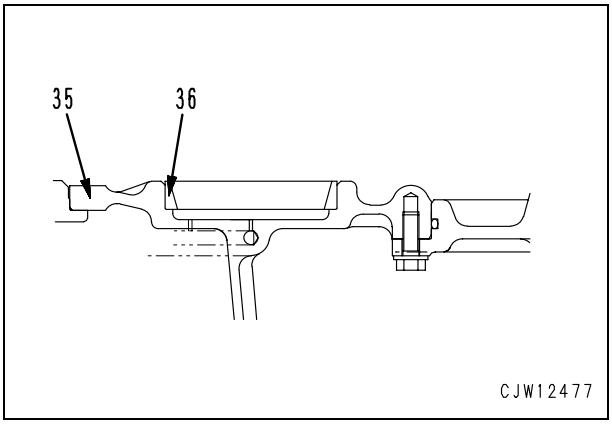
7) Remove 16 mounting bolts (30).
   ★ Before removing shaft (31), remove gear (34) from it. (Forcing tap: M10, P = 1.5 mm)
8) Remove input shaft (31).
9) Remove bearings (32) and (33) from input shaft (31).



10) Remove gear (34).
   ★ Move the gear aside to remove.

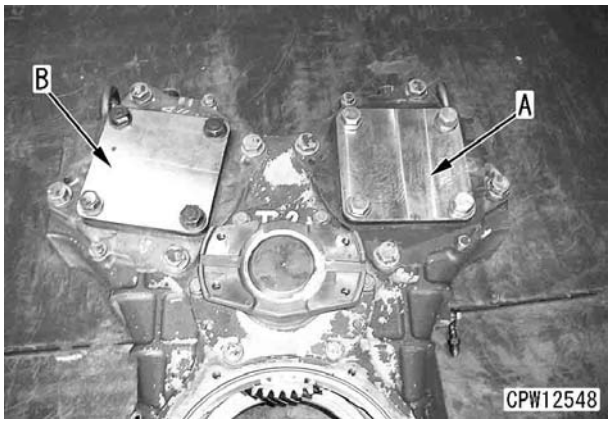


11) Remove outer race (36) from torque converter case (35)



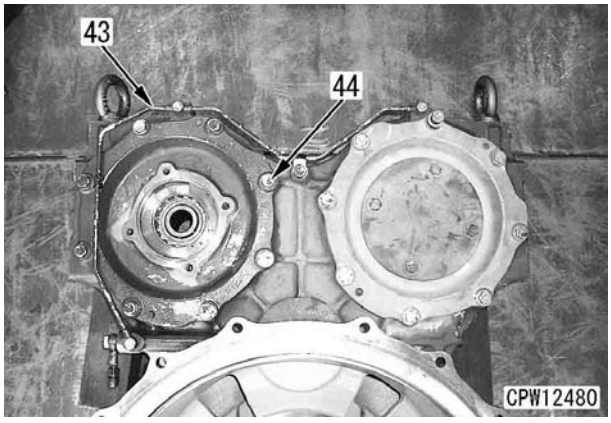
6. PTO gear

★ Since the right and left cages and gears of PTO A (Right side) and PTO B (Left side) are different, keep the removed parts separately.
★ The covers of the PTO A and PTO B are used for transportation of the unit. Accordingly, they are not installed to the actual machine.

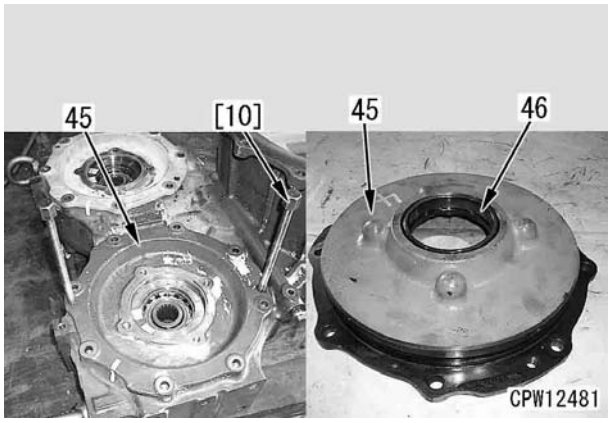


1) PTO gear A (Right side)

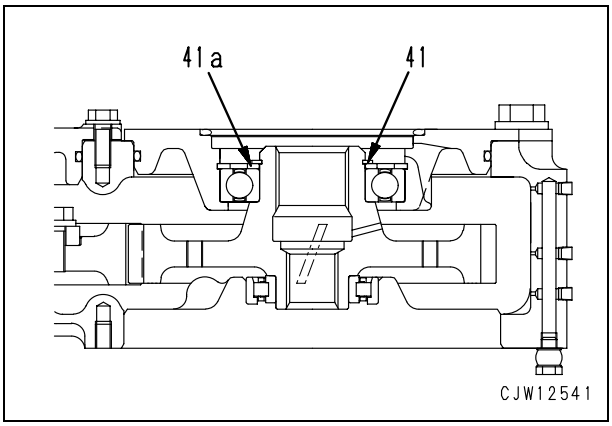
1] Reverse the torque converter case.
2] Remove lubrication tube (43).
3] Remove 8 mounting bolts (44).



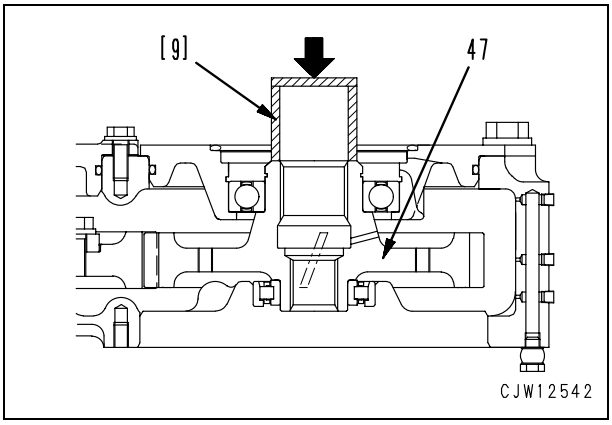
4] Using forcing screws [10] (M12, P = 1.75 mm), remove cage (45).
5] Remove outer race (46) from cage (45).



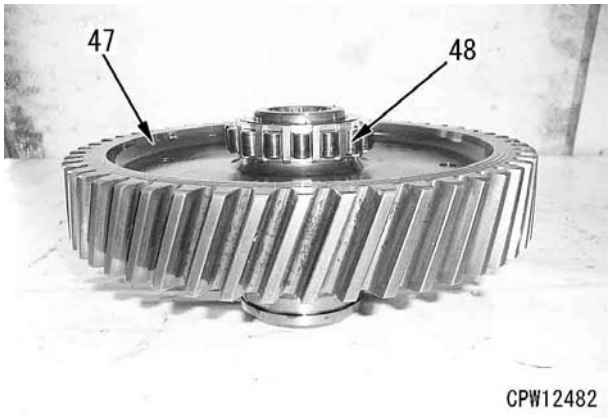
6] Reverse the torque converter case.
7] Remove snap ring (41) and plate (41a).



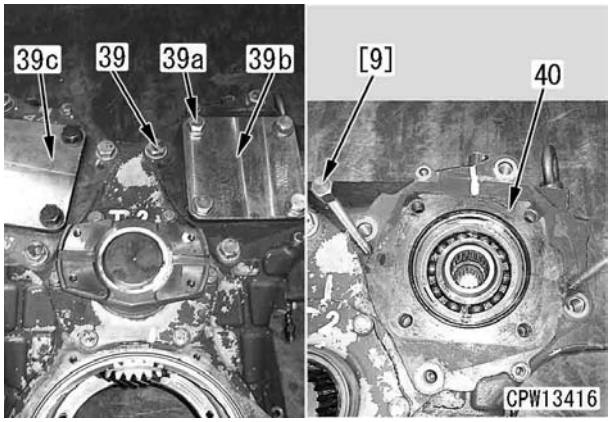
8] Using push tool [9] (Outside diameter: 80 mm), remove gear (47).
★ Take care not to drop the gear.



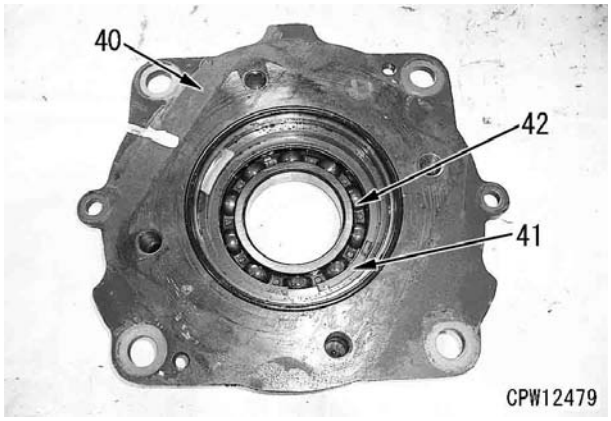
9] Remove bearing (48) from gear (47).



10] Remove 2 mounting bolts (39) and 4 mounting bolts (39a).
11] Using forcing screws [9] (M12, P = 1.75 mm), remove cage (40).
★ Covers (39b) and (39c) are used for transportation of the unit. Accordingly, they are not installed to the actual machine.



12] Remove snap ring (41) from cage (40) and remove bearing (42).

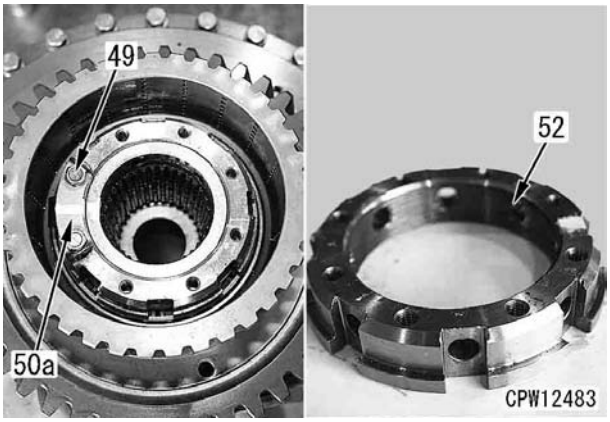


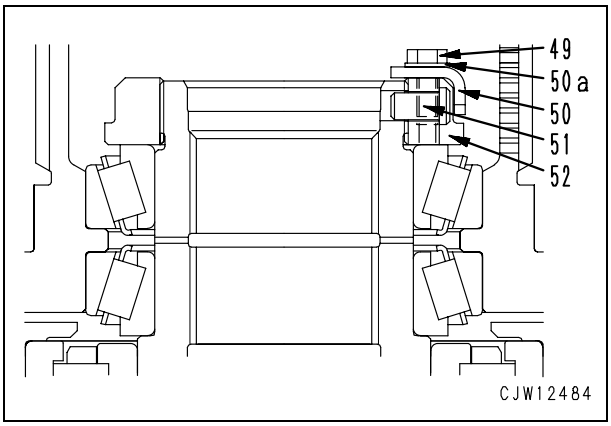
2) **PTO gear B (Left side)**
Remove PTO gear B similarly to PTO gear A (Right side).

<Steps 7 – 17 are disassembly procedures for the torque converter>

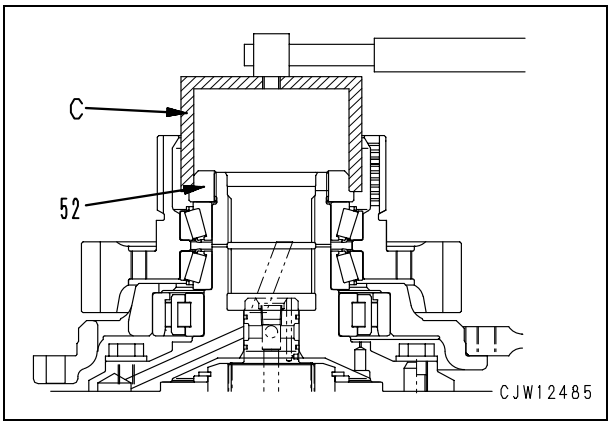
7. Locknut

1) Straighten the locking part of lock plate (50a) and remove 2 lock bolts (49) and stopper plate (50).
2) Remove side pin (51) from locknut (52).



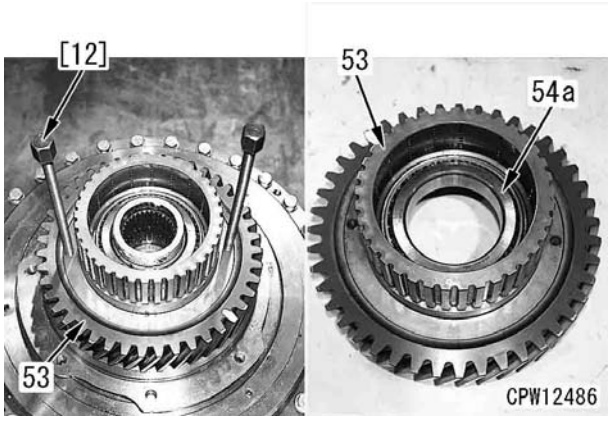


3) Using tool **C**, remove locknut (52).

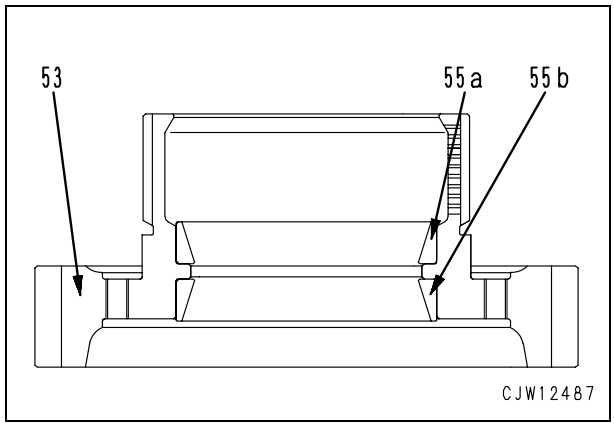


8. Modulated clutch gear

1) Using forcing screws [12] (M10, P = 1.5 mm), remove modulated clutch gear (53).
2) Remove upper bearing (54a) from modulated clutch gear (53).

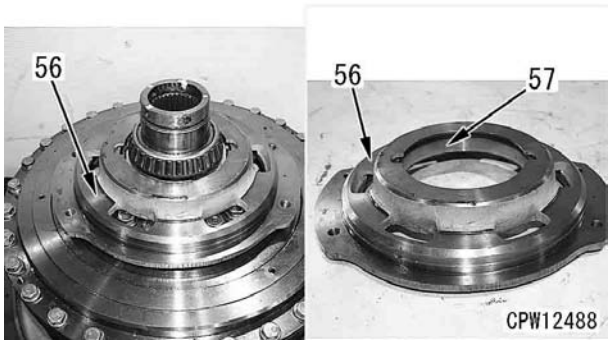


3) Remove outer races (55a) and (55b) from modulated clutch gear (53).



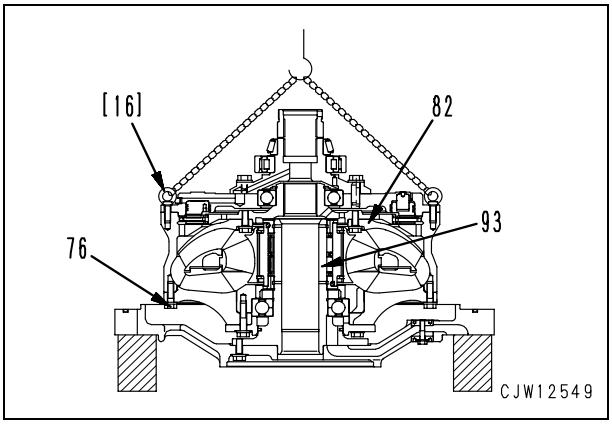
9. Cage

1) Remove cage (56).
2) Remove outer race (57) from cage (56).

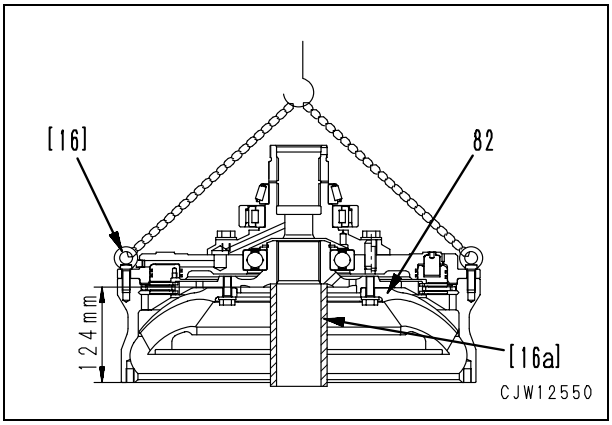


10. Torque converter assembly

1) Set the torque converter assembly on the blocks.
2) Remove 30 mounting bolts (76).
3) Using eyebolts [16] (M10, P = 1.5 mm), remove turbine shaft assembly (82) from stator shaft assembly (93).

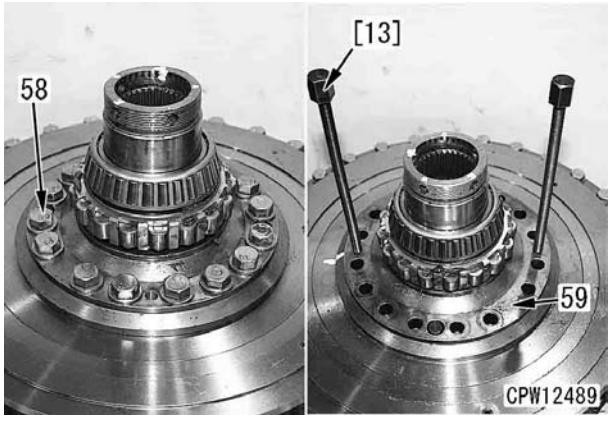


4) Using eyebolts [16] (M10, P = 1.5 mm), set turbine shaft assembly (82) to tool [16a] (Height: 124 mm).

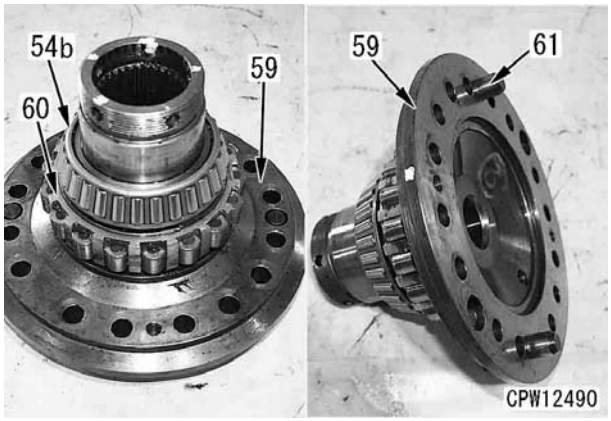


11. Torque converter input shaft

1) Remove 16 mounting bolts (58).
2) Using forcing screws [13] (M10, P = 1.5 mm), remove torque converter input shaft (59).

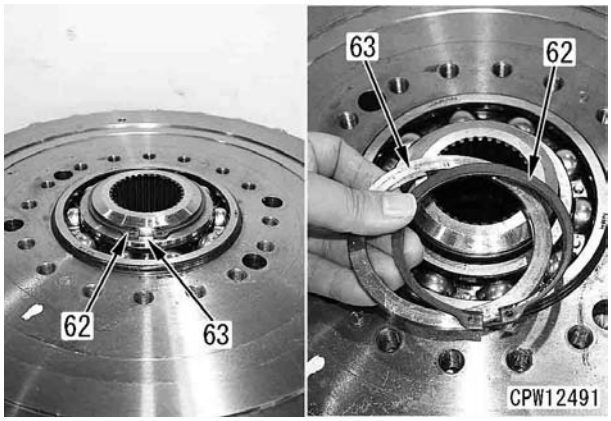


3) Remove bearings (54b) and (60) from torque converter input shaft (59).
4) Remove 2 dowel pins (61).

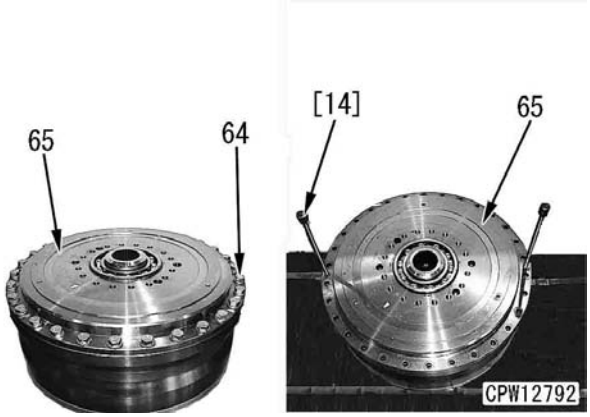


12. Lockup clutch housing

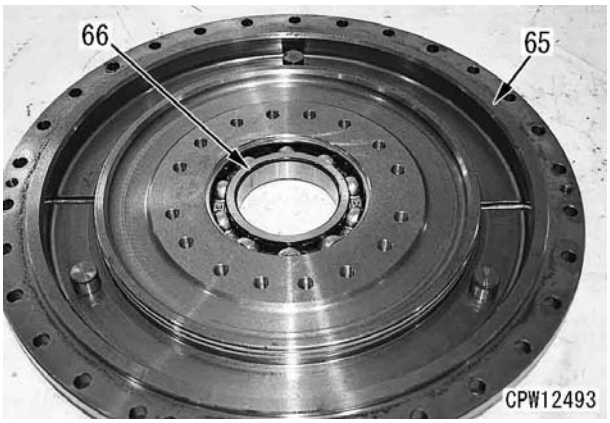
1) Remove snap ring (62) and plate (63).



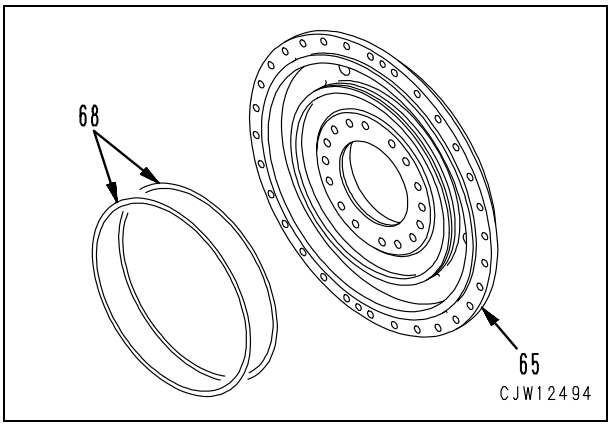
2) Remove 30 mounting bolts (64).
3) Using forcing screws [14] (M10, P = 1.5 mm), remove lockup clutch housing (65).



4) Remove bearing (66) from lockup clutch housing (65).



5) Remove seal rings (68) from lockup clutch housing (65).

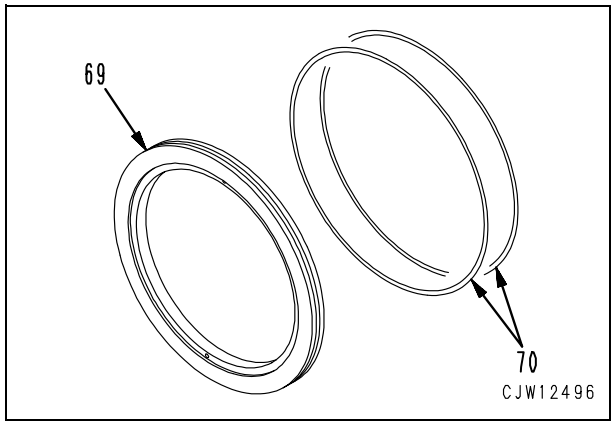


13. Piston

1) Using eyebolts (M6, P = 1 mm), remove piston (69).

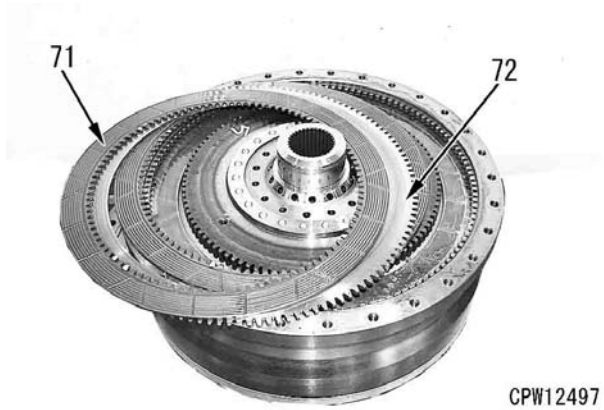


2) Remove seal rings (70) from piston (69).



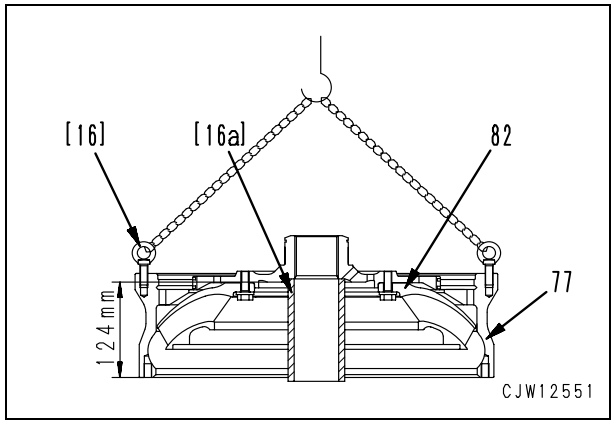
14. Discs and plate

Remove 2 discs (71) and 1 plate (72).

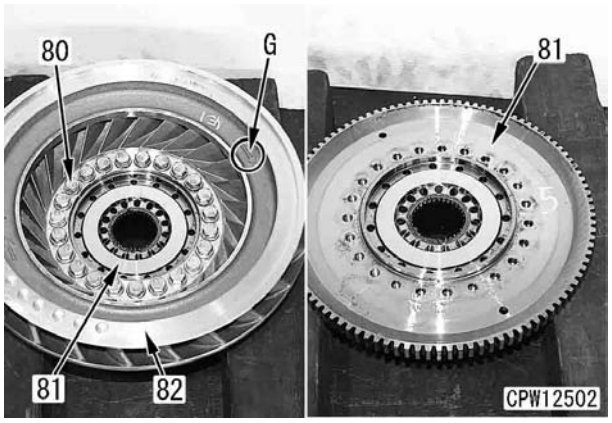


15. Turbine

1) Using tool [16a] (M10, P = 1.5 mm), support turbine shaft assembly (82).
2) Using eyebolts [16] (M10, P = 1.5 mm), remove drive case (77).

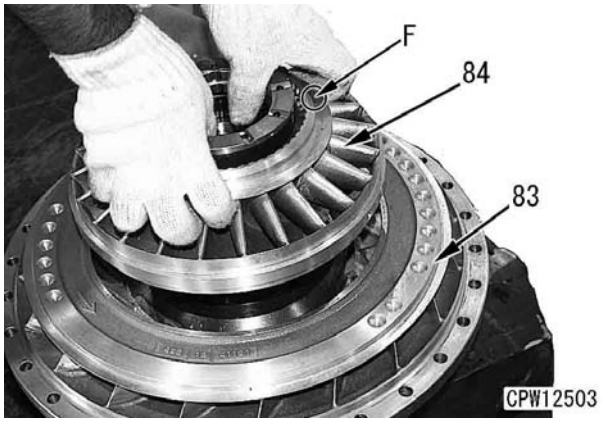


3) Remove 23 mounting bolts (80)
4) Remove turbine (82) from boss (81).
   ★ Check the arrow of the turbine rotation direction at part (G).

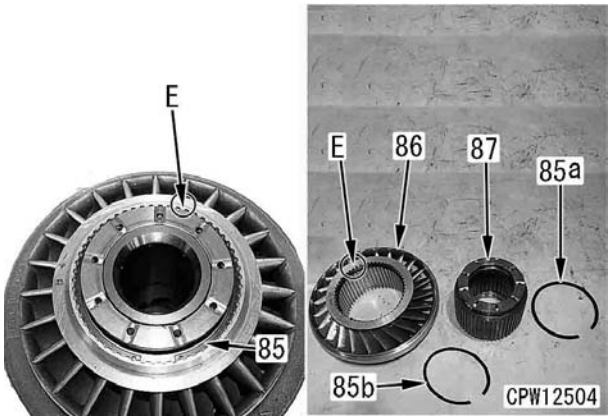


16. Stator

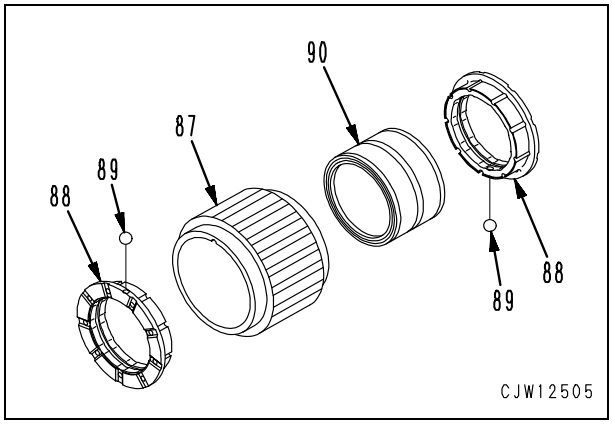
1) Remove stator assembly (84) from pump (83).
   ★ Check that the side having a shoulder at stator part (F) is on the input side.



2) Remove upper snap ring (85a).
3) Remove race (87) from stator (86).
4) Remove lower snap ring (85b).

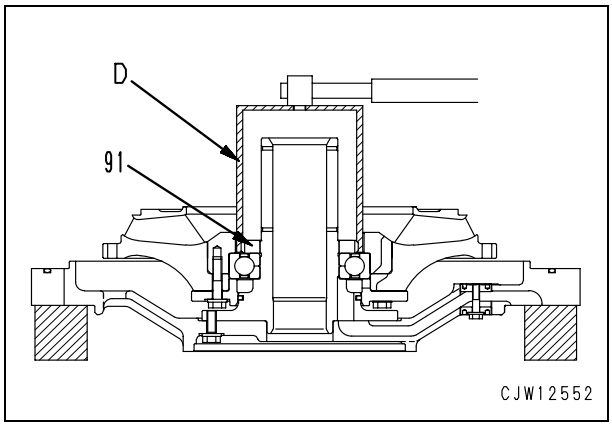


5) Remove bushing (88), ball (89) and freewheel (90) from race (87).
   ★ Take care not to lose the ball.

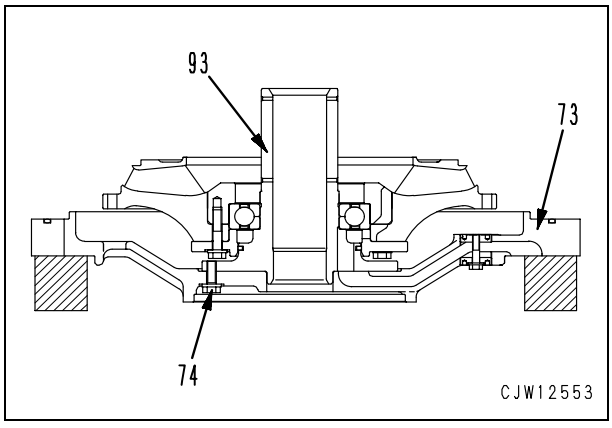


17. Pump

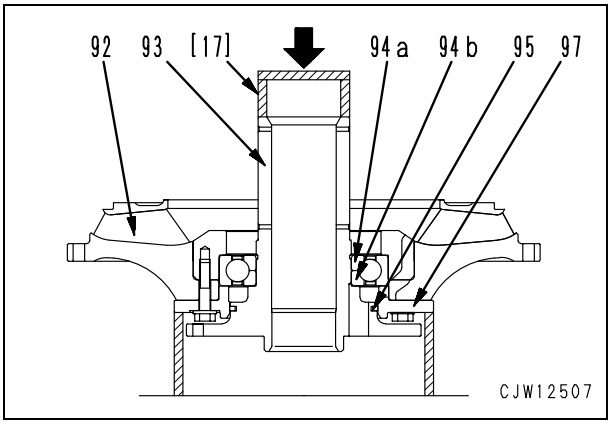
1) Using tool **D**, remove locknut (91).
   ★ Note that locknut (91) has left-handed threads.



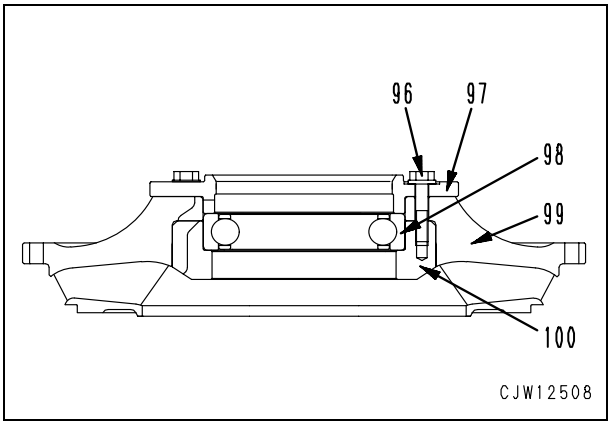
2) Remove 14 mounting bolts (74).
3) Remove stator shaft assembly (93) from housing (73).



4) Support retainer (97) and push out stator shaft (93) with push tool [17].
5) Remove inner race (94a).
6) Remove inner race (94b) from stator shaft (93).
7) Remove seal ring (95).



8) Remove 12 mounting bolts (96) from pump (99).
9) Remove retainer (97).
10) Remove bearing (98) from guide (100).



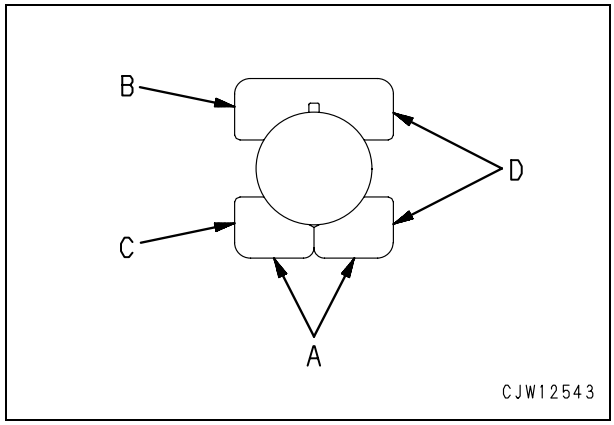
Assembly

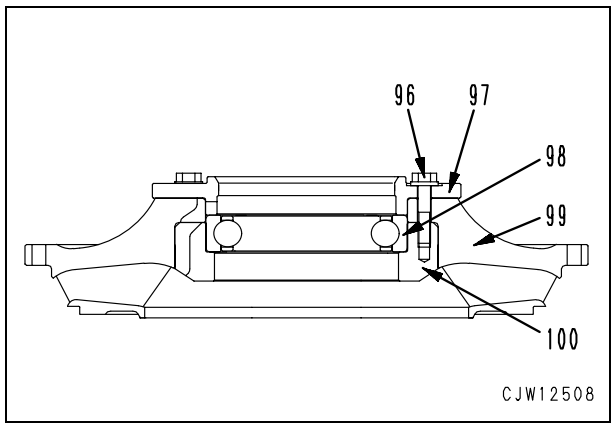
<Steps 1 – 12 are assembly procedures for the torque converter>

★ After installing each bearing, drop about **6 cc** of transmission oil (**TO10** or **TO30**) onto it and rotate it about 10 turns.
★ When installing a bearing by expansion fit, drop about **6 cc** of transmission oil (**TO10** or **TO30**) onto it and rotate it about 10 turns before cooling it in dry ice.

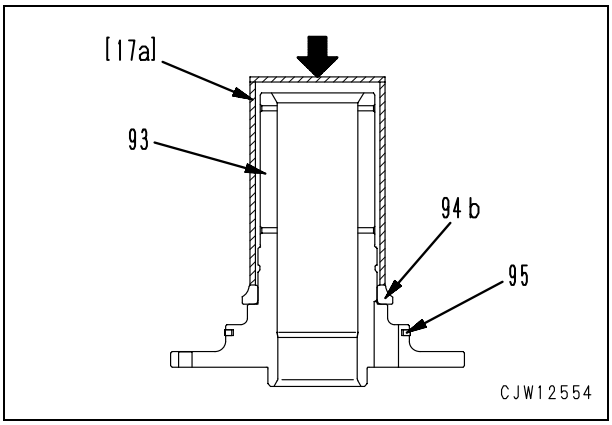
1. Pump

1) Install bearing (98) to guide (100).
   ★ Match the product Nos. (C) and match symbols "**A**" (D) of the inner race (A) and outer race (B) of the bearing and use those races as an assembly.
2) Install pump (99) and retainer (97).
   ★ Check the arrow of rotation direction of the pump.
   Direction of arrow: Counterclockwise when seen from input side
3) Install 12 mounting bolts (96).
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt:
   59 – 74 Nm {6.0 – 7.5 kgm}

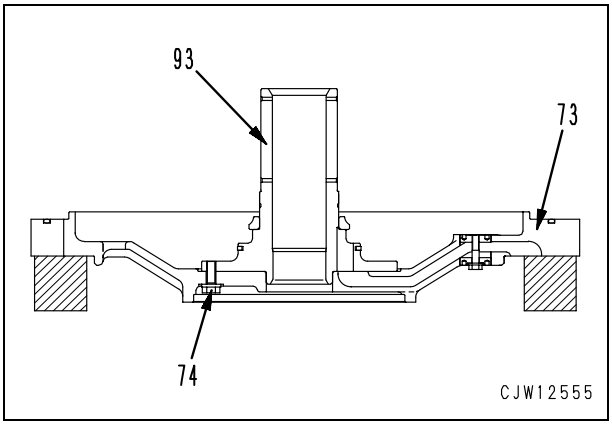




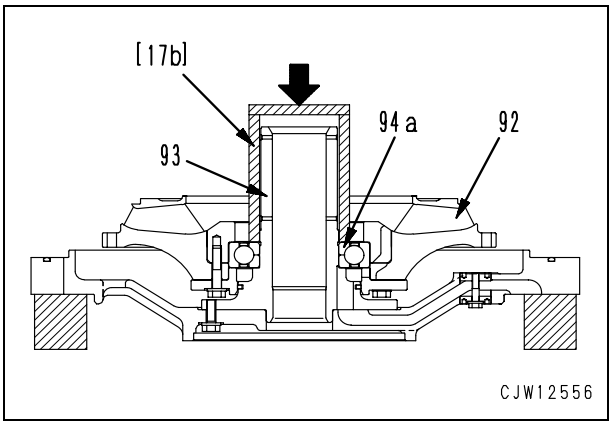
4) Install seal ring (95) to stator shaft (93).
5) Using push tool [17a] (Inside diameter: 91 mm), install inner race (94b).
Seal ring: **Grease (G2-LI)**



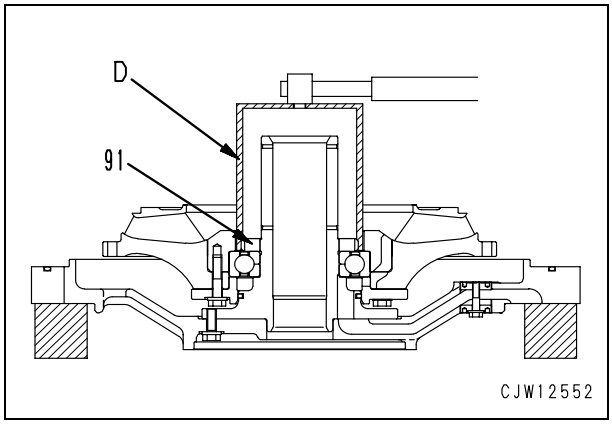
6) Install stator shaft (93) to housing (73) and tighten 14 mounting bolts (74).
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt:
59 – 74 Nm {6.0 – 7.5 kgm}



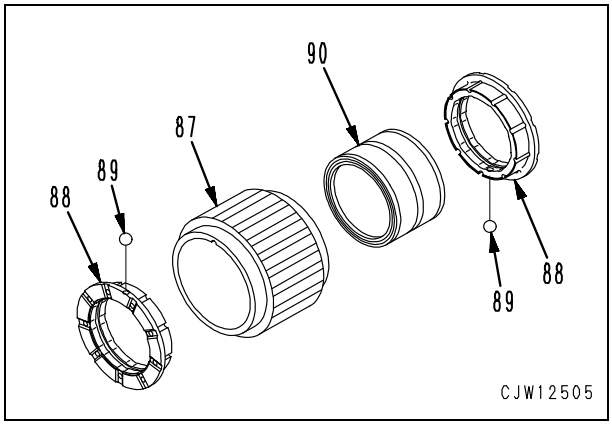
7) Install pump assembly (92) to shaft (93).
8) Using push tool [17b] (Inside diameter: 91 mm), press fit inner race (94a).



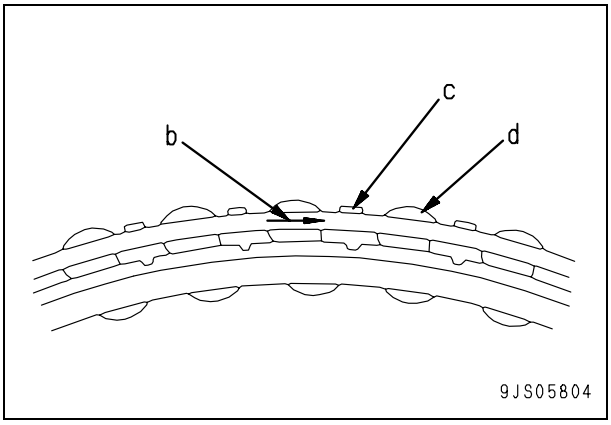
9) Install locknut (91) and tighten it with tool **D**.
★ Note that locknut (91) has left-handed threads.
Locknut: **Adhesive (LT-2)**
Locknut:
441 – 490 Nm {45 – 50 kgm}



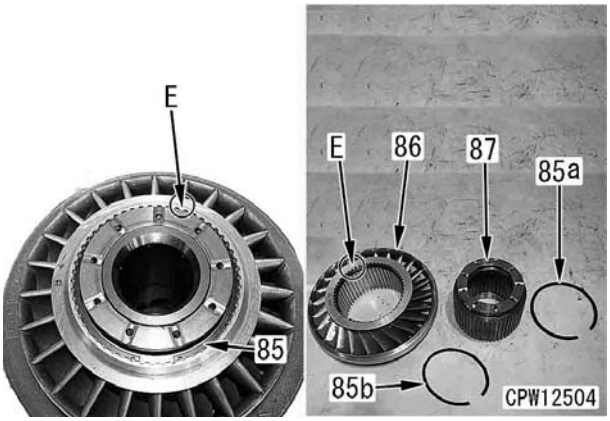
2. Stator
1) Install freewheel (90), ball (89) and bushing (88) to race (87).
★ When installing, take care of the ball.



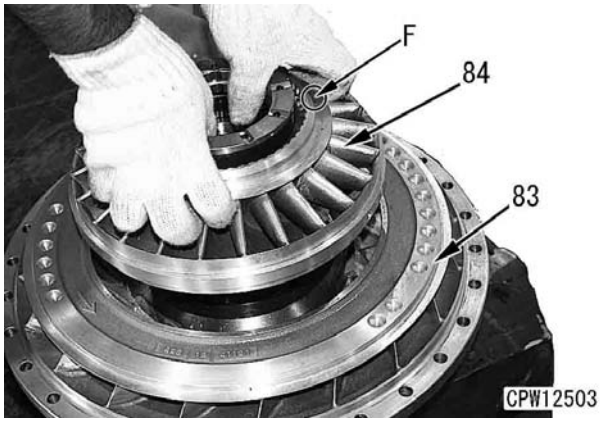
★ When installing the freewheel, direct arrow (b) of the free rotation direction indicated on the front side of the cage toward the output (pump) side.
★ Do not remove sprag (d).
★ When inserting, take care that drag clip (c) on the periphery of the one-way clutch will not be hitched in the ball groove of the outer race.
★ When inserting, do not use a hammer etc. but use your hands.



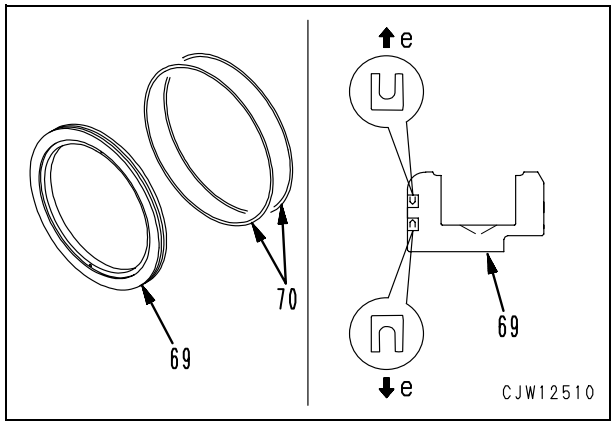
2) Install lower snap ring (85b) to stator (86).
★ Check the arrow of rotation direction of the stator (E).
Direction of arrow: Counterclockwise when seen from input side
3) Install race (87).
4) Install upper snap ring (85a).



5) Install stator assembly (84) to pump assembly (83).
★ Apply transmission oil (**TO10** or **TO30**) to bushing (88) shown in the above figure.
★ Check that the side having a shoulder at stator part (F) is on the input side.
★ Check the rotation direction from the input side. (Take care that the rotation direction is opposite to the normal rotation direction.)
Clockwise direction: Locked
Counterclockwise direction: Free

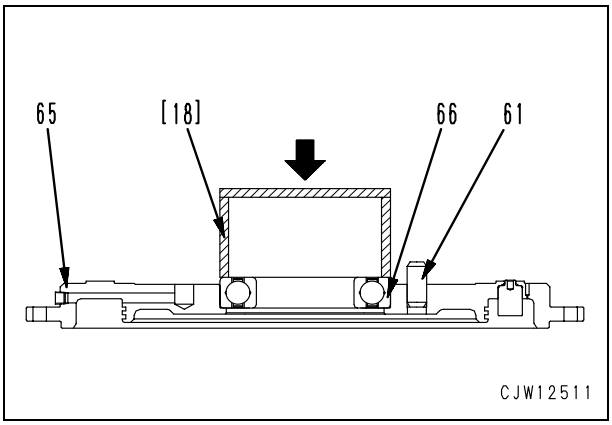


3. Piston
Install seal rings (70) to piston (69).
★ Set pressure receiving side (e) of the seal ring in the direction of the arrow shown below.
Seal ring: **Grease (G2-LI)**

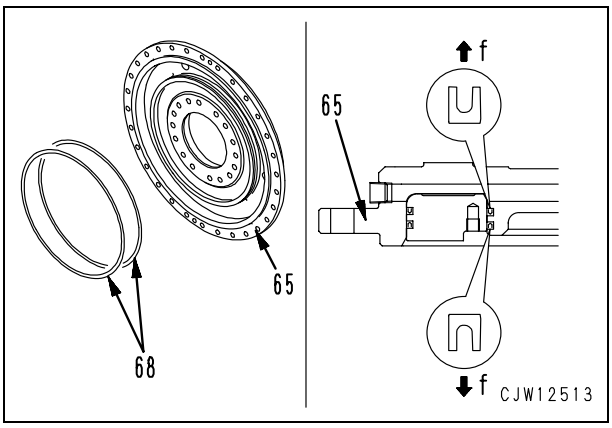


4. Lockup clutch housing

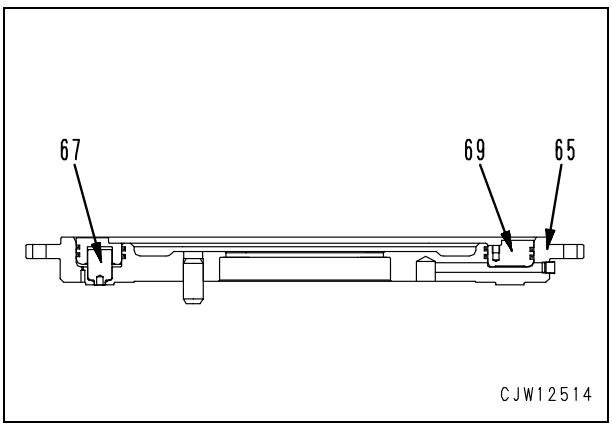
1) Using push tool [18] (Outside diameter: 139 mm), press fit bearing (66) to lockup clutch housing (65).
2) Install 2 dowel pins (61).



3) Install seal ring (68) to lockup clutch housing (65).
   ★ Set pressure receiving side (f) of the seal ring in the direction of the arrow shown below.
   Seal ring: **Grease (G2-LI)**

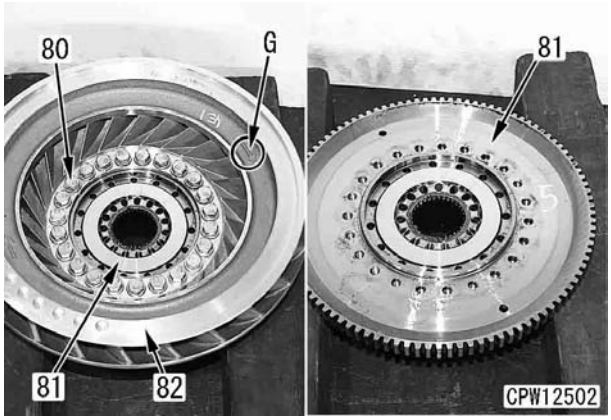


4) Using eyebolts (M6, P = 1 mm), install piston (69) to housing (65).
   ★ Set the dowel pin (67) to the hole on the piston side.

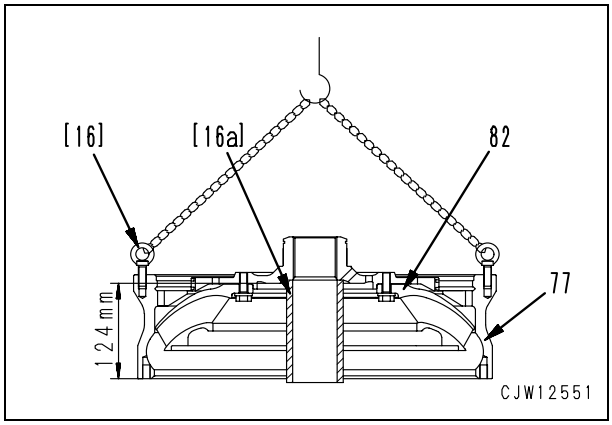


5. Turbine

1) Install boss (81) to turbine (82).
   ★ Check the arrow of rotation direction of the turbine at (G).
   Direction of arrow: Counterclockwise when seen from input side
2) Install 23 mounting bolts (80).
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt:
   59 – 74 Nm {6.0 – 7.5 kgm}

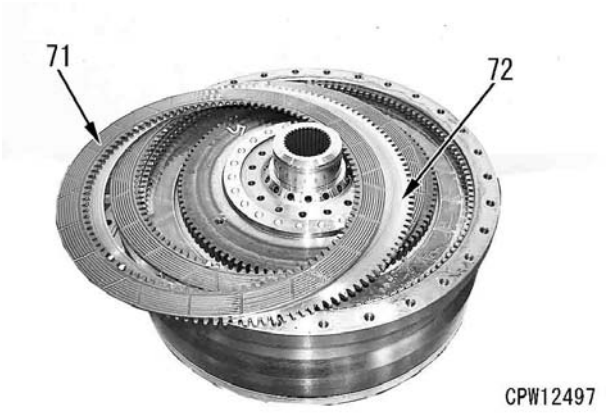


3) Support turbine (82) with tool [16a] (Height: 124 mm).
4) Using eyebolts [16] (M10, P = 1.5 mm), set drive case (77).



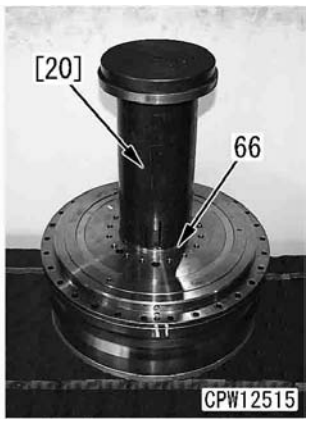
6. Discs and plate

1) Install 2 discs (71) and 1 plate (72) alternately.
   ★ Apply transmission oil (**TO30**) to the discs.



2) Using eyebolts [19] (M12, P = 1.75 mm), install lockup clutch housing (65).
   ★ Take care that the piston will not come off.
3) Using push tool [20] (Inside diameter: 81 mm), press fit the inner race of bearing (66).



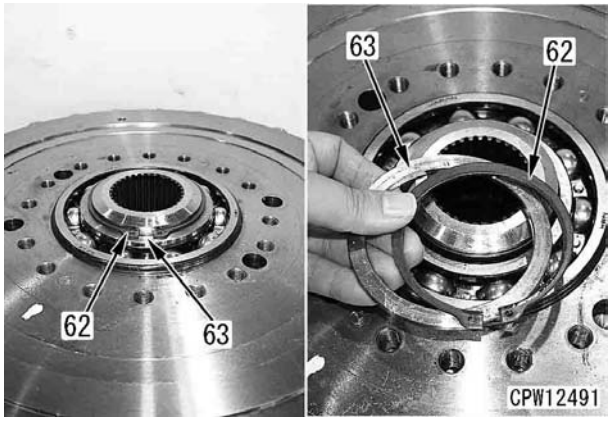


4) Tighten 30 mounting bolts (64) into lockup clutch housing (65).
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt:
   59 – 74 Nm {6.0 – 7.5 kgm}

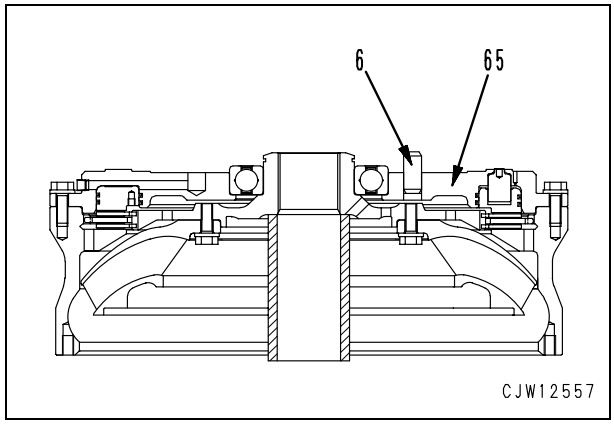


7. Torque converter input shaft

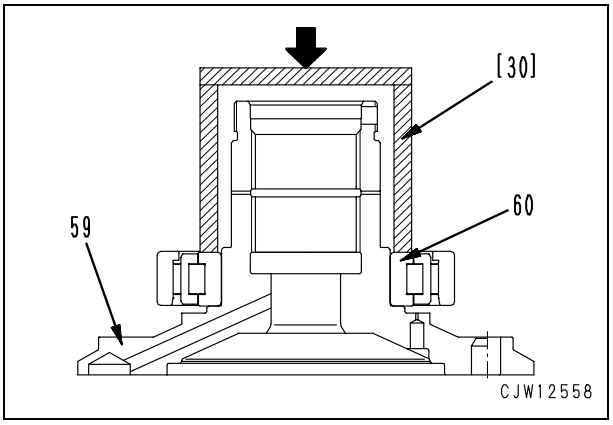
1) Install plate (63) and snap ring (62).



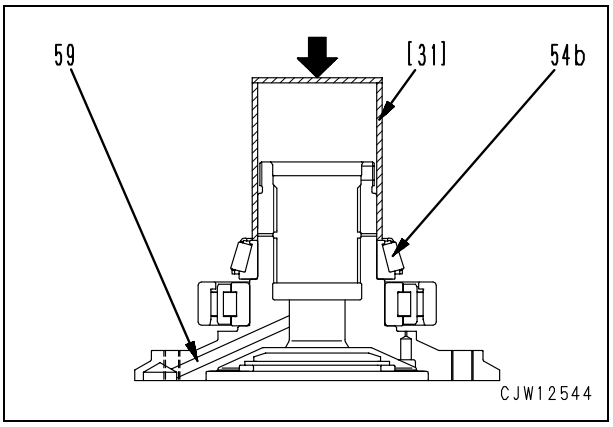
2) Drive 2 dowel pins (6) into lockup clutch housing (65).



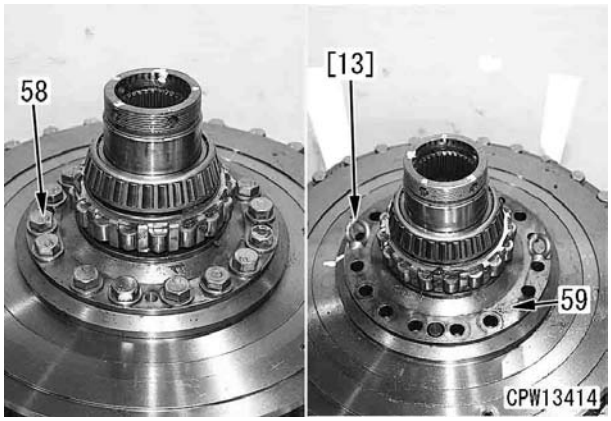
3) Using push tool [30] (Inside diameter: 66 mm), press fit bearing (60) to torque converter input shaft (59).



4) Using push tool [31] (Inside diameter: 76 mm), press fit bearing (54b) to torque converter input shaft (59).

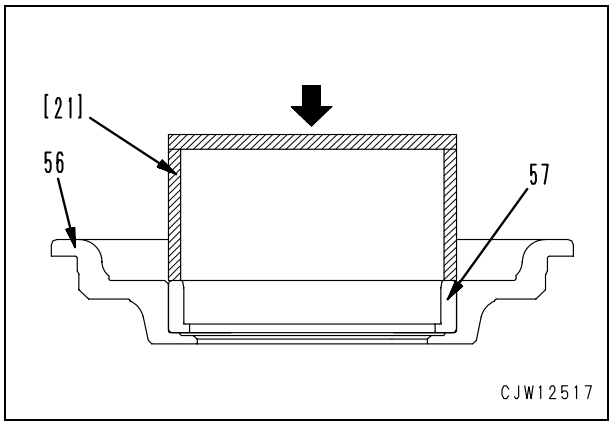


5) Using eyebolts [13] (M10, P = 1.5 mm), install torque converter input shaft (59).
6) Tighten 16 mounting bolts (58).
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt:
   98 – 123 Nm {10.0 – 12.5 kgm}

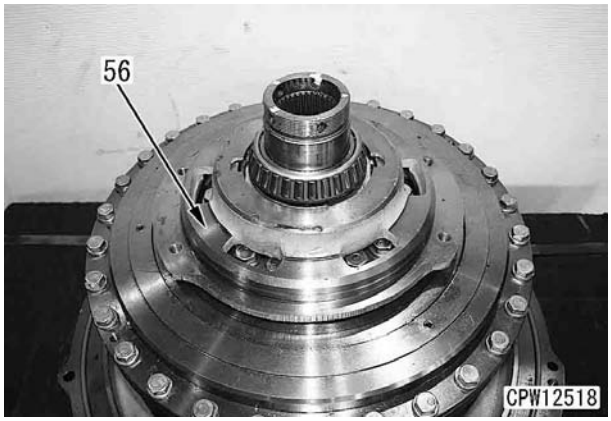


8. Cage

1) Using push tool [21] (Outside diameter: 149 mm), press fit outer race (57) to cage (56).

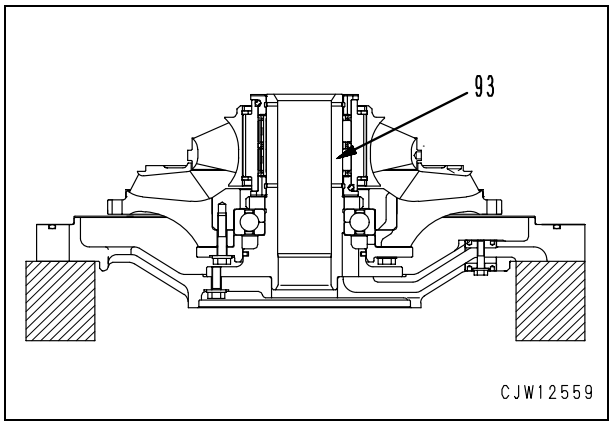


2) Install cage (56).

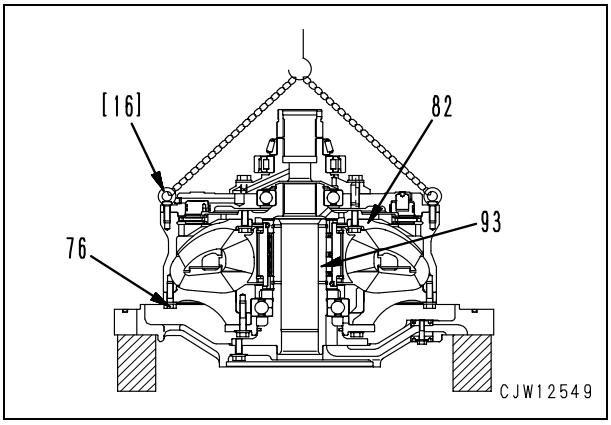


9. Torque converter assembly

1) Set stator shaft assembly (93) on the blocks.

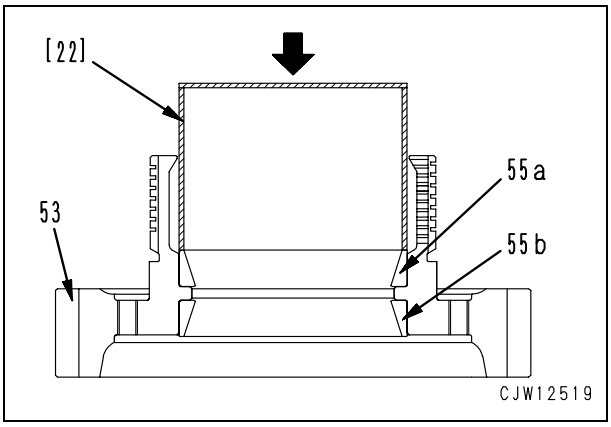


2) Using eyebolts [16] (M10, P = 1.5 mm), install turbine shaft assembly (82) to stator shaft assembly (93).
3) Tighten 30 mounting bolts (76).
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt:
   49 – 59 Nm {5 – 6 kgm}

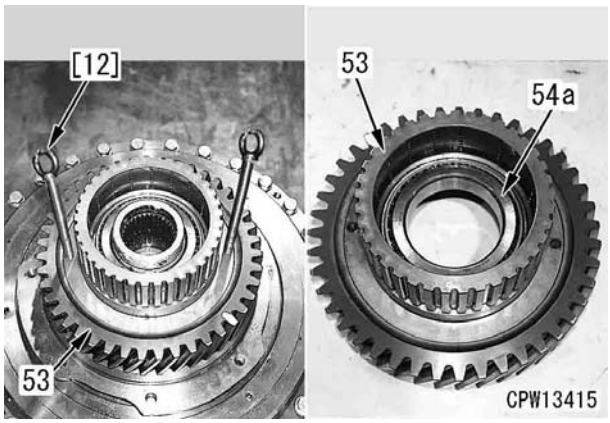


10. Modulated clutch gear

1) Using push tool [22] (Outside diameter: 114 mm), press fit outer races (55a) and (55b) to modulated clutch gear (53).
   ★ Press fit the outer races until the clearance is eliminated.

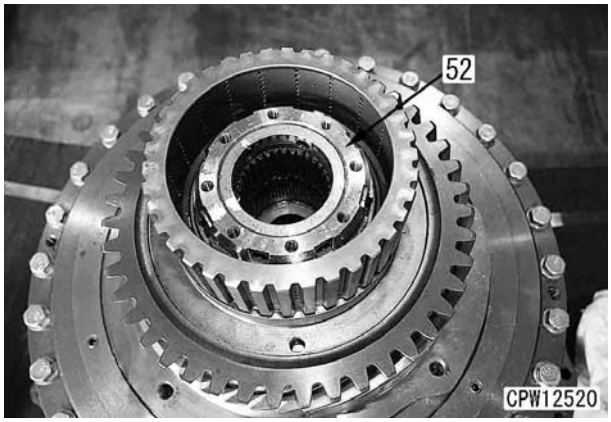


2) Install upper bearing (54a) to modulated clutch gear (53).
   ★ Press fit the bearing until the clearance is eliminated.
3) Using eyebolts [12] (M10, P = 1.5 mm), install modulated clutch gear (53).

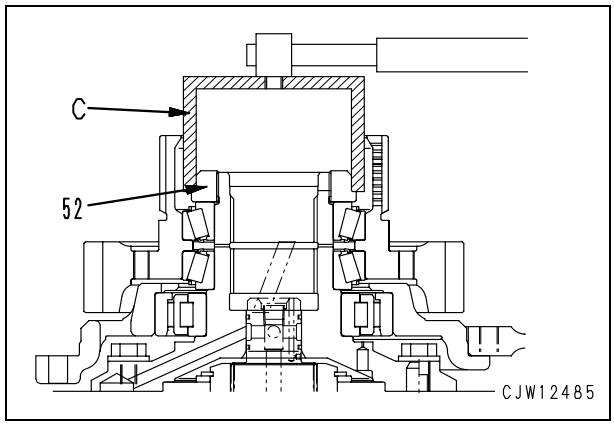


11. Locknut

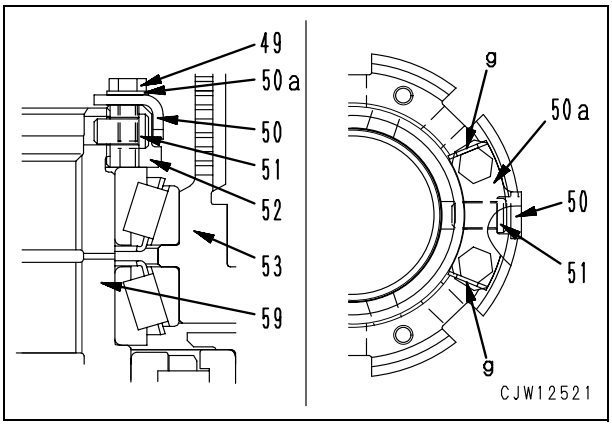
1) Install locknut (52).
   ★ Install the locknut and adjust the preload after assembling the case.



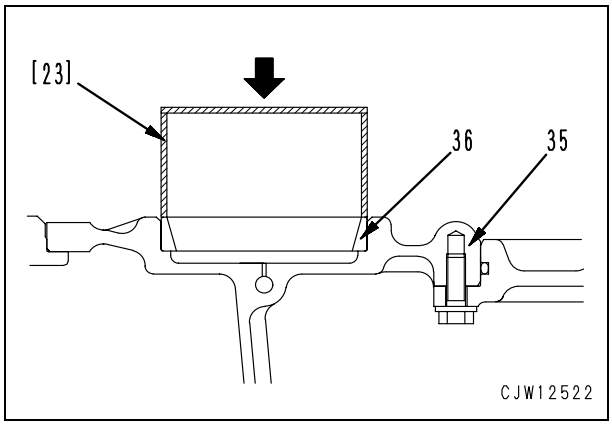
2) Using tool **C**, tighten locknut (52).



3) Adjustment of preload on modulated clutch gear bearing
Adjust the bearing according to the following procedure.
★ After installing the bearing, drop 6 cc of transmission oil (**TO30**) onto it and revolve it about 10 turns.
1] Tighten locknut (52) to **98 – 123 Nm {10.0 – 12.5 kgm}**.
2] Rotate modulated clutch gear (53) 20 turns and check the tightening torque of **98 – 123 Nm {10.0 – 12.5 kgm}** for locknut (52) again.
3] If the tightening torque has changed, repeat 1] and 2] above.
4] If the tightening torque has not changed, loosen locknut (52).
5] Tighten locknut (52) to **39 – 49 Nm {4 – 5 kgm}** and rotate modulated clutch gear (53) 20 turns.
6] Loosen locknut (52) until the phase of the 8 side pin holes of locknut (52) is matched to that of the 5 side pin holes of torque converter input shaft (59).
★ The loosening angle must be in the range of 0 – 9°, however.
7] When the holes are matched by the above operation, insert side pin (51) from the side and install stopper plate (50) and lock plate (50a).
8] Check that modulated clutch gear (53) has not play.
9] Under this condition, measure the rotation torque of torque converter input shaft (59).
Rotation torque: Must be in range of **0.98 – 2.94 Nm {0.1 – 0.3 kgm}**.
★ When measuring the rotation torque, fix modulated clutch gear (53) so that it will not be turned by dragging.
10] Tighten 2 lock bolts (49).
11] Bend part (g) of lock plate (50a) to lock the bolt securely.
★ Use a new lock plate.



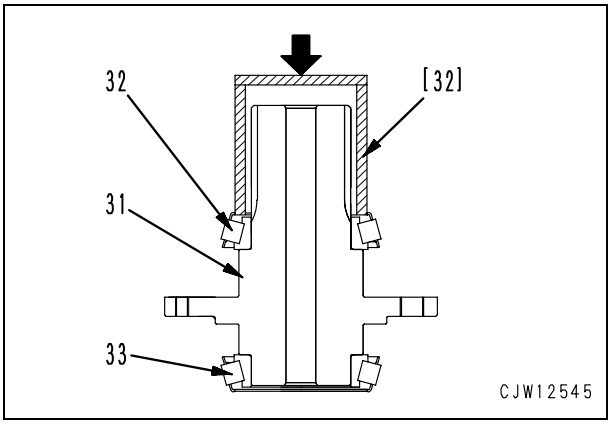
12. Drive gear
1) Using push tool [23] (Outside diameter: 129 mm), press fit outer race (36) to torque converter case (35).

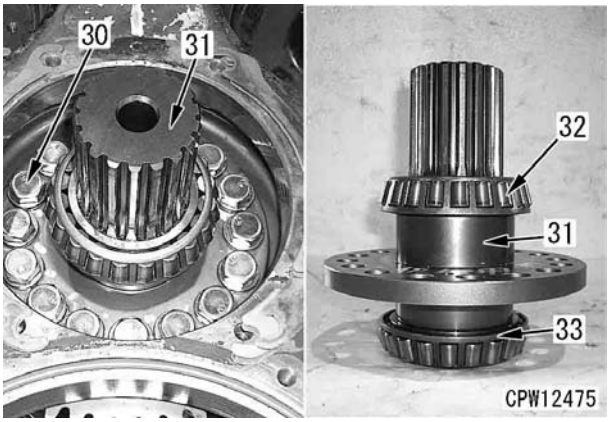


2) Set gear (34) to the case.
★ Move the gear aside to install.

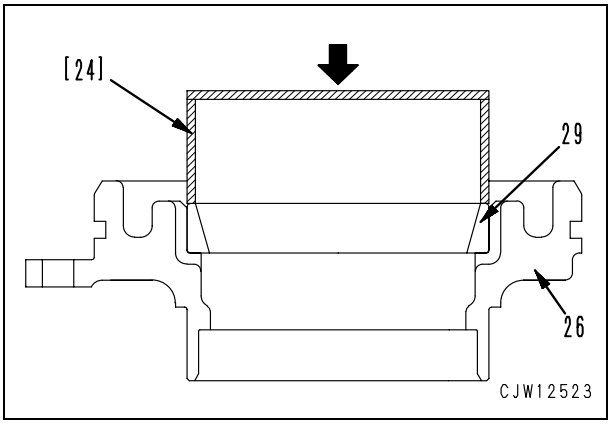


3) Using push tool [32] (Inside diameter: 76 mm), press fit bearings (32) and (33) to input shaft (31).
4) Install input shaft (31) to gear (34).
5) Tighten 16 mounting bolts (30).
   ★ Since the gear and shaft are press fitted to each other, tighten all the bolts gradually.
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt: **245.0 – 309.0 Nm {25.0 – 31.5 kgm}**

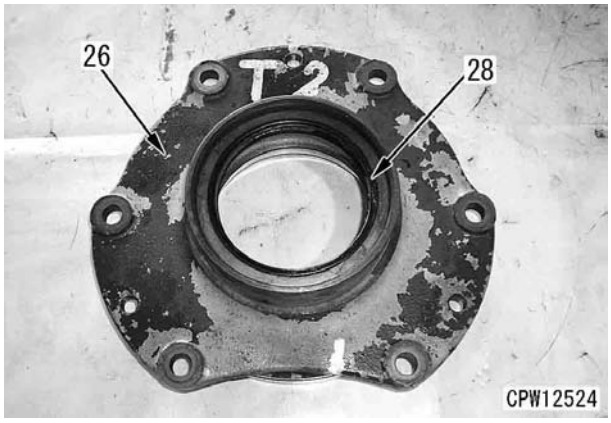




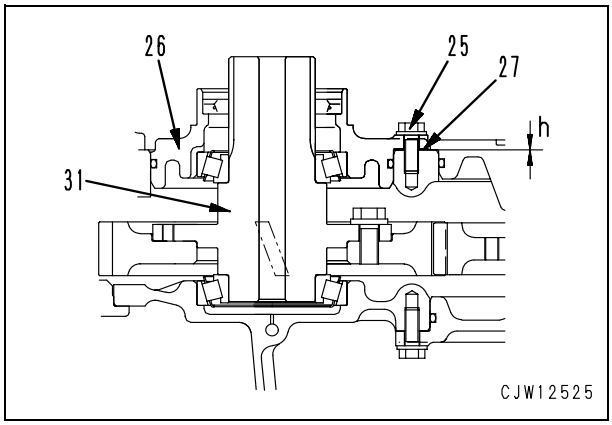
6) Using push tool [24] (Outside diameter: 129 mm), press fit outer race (29) to cage (26).

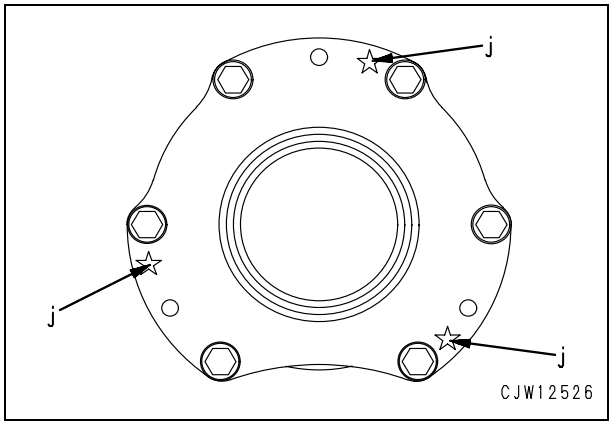


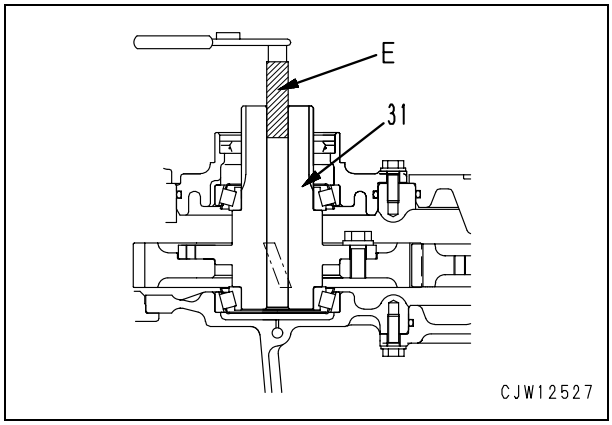
7) Press fit oil seal (28) to cage (26).
   Oil seal: **Grease (G2-LI)**
   ★ Fill 40 – 60% of the space between the main lip and dust lip with grease.
   Oil seal press fitting face: **Gasket sealant (LG-5)**
   ★ Apply the gasket sealant thinly to the inside of the housing hole and wipe off the projected part.



8) Adjustment of preload on input shaft (31) bearing
Adjust the bearing according to the following procedure.
★ After installing the bearing, drop 6 cc of transmission oil (TO30) onto it and revolve it about 10 turns.
1] Fit the O-ring and install cage (26) without setting shim (27).
O-ring: **Grease (G2-LI)**
2] Tighten mounting bolts (25) to **4.80 ± 0.98 Nm {0.5 ± 0.1 kgm}**.
3] Rotate input shaft (31) 20 turns and check the tightening torque of **4.80 ± 0.98 Nm {0.5 ± 0.1 kgm}** for mounting bolts (25) again.
4] If the tightening torque has changed, repeat 2] and 3] above.
5] If the tightening torque has not changed, measure clearance (h) between the case and cage (27) at 3 places (j) and obtain the average.
★ Check that the dispersion of clearance (h) is 0.15 mm or less.
★ If the dispersion of clearance (h) is larger than 0.15 mm, check the bearing for improper installation and then take remedies to reduce the dispersion to 0.15 mm or less.
6] Loosen the bolts to set input shaft (31) free and measure rotation torque (A) of input shaft (31) with tool **E**.
7] Install shim (27) increased by the clearance obtained in the above steps.
Shim thickness (k): Average clearance + (Increased shim: **0.15 – 0.35 mm**)
Standard clearance: **1.05 – 1.70 mm**
Standard shim thickness: **1.2 mm**
8] Tighten mounting bolts (25) to **98.0 – 122.5 Nm {10.0 – 12.5 kgm}**.
9] Check that input shaft (31) has no play.
10] Under this condition, measure rotation torque (B) of input shaft (31) with tool **E**.
Rotation torque (B – A): Must be in range of **0.98 – 1.96 Nm {0.1 – 0.2 kgm}**.

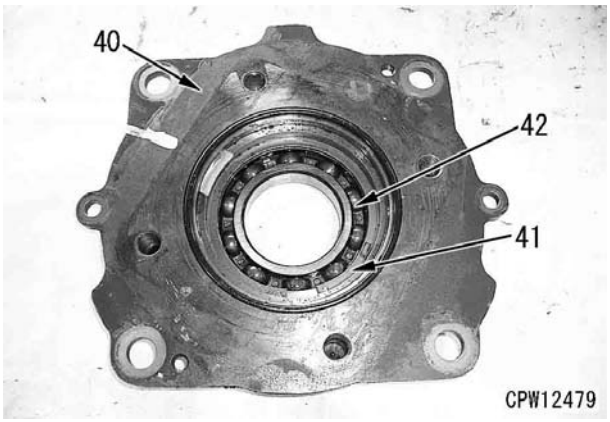




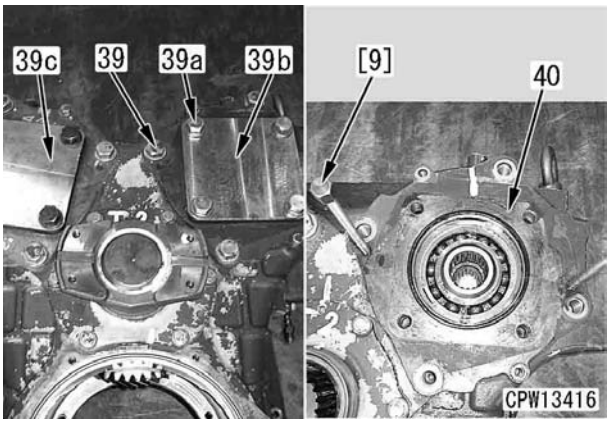


13. PTO gear A (Right side)

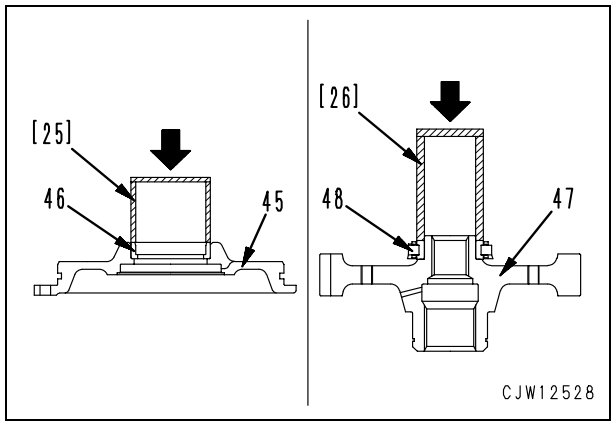
1) Install bearing (42) to cage (40) and install snap ring (41).



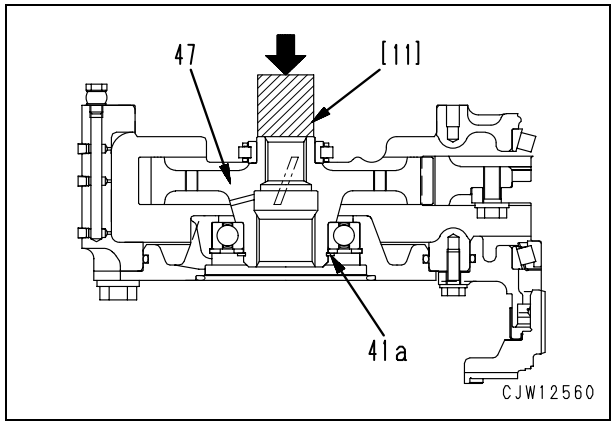
2) Fit the O-ring and install cage (40) by using forcing screws [9] (M12, P = 1.75 mm).
   O-ring: **Grease (G2-LI)**
3) Tighten 4 mounting bolts (39a) and 2 mounting bolts (39).
   ★ Covers (39b) and (39c) are used for transportation of the unit. Accordingly, they are not installed to the actual machine.



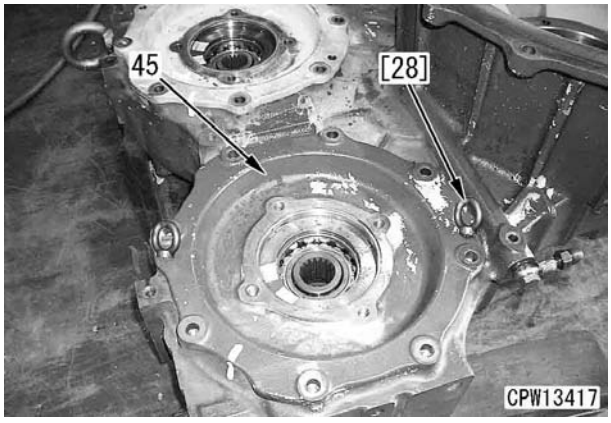
4) Using push tool [25] (Outside diameter: 99 mm), press fit outer race (46) to cage (45).
5) Using push tool [26] (Inside diameter: 56 mm), press fit bearing (48) to gear (47).



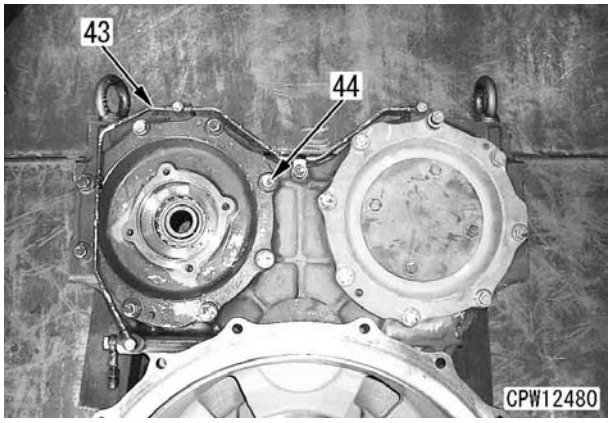
6) Reverse the torque converter case.
7) Set gear (47) to the case and press fit it with push tool [11] (Outside diameter: 55 mm).
8) After press fitting gear (47), install snap ring (41a).



9) Using eyebolts [28] (M12, P = 1.75 mm), install cage (45).

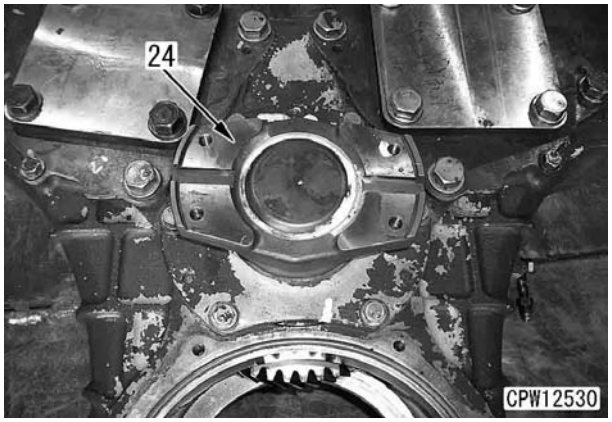


10) Tighten 8 mounting bolts (44).
11) Install lubrication tube (43).
Joint bolt:
19.6 – 29.4 Nm {2.0 – 3.0 kgm}

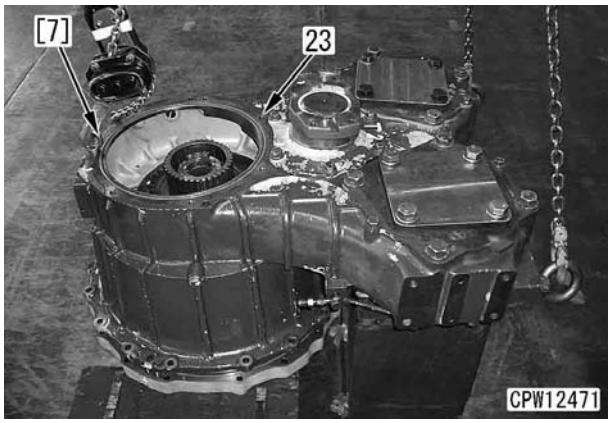


14. PTO gear B (Left side)
Install the PTO gear B (Left side) similarly to PTO gear A (Right side).

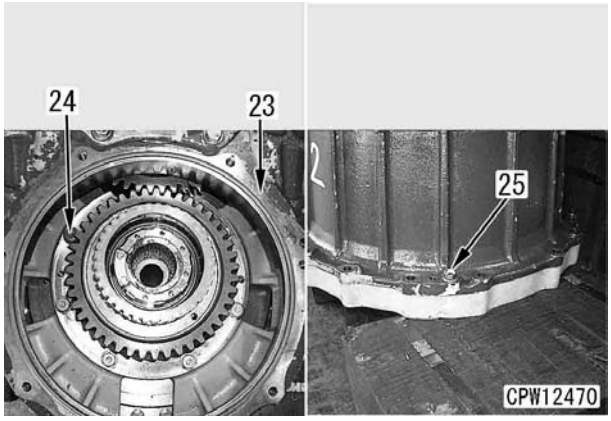
15. Coupling
Install coupling (24).



16. Torque converter case
1) Using sling [7], install torque converter case (23).

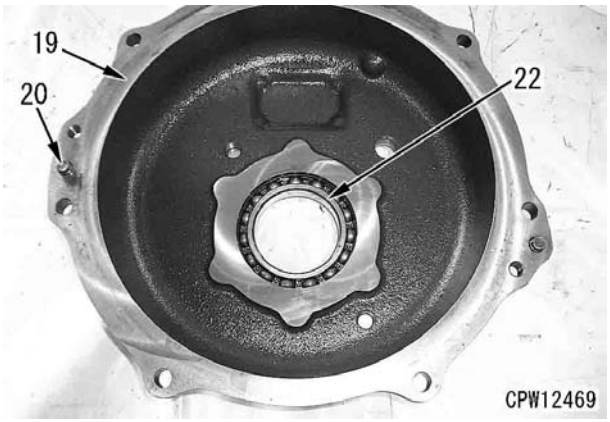


2) Tighten 2 sub-assembly bolts (25).
3) Tighten 6 mounting bolts (24) on the inside of torque converter case (23).
★ Since the case and cage are press fitted to each other, tighten all the bolts gradually.
Mounting bolt: **Adhesive (LT-2)**

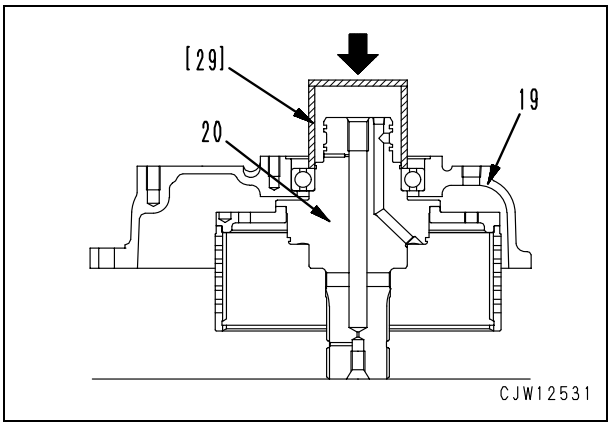


17. Modulated clutch assembly

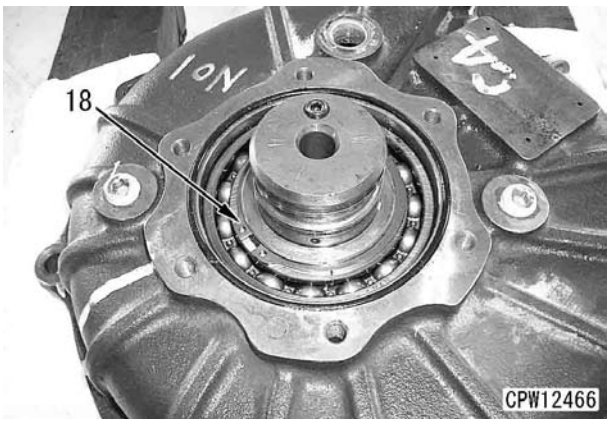
1) Assemble the modulated clutch assembly according to the following procedure.
   1] Using push tool (Outside diameter: 114 mm), install bearing (22) to cover (19).
   2] Install 2 dowel pins (20).



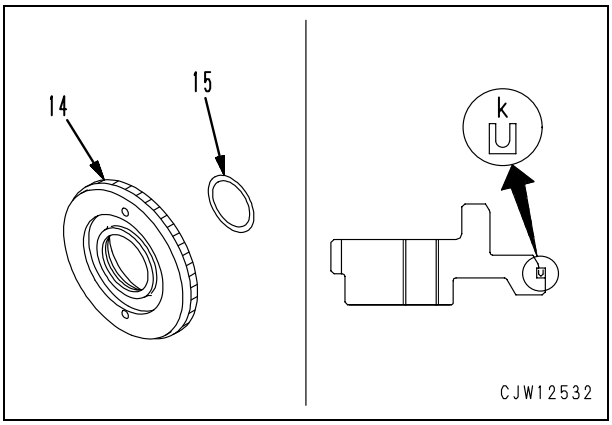
   3] Using push tool [29] (Inside diameter: 76 mm), press fit cover (19) to clutch outer drum shaft (20).
      ★ Press the inner race.



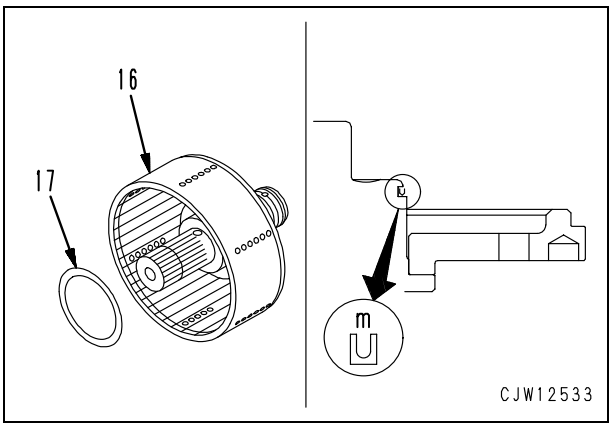
   4] Install snap ring (18).



   5] Install seal ring (15) to piston (14).
      Seal ring: **Grease (G2-LI)**
      ★ Set groove (k) of the seal ring as shown below.



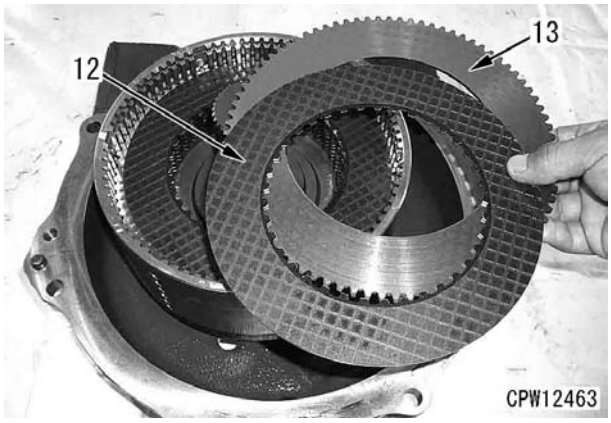
   6] Install seal ring (17) to clutch outer drum shaft (16).
      Seal ring: **Grease (G2-LI)**
      ★ Set groove (m) of the seal ring as shown below.



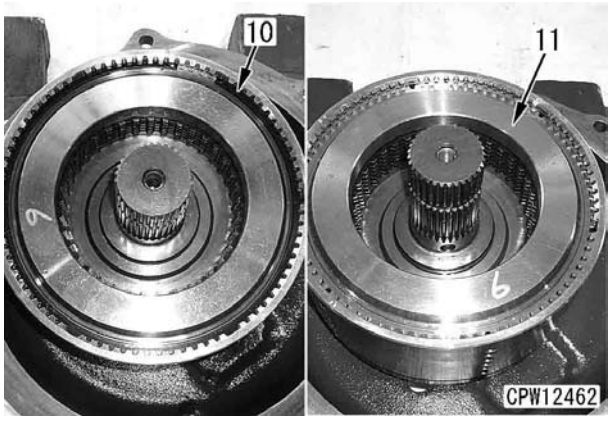
   7] Using eyebolts (M12, P = 1.75 mm), install piston (14).



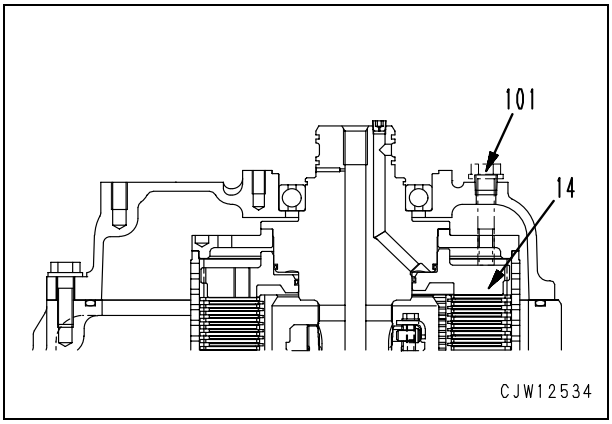
8] Install 8 plates (13) and 7 discs (12) alternately.
★ Soak the disc in clean transmission oil for at least 2 minutes.



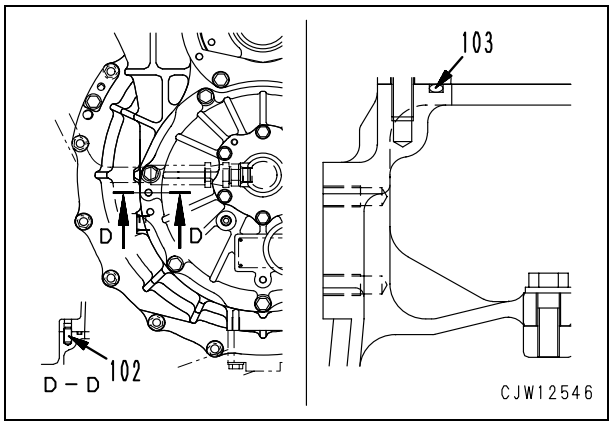
9] Install plate (11).
10] Install snap ring (10).
★ Using a bar which can be inserted in the internal tooth space, adjust the internal teeth of the disc.



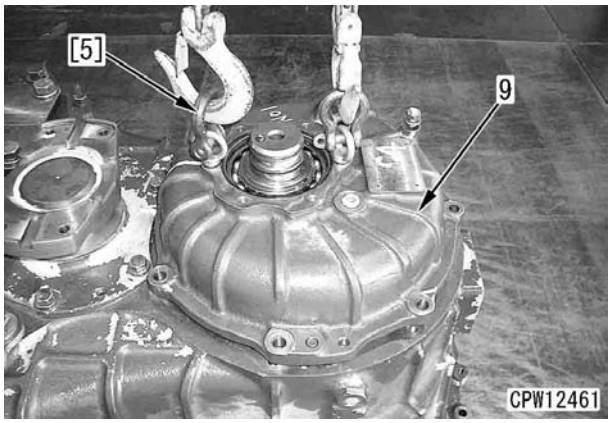
2) Remove the plug and tighten 2 disc bolts (101) (M12, P = 1.75 mm, 01024-81270).
Disc bolt:
Max. 49 Nm {Max. 5 kgm}
★ By this work, piston (14) is pressed to prevent the disc from moving.



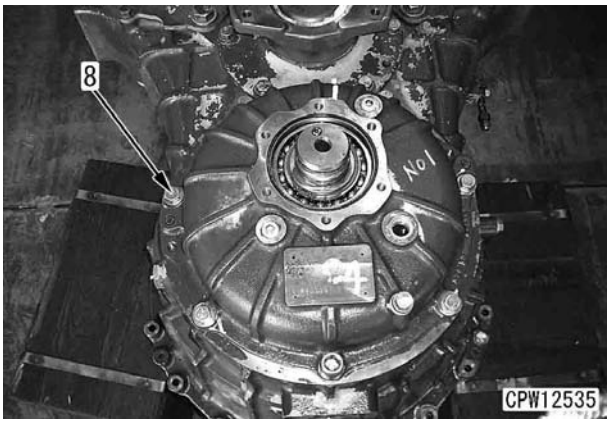
3) Install 2 dowel pins (102) to the case.
★ Drive in each dowel pins to the hole end of the case.
4) Install O-ring (103) to the case.
O-ring: **Grease (G2-LI)**



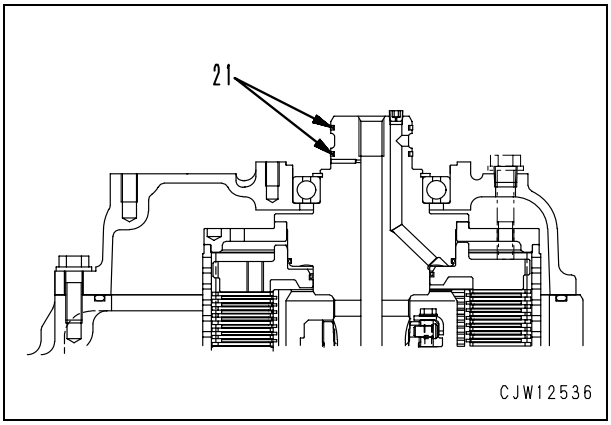
5) Using sling [5] (M10, P = 1.5 mm), install modulated clutch assembly (9).
★ To check that the disc of the modulated clutch assembly is not caught, check that there is not clearance between the cover and case before tightening the cover mounting bolts.



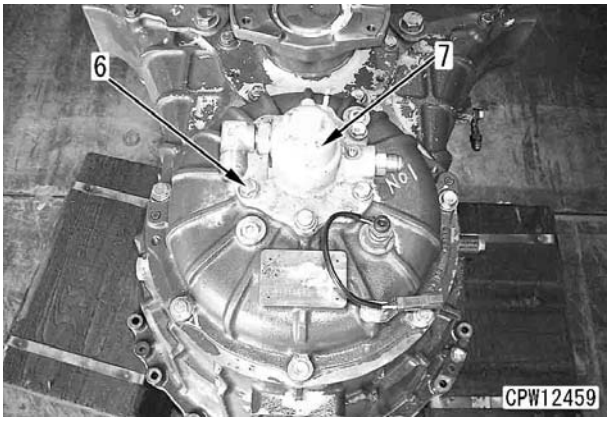
6) Tighten 7 mounting bolts (8).
★ Remove 2 disc bolts (101) (01024-81270) installed in the above step and install the plug.
Plug (when reused): **Gasket sealant (LG-5)**



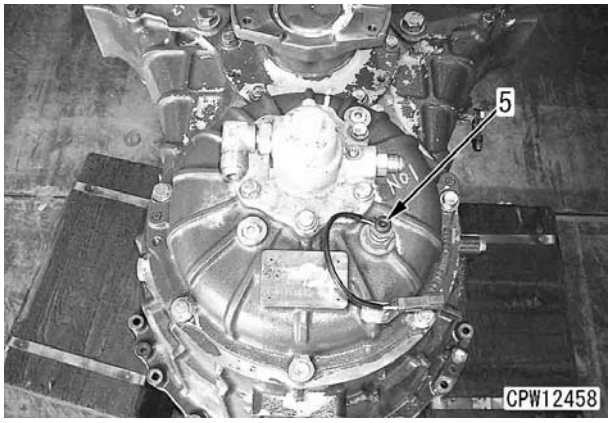
18. Seal cage
1) Install seal ring (21).
Seal ring: **Grease (G2-LI)**



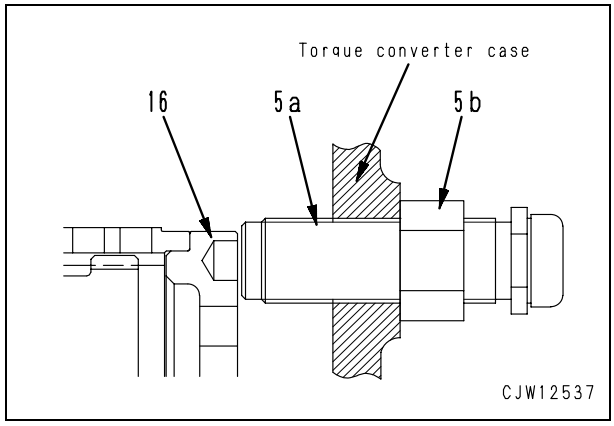
2) Fit the O-ring and install seal cage (7).
3) Tighten mounting bolts (6).



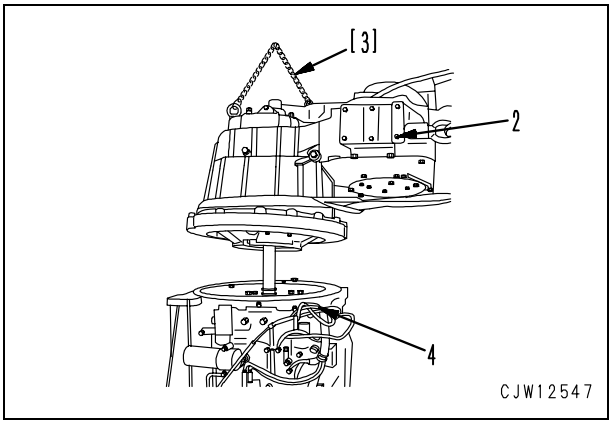
19. Related work
1) Install modulated clutch speed sensor (5).
Between cover and threaded part of sensor: **Gasket sealant (LG-5)**

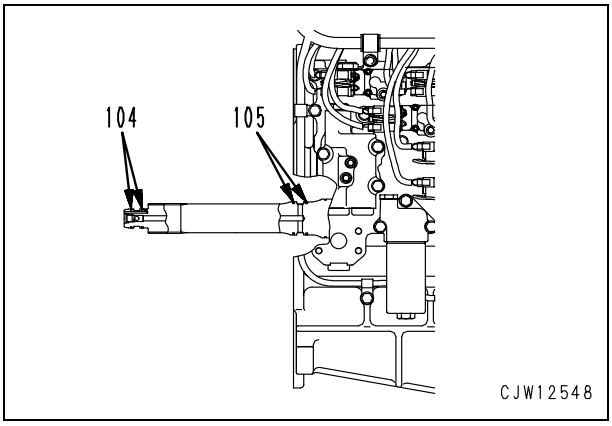


2) Procedure for adjusting modulated clutch speed sensor
1] Tighten modulated clutch speed sensor (5a) until it touches the plate of clutch outer drum shaft (16) and then return it 3/4 – 1 turn.
2] Tighten locknut (5b).
Locknut: **49.0 – 68.6 Nm {5 – 7 kgm}**

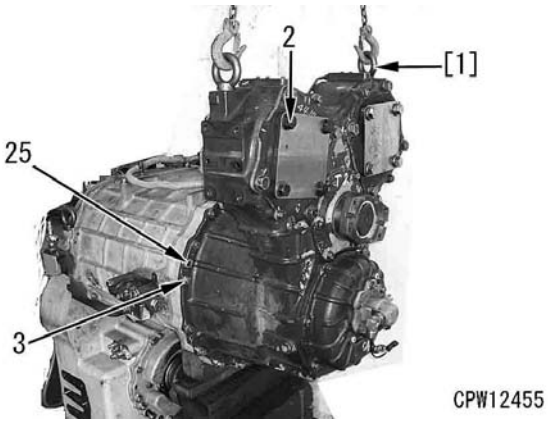


3) Using sling [3], install torque converter and PTO assembly (2) to transmission assembly (4).
   - Torque converter and PTO assembly: **490 kg**
   - Transmission input shaft seal ring: **Grease (G2-LI)**
   - ★ Project each seal ring evenly from the shaft.
   - ★ If 2 seal rings (104) and 2 seal rings (105) are pushed in forcibly, they may be broken. Take care.

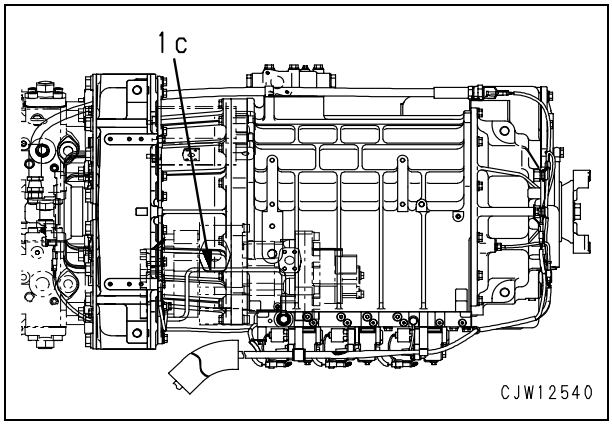




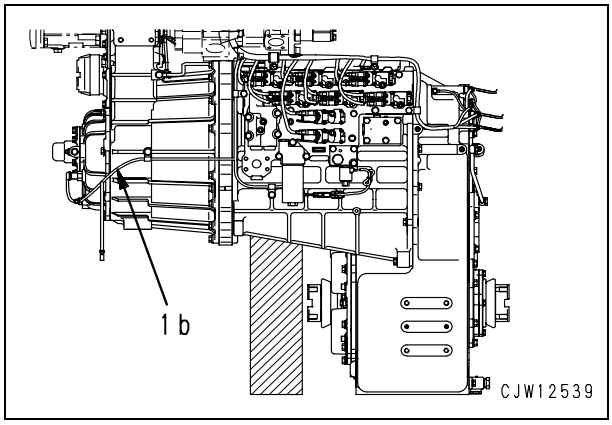
4) Using sling [1], sling torque converter and PTO assembly (2).
5) Tighten 16 mounting bolts (3).
   - ★ The 2 sub-assembly bolts (25) do not need to be tightened since they have not been removed.



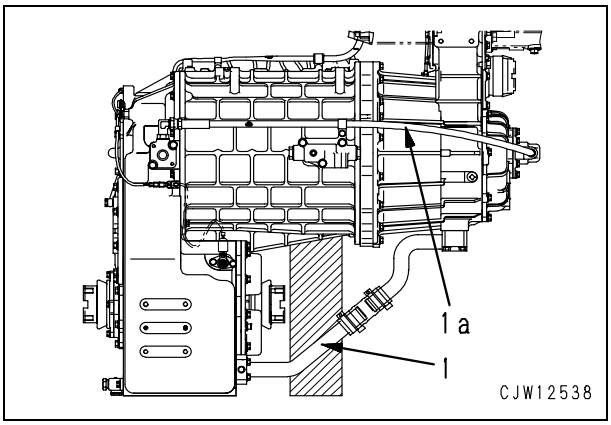
6) Set the transmission and torque converter assembly on the block.
   - Transmission and torque converter assembly: **1,800 kg**
7) Install torque converter PTO lubrication tube (1c).



8) Install torque converter speed sensor wiring harness (1b).



9) Install modulated clutch lubrication hose (1a).
10) Install oil tube (1) between the torque converter and transfer.



Disassembly and assembly of transmission assembly

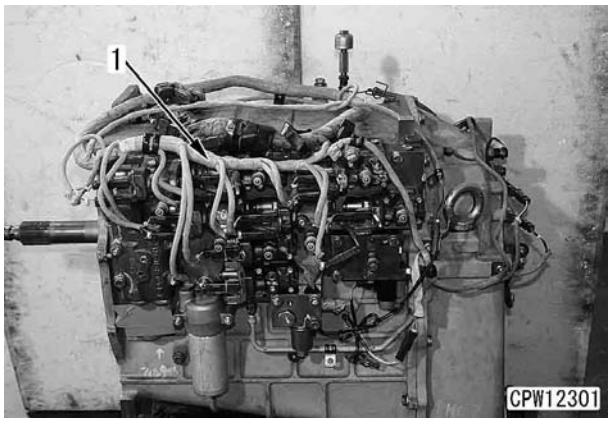
Special tool

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
F	799-301-1500	Oil leak tester	■	1		

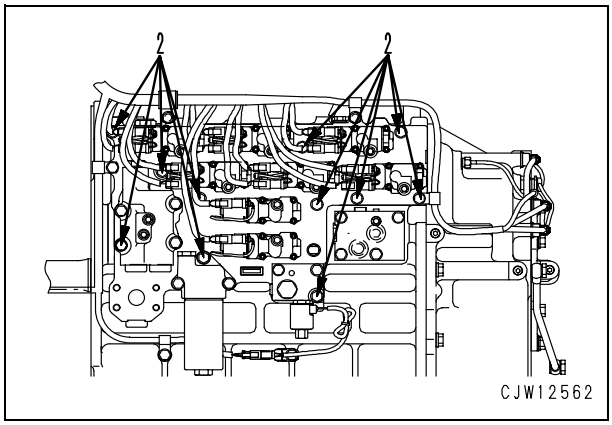
Disassembly

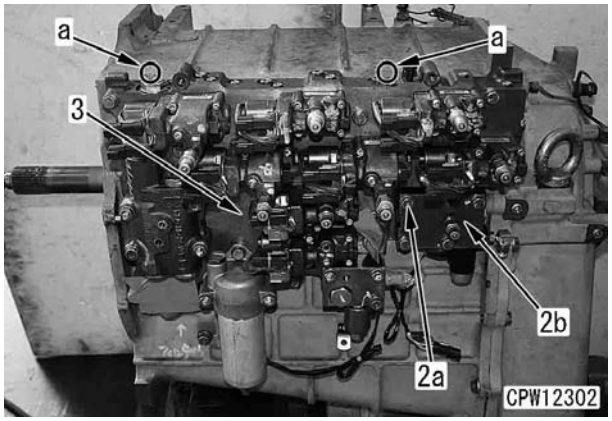
1. Preparation work

1) Disconnect the torque converter assembly from the transmission assembly. For details, see “Disassembly and assembly of torque converter assembly”.
2) Remove transmission wiring harness (1).

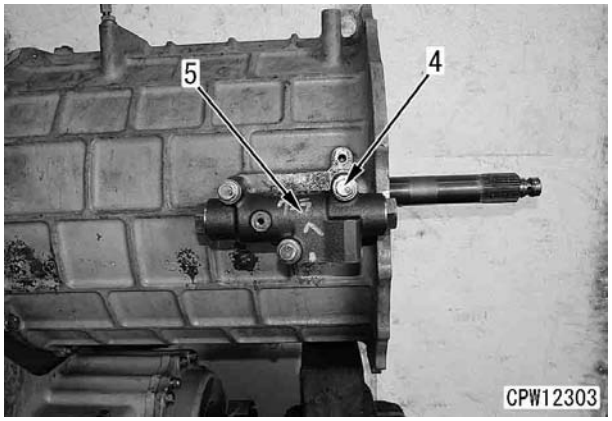


3) Install eyebolts (M10, P = 1.5 mm) to part (a) and sling the transmission control valve assembly.
4) Remove 11 transmission control valve assembly mounting bolts (2).
5) Lift off transmission control valve assembly (3).
   ★ Remove the O-ring, too.
   Transmission control valve assembly: **65 kg**
6) Remove 4 lubrication valve mounting bolts (2a) and lubrication valve assembly (2b).

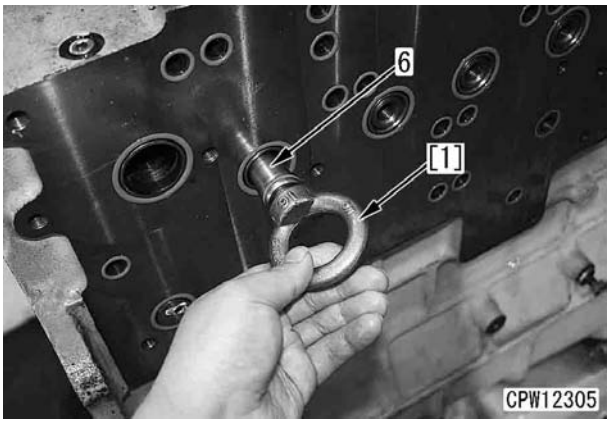




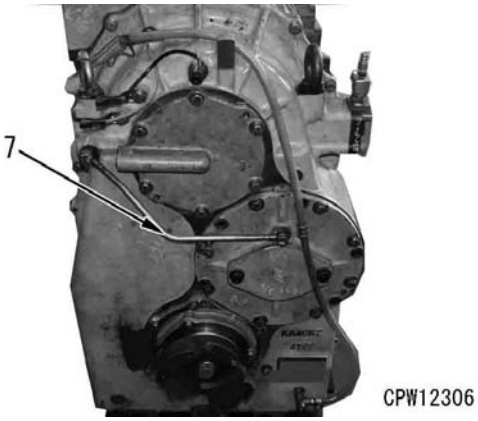
7) Remove 3 torque converter regulator mounting bolts (4) and torque converter regulator valve (5).



8) Using eyebolts [1] (M16, P = 2.0 mm), remove 6 sleeves (6).



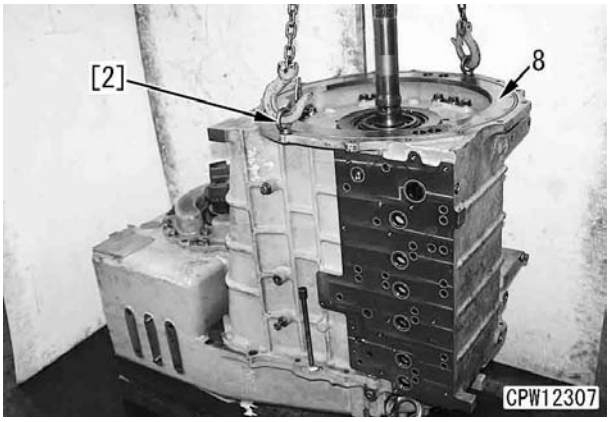
9) Remove lubrication tube (7).



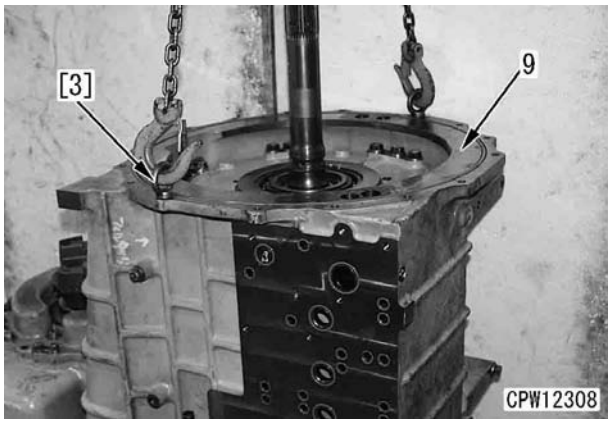
2. Transmission case

1) Using sling [2] (M12, P = 1.75 mm), sling transmission and transfer assembly (8).
2) Set transmission and transfer assembly (8) on the block with the transfer case down.

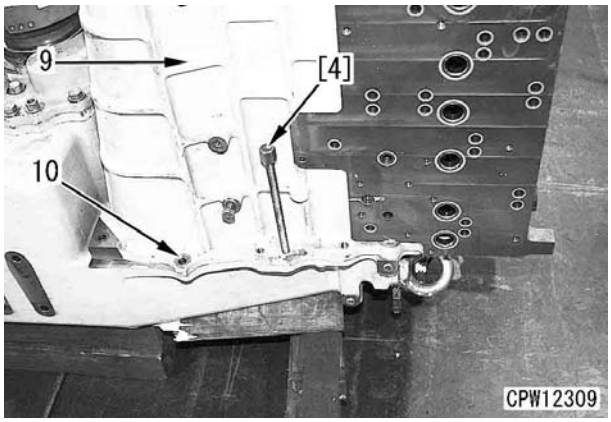
Transmission and transfer assembly: **1,250 kg**



3) Using sling [3] (M12, P = 1.75 mm), sling transmission case (9).

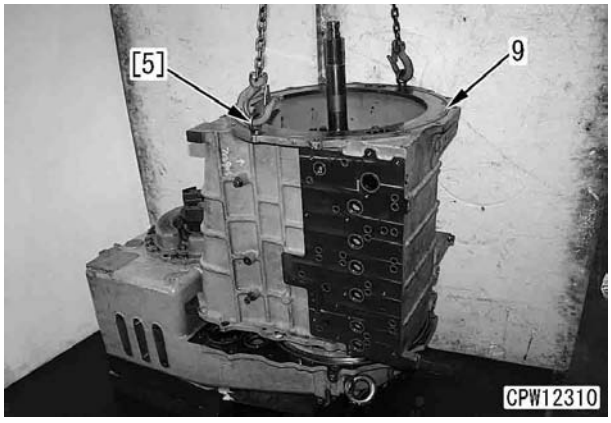


4) Remove 14 case mounting bolts (10).
5) Using 2 forcing screws [4] (M12, P = 1.75 mm), disconnect transmission case (9).



6) Using sling [5] (M12, P = 1.75 mm), remove transmission case (9).

Transmission case: **160 kg**

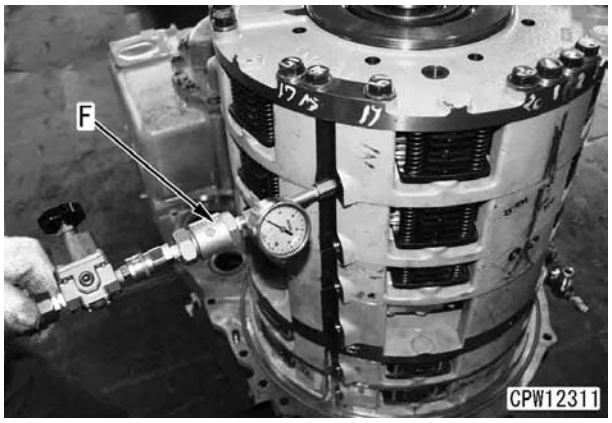


3. Check of operating condition of piston

Using tool **F**, check the operating condition of the piston before disassembling.

Air pressure: **0.29 – 0.49 MPa {3 – 5 kg/cm²}**

Piston (from above)	Stroke (mm)
No.1	6.1
No.2	6.1
No.3	4.2
No.4	8.1
No.5	3.7
No.6	3.7



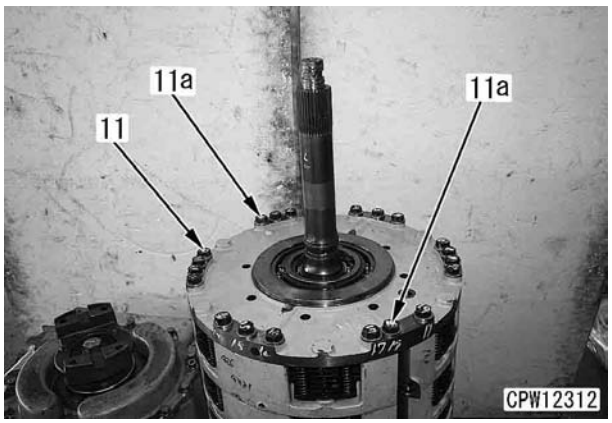
4. Tie bolts

Remove 20 tie bolts (11).

★ When only the transfer assembly needs to be disassembled, leave 2 tie bolts (11a), and the transmission assembly can be removed from the transfer case.

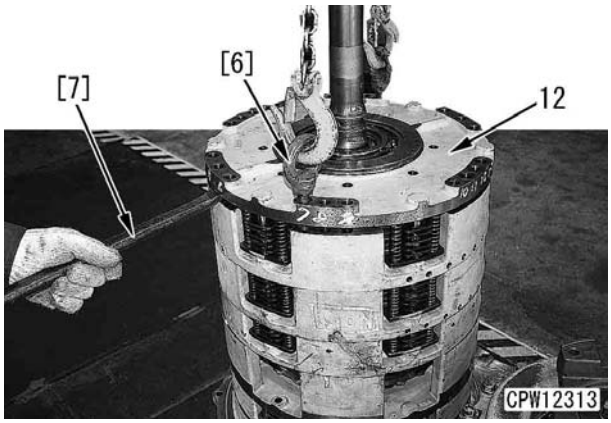
★ Since 2 (11a) of the 20 tie bolts are short, make marks on them.

★ Do not use an impact wrench to loosen the tie bolts, since it can damage the cushion sleeve.

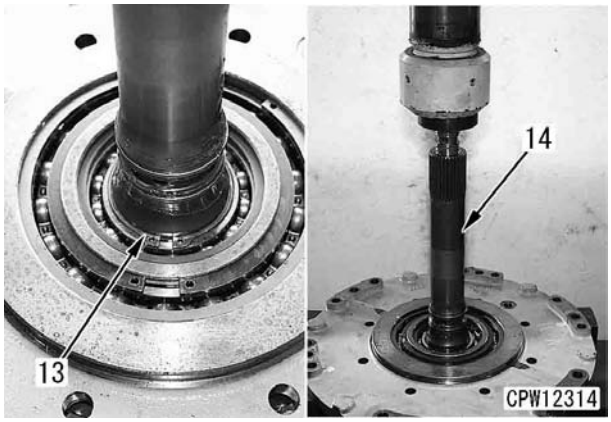


5. Input shaft and No. 1 carrier assembly

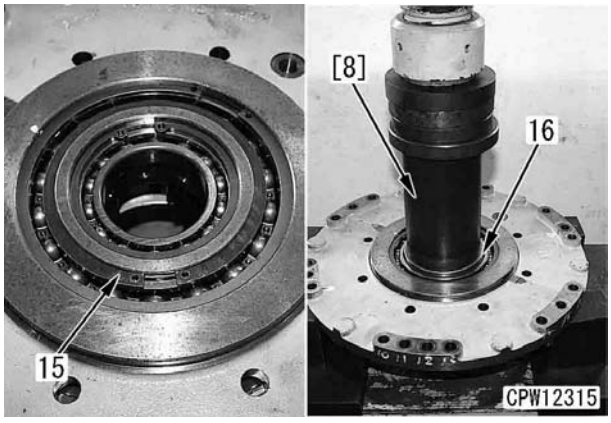
1) Install 2 eyebolts [6] (M16, P = 2.5 mm).
   ★ Stop tightening eyebolts [6] before they reach the housing.
2) Using bar [7], remove input shaft and carrier assembly (12).



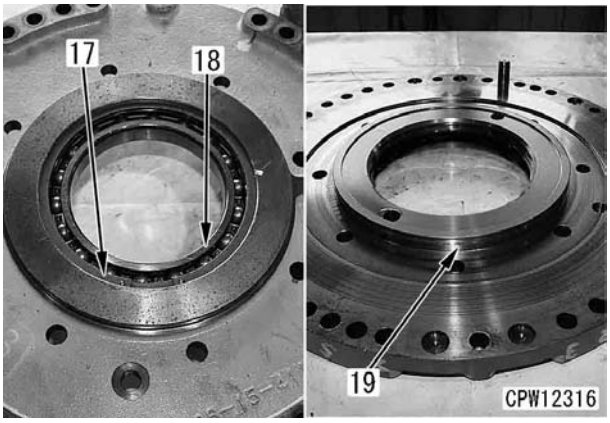
3) Disassemble the input shaft and carrier assembly according to the following procedure.
   1] Remove snap ring (13).
   2] While supporting the housing, push out shaft (14).



   3] Remove snap ring (15).
   4] While supporting the housing, push out carrier assembly (16) with push tool [8] (Outside diameter: 129 mm).



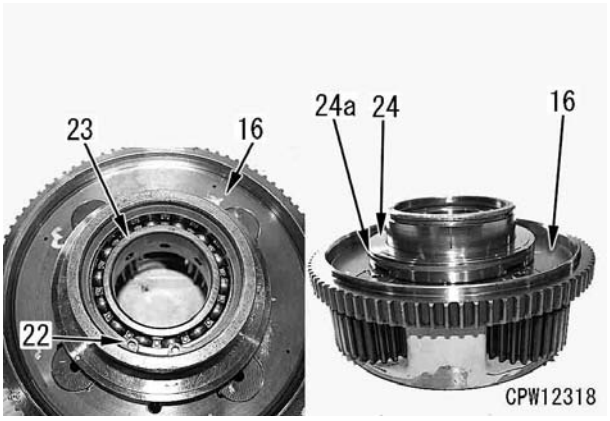
5] Remove snap ring (17) from the housing and remove bearing (18).
6] Remove seal ring (gold) (19) from the bearing.



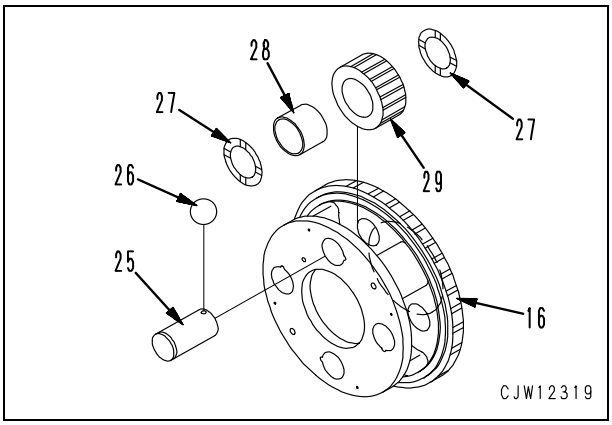
7] Remove snap ring (20) from carrier assembly (16) and remove ring gear (21).



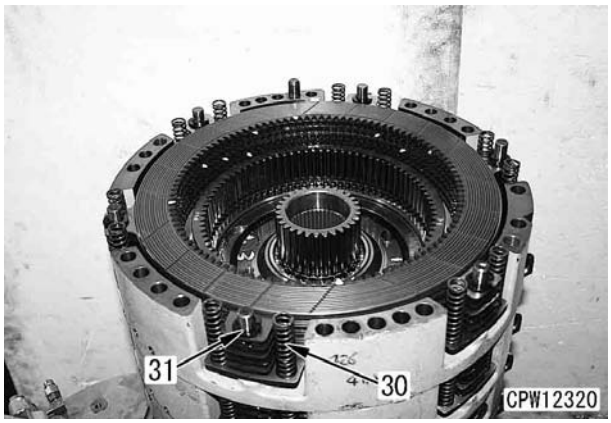
8] Remove snap ring (22) from carrier assembly (16) and remove bearing (23).
9] Remove spacer (24) from carrier assembly (16).
10] Remove seal ring (gold) (24a) from spacer (24).



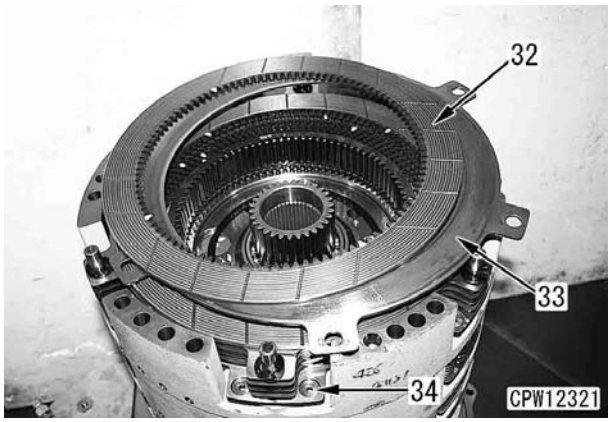
11] Remove shaft (25), ball (26), 2 thrust washers (27), bearing (28) and planetary gear (29) from carrier (16).
★ Take care not to lose the ball.



6. Springs
Remove 12 springs (30) and 36 springs (31).
★ Springs (31) are installed between the plates.

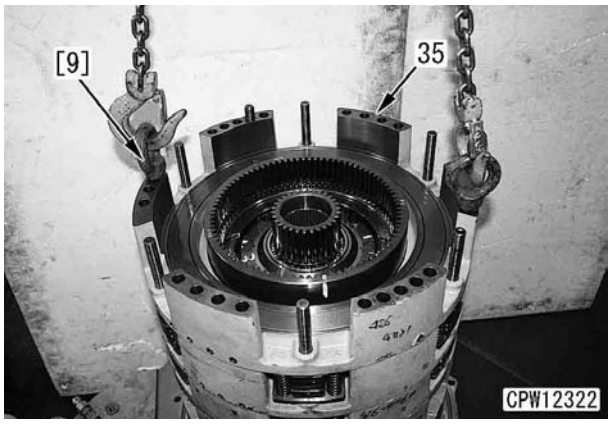


7. Discs and plates
Remove 6 discs (32), 5 plates (33) and piston plate (34).

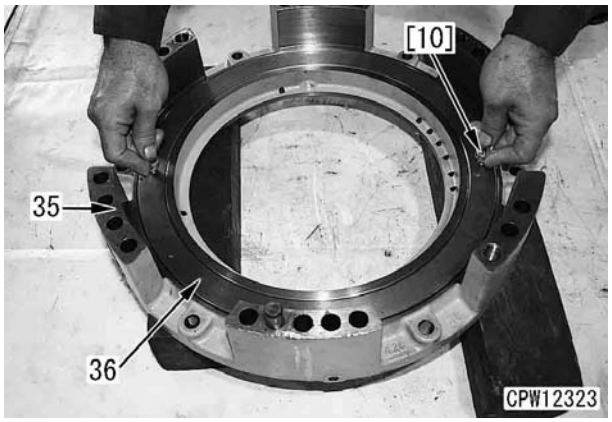


8. No. 1 piston housing

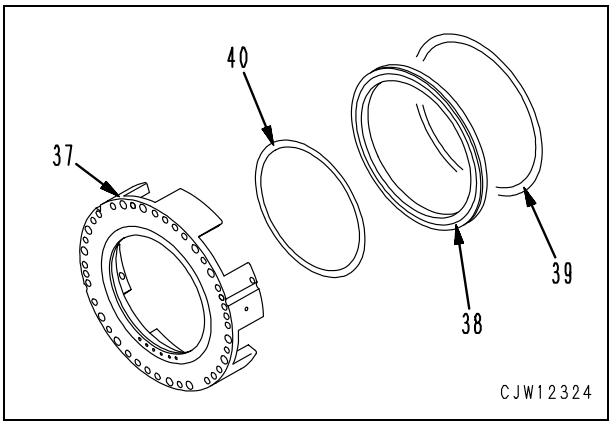
1) Using eyebolts [9] (M18, P = 2.5 mm), remove piston housing (35).



2) Using eyebolts [10] (M10, P = 1.5 mm), remove piston (36) from housing (35).



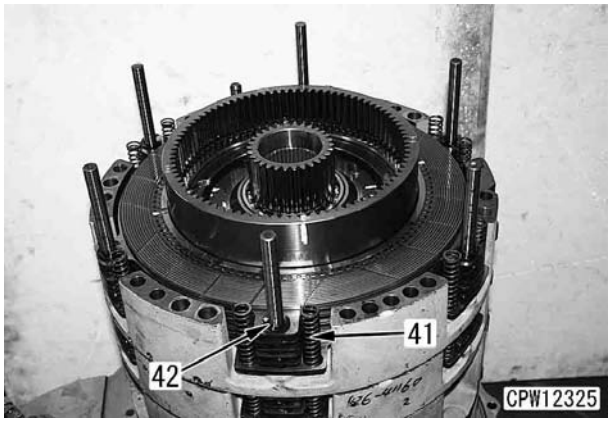
3) Remove piston (38) and seal rings (39) and (40) from housing (37).



9. Springs

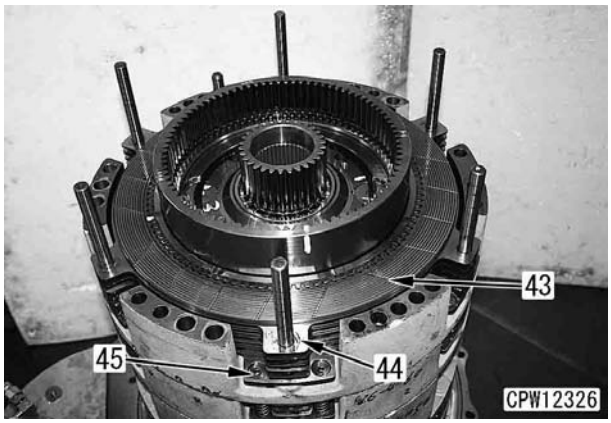
Remove 12 springs (41) and 36 springs (42).

★ Springs (42) are installed between the plates.



10. Discs and plates

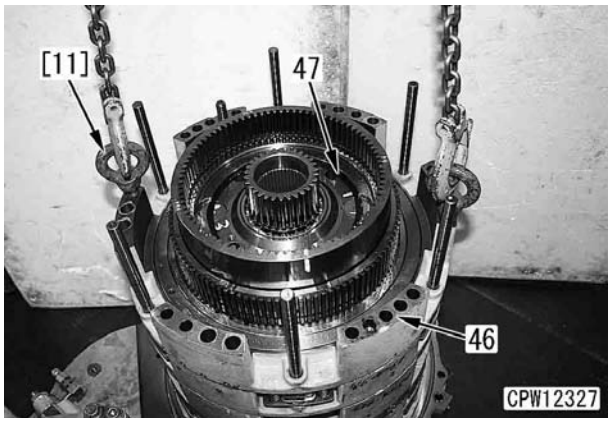
Remove 6 discs (43), 5 plates (44) and piston plate (45).



11. No. 2 piston housing

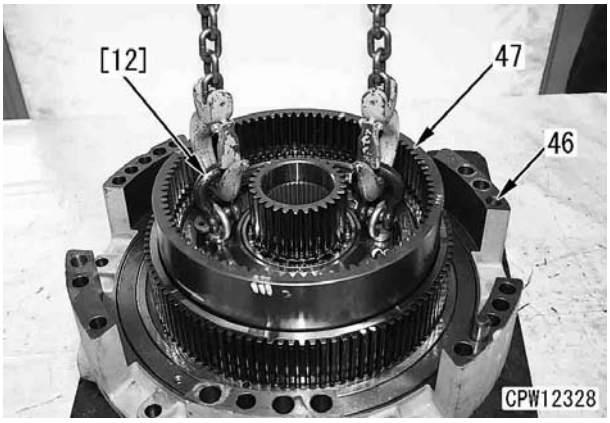
Using eyebolts [11] (M18, P = 2.5 mm), remove piston housing (46).

★ Remove ring gear and carrier assembly (47), too.

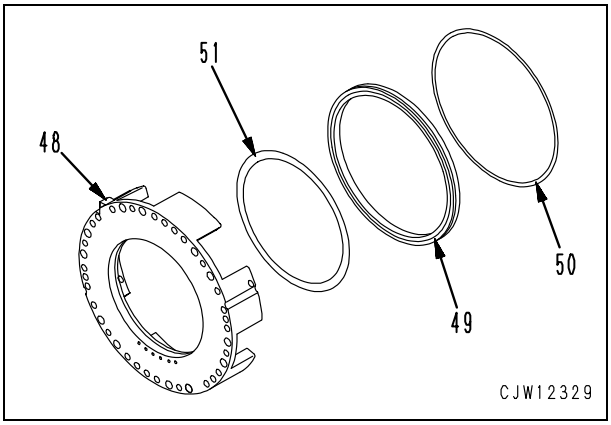


12. No. 1 ring gear and No. 2 carrier assembly

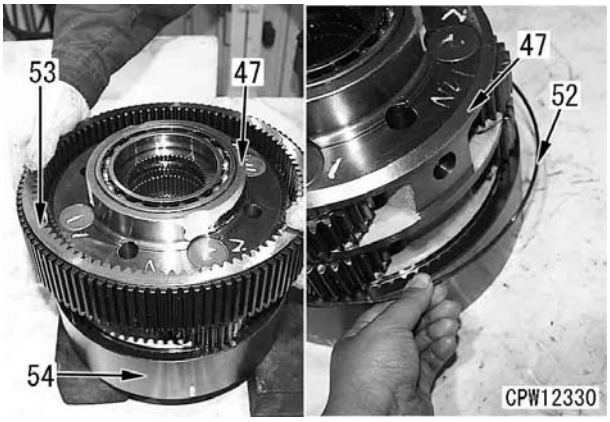
1) Using eyebolts [12] (M10, P = 1.5 mm), remove ring gear and carrier assembly (47) from No. 2 piston housing (46).



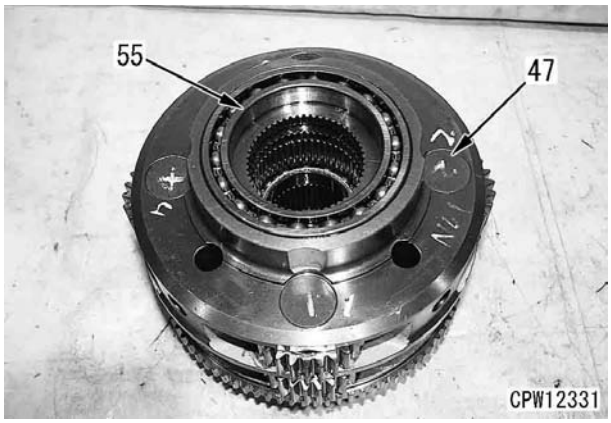
2) Remove piston (49) and seal rings (50) and (51) from housing (48).



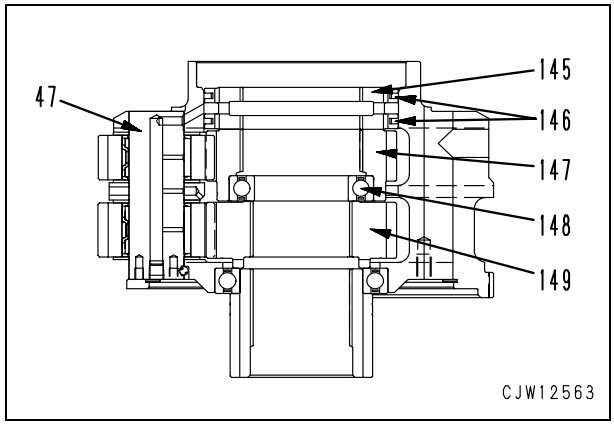
3) Disassemble the ring gear and carrier assembly according to the following procedure.
   1] Reverse ring gear and carrier assembly (47).
   2] Remove ring gear (53).
   3] Remove snap ring (52) and ring gear (54).



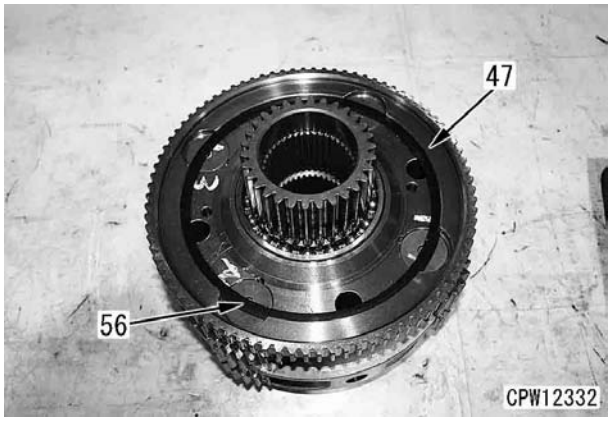
4] Remove bearing (55) from carrier assembly (47).



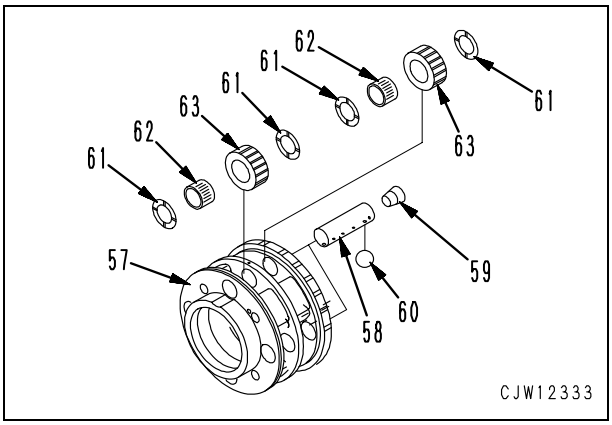
5] Remove spacer (145) from carrier (47).
6] Remove 2 seal rings (gold) (146) from spacer (145).
7] Remove sun gear (147).
8] Remove bearing (148) from sun gear (147).
9] Remove sun gear (149).



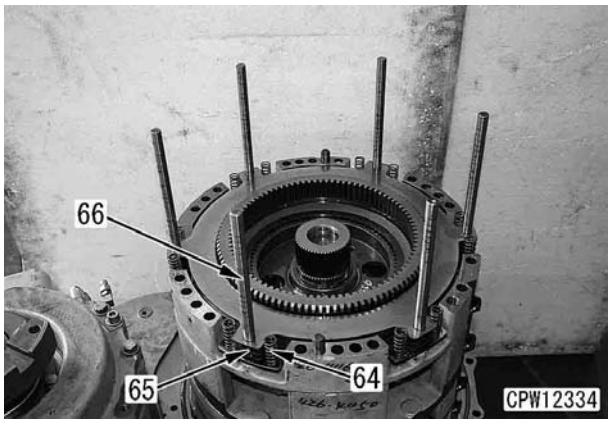
10] Reverse ring gear and carrier assembly (47).
11] Remove snap ring (56) which is fixing the planetary gear shaft.



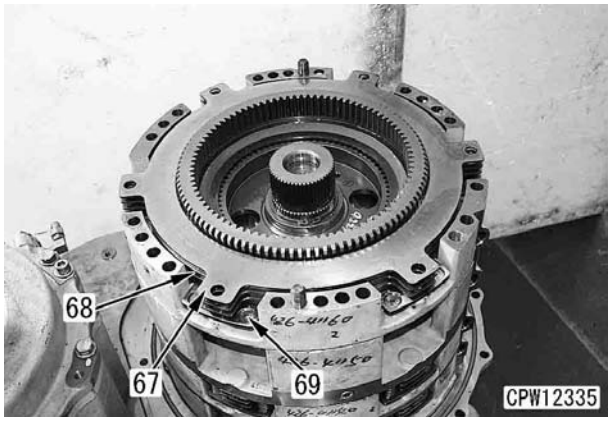
12] Remove shaft (58), plug (59), ball (60), thrust washer (61), bearing (62) and planetary gear (63) from carrier (57).
★ Take care not to lose the ball.



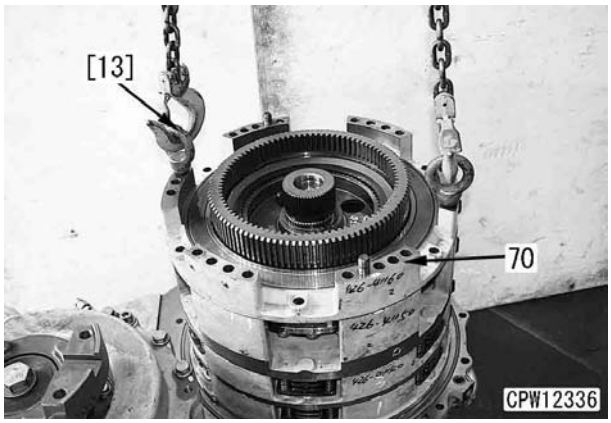
13. Springs
1) Remove 12 springs (64) and 18 springs (65).
★ Springs (65) are installed between the plates.
2) Remove guide pin (66).



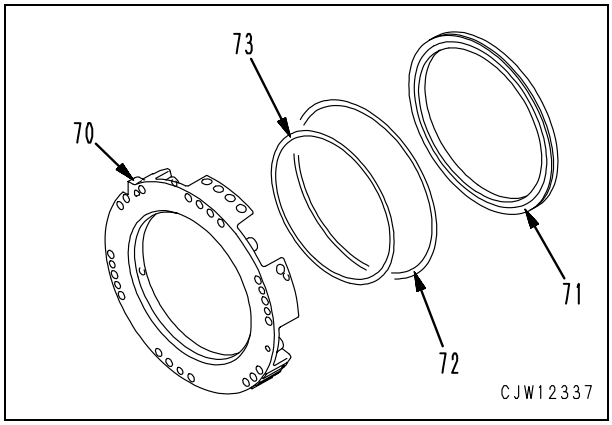
14. Discs and plates
Remove 3 plates (67), 3 discs (68) and piston plate (69).



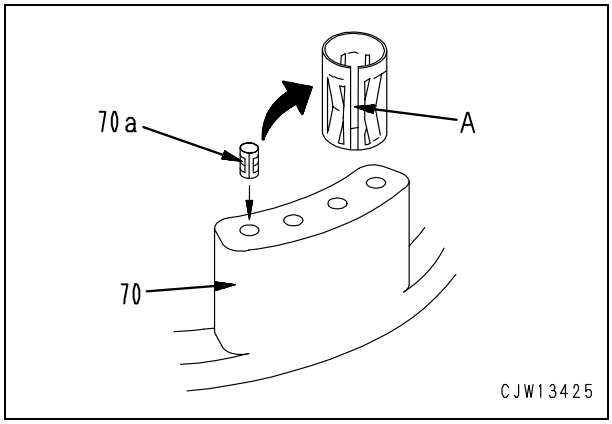
15. No. 3 piston housing
1) Using eyebolts [13] (M18, P = 2.5 mm), remove No. 3 piston housing (70).



2) Remove piston (71) and seal rings (72) and (73) from housing (70).

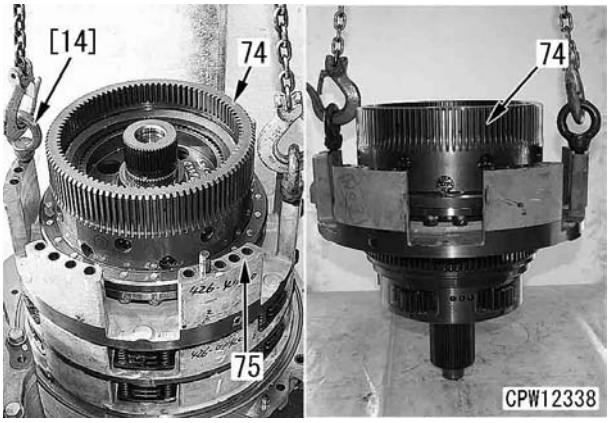


3) Remove cushion sleeve (70a) from No. 3 piston housing (70).
★ Check slit position (A).

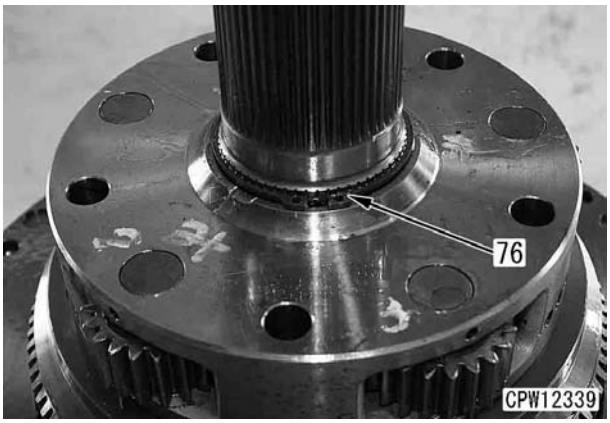


16. No. 4 clutch (Revolution clutch)

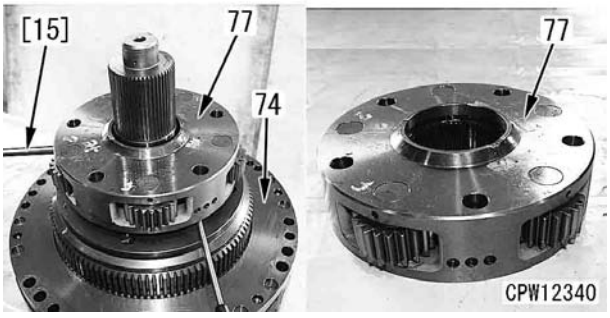
1) Using eyebolts [14] (M18, P = 2.5 mm), remove revolution clutch assembly (74) and No. 4 housing (75) together.



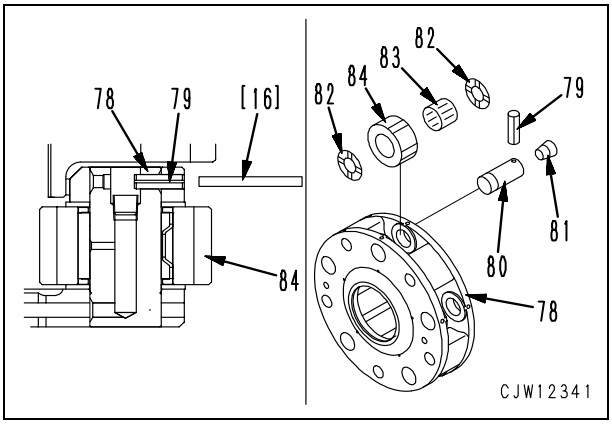
2) Disassemble the No. 6 carrier assembly according to the following procedure.
   1] Reverse the revolution clutch assembly.
   2] Remove snap ring (76).



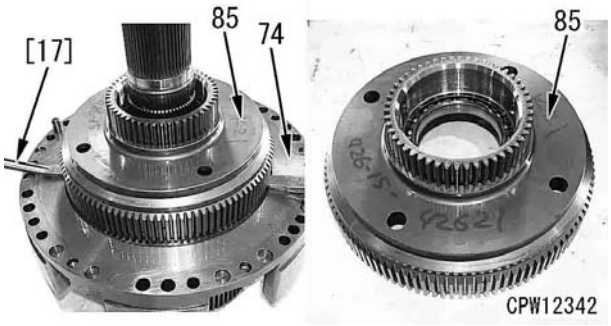
   3] Using bar [15], remove No. 6 carrier assembly (77) from revolution clutch assembly (74).



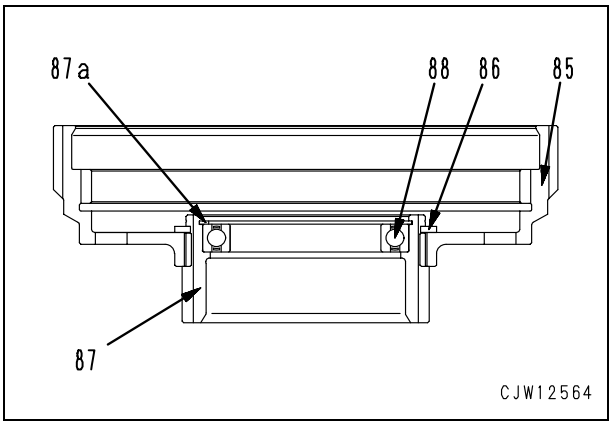
   4] Using push tool [16] (Outside diameter: 5 mm), drive roll pin (79) into the inside of carrier (78).
   5] Remove shaft (80), plug (81), thrust washer (82), bearing (83) and planetary gear (84) from carrier (78).
      ★ Take care not to lose the roll pin.

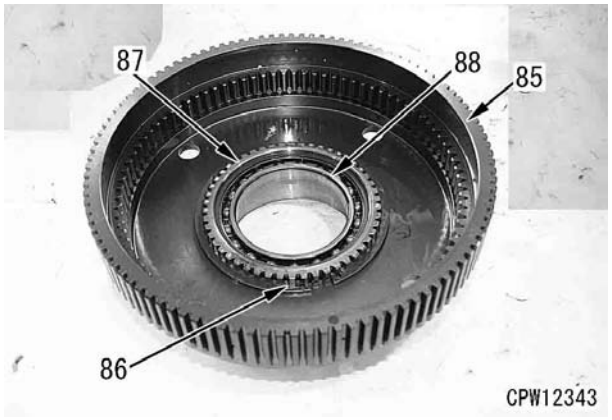


3) Disassemble the No. 5 carrier assembly and ring gear according to the following procedure.
   1] Using bar [17], remove No. 5 ring gear (85) from revolution clutch assembly (74).

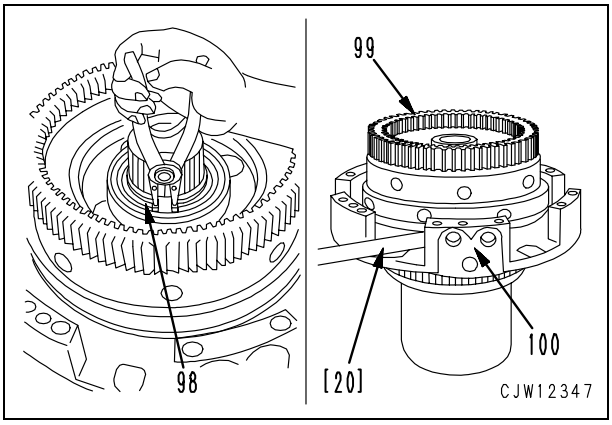


2] Remove snap ring (86) and remove sun gear (87) and bearing (88) from No. 5 ring gear (85).
3] Remove snap ring (87a) of sun gear (87) and then remove bearing (88).

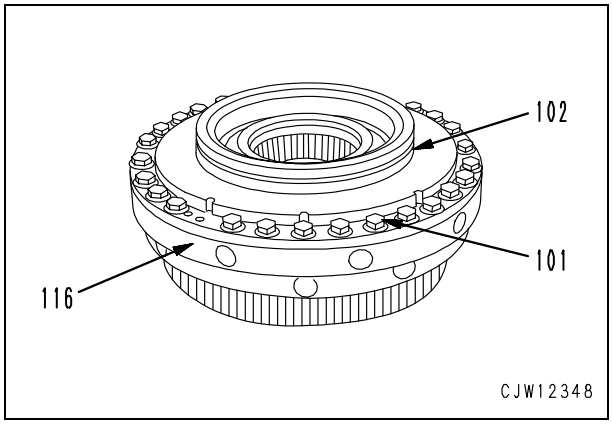




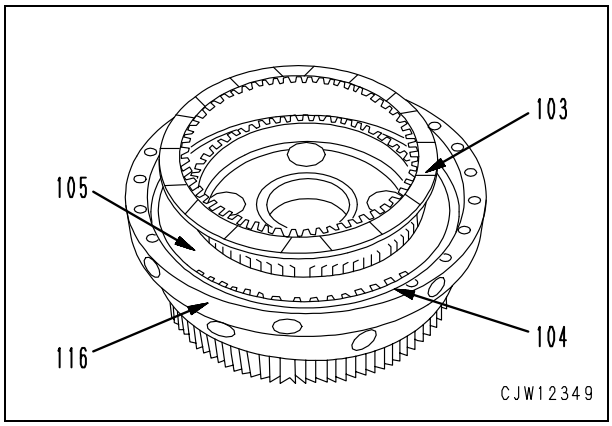
4) Disassemble the revolution clutch assembly according to the following procedure.
1] Remove snap ring (98) and then remove revolution clutch (99) from housing (100) with bar [20].



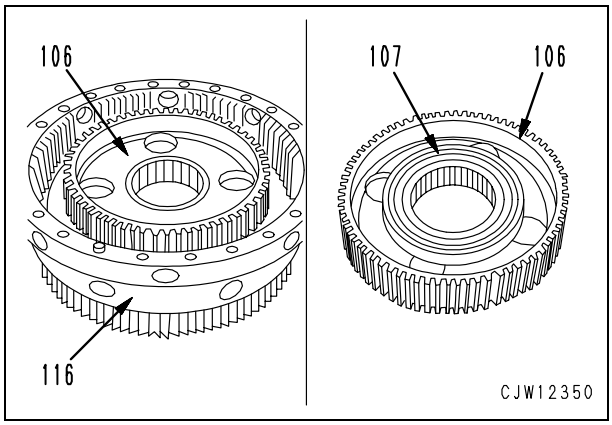
2] Remove bolts (101) and housing (102).



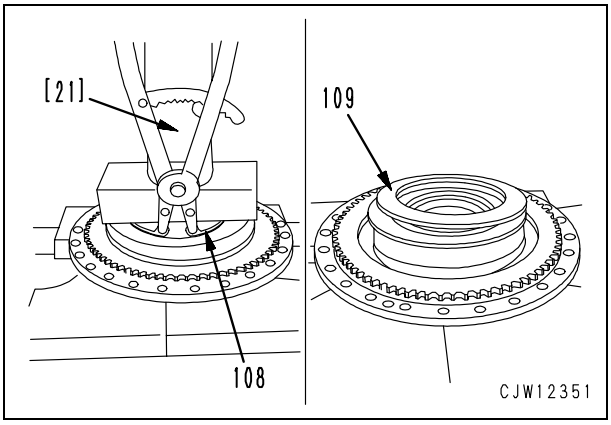
3] Remove 8 discs (103), 8 wave springs (104) and 7 plates (105).



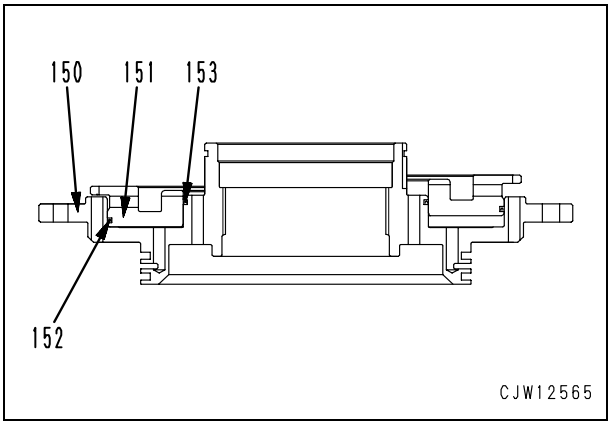
4] Remove inner gear (106).
5] Remove bearing (107) from inner gear (106).



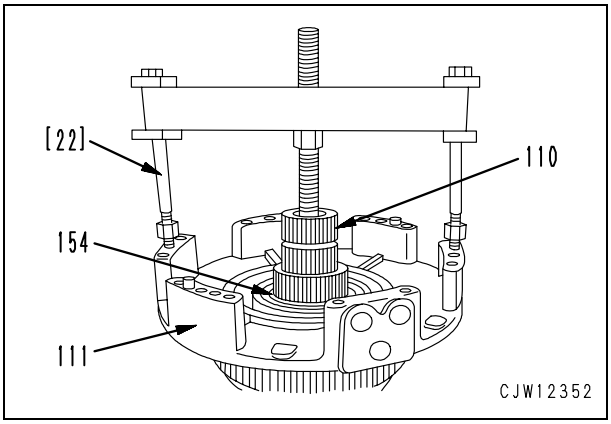
6] Using press fitting tool [21] (Inside diameter: 160 mm), compress the disc spring and remove snap ring (108).
★ Installed load of disc spring: **240 kg**
7] Remove 5 disc springs (109).



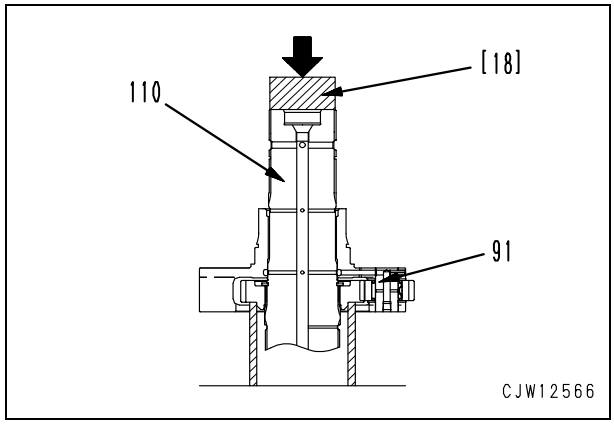
8] Remove piston (151) from housing (150).
9] Remove seal rings (152) and (153).



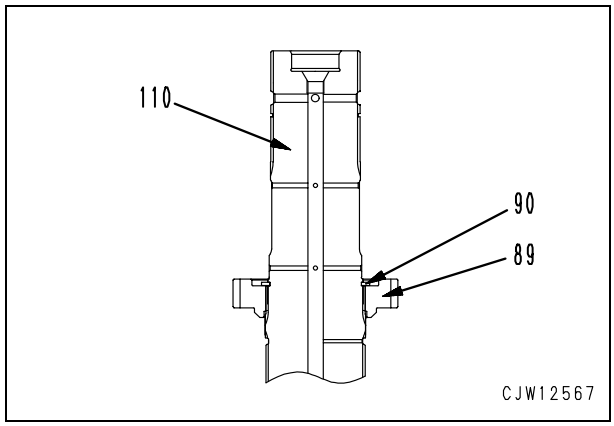
10] Remove snap ring (154).
11] Using puller [22], remove housing (111) from shaft (110).



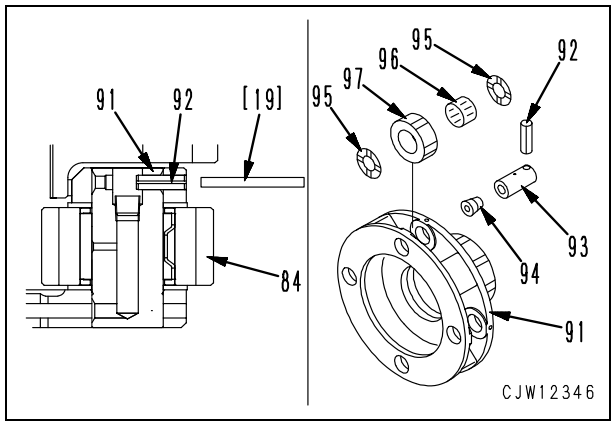
12] Using puller [18], remove shaft (110) from No. 5 carrier (91).



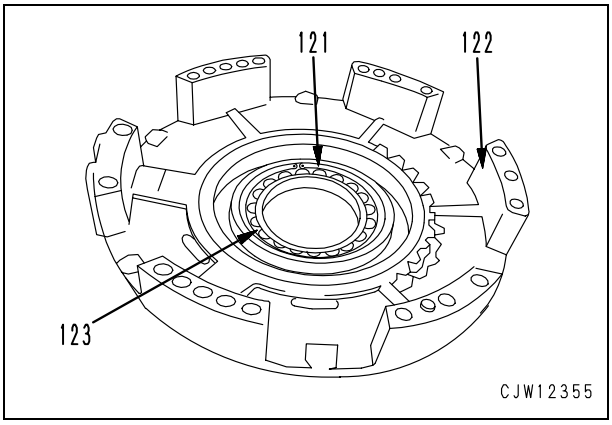
13] Remove snap ring (90) from shaft (110) and remove sun gear (89).



14] Using push tool [19] (Outside diameter: 5 mm), drive roll pin (92) into carrier (91).
15] Remove shaft (93), plug (94), thrust washer (95), bearing (96) and planetary gear (97) from carrier (91).
★ Take care not to lose the roll pin.



16] Remove snap ring (121) and then remove bearing (123) from housing (122).



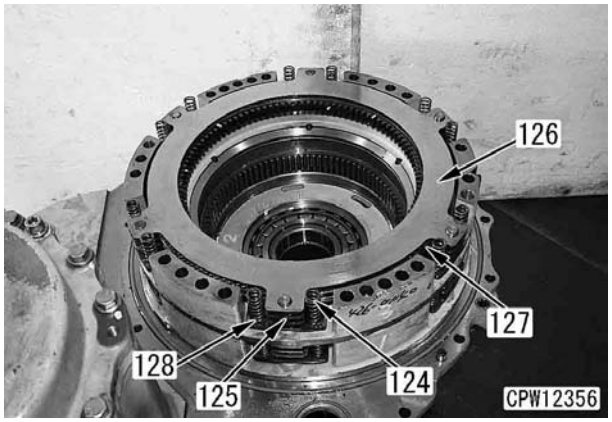
17. Springs

Remove 12 springs (124) and 18 springs (125).

★ Springs (125) are installed between the plates.

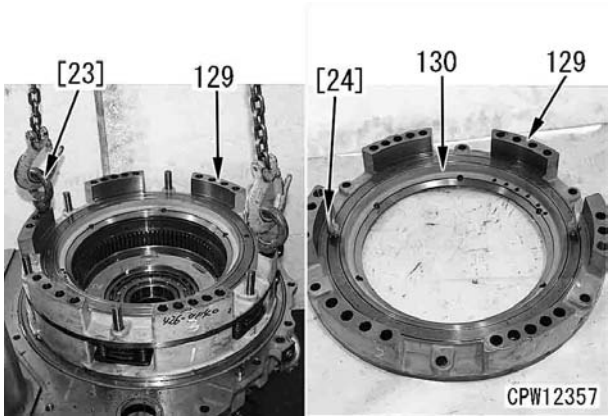
18. Discs and plates

Remove 3 plates (126), 3 discs (127) and piston plate (128).

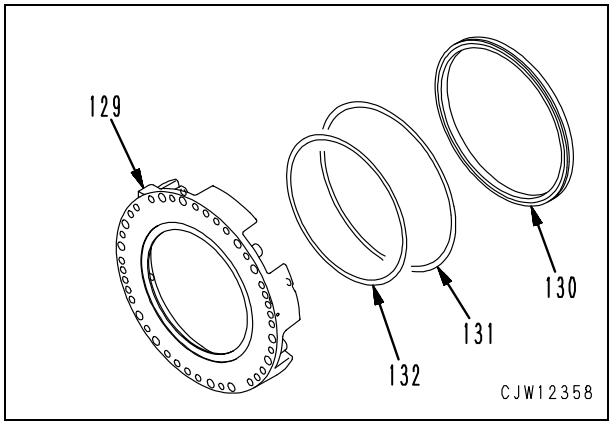


19. No. 5 piston housing

1) Using eyebolts [23] (M18, P = 2.5 mm), remove No. 5 piston housing (129).
2) Using eyebolts [24] (M10, P = 1.5 mm), remove piston (130) from piston housing (129).



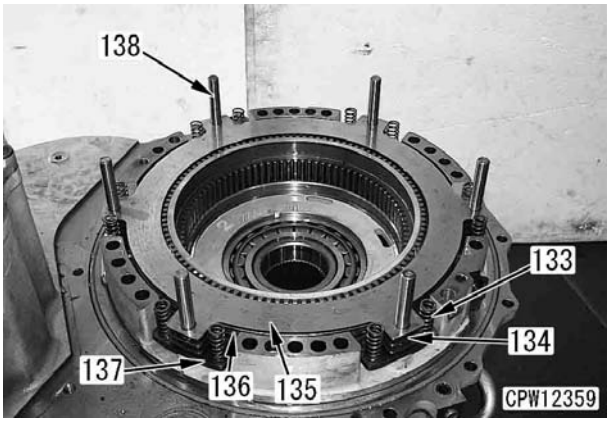
3) Remove seal ring (132) from housing (129) and remove seal ring (131) from piston (130).



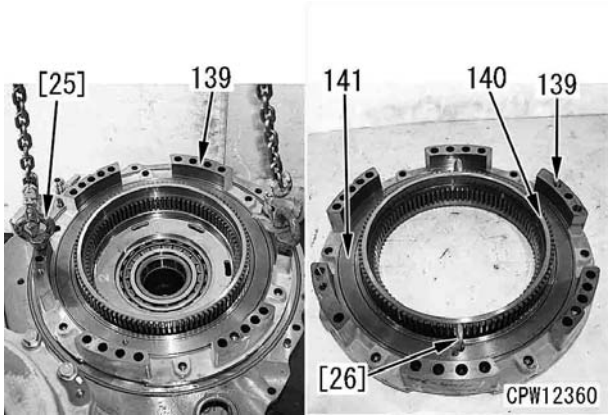
20. Springs
Remove 12 springs (133) and 18 springs (134).
★ Springs (134) are installed between the plates.

21. Discs and plates
Remove 3 plates (135), 3 discs (136) and piston plate (137).

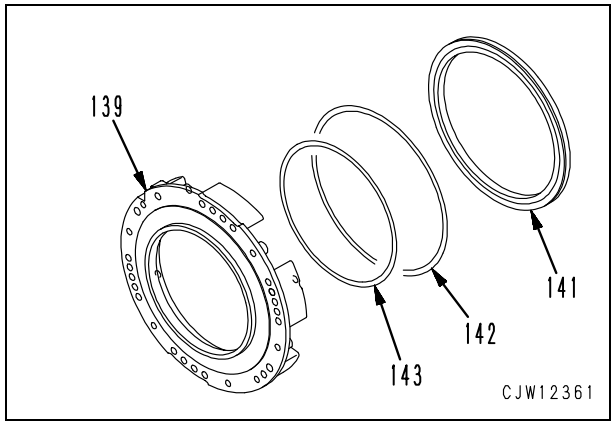
22. Guide pins
Remove 6 guide pins (138).



23. No. 6 piston housing
1) Using eyebolts [25] (M18, P = 2.5 mm), remove No. 6 piston housing (139).
2) Remove ring gear (140).
3) Using eyebolts [26] (M10, P = 1.5 mm), remove piston (141) from piston housing (139).



4) Remove seal ring (143) from housing (139) and remove seal ring (142) from piston (141).



Assembly

Precautions for assembly

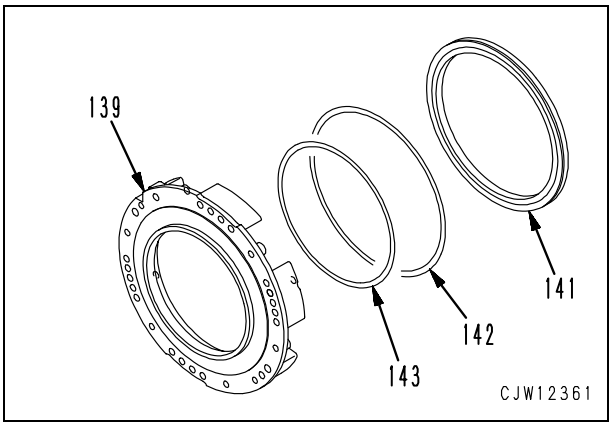
- Apply transmission oil (**TO10**) to the rotary parts and sliding parts before installing.
- Coat each seal ring with grease (**G2-LI**) and install it evenly.
- Coat the inside and outside fixed surfaces of each bearing with adhesive (**ThreeBond 1373B or equivalent**) when installing.
- When installing the discs of each clutch, set their notches to each other.
- Check that each snap ring is fitted securely to the groove.

1. Preparation work

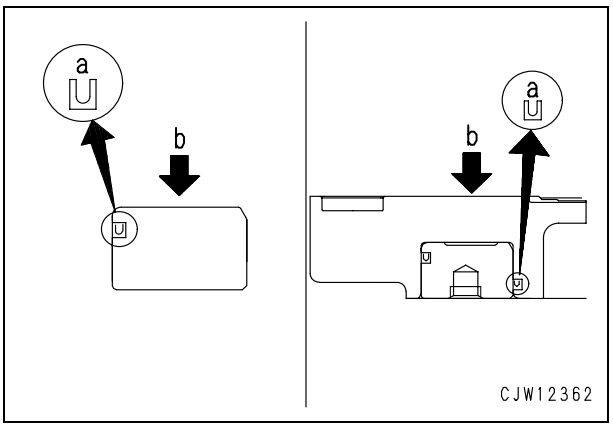
Clean all the parts and remove burrs etc.

2. No. 6 piston housing

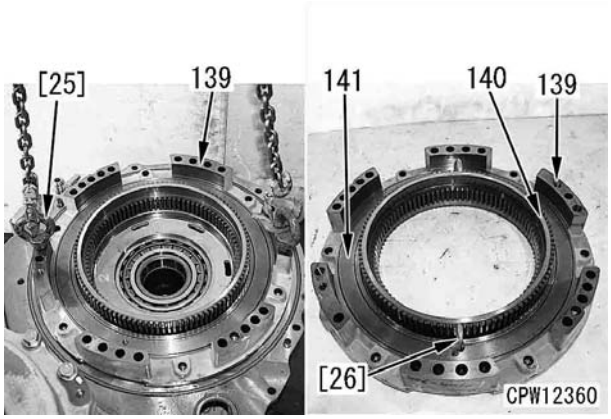
1) Install seal ring (143) to housing (139) and install seal ring (142) to piston (141).
   Seal ring: **Grease (G2-LI)**

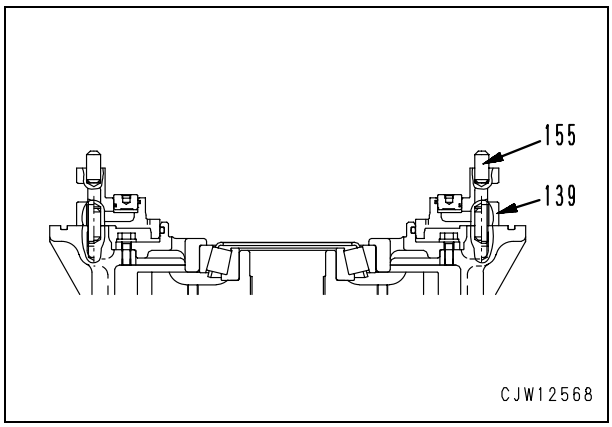


★ Set groove (a) of the seal ring against direction (b) of the pressure.



2) Using eyebolts [26] (M10, P = 1.5 mm), install piston (141) to piston housing (139).
3) Using eyebolts [25] (M18, P = 2.5 mm), install No. 6 piston housing (139).
4) Install ring gear (140).
5) Drive 2 dowel pins (155) into housing (139).





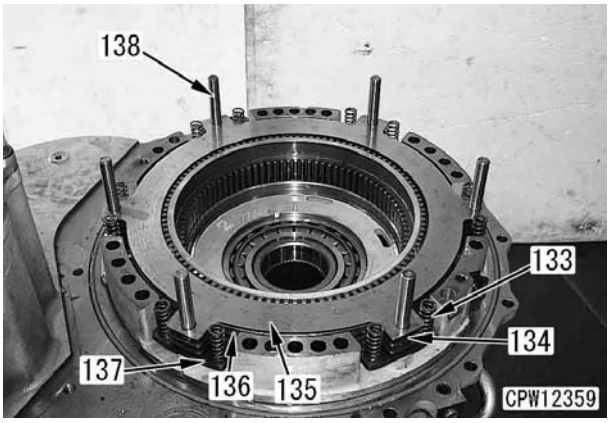
3. Guide pins

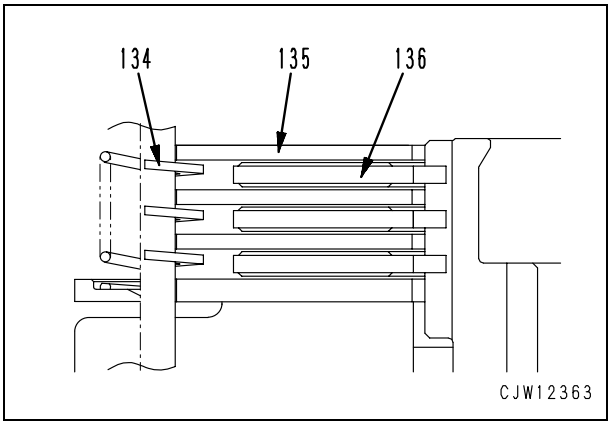
Install 6 guide pins (138).

★ Length of guide pin: **125 mm**

4. Discs, plates and springs

1) Install piston plate (137).
2) Install 3 discs (136), 18 springs (134) and 3 plates (135) alternately.
3) Install 12 springs (133).

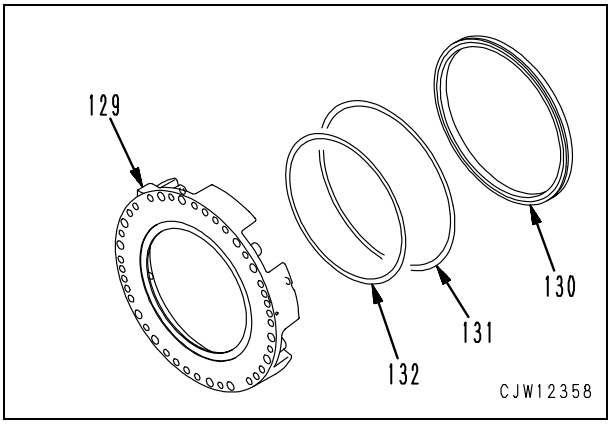




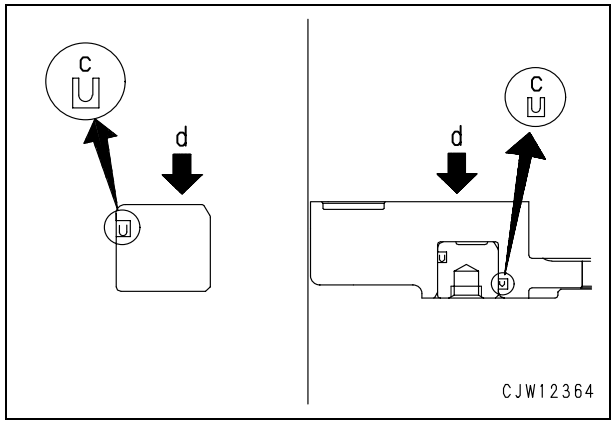
5. No. 5 piston housing

1) Install seal ring (132) to housing (129) and install seal ring (131) to piston (130).

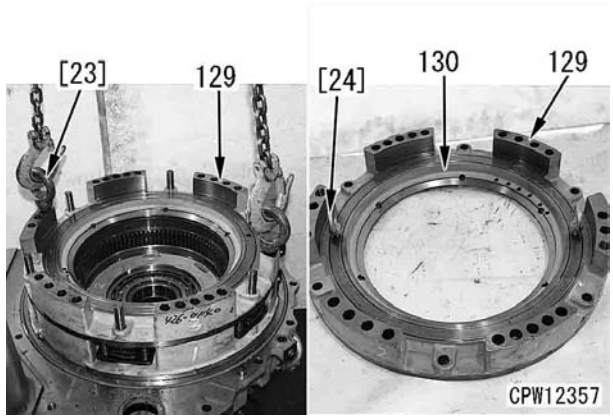
Seal ring: **Grease (G2-LI)**



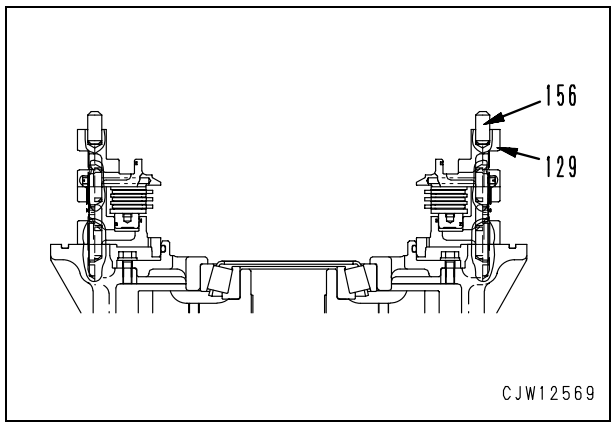
★ Set groove (c) of the seal ring against direction (d) of the pressure.



2) Using eyebolts [24] (M10, P = 1.5 mm), install piston (130) to No. 5 piston housing (129).
3) Using eyebolts [23] (M18, P = 2.5 mm), install No. 5 piston housing (129).

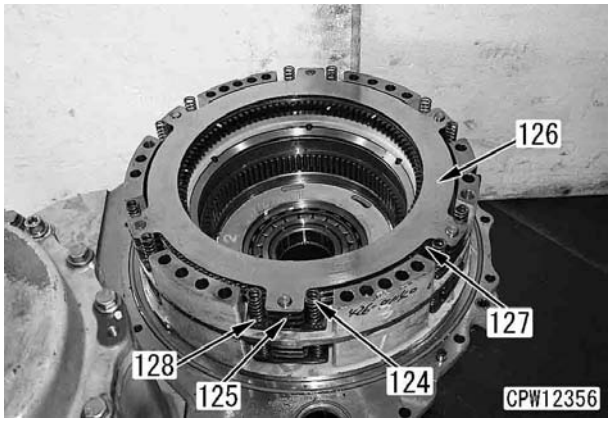


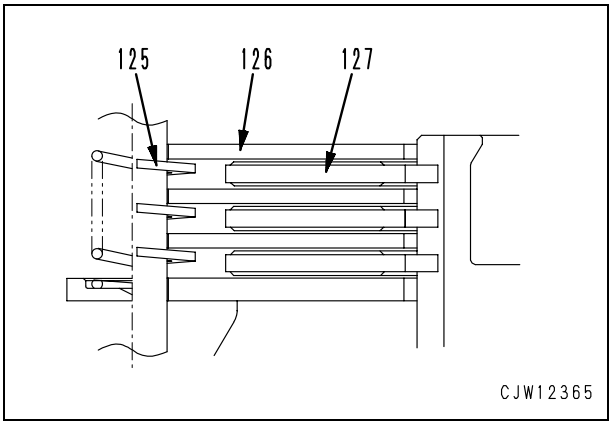
4) Drive 2 dowel pins (156) into housing (129).



6. Discs, plates and springs

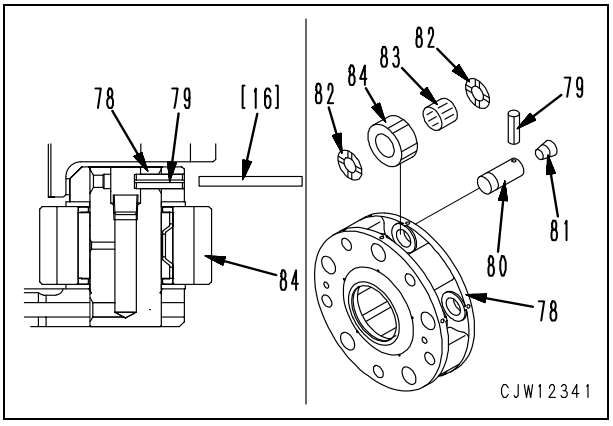
1) Install lower plate (128).
2) Install 3 discs (127), spring (125) and 3 plates (126) alternately.
3) Install springs (124).



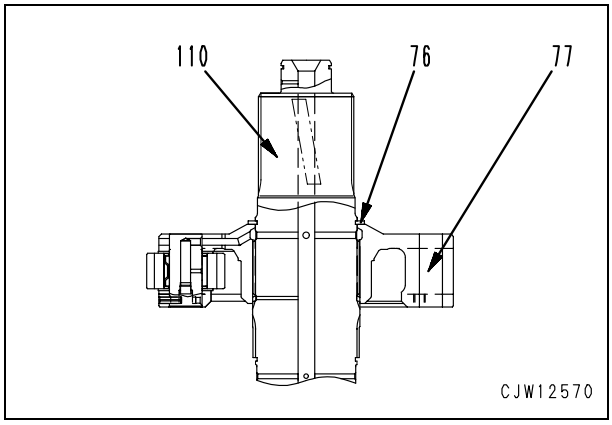


7. No. 6 and No. 5 carriers

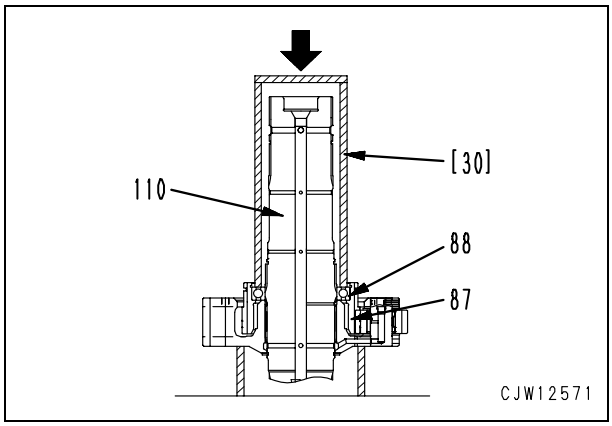
1) Assemble the No. 6 carrier assembly according to the following procedure.
   1] Install thrust washer (82), bearing (83), planetary gear (84), plug (81) and shaft (80) to carrier (78).
   2] Using push tool [16] (Outside diameter: 5 mm), drive in roll pin (79).



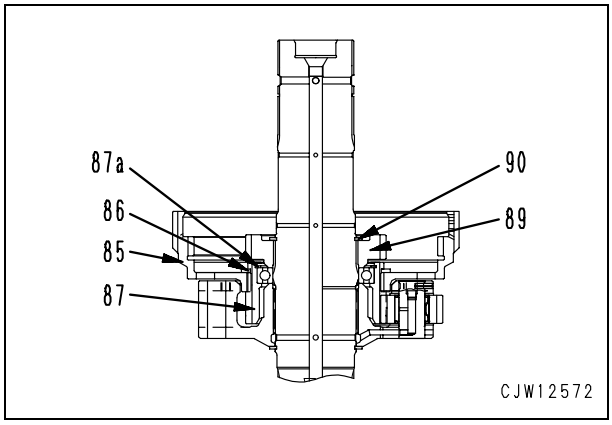
   3] Install No. 6 carrier assembly (77) to shaft (110).
   4] Install snap ring (76).



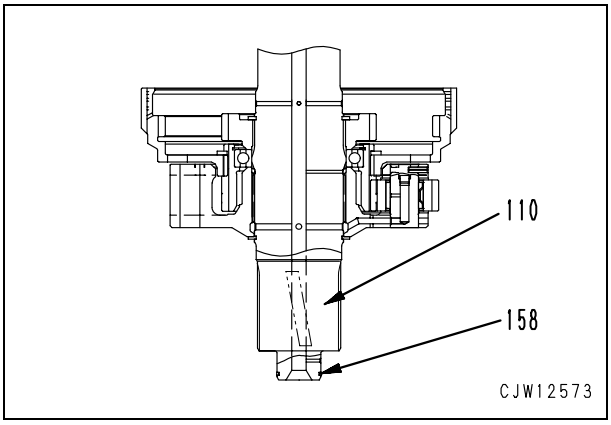
   5] Install sun gear (87) and bearing (88) to shaft (110).
   6] Using push tool [30] (Inside diameter: 95 mm), press fit bearing (88).



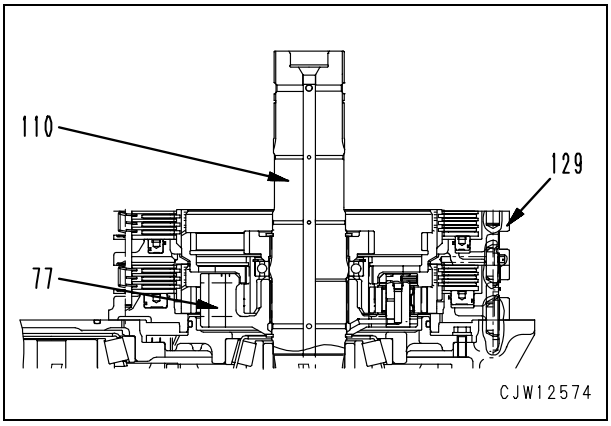
   7] Install snap ring (87a).
   8] Install No. 5 ring gear (85) to sun gear (87).
   9] Install snap ring (86).
   10] Install sun gear (89) and snap ring (90).



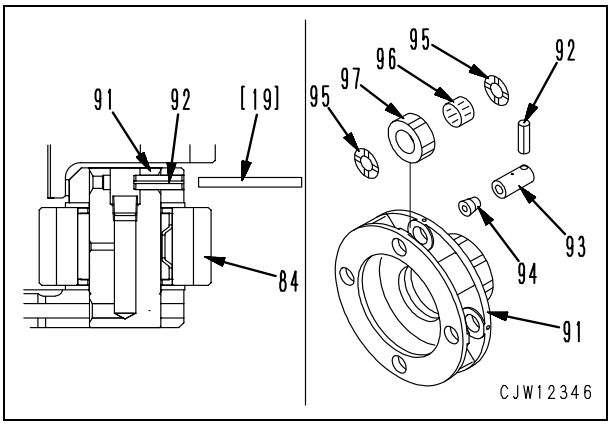
11] Install seal ring (158) to shaft (110).
Seal ring: **Grease (G2-LI)**



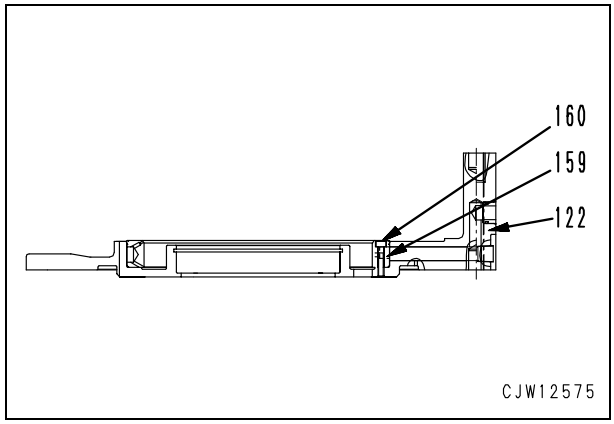
2) Install shaft (110) and No. 6 carrier assembly (77) to No. 5 piston housing (129).



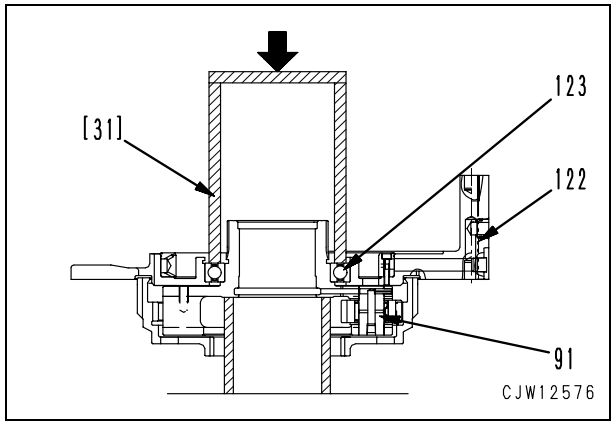
3) Assemble the No. 5 carrier assembly according to the following procedure.
1] Install thrust washer (95), bearing (96), planetary gear (97), plug (94) and shaft (93) to carrier (91).
2] Using push tool [19] (Outside diameter: 5 mm), drive in roll pin (92).



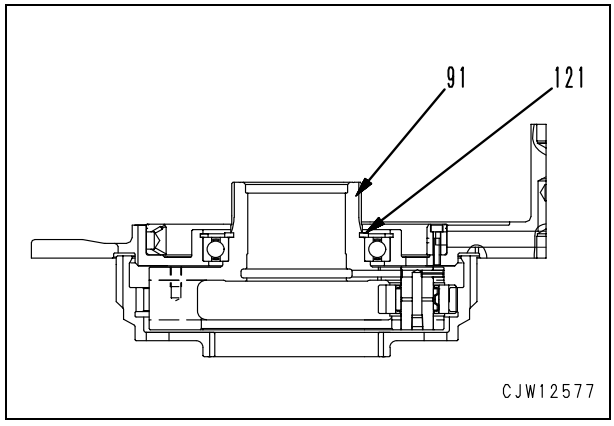
3] Fit spacer (159) to No. 4 housing (122) and tighten 2 mounting bolts (160).
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt:
11.8 – 14.7 Nm {1.2 – 1.5 kgm}



4] Set No. 5 carrier (91) to the tool and install No. 4 housing (122).
5] Using push tool [31] (Inside diameter: 121 mm), press fit bearing (123).

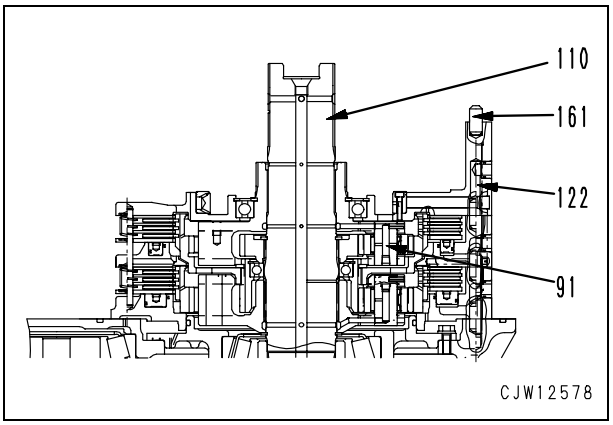


6] Install snap ring (121) to No. 5 carrier (91).



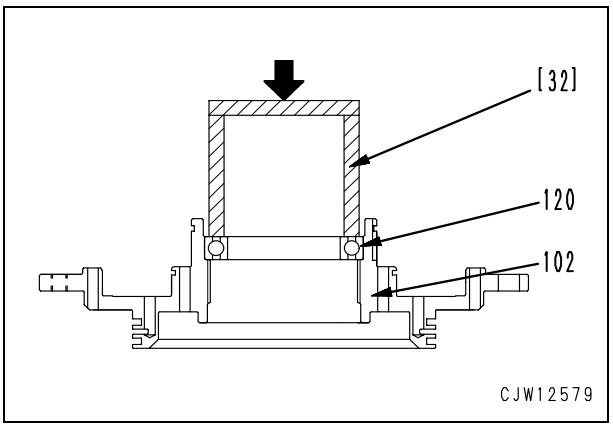
8. No. 4 housing

1) Install No. 4 housing (122) and No. 5 carrier (91) to shaft (110).
2) Drive in 2 dowel pins (161).

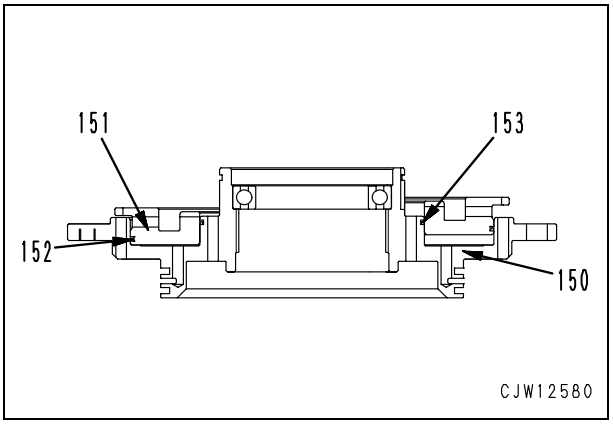


9. No. 4 clutch (Revolution clutch)

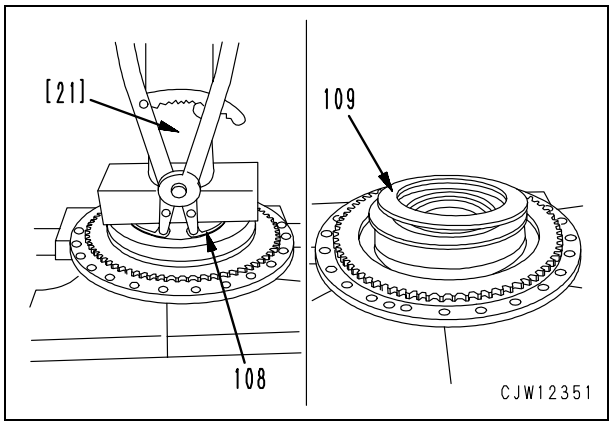
1) Using push tool [32] (Outside diameter: 119 mm), press fit bearing (120) to housing (102).



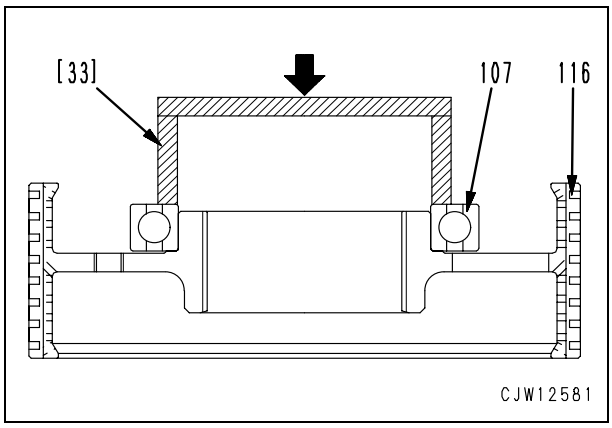
2) Install seal ring (153) to housing (150) and install seal ring (152) to piston (151).
   Seal ring: **Grease (G2-LI)**
3) Install piston (151) to housing (150).

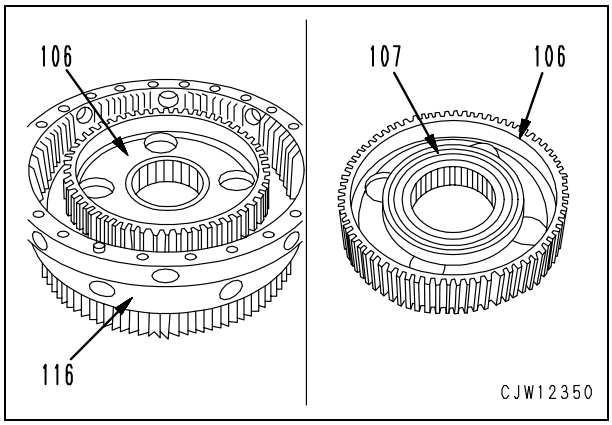


4) Install 5 disc springs (109).
5) Using press fitting tool [21] (Inside diameter: 160 mm), compress the disc spring and install snap ring (108).
   ★ Installed load of disc spring: **240 kg**

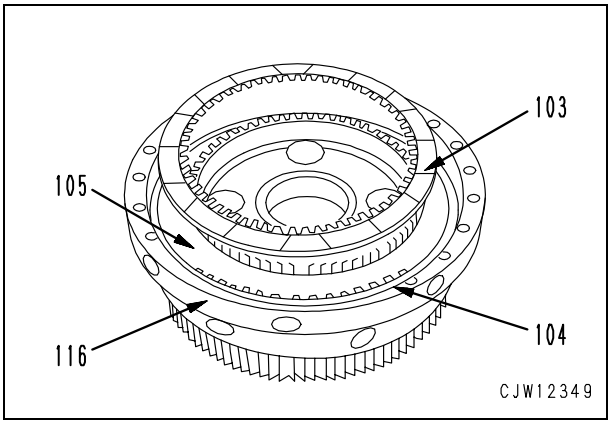


6) Using push tool [33] (Inside diameter: 106 mm), press fit bearing (107) to inner gear (106).
7) Install inner gear (106) to ring gear (116).

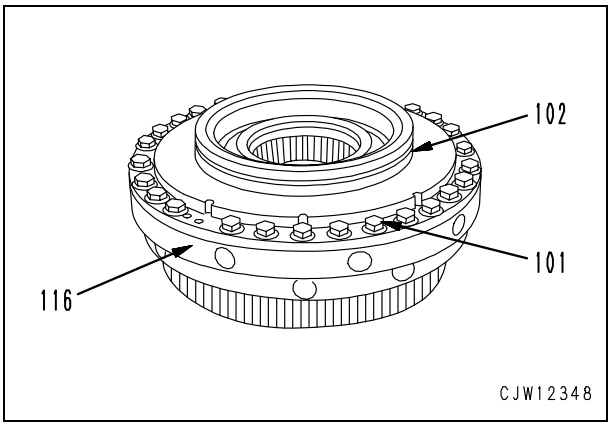




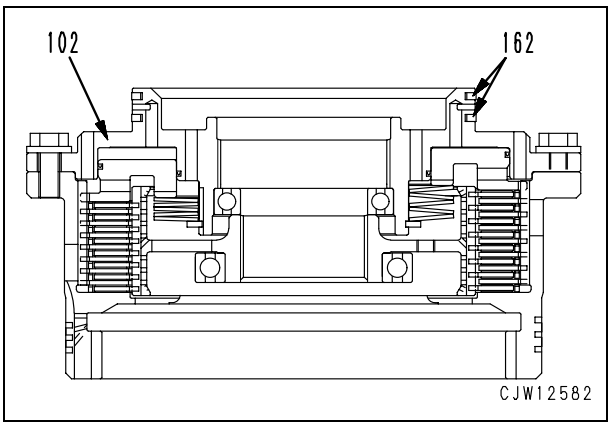
8) Install 7 plates (105), 8 wave springs (104) and 8 discs (103) to ring gear (116).



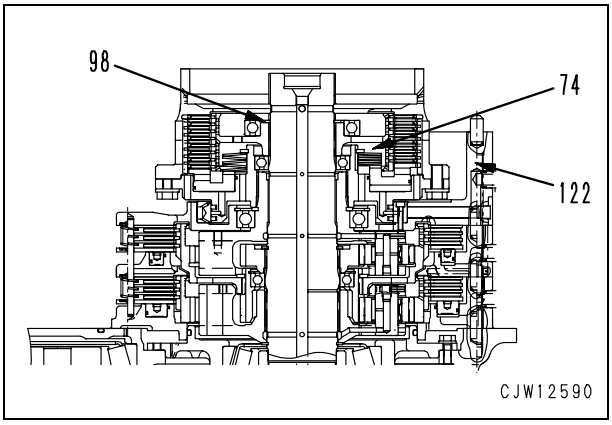
9) Install housing (102) to ring gear (116) and tighten bolts (101).
   - Mounting bolt: **Adhesive (LT-2)**
   - Mounting bolt: **156.8 – 196.0 Nm {16 – 20 kgm}**



10) Install 2 seal rings (162) to housing (102).
   - Seal ring: **Grease (G2-LI)**

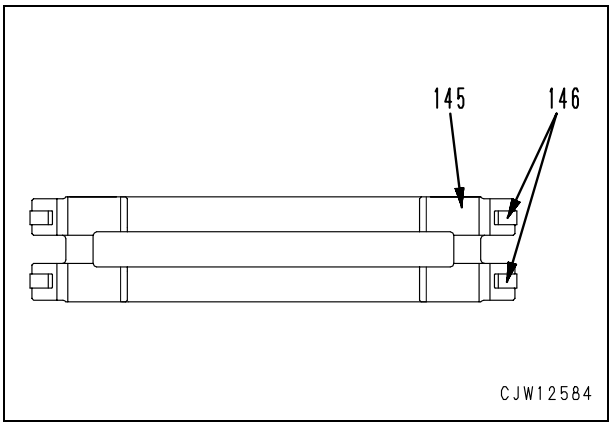


11) Using eyebolts, install revolution clutch assembly (74) to No. 4 housing (122).
12) Install snap ring (98).

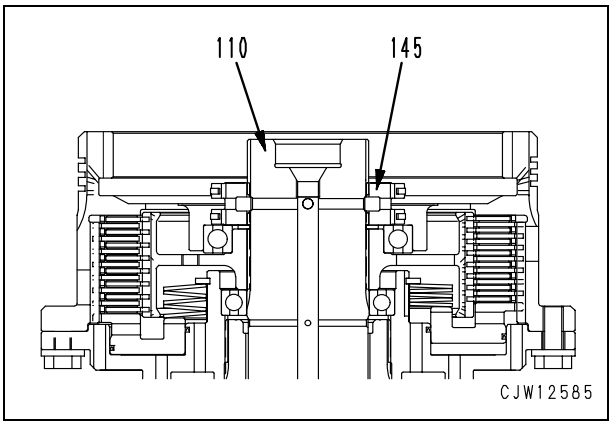


10. Spacer

1) Install 2 seal rings (146) to spacer (145).
   - Seal ring: **Grease (G2-LI)**

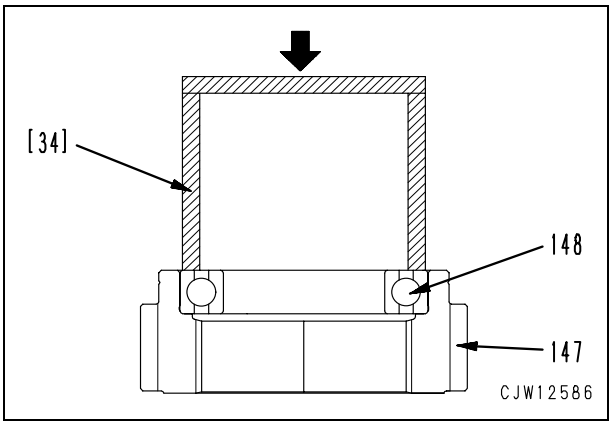


2) Install spacer (145) to shaft (110).

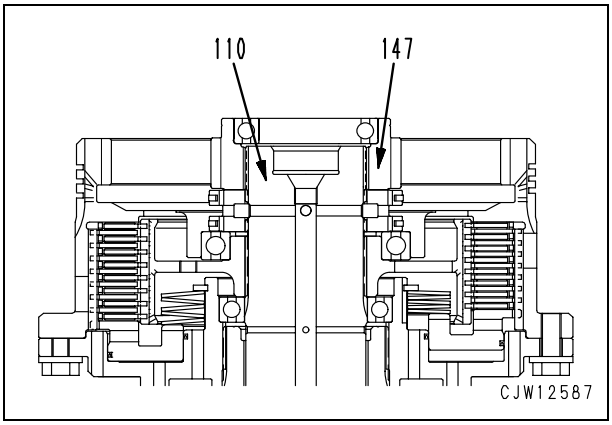


11. Sun gear

1) Using push tool [34] (Outside diameter: 99 mm), press fit bearing (148) to sun gear (147).

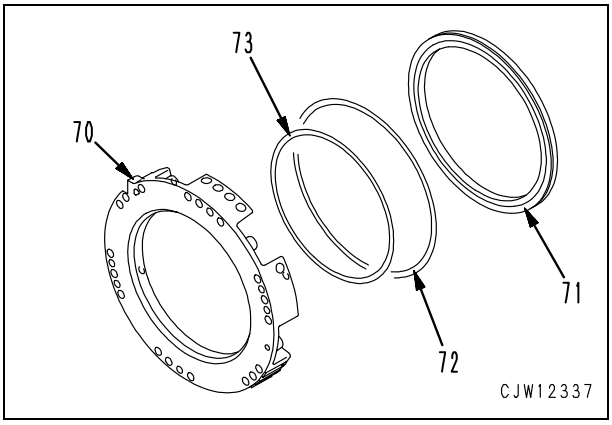


2) Install sun gear (147) to shaft (110).

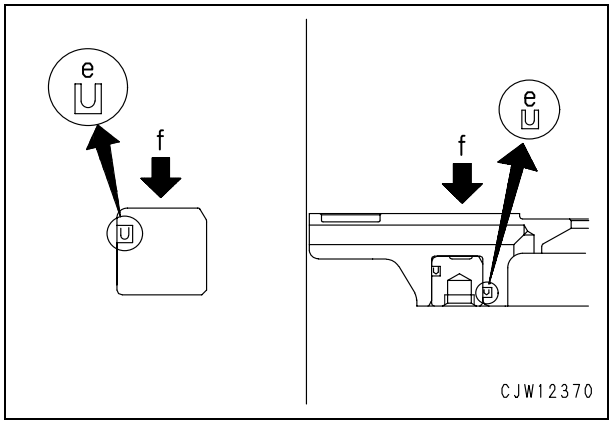


12. No. 3 piston housing

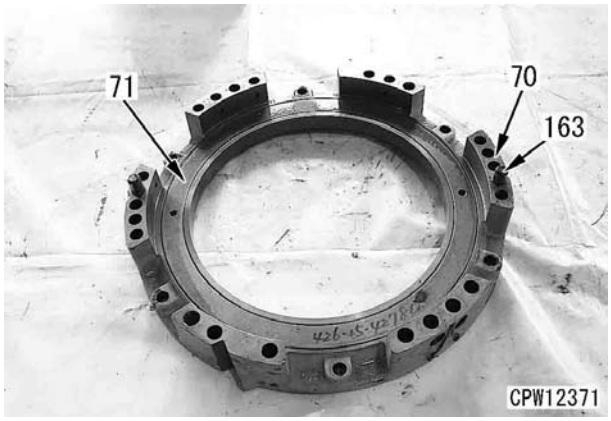
1) Install seal ring (73) to housing (70) and install seal ring (72) to piston (71).
   Seal ring: **Grease (G2-LI)**



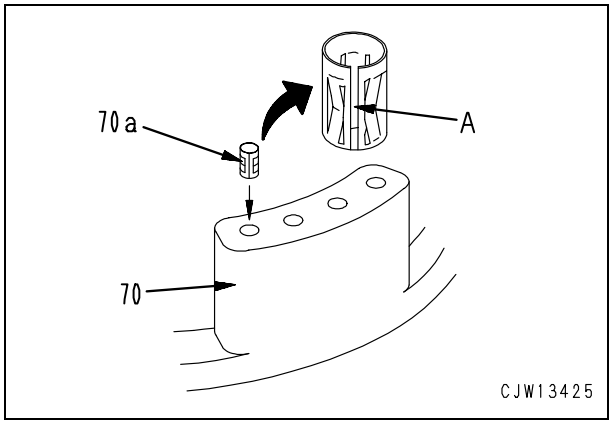
★ Set groove (e) of the seal ring against direction (f) of the pressure.



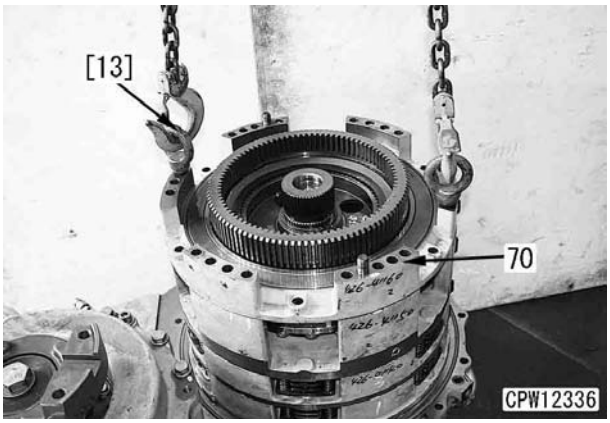
2) Install piston (71) to piston housing (70).
3) Drive 2 dowel pins (163) into piston housing (70).



4) Install cushion sleeve (70a) to No. 3 piston housing (70).
   ★ Set slit position (A) as checked when removed.



5) Using eyebolts [13] (M18, P = 2.5 mm), install No. 3 piston housing (70).



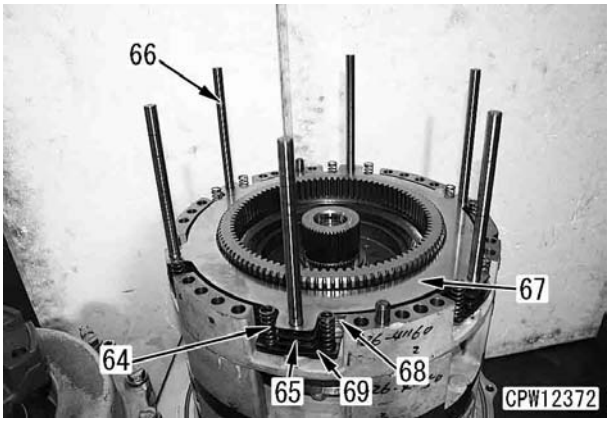
13. Guide pins

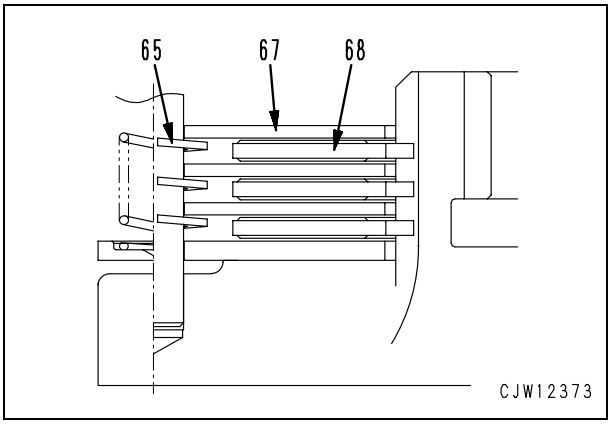
Install 6 guide pins (66).

★ Length of guide pin: **225 mm**

14. Discs, plates and springs

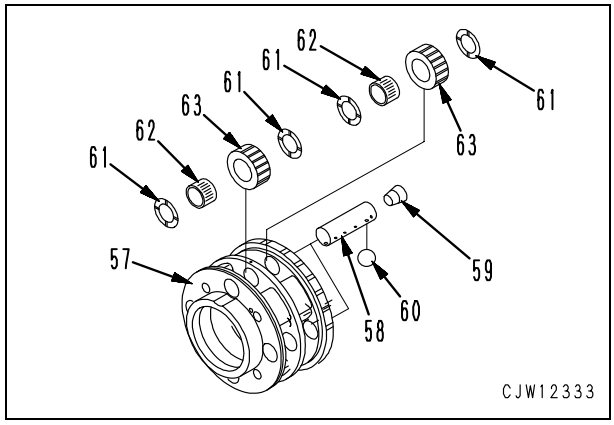
1) Install piston plate (69).
2) Install 3 discs (68), 18 springs (65) and 3 plates (67) alternately.
3) Install 12 springs (64).



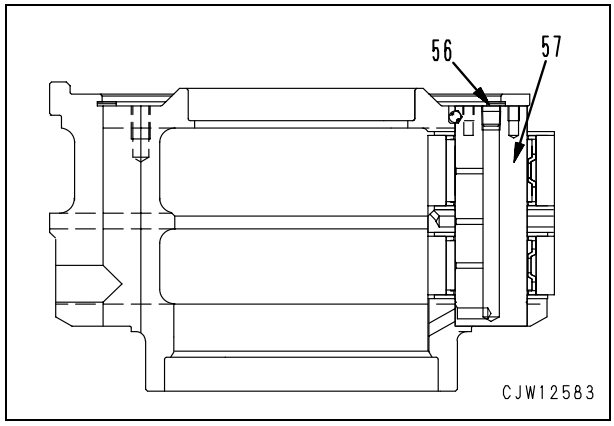


15. No. 1 ring gear and No. 2 and No. 3 carrier assembly

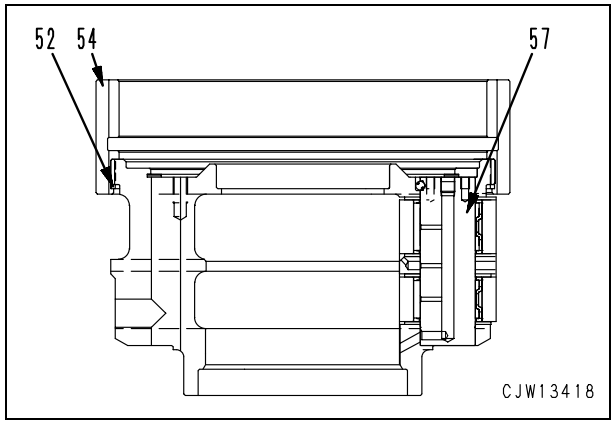
1) Assemble the ring gear and carrier assembly according to the following procedure.
   1] Install thrust washer (61), bearing (62) and planetary gear (63) to carrier (57).
   2] Install plug (59) and ball (60) to shaft (58) and then install them to carrier (57).



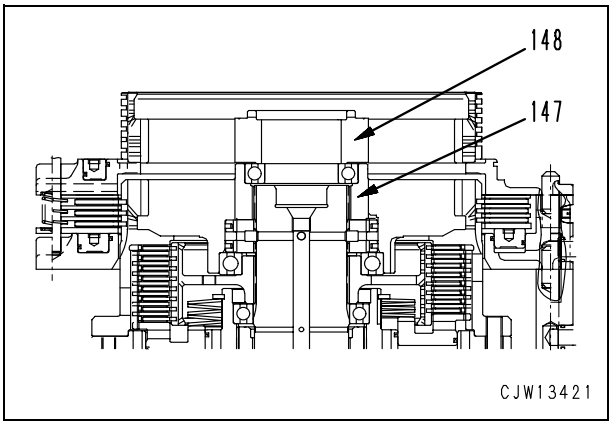
3] Install snap ring (56) to fix the planetary gear shaft to ring gear and carrier assembly (57).



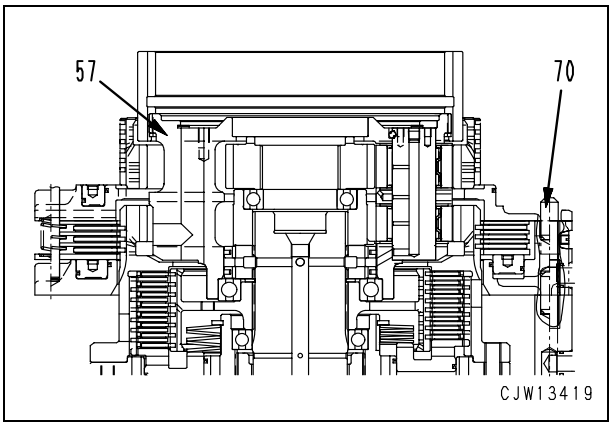
4] Install No. 1 ring gear (54) to carrier assembly (57).
5] Install snap ring (52).



2) Install sun gear (148) to sun gear (147).

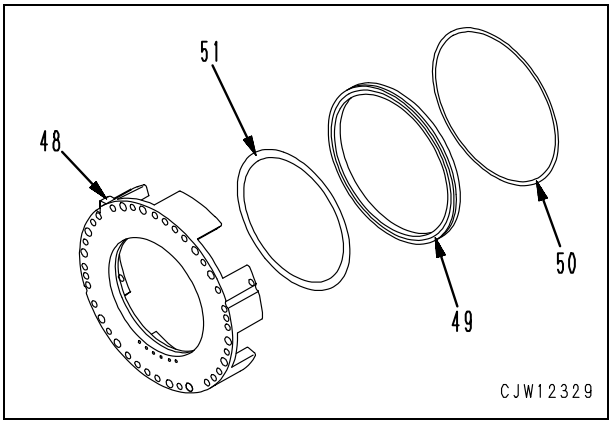


3) Install No. 2 and No. 3 carriers (57) to No. 3 piston housing (70).

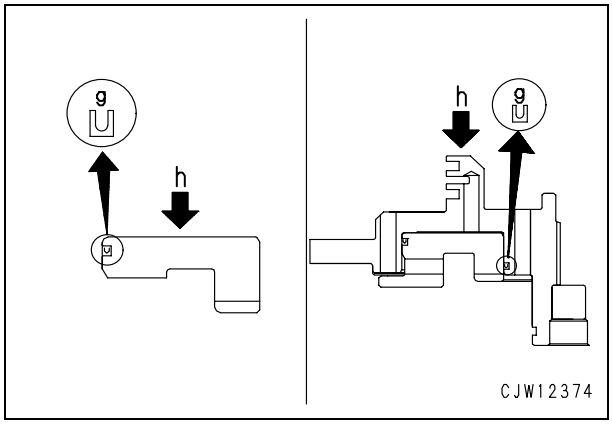


16. No. 2 piston housing

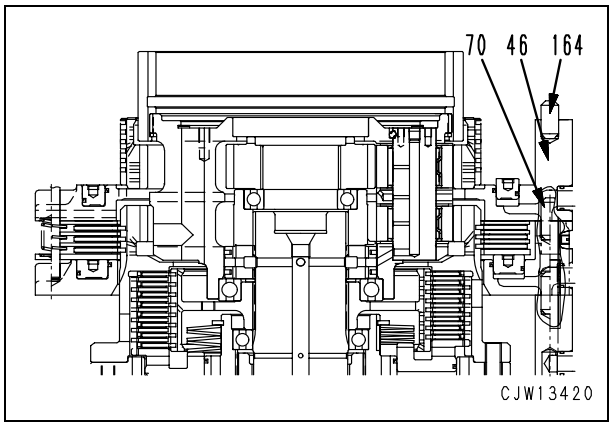
1) Install seal ring (51) to housing (48) and install seal ring (50) to piston (49).
   Seal ring: **Grease (G2-LI)**
2) Install piston (49) to housing (48).



★ Set groove (g) of the seal ring against direction (h) of the pressure.

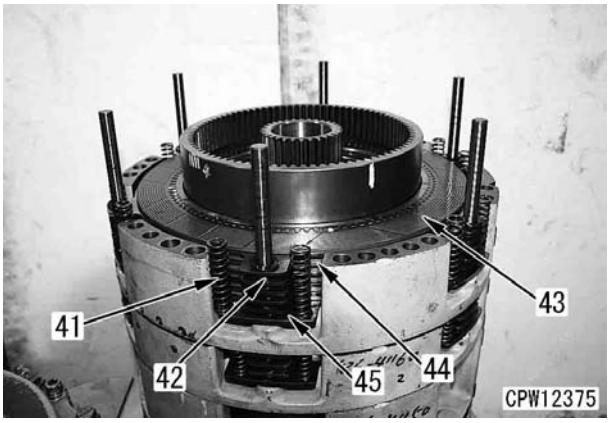


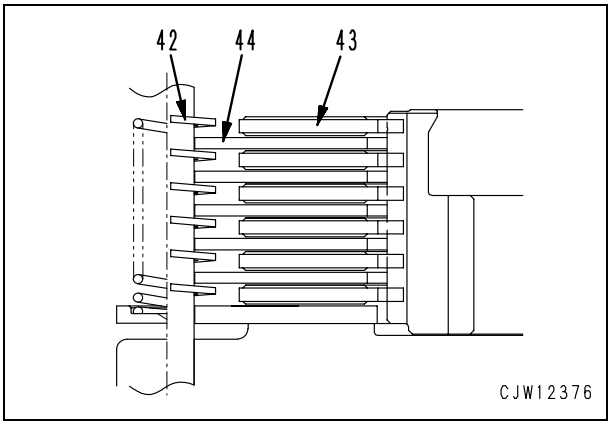
3) Using eyebolts (M18, P = 2.5 mm), install No. 2 piston housing (46) to No. 3 piston housing (70).
4) Drive 2 dowel pins (164) into piston housing (70).



17. Discs, plates and springs

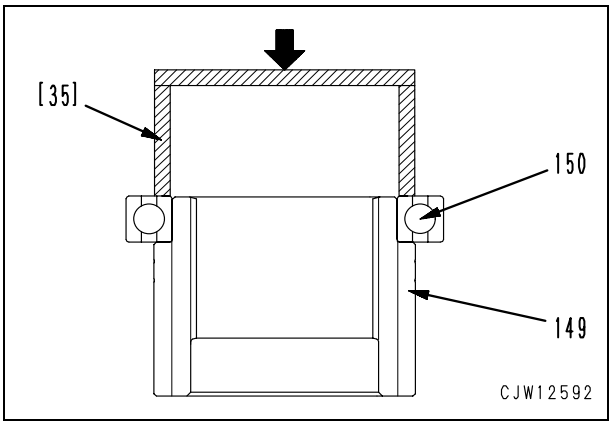
1) Install lower plate (45).
2) Install 6 discs (43), springs (42) and 6 plates (44) alternately.
3) Install springs (41).



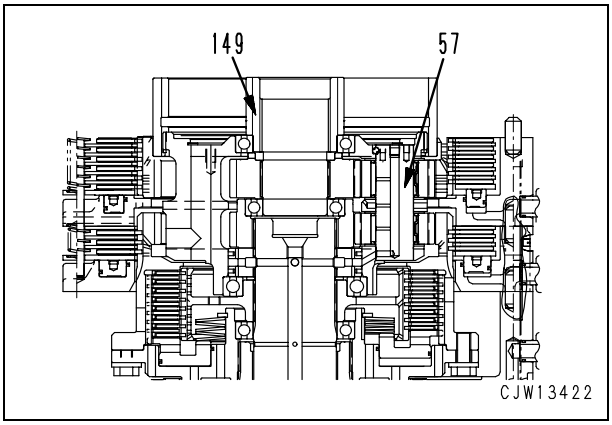


18. Sun gear

1) Using push tool [35] (Inside diameter: 86 mm), press fit bearing (150) to sun gear (149).

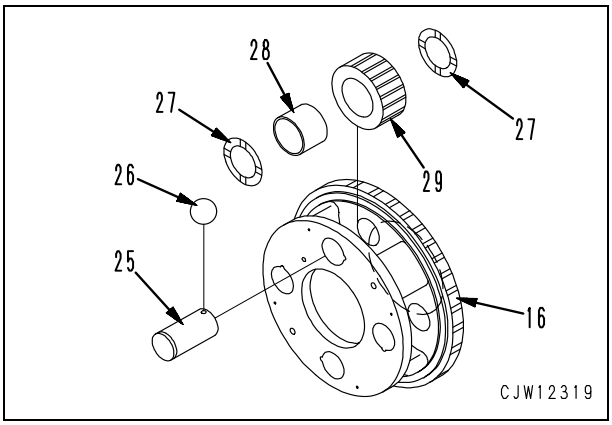


2) Install sun gear (149) to No. 2 and No. 3 carrier (57).

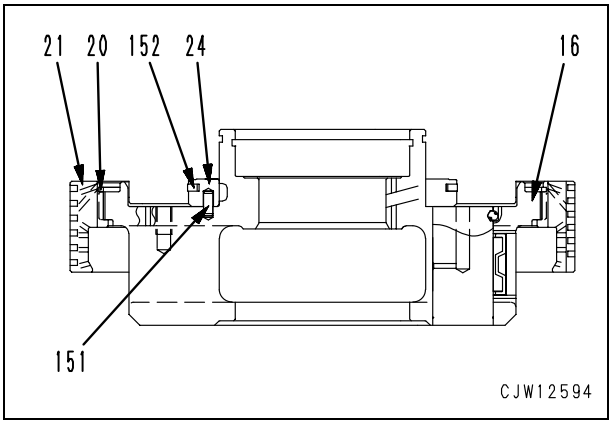


19. No. 1 carrier assembly and input shaft

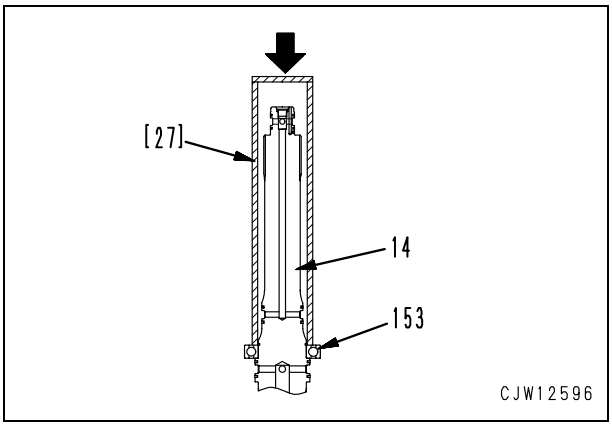
1) Assemble the input shaft and carrier assembly according to the following procedure.
   1] Install thrust washer (27), bearing (28) and planetary gear (29) to carrier (16).
   2] Install ball (26) to shaft (25) and then install them to carrier (16).



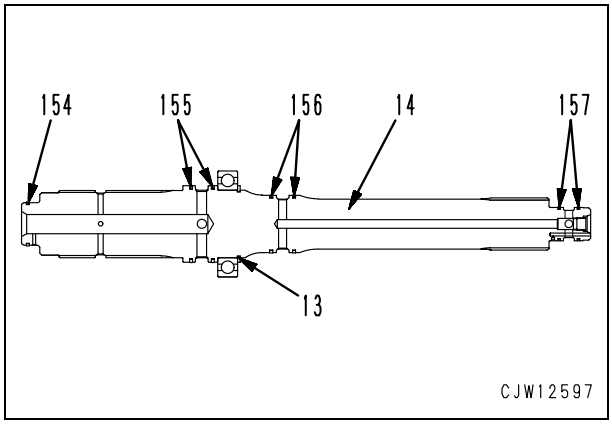
3] Drive 1 dowel pin (151) to carrier (16).
4] Install seal ring (gold) (152) to spacer (24).
Seal ring: **Grease (G2-LI)**
5] Install spacer (24) to carrier (16).
6] Install ring gear (21) and snap ring (20).



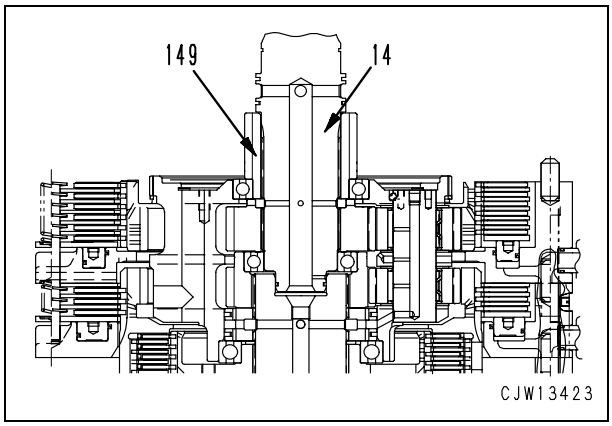
2) Assemble the input shaft according to the following procedure.
1] Using push tool [27] (Inside diameter: 71 mm), press fit bearing (153) to input shaft (14).



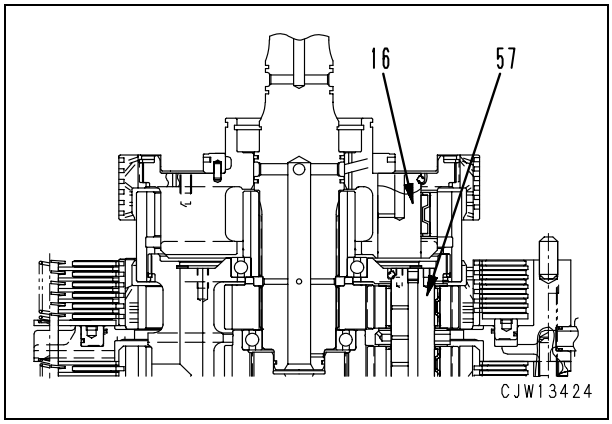
2] Install snap ring (13) to input shaft (14).
3] Install seal ring (154), 2 seal rings (155), 2 seal rings (156) and 2 seal ring (157) to input shaft (14).
Seal ring: **Grease (G2-LI)**



3) Install input shaft (14) to sun gear (149).

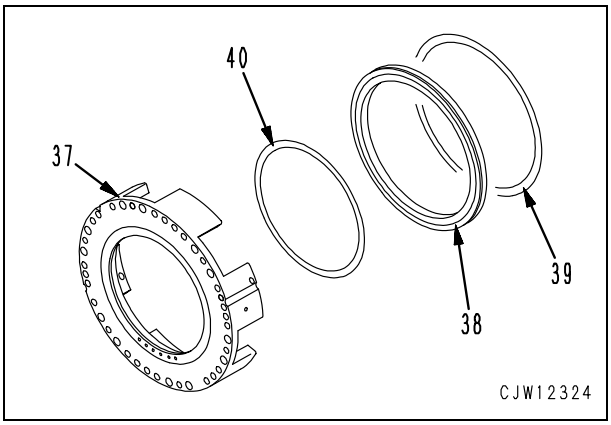


4) Install No. 1 carrier (16) to No. 2 and No. 3 carrier (57).

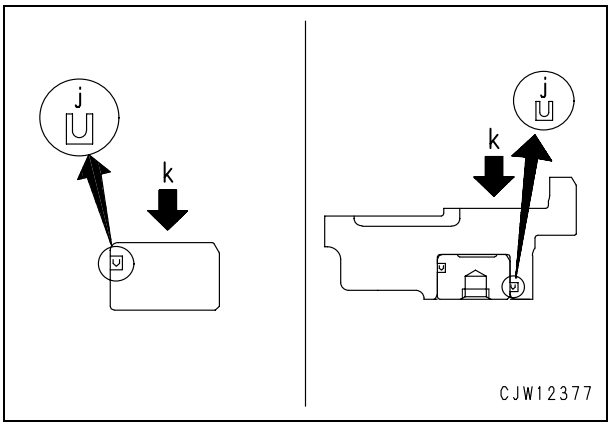


20. No. 1 piston housing

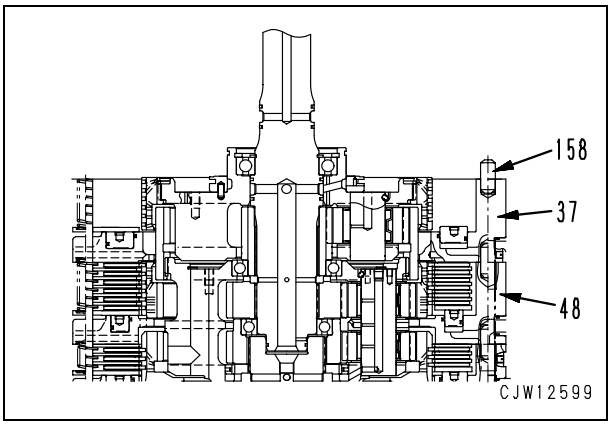
1) Install seal ring (40) to housing (37) and install seal ring (39) to piston (38).
   Seal ring: **Grease (G2-LI)**
2) Install piston (38) to housing (37).



★ Set groove (j) of the seal ring against direction (k) of the pressure.

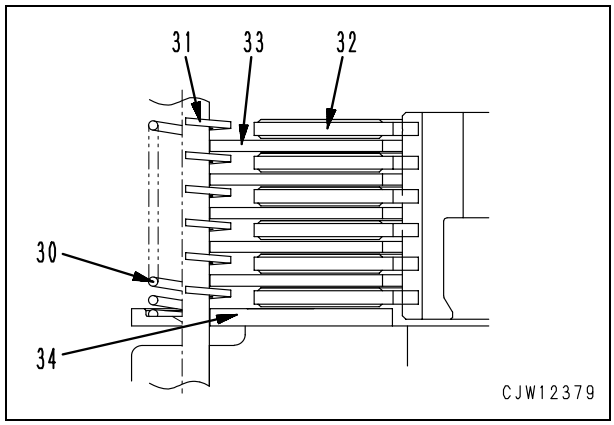


3) Using eyebolts (M18, P = 2.5 mm), install No. 1 piston housing (37) to No. 2 piston housing (48).
4) Drive in 2 dowel pins (158).



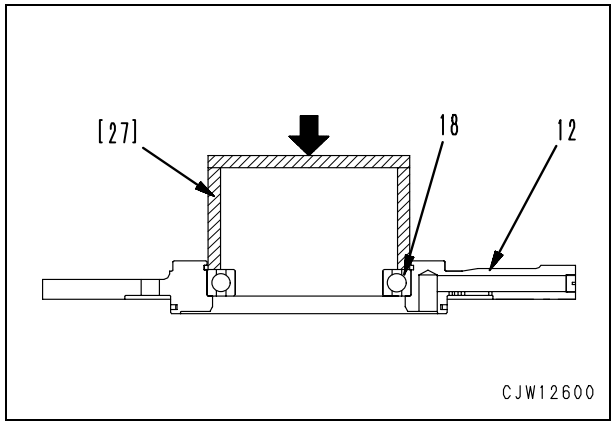
21. Discs, plates and springs

1) Install piston plate (34).
2) Install 6 discs (32), springs (31) and 5 plates (33) alternately.
3) Install spring (30).

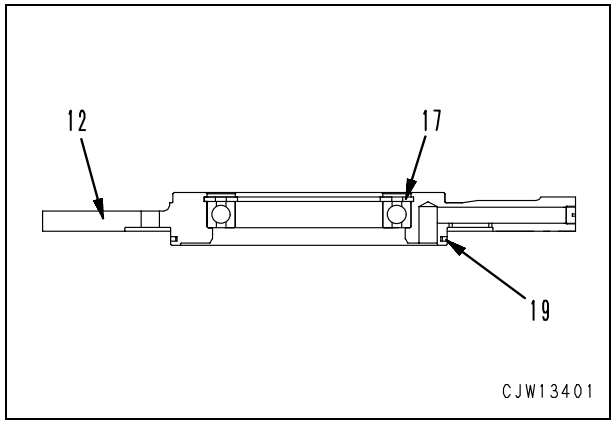


22. Housing

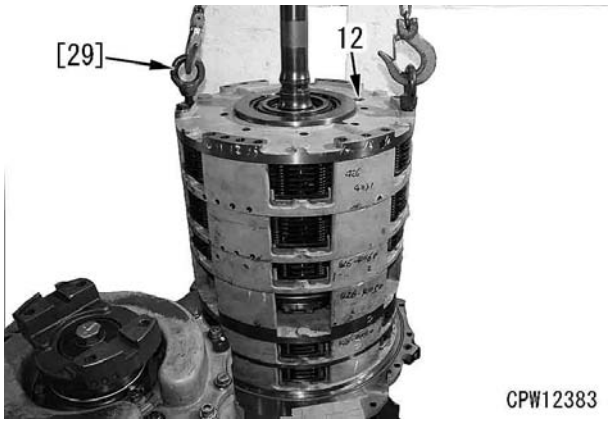
1) Using push tool [27] (Inside diameter: 131 mm), press fit bearing (18) to housing (12).

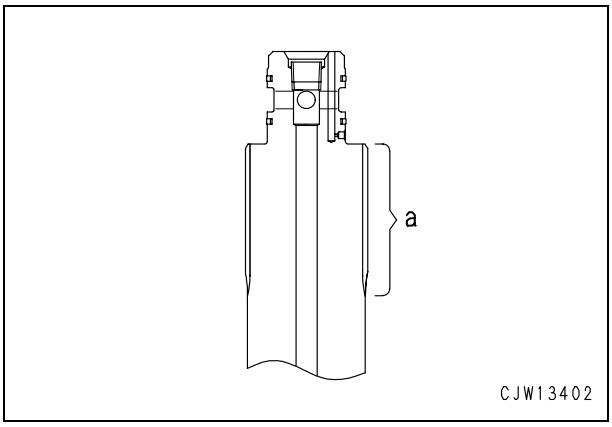


2) Install snap ring (17) to housing (12).
3) Install seal ring (gold) (19) to housing (12).
   Seal ring: **Grease (G2-LI)**

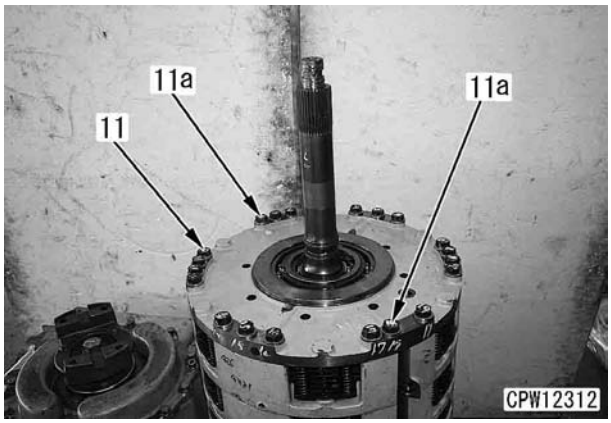


4) Install 2 eyebolts [29] (M10, P = 2.5 mm).
   ★ Stop tightening eyebolts [29] before they reach the housing.
5) Sling and install housing (12).
   Spline (a) of input shaft:
   Grease (LM-G)



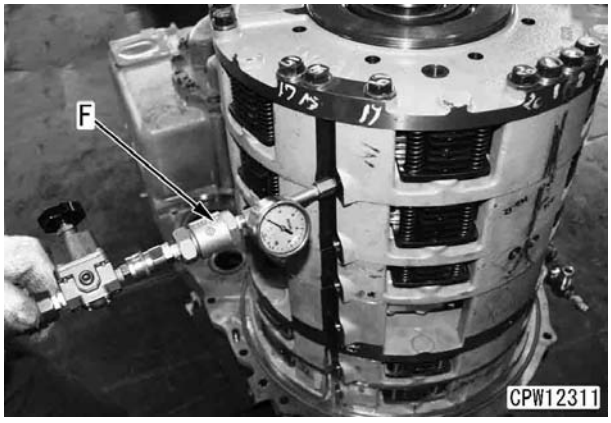


23. Tie bolts
Install 20 tie bolts (11).
★ If only the transfer assembly was disassembled, fix the clutch with 2 tie bolts (11a).
★ There are 2 short ones (11a) in the 20 tie bolts. Check their marks made when removed.
★ Tighten each tie bolt with the fingers until it reaches the tap hole so that it will not damage the cushion sleeve.
★ Use an impact wrench only after the threads are engaged perfectly.
Mounting bolt:
157 – 177 Nm {16 – 18 kgm}



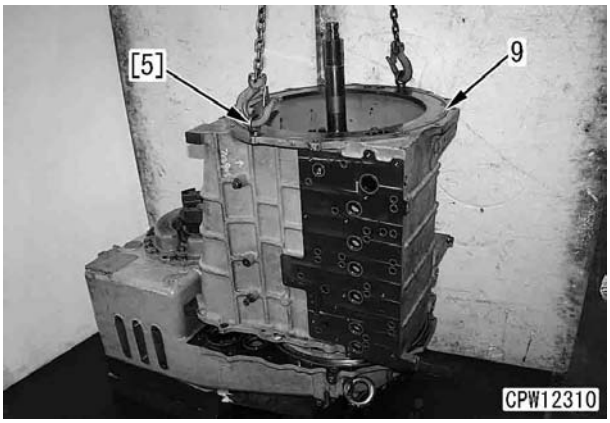
24. Check of operating condition of piston
Using tool **F**, check the operating condition of the piston before disassembling.
Air pressure: **0.29 – 0.49 MPa {3 – 5 kg/cm²}**

Piston (from above)	Stroke (mm)
No.1	6.1
No.2	6.1
No.3	4.2
No.4	8.1
No.5	3.7
No.6	3.7

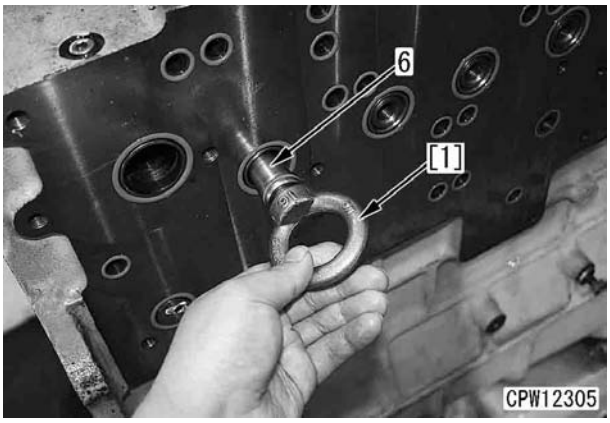


25. Transmission case

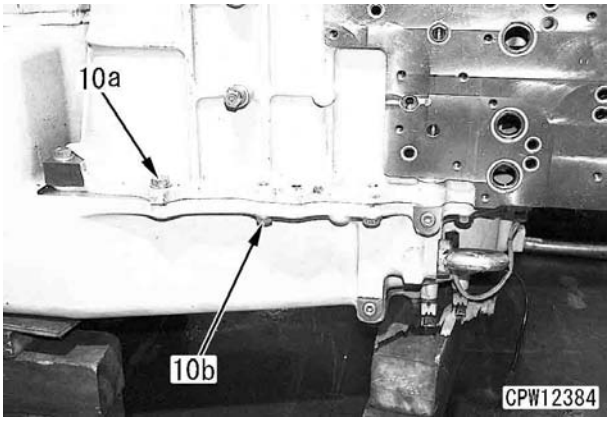
1) Using sling [5] (M12, P = 1.75 mm), install transmission case (9).
   Transmission case: **160 kg**



2) Using eyebolts [1] (M16, P = 2.0 mm), install 6 sleeves (6).



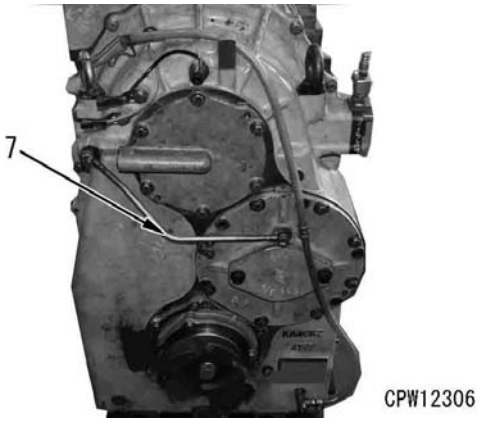
3) Install case mounting bolts (10a) and (10b).
   Mounting bolt:
   53.9 – 122.6 Nm {5.5 – 12.5 kgm}



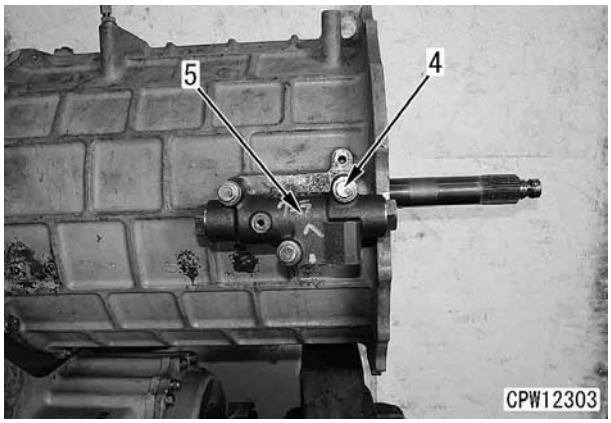
26. Related work

1) Sling the transmission and transfer assembly and set them on the side.
   Transmission and transfer assembly: **1,250 kg**

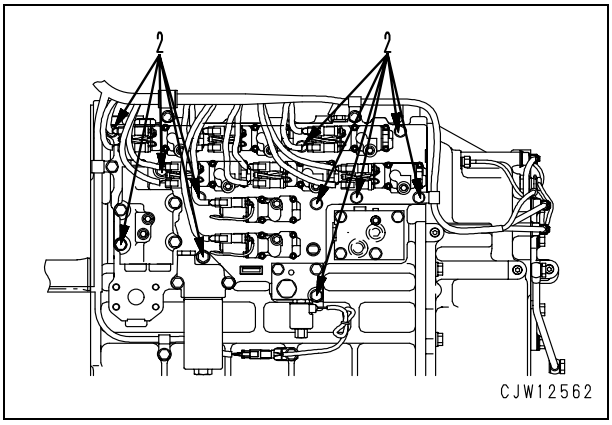
2) Install lubrication tube (7).
   Joint bolt:
   34.3 – 44.1 Nm {3.5 – 4.5 kgm}

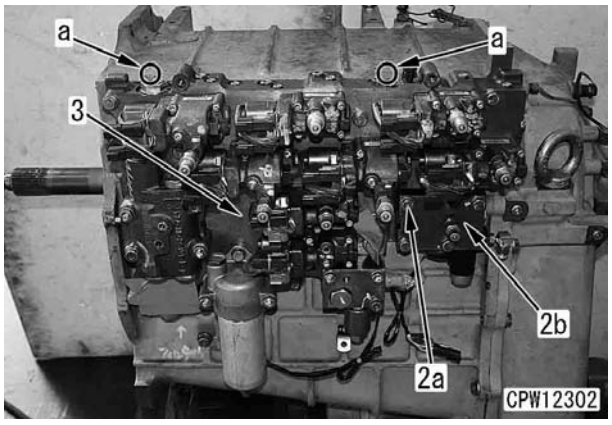


3) Install torque converter regulator valve (5).
   Mounting bolt (4):
   53.9 – 63.7 Nm {5.5 – 6.5 kgm}

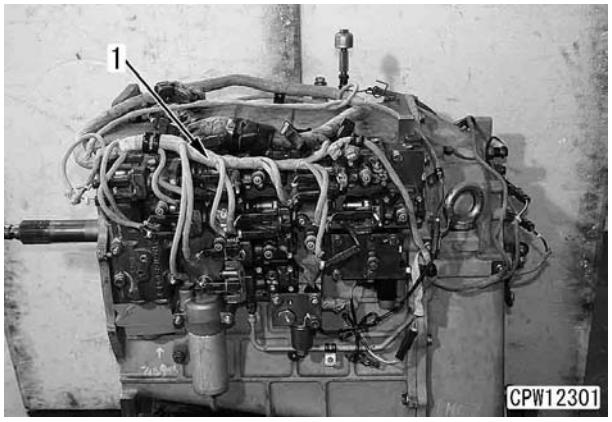


4) Fit the O-ring, install eyebolts (M10, P = 1.5mm) to part (a), and install transmission control valve assembly (3).
   - O-ring: **Grease (G2-LI)**
   - Mounting bolt (2): **44.1 – 53.9 Nm {4.5 – 5.5 kgm}**
   - Transmission control valve assembly: **65 kg**
5) Install lubrication valve assembly (2b) and tighten 4 mounting bolts (2a).





6) Install transmission wiring harness (1).



7) Install the torque converter assembly to the transmission assembly. For details, see “Disassembly and assembly of torque converter assembly”.

Disassembly and assembly of transfer assembly

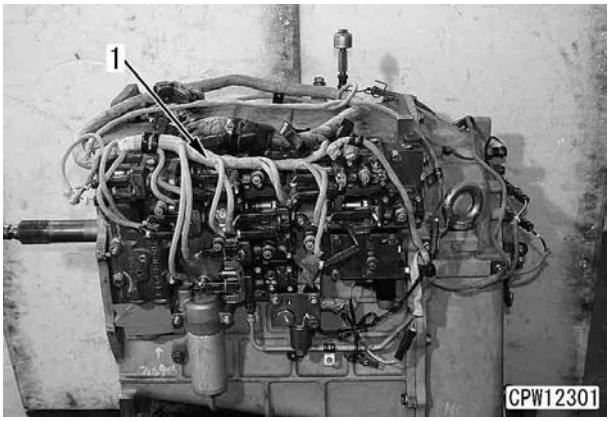
Special tool

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
F		799-301-1500	Oil leak tester	■	1		
G	1	793-615-1130	Spline wrench	■	1		
	2	796-730-2300	Wrench assembly	■	1		

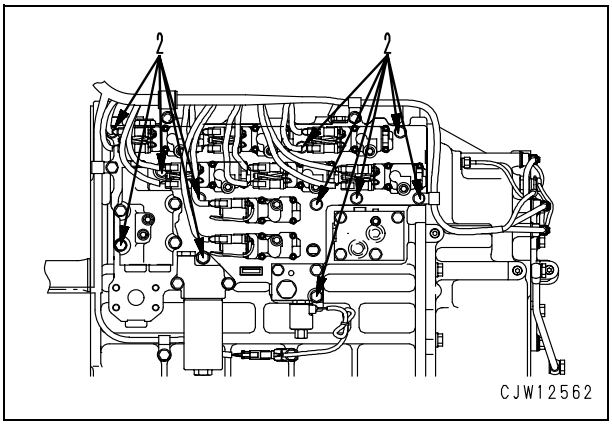
Disassembly

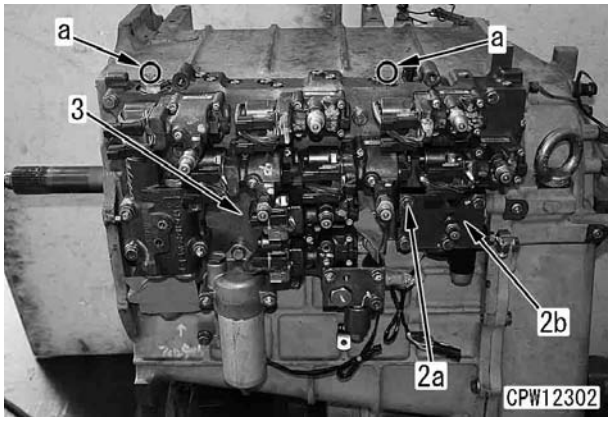
1. Preparation work

1) Disconnect the torque converter assembly from the transmission assembly. For details, see “Disassembly and assembly of torque converter assembly”.
2) Remove transmission wiring harness (1).

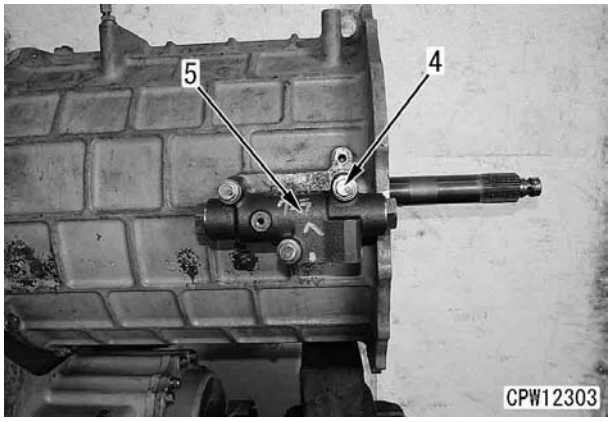


3) Install eyebolts (M10, P = 1.5 mm) to part (a) and sling the transmission control valve assembly.
4) Remove 11 transmission control valve assembly mounting bolts (2).
5) Lift off transmission control valve assembly (3).
   ★ Remove the O-ring, too.
   Transmission control valve assembly: **65 kg**
6) Remove 4 lubrication valve mounting bolts (2a) and lubrication valve assembly (2b).

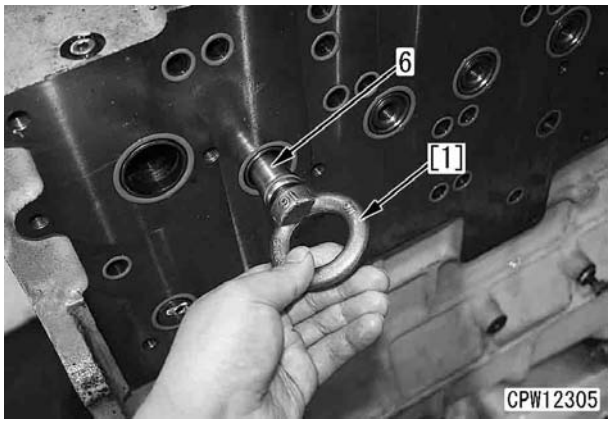




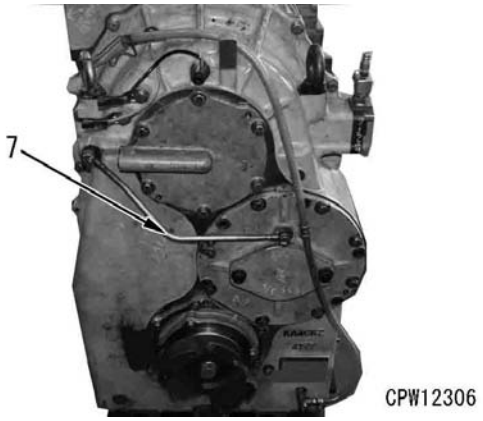
7) Remove 3 torque converter regulator mounting bolts (4) and torque converter regulator valve (5).



8) Using eyebolts [1] (M16, P = 2.0 mm), remove 6 sleeves (6).



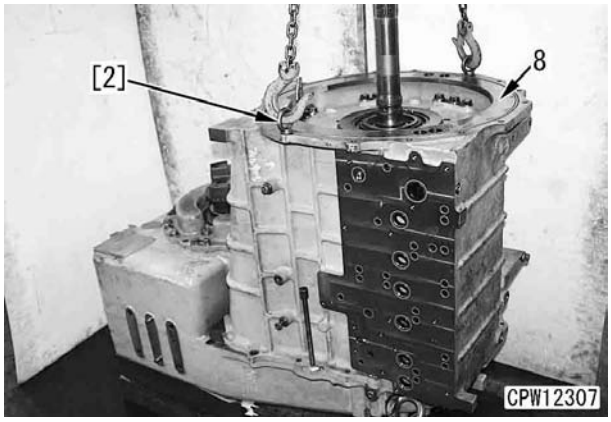
9) Remove lubrication tube (7).



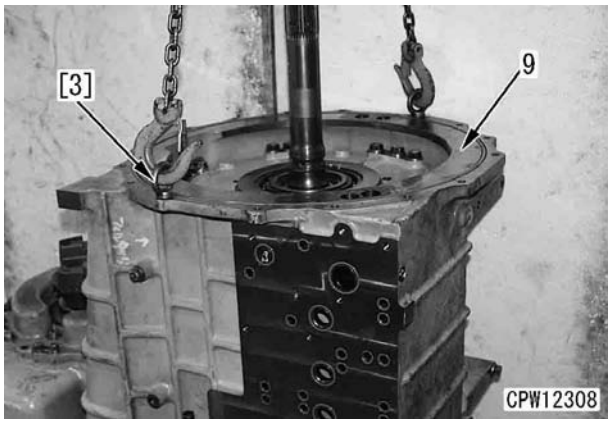
2. Transmission case

1) Using sling [2] (M12, P = 1.75 mm), sling transmission and transfer assembly (8).
2) Set transmission and transfer assembly (8) on the block with the transfer case down.

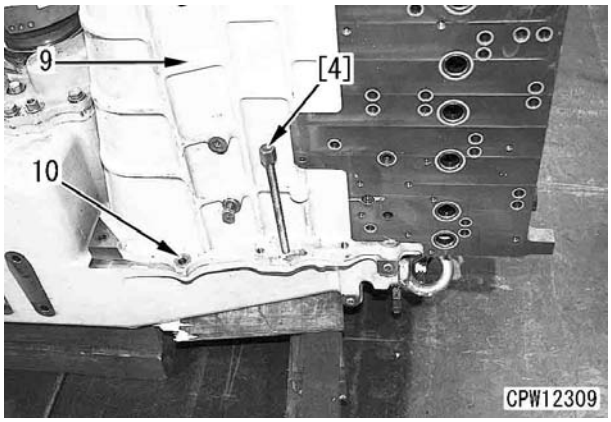
Transmission and transfer assembly: **1,250 kg**



3) Using sling [3] (M12, P = 1.75 mm), sling transmission case (9).

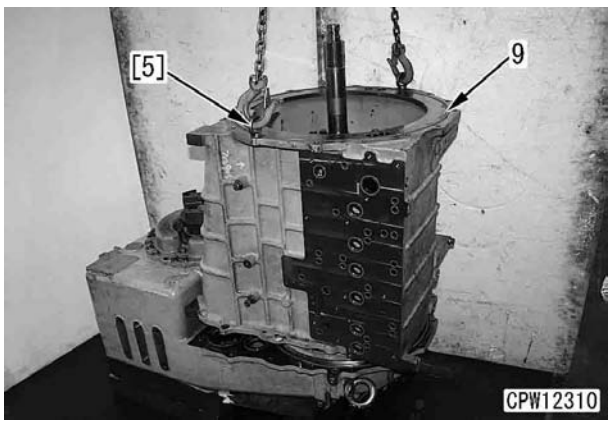


4) Remove 14 case mounting bolts (10).
5) Using 2 forcing screws [4] (M12, P = 1.75 mm), disconnect transmission case (9).



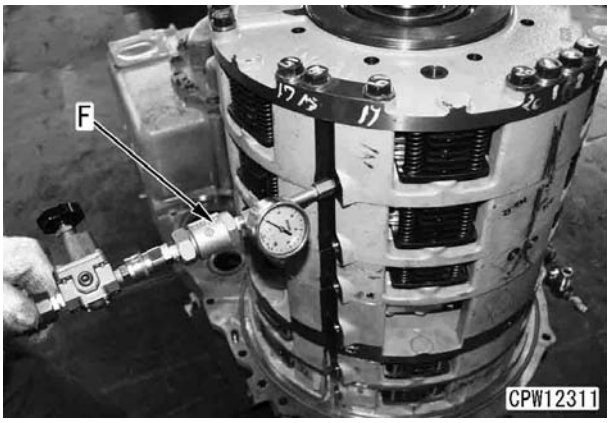
6) Using sling [5] (M12, P = 1.75 mm), remove transmission case (9).

Transmission case: **160 kg**

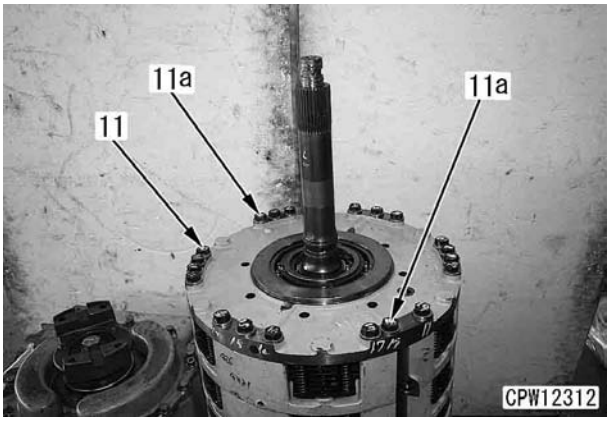


3. Check of operating condition of piston
Using tool **F**, check the operating condition of the piston before disassembling.
Air pressure: **0.29 – 0.49 MPa {3 – 5 kg/cm²}**

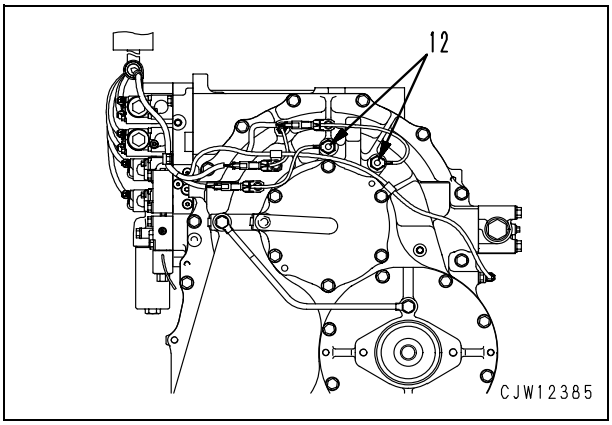
Piston (from above)	Stroke (mm)
No.1	6.1
No.2	6.1
No.3	4.2
No.4	8.1
No.5	3.7
No.6	3.7



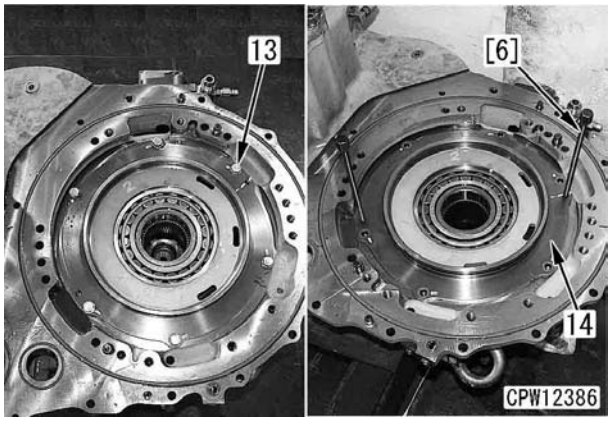
4. Tie bolts
1) Remove 18 tie bolts (11).
★ Since the transmission assembly is not disassembled at this time, leave 2 tie bolts (11a) to fix the sub-assembly.
★ Do not use an impact wrench to loosen the tie bolts, since it can damage the cushion sleeve.
2) Install 2 eyebolts (M10, P = 2.5 mm) to the tie bolt holes and lift off the transmission assembly.
Transmission assembly: **500 kg**



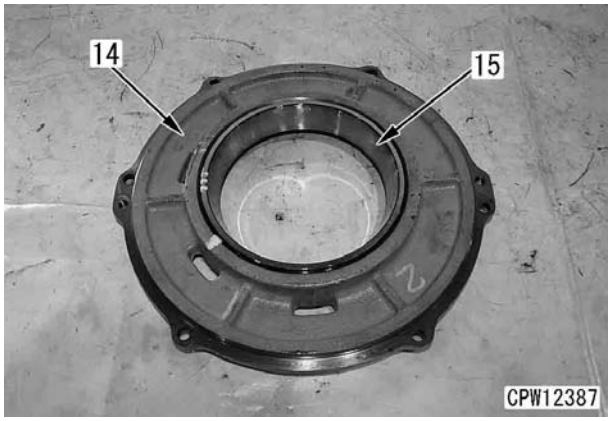
5. Remove speed sensors (12).



6. Input shaft bearing cage assembly
1) Remove 6 mounting bolts (13).
2) Using forcing screws [6] (M10, P = 1.5 mm), remove bearing cage assembly (14).

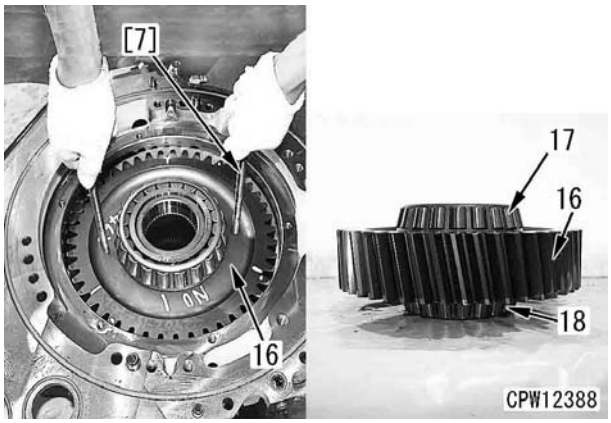


3) Remove outer race (15) from bearing cage assembly (14).



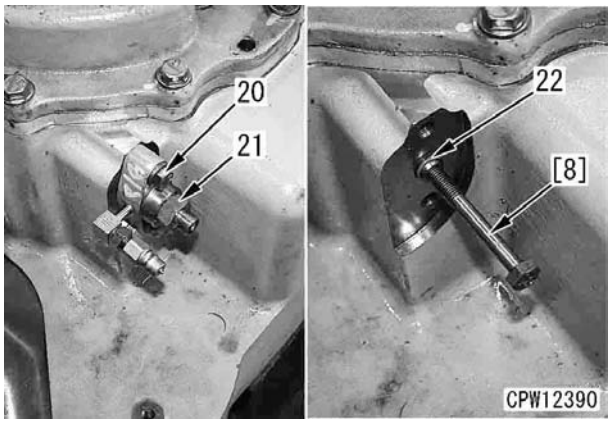
7. Input shaft gear assembly

1) Using forcing screws [7] (M12, P = 1.75 mm), remove input shaft gear assembly (16).
2) Remove bearings (17) and (18) from input shaft gear assembly (16).



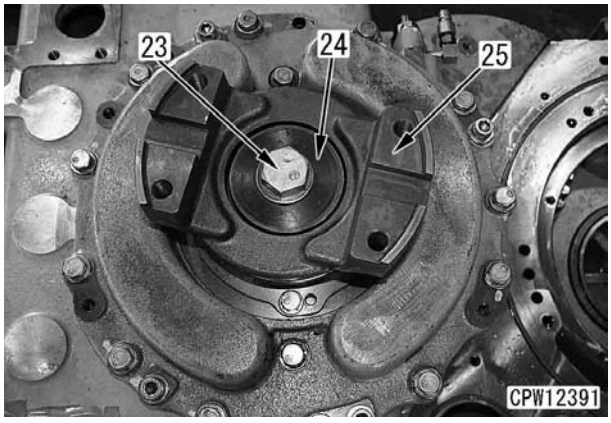
8. Parking brake emergency release valve

1) Reverse the case.
2) Remove mounting bolts (20) and parking brake emergency release valve (21).
3) Using forcing screws [8] (M10, P = 1.5 mm), remove sleeve (22).



9. Coupling (rear side)

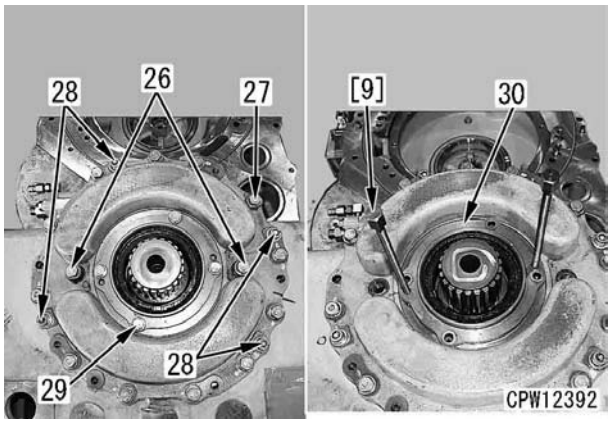
Remove mounting bolt (23), holder (24) and coupling (25).



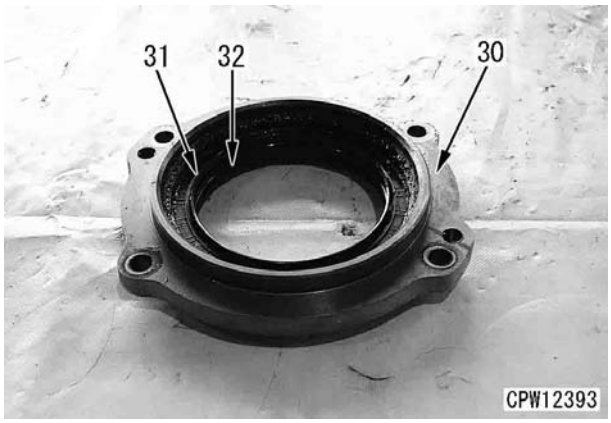
10. Parking brake assembly

★ For disassembly of the parking brake assembly, see “Disassembly and assembly of parking brake assembly”.

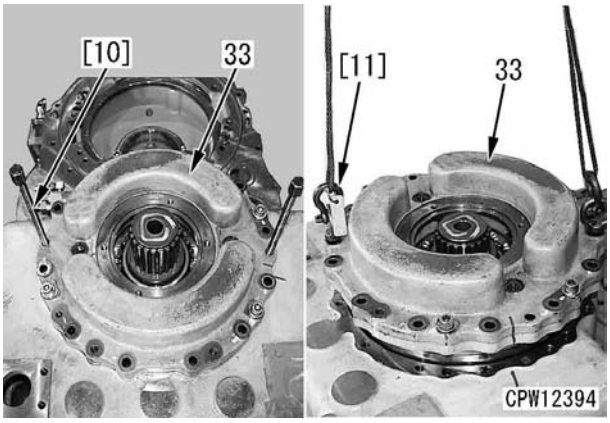
1) Remove 2 plugs (26) and tighten the mounting bolts.
   ★ Tighten the bolts alternately little by little.
   ★ Tighten the bolts to pull the piston.
2) Remove 12 mounting bolts (27).
   ★ Do not remove 4 hexagon socket head bolts (sub-assembly bolts) (28).
3) Remove 4 mounting bolts (29).
4) Using forcing screws [9], remove seal cage (30).



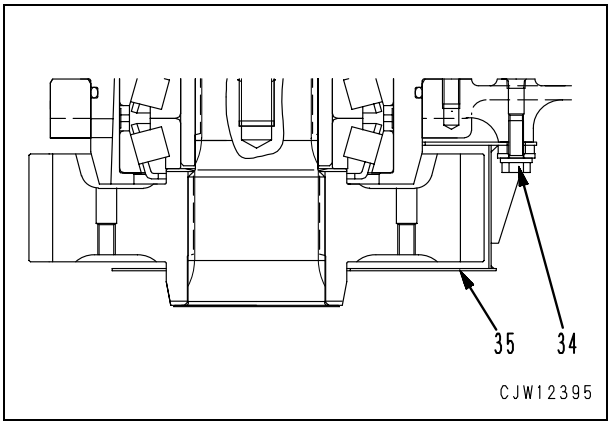
5) Remove oil seal (31) and dust seal (32) from seal cage (30).



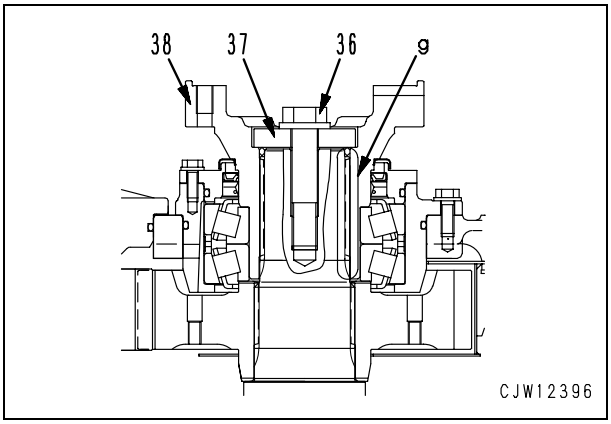
6) Using forcing screws [10] (M12, P = 1.75mm), disconnect parking brake assembly (33).
7) Using eyebolts [11], remove parking brake assembly (33).



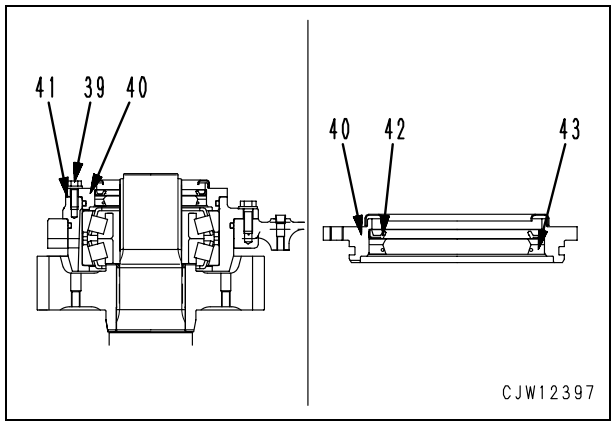
11. Gear cover
1) Remove 3 mounting bolts (34).
2) Move gear cover (35) aside.



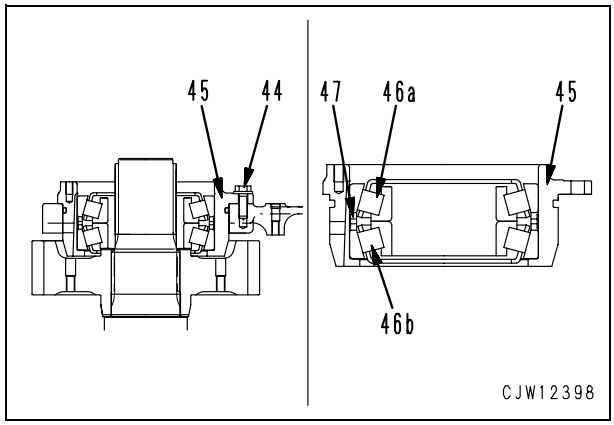
12. Coupling (front side)
Remove mounting bolt (36), holder (37) and coupling (38).



13. Seal cage
1) Remove 4 mounting bolts (39).
2) Remove seal cage (40).
3) Remove shim (41).
   ★ Check the quantity and thickness of the inserted shim.
4) Remove oil seal (43) and dust seal (42) from seal cage (40).

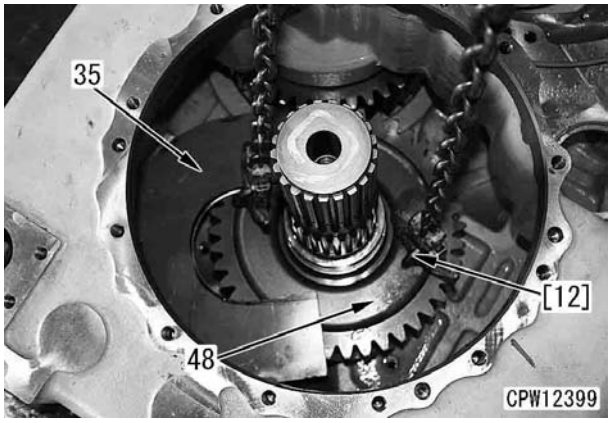


14. Input shaft bearing cage
1) Remove 6 mounting bolts (44).
2) Remove seal cage (45).
3) Remove bearings (46a) and (46b) and spacer (47) from seal cage (45).
   ★ Since the 2 bearings are not interchangeable, keep them as a set.

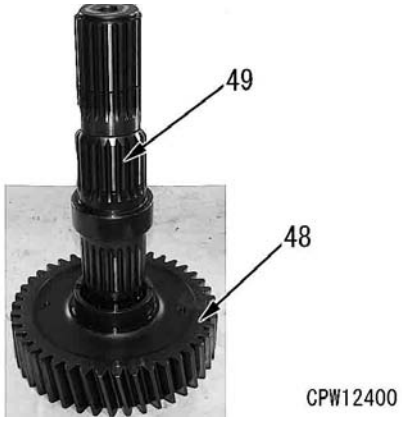


15. Output shaft gear
1) Using eyebolts [12] (M12, P = 1.75 mm), take out output shaft gear (48) and output shaft together.
   ★ Sling output shaft gear (48) around gear cover (35).

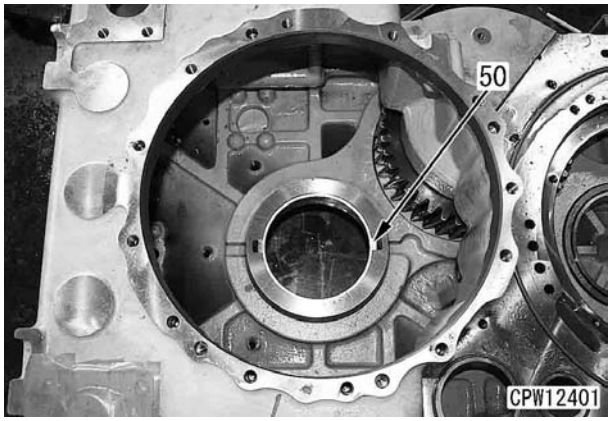
2) Remove gear cover (35).



3) Remove output shaft (49) from output shaft gear (48).

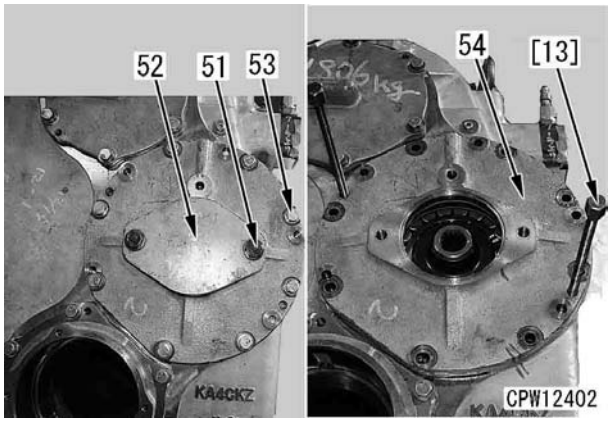


4) Remove outer race (50).

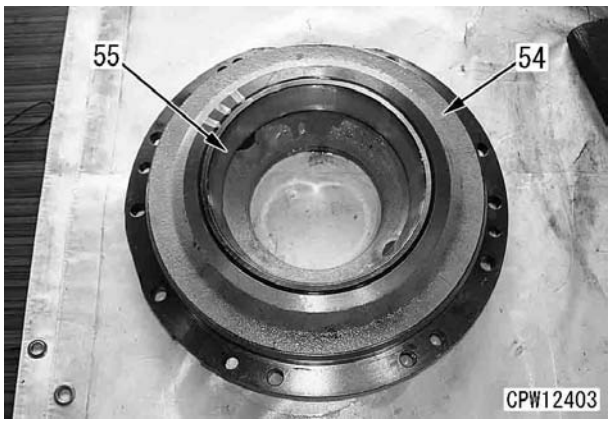


16. Intermediate shaft bearing cage assembly

1) Remove 2 mounting bolts (51).
2) Remove cover (52).
3) Remove 8 mounting bolts (53).
4) Using forcing screws [13] (M12, P = 1.75 mm), remove bearing cage assembly (54).
   ★ Check the quantity and thickness of the inserted shim.

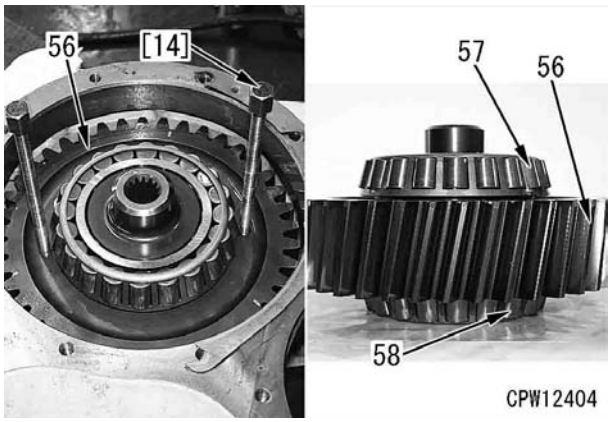


5) Remove outer race (55) from bearing cage assembly (54).

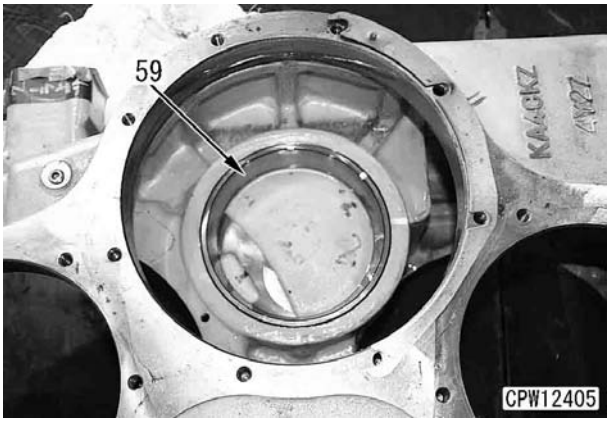


17. Intermediate shaft gear assembly

1) Using forcing screws [14] (M12, P = 1.75 mm), remove intermediate shaft gear assembly (56).
2) Remove bearings (57) and (58) from intermediate shaft gear assembly (56).

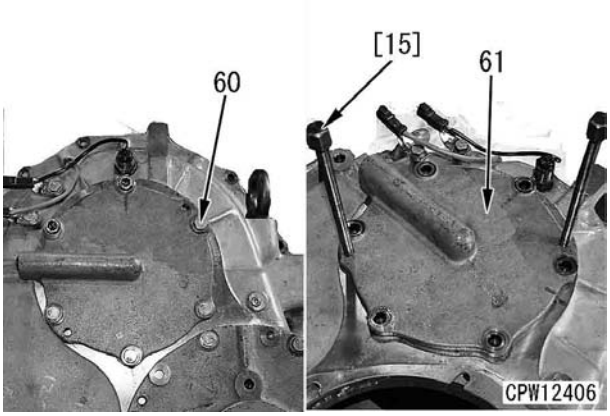


3) Remove outer race (59).

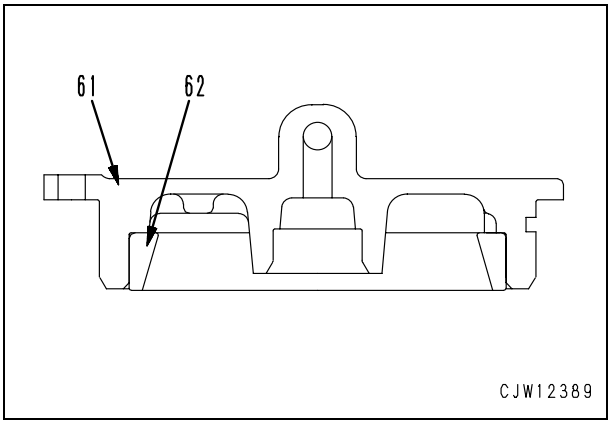


18. Cover (input shaft side)

1) Remove 6 mounting bolts (60).
2) Using forcing screw [15] (M12, P = 1.75 mm), remove cover (61).



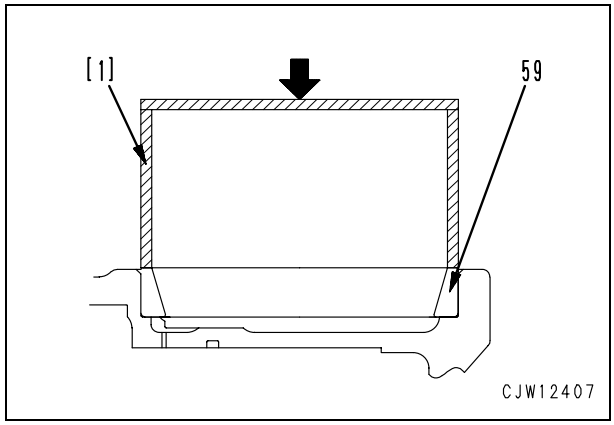
3) Remove outer race (62) from cover (61).



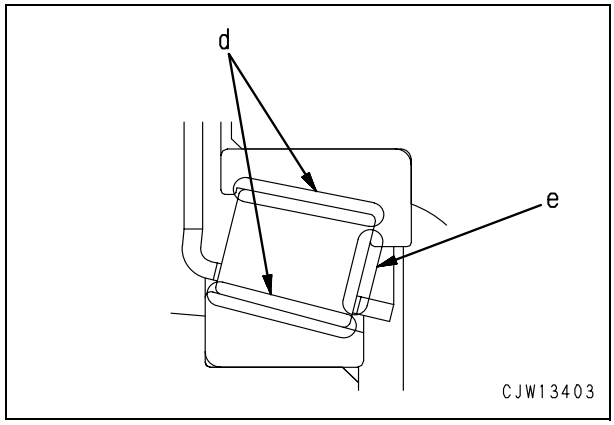
Assembly

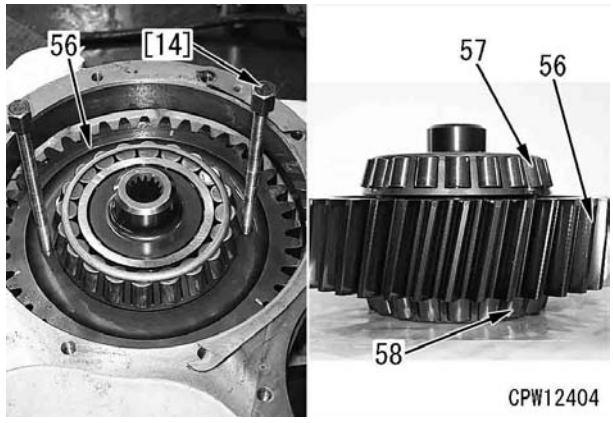
1. Intermediate shaft gear assembly

1) Outer race (intermediate shaft side)
Using push tool [1] (Outside diameter: 199 mm), press fit outer race (59) to the case.



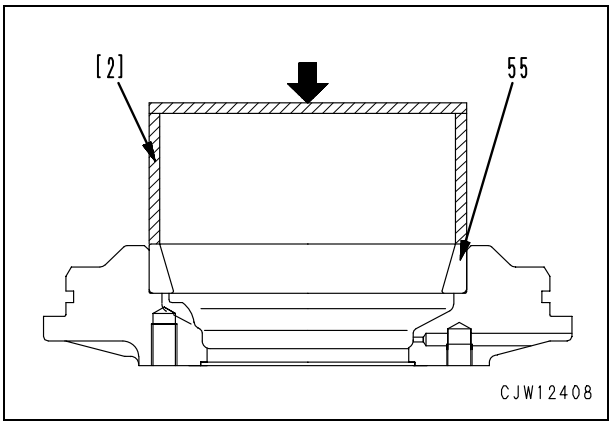
2) Install bearings (57) and (58) to intermediate shaft gear (56).
3) Apply grease to the roller surfaces of the bearing, rolling surfaces (d) of the inner and outer races, inner race flanges, and roller contact surface (e).
Parts (d) and (e) of bearing:
Grease (LM-G)
4) Using forcing screws [14] (M12, P = 1.75 mm), install intermediate shaft gear assembly (56).



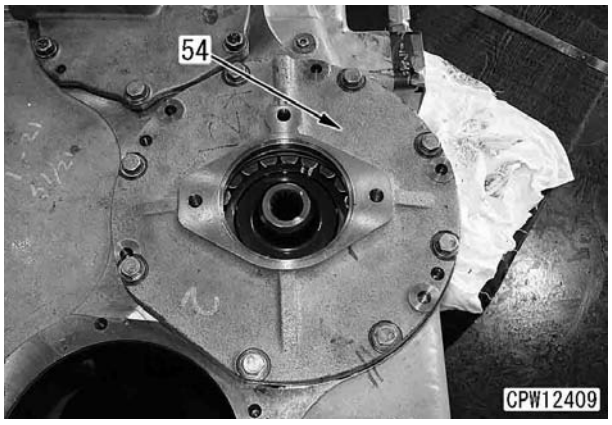


2. Intermediate shaft bearing cage assembly

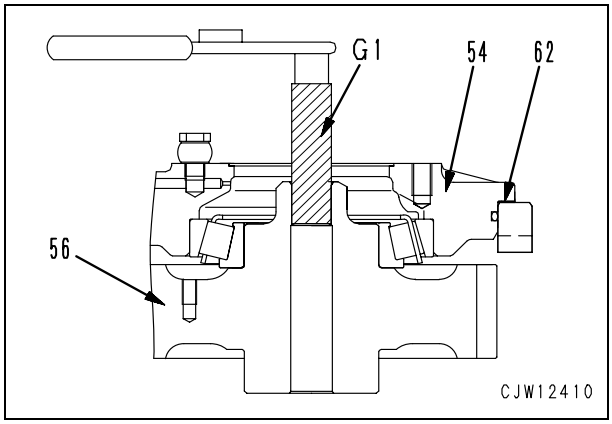
1) Using push tool [2] (Outside diameter: 199 mm), press fit outer race (55) to bearing cage (54).



2) Fit the O-ring and install intermediate shaft bearing cage assembly (54) without setting the shim.
O-ring: **Grease (G2-LI)**

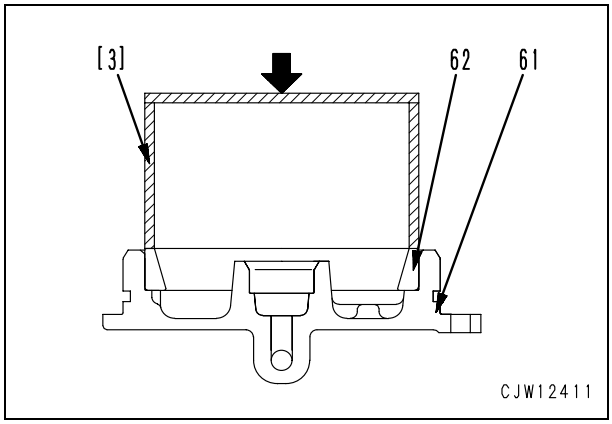


3) Adjustment of preload on intermediate shaft bearing
Adjust the shim of bearing cage (54) according to the following procedure.
1] Install bearing cage (54) without setting shim (62) and tighten the mounting bolts to **4.9 Nm {0.5 kgm}**.
★ Use all the mounting bolts.
2] Rotate intermediate shaft gear (56) 20 turns and check the tightening torque of **4.9 Nm {0.5 kgm}** for the mounting bolts.
3] If the tightening torque has changed, repeat 1] and 2] above.
4] If the tightening torque has not changed, set shim (62) (Standard thickness: 1 mm) and tighten the mounting bolts to the specified torque.
5] Using tool **G1** and a torque wrench, measure the rotation torque of intermediate shaft gear (56).
Rotation torque:
0.98 – 1.96 Nm {0.1 – 0.2 kgm}
Standard shim thickness: **1 mm**
Standard clearance: **0.63 – 1.37 mm**
★ Check that the gear has no play.
6] Adjust the quantity of the shims to set the rotation torque in the above range.
7] After finishing adjustment, tighten the mounting bolts to the specified torque.
★ After installing the bearing, drop about **6 cc** of transmission oil (**TO30**) onto it and revolve it about 10 turns.

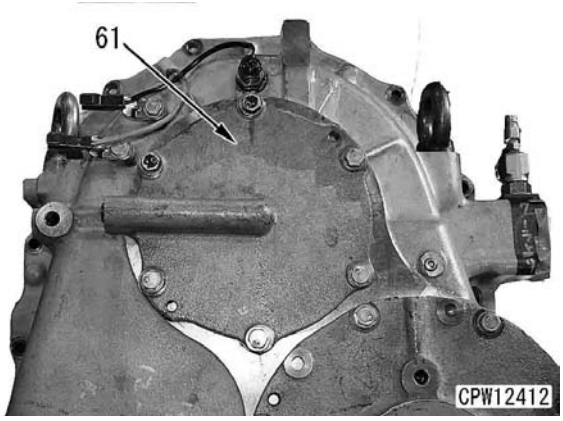


3. Cover (input shaft side)

1) Using push tool [3] (Outside diameter: 189 mm), press fit outer race (62) to bearing cage (61).

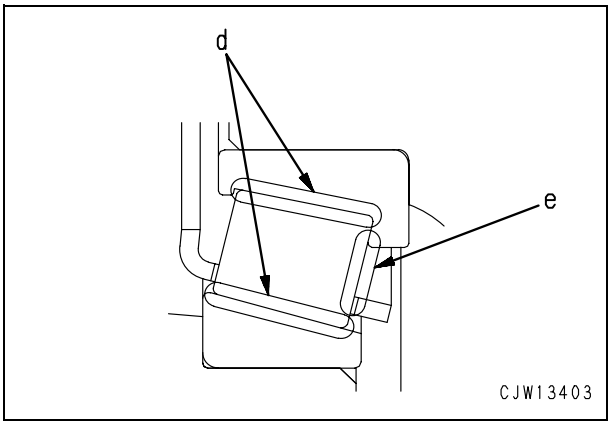


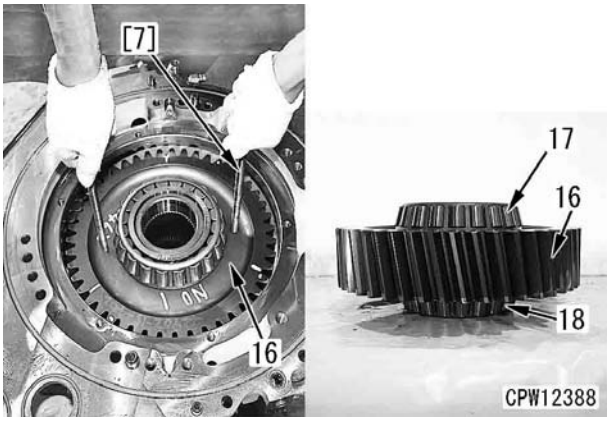
2) Fit the O-ring and install cover (61) without setting the shim.
   - O-ring: **Grease (G2-LI)**
   - ★ Tighten the bolts temporarily at this time.



4. Input shaft gear assembly

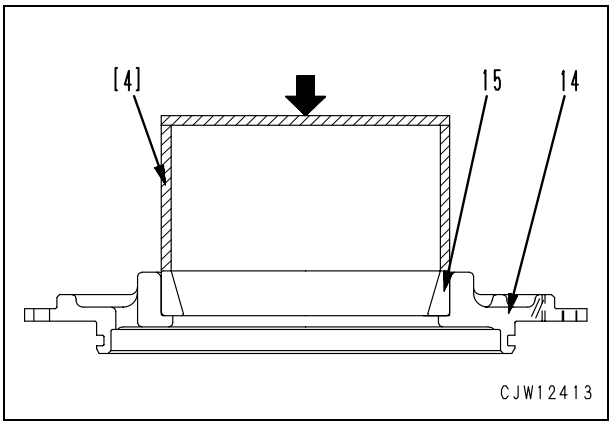
1) Press fit bearings (17) and (18) to input shaft gear (16).
2) Apply grease to the roller surfaces of the bearing, rolling surfaces (d) of the inner and outer races, inner race flanges, and roller contact surface (e).
   - Parts (d) and (e) of bearing: **Grease (LM-G)**
3) Using forcing screws [7] (M12, P = 1.75 mm), install input shaft gear (16).



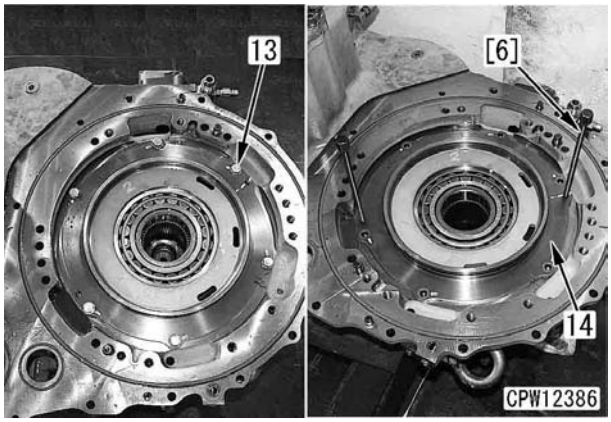


5. Bearing cage assembly (input shaft gear side)

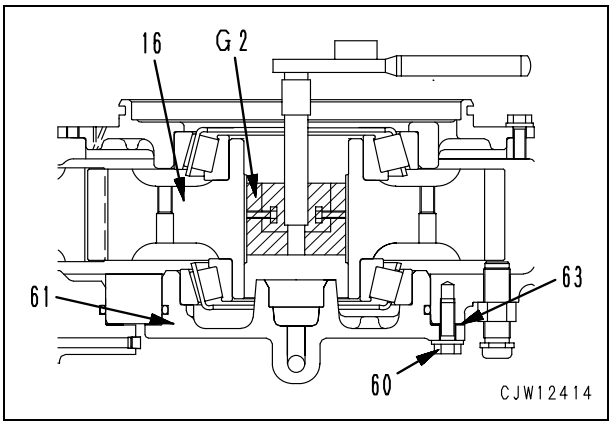
1) Using push tool [4] (Outside diameter: 199 mm), press fit outer race (15) to bearing cage (14).



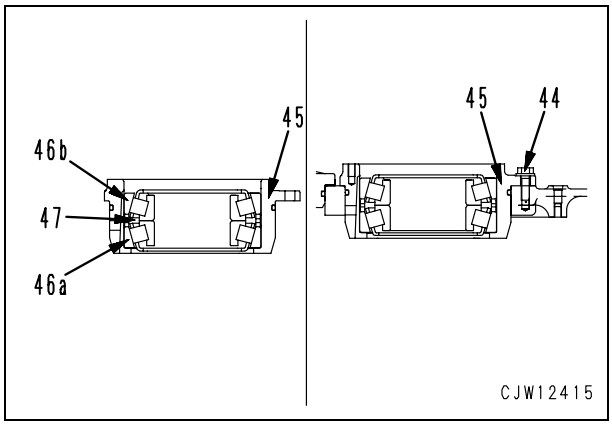
2) Using forcing screws [6] (M12, P = 1.75 mm), install input shaft bearing cage assembly (14).
3) Install 6 mounting bolts (13).
   - Mounting bolt: **Adhesive (LT-2)**



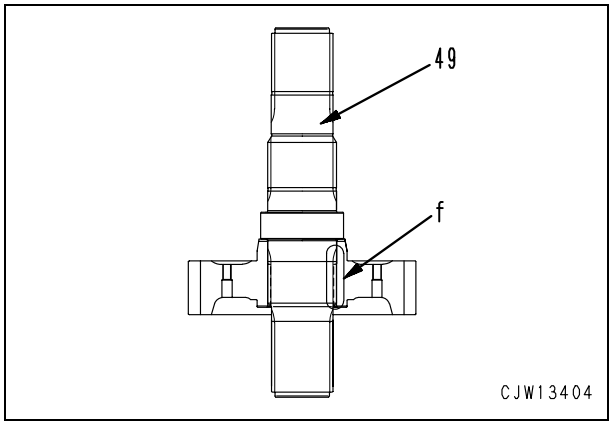
4) Adjustment of preload on input shaft bearing
Adjust the shim of bearing cage (61) according to the following procedure.
★ Since the preload on the input shaft bearing is adjusted without removing the intermediate shaft bearing, the rotation torque is roughly doubled.
1] Install bearing cage (61) without setting shim (63) and tighten the mounting bolts to **4.9 Nm {0.5 kgm}**.
★ Use all the mounting bolts.
2] Rotate input shaft gear (16) 20 turns and check the tightening torque of **4.9 Nm {0.5 kgm}** for mounting bolts (60).
3] If the tightening torque has changed, repeat 1] and 2] above.
4] If the tightening torque has not changed, set shim (63) (Standard thickness: 1.1 mm) and tighten the mounting bolts to the specified torque.
5] Using tool **G2** and a torque wrench, measure the rotation torque of intermediate shaft gear (16).
Rotation torque:
1.96 – 3.92 Nm {0.2 – 0.4 kgm}
Standard shim thickness: **1.1 mm**
Standard clearance: **0.85 – 1.70 mm**
★ Check that the gear has no play.
6] Adjust the quantity of the shims to set the rotation torque in the above range.
7] After finishing adjustment, tighten the mounting bolts to the specified torque.



6. Bearing cage assembly (output shaft side)
1) Using the push tool, press fit outer race (46a), spacer (47) and bearing (46b) to bearing cage (45).
2) Fit the O-ring and install bearing cage assembly (45).
O-ring: **Grease (G2-LI)**
3) Install 6 mounting bolts (44).



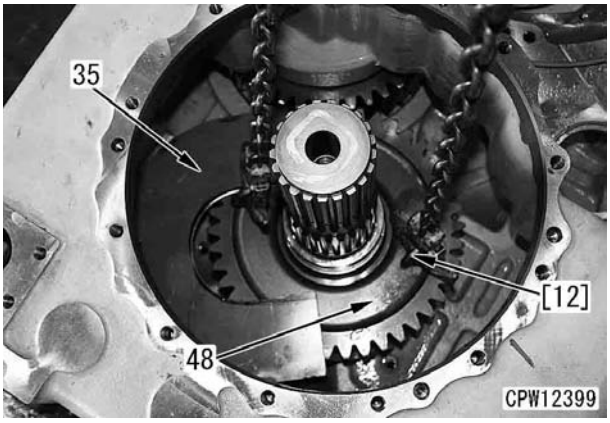
7. Output shaft gear assembly
1) Apply grease to spline (f) of output shaft (49).
Spline (f) of shaft: **Grease (LM-G)**



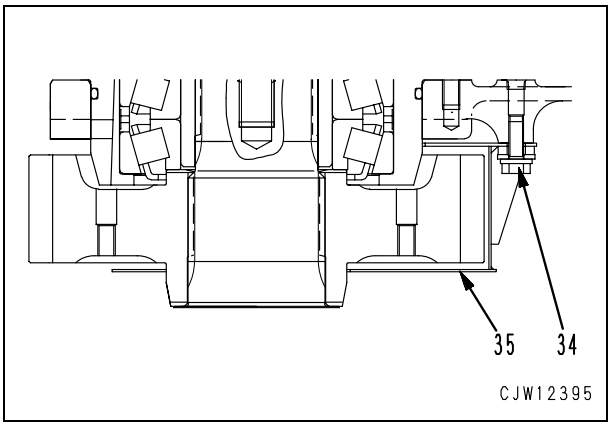
2) Install output shaft (49) to output shaft gear (48).



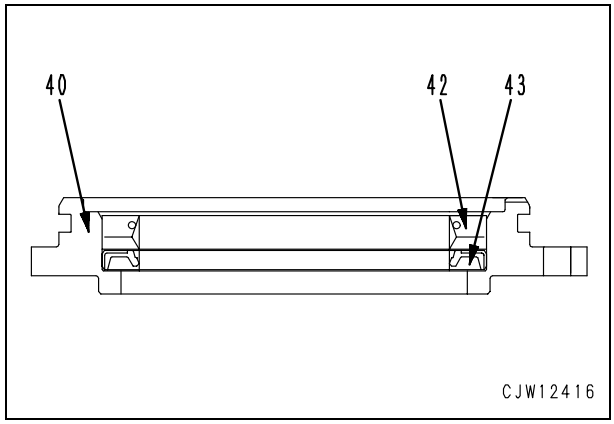
3) Put gear cover (35) in the case.
4) Using sling [12], sling and install output shaft gear (48).
   ★ Sling output shaft gear (48) around gear cover (35).

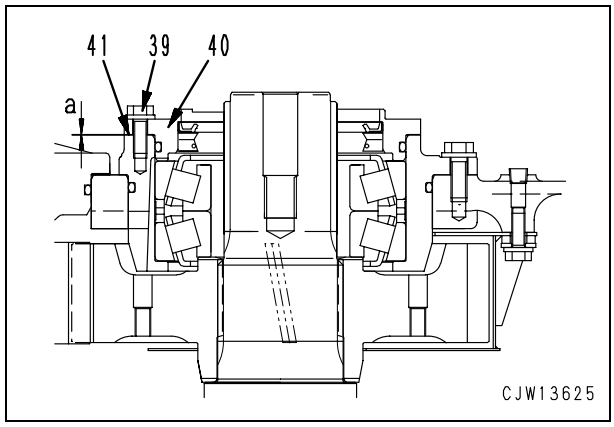


5) Set gear cover (35) and install 3 mounting bolts (34).
   Mounting bolt: **Adhesive (LT-2)**

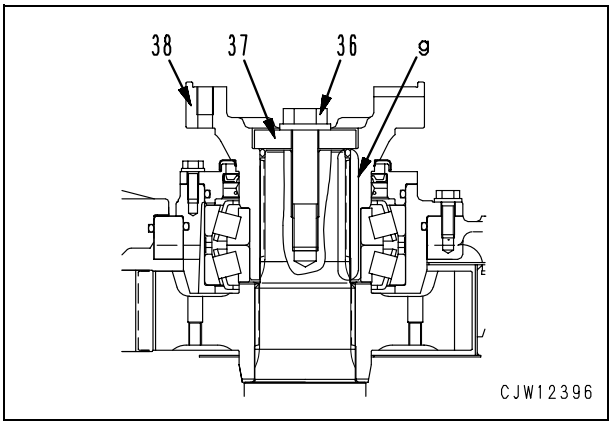


8. Seal cage assembly (output shaft side)
1) Using the push tool, press fit oil seal (43) and dust seal (42) to seal cage (40).
   Oil seal: **Grease (G2-LI)**
   Press fitting face of oil seal: **Gasket sealant (LG-5)**
   Dust seal: **Grease (G2-LI)**
   Mating faces of oil seal and dust seal: **Grease (G2-LI)**
   ★ Apply the gasket sealant thinly to the inside of the housing hole and wipe off the projected part.
2) Adjust the shim according to the following procedure.
   1] Fit the O-ring and install seal cage (40) without setting the shim.
      O-ring: **Grease (G2-LI)**
   2] Install the coupling temporarily and rotate the shaft about 20 turns.
   3] Tighten mounting bolts (39) to **0.49 – 0.98 Nm {0.05 – 0.10 kgm}**.
   4] Using the thickness gauge, measure clearance (a) between seal cage (40) and mounting face.
      Shim thickness (b):
      a – (0.05 to 0.10 mm)
   5] Install shim (41) of thickness (b) obtained by the above step and tighten mounting bolts (39).
      Shim thickness: **0.15**, **0.2**, **0.5 mm**
   6] After adjusting the shim, tighten mounting bolts (39) to the specified torque.





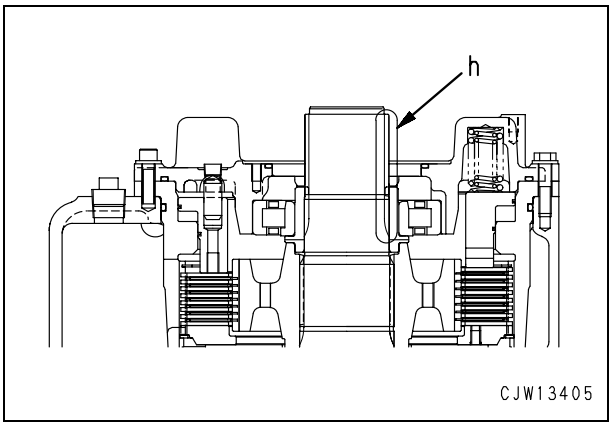
9. Coupling (front side)
1) Apply grease to spline (g) of the shaft.
   Spline (g) of shaft: **Grease (LM-G)**
2) Fit the O-ring and press fit coupling (38).
3) Install holder (37) and bolt (36).
   O-ring: **Grease (G2-LI)**
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt: **824 – 1,030 Nm {84 – 105 kgm}**



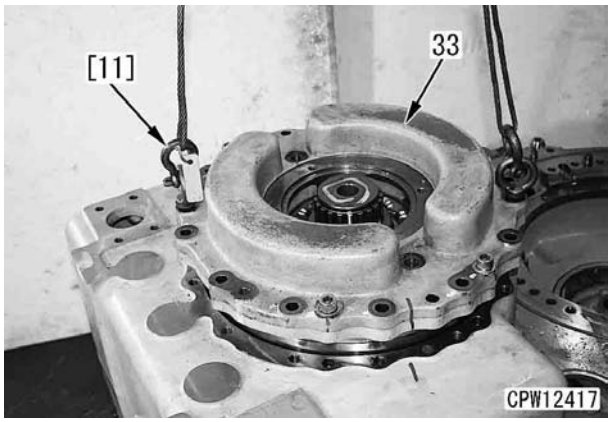
10. Parking brake assembly

★ For assembly of the parking brake assembly, see "Disassembly and assembly of parking brake assembly".

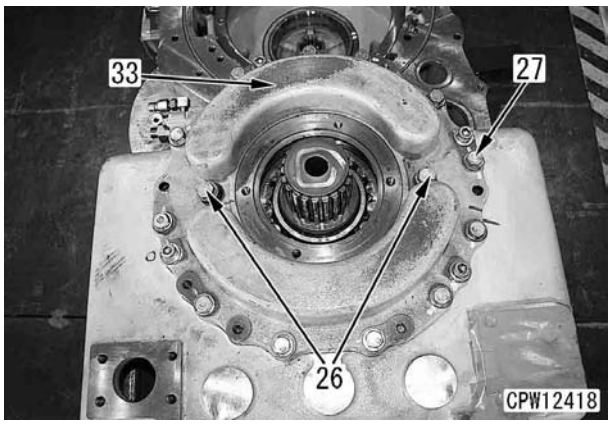
1) Apply grease to spline (h) of the shaft.
   Spline (h) of shaft: **Grease (LM-G)**



2) Using eyebolts [11], install parking brake assembly (33).

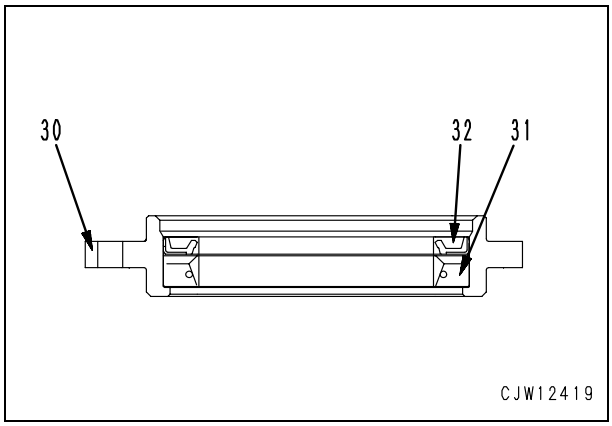


3) Install 12 mounting bolts (27).
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt:
   98.0 – 123 Nm {10.0 – 12.5 kgm}
4) Remove the bolts which have been clamping the piston and install 2 plugs (26).

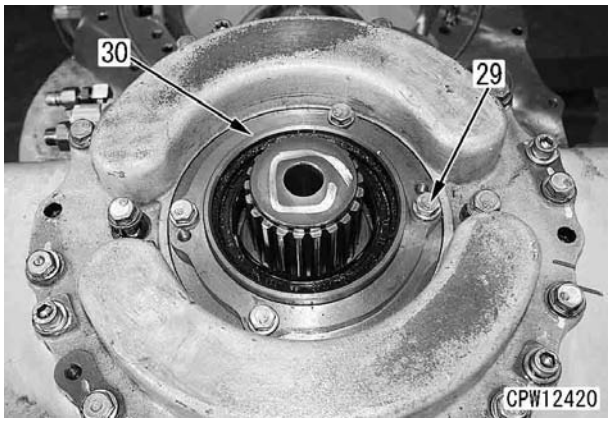


5) Using the push tool, press fit oil seal (31) and dust seal (32) to seal cage (30).
   Oil seal: **Grease (G2-LI)**
   Dust seal: **Grease (G2-LI)**
   Press fitting face of oil seal:
   Gasket sealant (LG-5)
   Mating faces of oil seal and dust seal: **Grease (G2-LI)**

★ Apply the gasket sealant thinly to the inside of the housing hole and wipe off the projected part.



6) Fit the O-ring, install seal cage (30), and tighten 4 mounting bolts (29).
   O-ring: **Grease (G2-LI)**



11. Coupling (rear side)

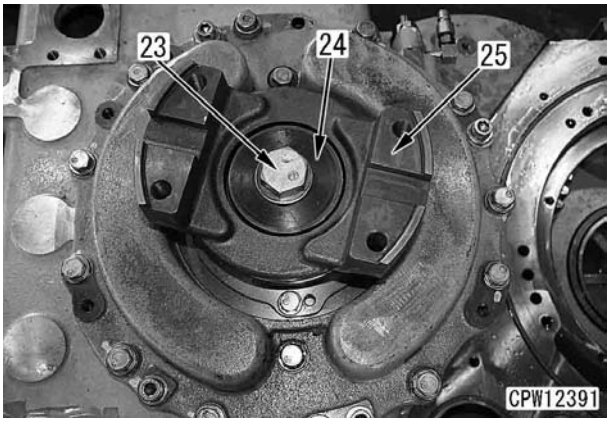
Fit the O-ring and install coupling (25), holder (24) and bolt (23).

★ Set coupling (25) to the position of the coupling on the opposite side.

O-ring: **Grease (G2-LI)**

Mounting bolt:

824 – 1,030 Nm {84 – 105 kgm}



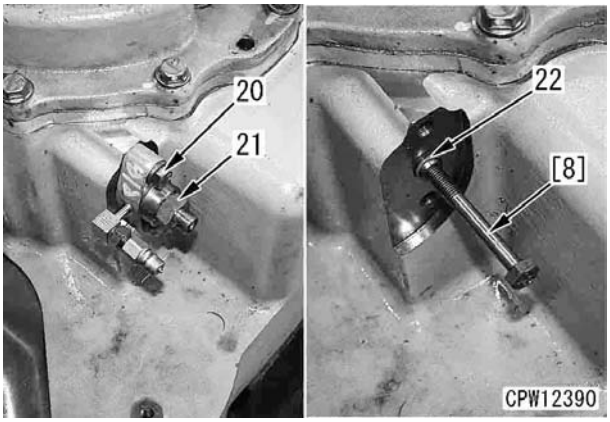
12. Parking brake emergency release valve

1) Fit the O-ring and install sleeve (22), using forcing screws [8].

O-ring: **Grease (G2-LI)**

2) Fit the O-ring, install parking brake emergency release valve (21) and tighten mounting bolts (20).

O-ring: **Grease (G2-LI)**



13. Speed sensor

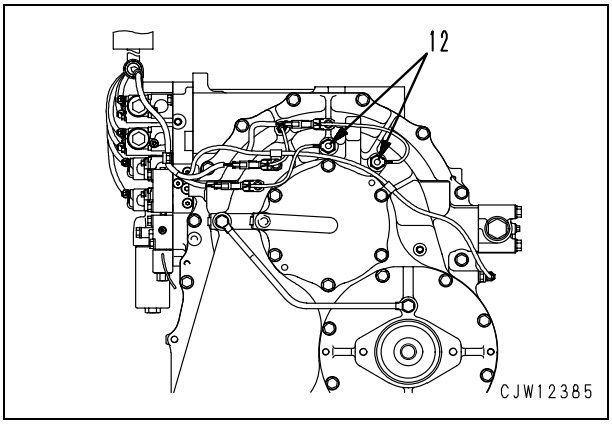
1) Install speed sensors (12).

★ Take care that the direction of the sensor wiring harness outlet will not be opposite to the mounting direction of the connector.

Between case and threaded part of speed sensor: **Adhesive (LG-5)**

Locknut:

49.0 – 68.6 Nm {5 – 7 kgm}



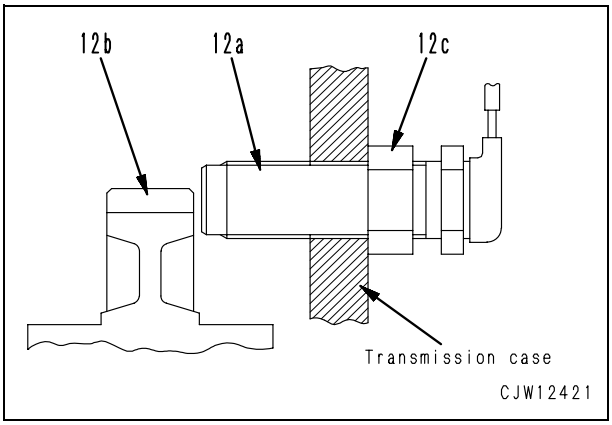
2) Method of adjusting speed sensor

1] Tighten speed sensor (12a) until it touches gear (12b) and then return it by 1/2 – 1 turn.

2] Tighten locknut (12c).

Locknut:

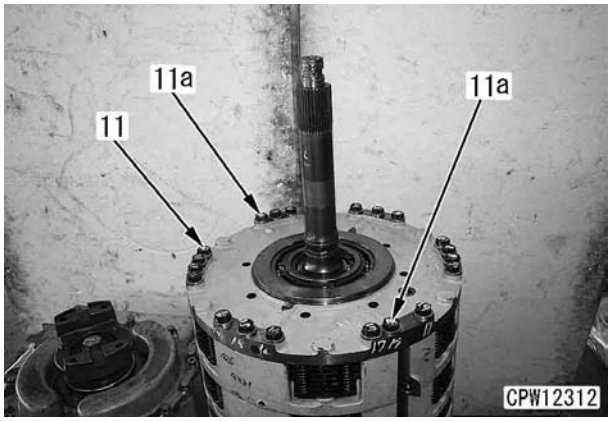
49.0 – 68.6 Nm {5 – 7 kgm}



14. Tie bolts

1) Install 2 eyebolts (M10, P = 2.5 mm) to the tie bolt holes and sling and install the transmission assembly.
   Transmission assembly: **500 kg**
2) Install 20 tie bolts (11).
   - ★ Use 2 tie bolts (11a) to fix the transmission as a sub-assembly.
   - ★ There are 2 short ones (11a) in the 20 tie bolts. Check their marks made when removed.
   - ★ Tighten each tie bolt with the fingers until it reaches the tap hole so that it will not damage the cushion sleeve.
   - ★ Use an impact wrench only after the threads are engaged perfectly.

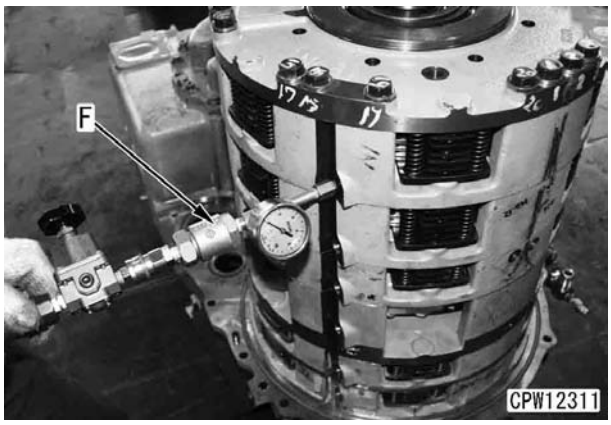
   Mounting bolt:
   157 – 177 Nm {16 – 18 kgm}



15. Check of operating condition of piston

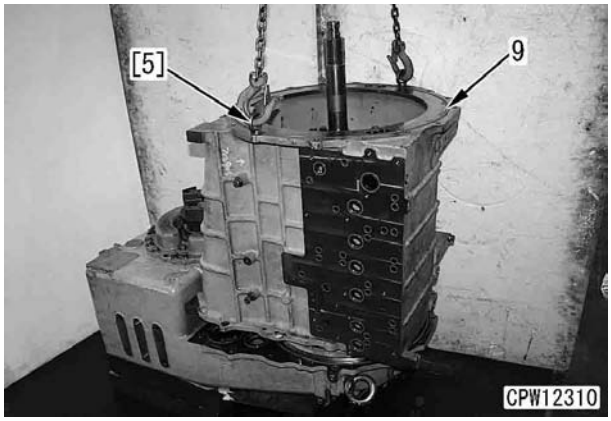
Using tool **F**, check the operating condition of the piston.
Air pressure: **0.29 – 0.49 MPa {3 – 5 kg/cm²}**

Piston (from above)	Stroke (mm)
No.1	6.1
No.2	6.1
No.3	4.2
No.4	8.1
No.5	3.7
No.6	3.7

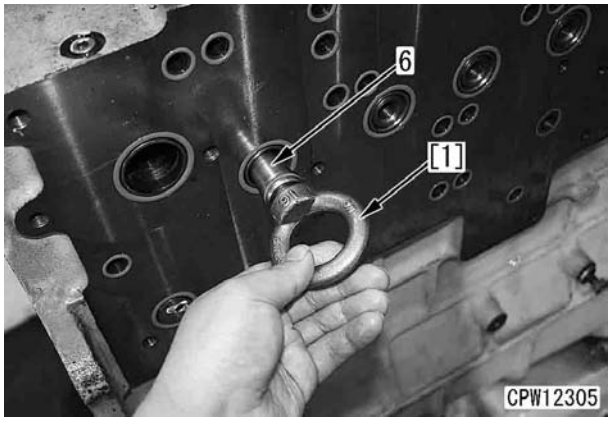


16. Transmission case

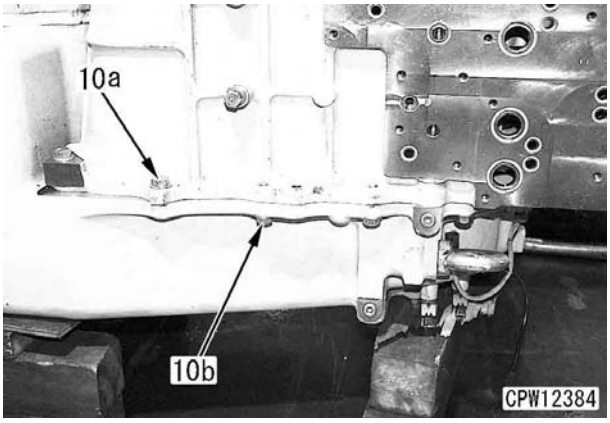
1) Using sling [5] (M12, P = 1.75 mm), install transmission case (9).
   Transmission case: **160 kg**



2) Using eyebolts [1] (M16, P = 2.0 mm), install 6 sleeves (6).

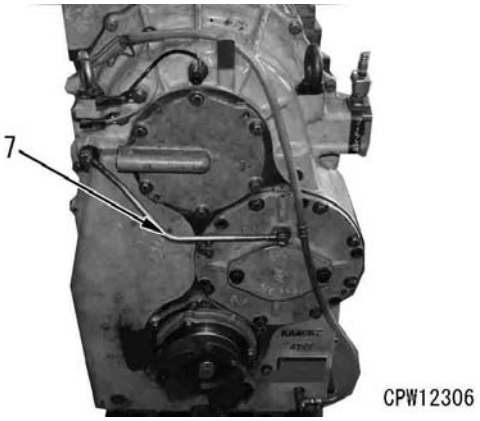


3) Install case mounting bolts (10a) and (10b).
Mounting bolt:
53.9 – 122.6 Nm {5.5 – 12.5 kgm}

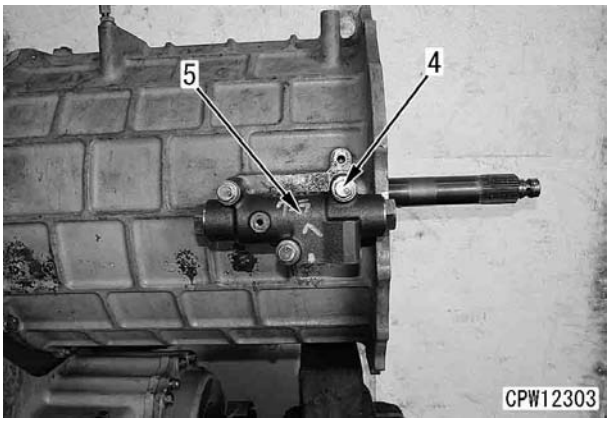


17. Related work

1) Install lubrication tube (7).

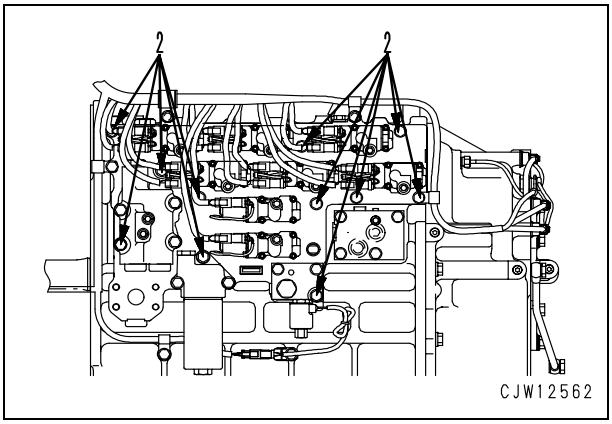


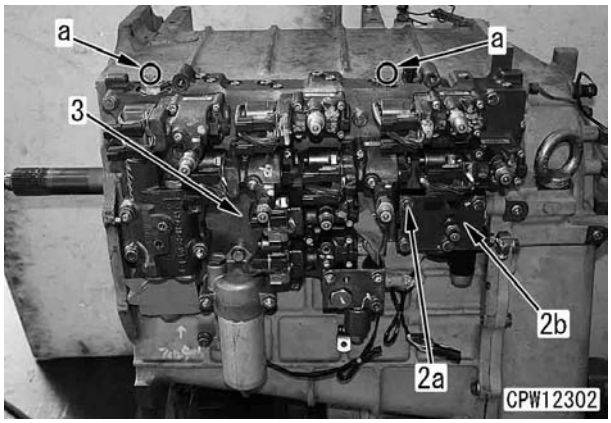
2) Install torque converter regulator valve (5).
Mounting bolt (4):
53.9 – 63.7 {5.5 – 6.5 kgm}



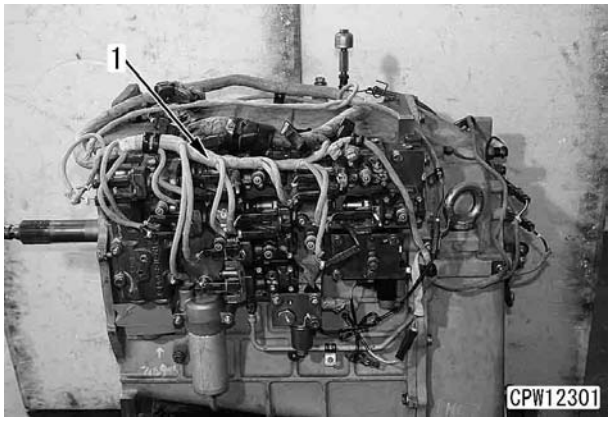
3) Fit the O-ring, install eyebolts (M10, P = 1.5 mm) to part (a), and install transmission control valve assembly (3).
O-ring: **Grease (G2-LI)**
Mounting bolt (2):
44.1 – 55.9 {4.5 – 5.5 kgm}
Transmission control valve assembly: **65 kg**

4) Install lubrication valve assembly (2b) and 4 mounting bolts (2a).





5) Install transmission wiring harness (1).
6) Connect the transmission assembly to the torque converter assembly. For details, see “Disassembly and assembly of torque converter assembly”.



Disassembly and assembly of parking brake assembly

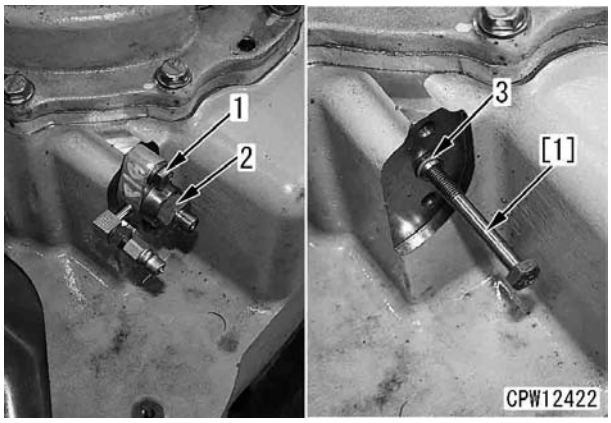
Disassembly

1. Preparation work

Disconnect the torque converter assembly from the transmission assembly. For details, see “Disassembly and assembly of transmission assembly”.

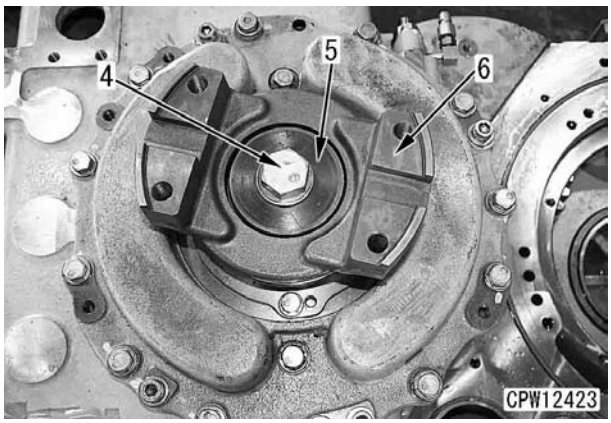
2. Parking brake emergency release valve

1) Remove mounting bolts (1) and parking brake emergency release valve (2).
2) Using forcing screws [1] (M10, P = 1.5 mm), remove sleeve (3).



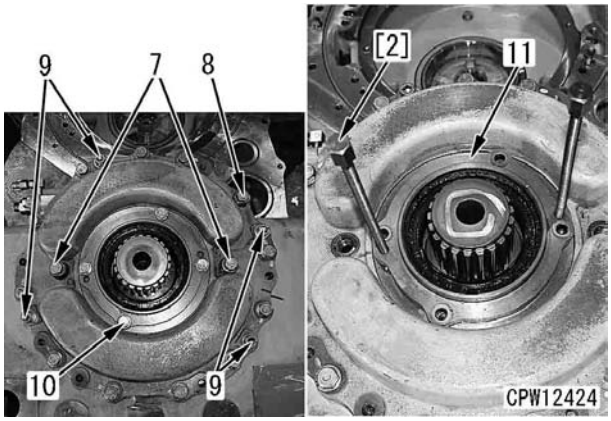
3. Coupling (rear side)

Remove mounting bolt (4), holder (5) and coupling (6).

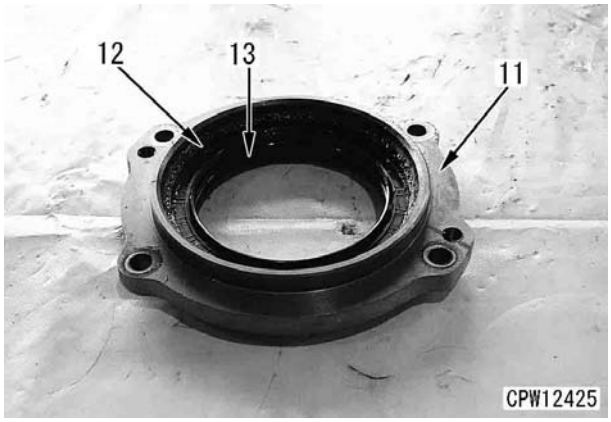


4. Parking brake assembly

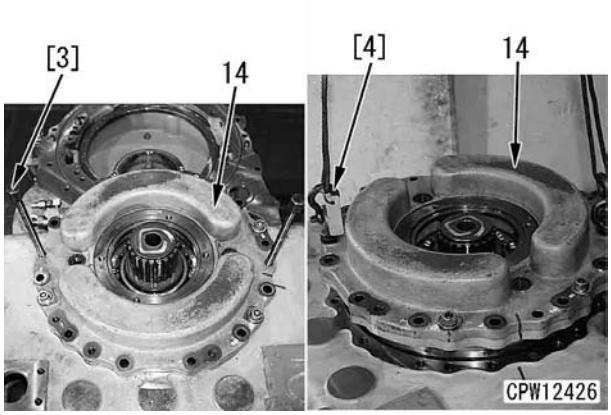
1) Remove 2 plugs (7) and tighten the mounting bolts.
   ★ Tighten the bolts alternately little by little.
   ★ Tighten the bolts to pull the piston.
2) Remove 12 mounting bolts (8).
   ★ Do not remove 4 hexagon socket head bolts (sub-assembly bolts) (9).
3) Remove 4 mounting bolts (10).
4) Using forcing screws [2], remove seal cage (11).



5) Remove oil seal (12) and dust seal (13) from seal cage (11).

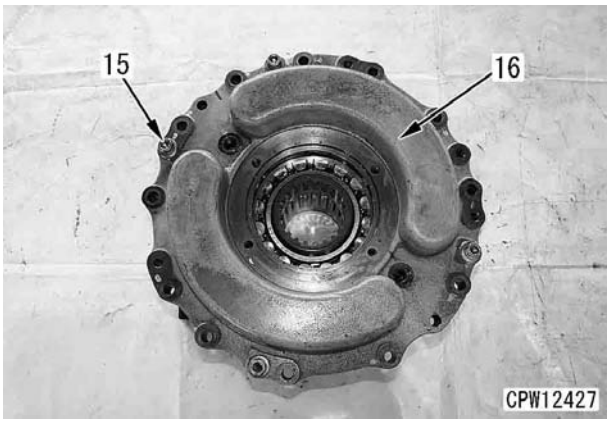


6) Using forcing screws [3] (M12, P = 1.75 mm), disconnect parking brake assembly (14).
7) Using eyebolts [4], remove parking brake assembly (14).



5. Cover assembly

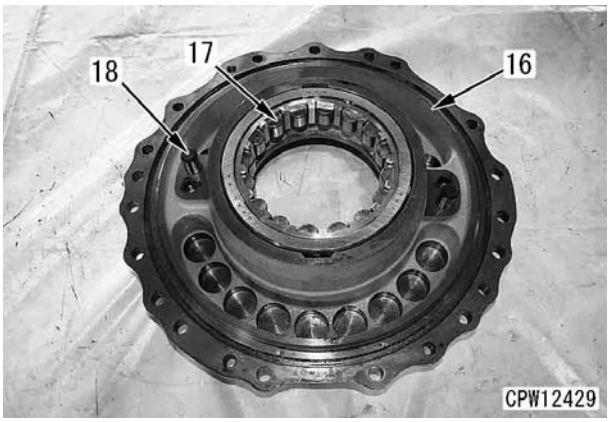
1) Remove 4 hexagon socket head bolts (15) from cover (16).
   ★ Since the cover is floated by the springs, loosen the hexagon socket head bolts gradually and evenly.



2) Using eyebolts [5], lift off cover (16).

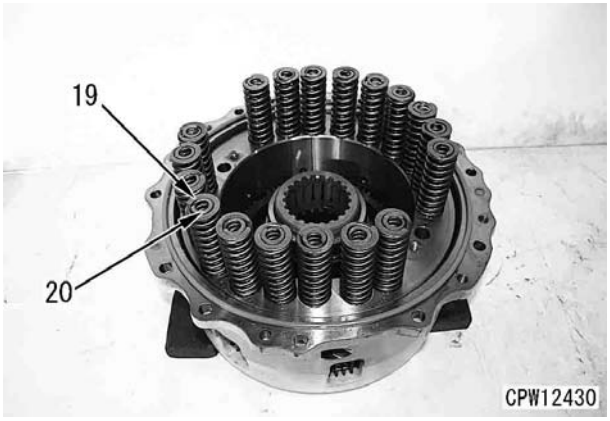


3) Remove bearing (17) and dowel pin (18) from cover (16).



6. Springs

Remove 18 outer springs (19) and 18 inner springs (20).

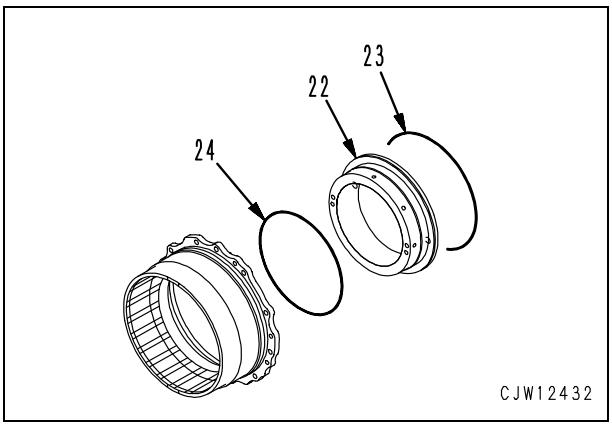


7. Piston

1) Using eyebolts [6] (M12, P = 1.75 mm), lift off piston (22) from housing (21).

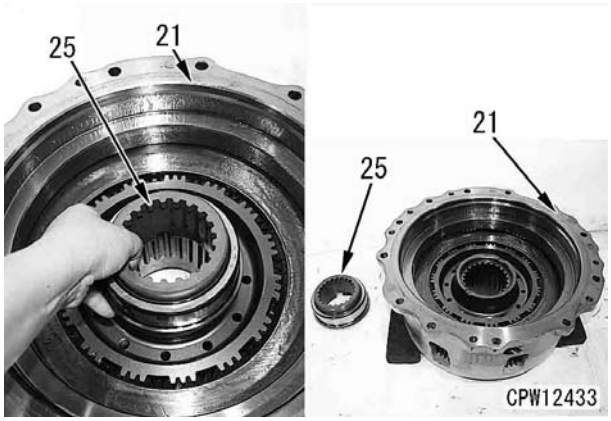


2) Remove seal rings (23) and (24) from piston (22).

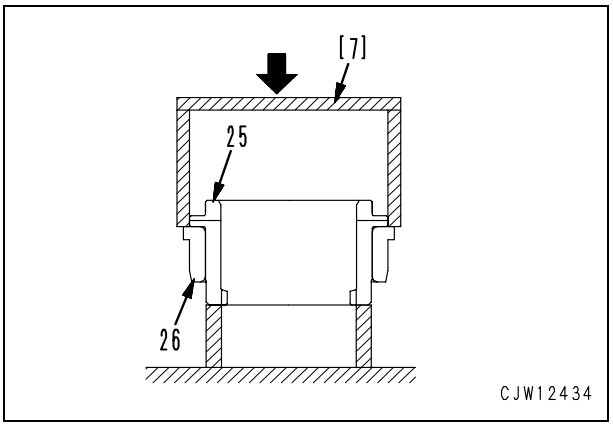


8. Spacer assembly

1) Remove spacer (25) from housing (21).

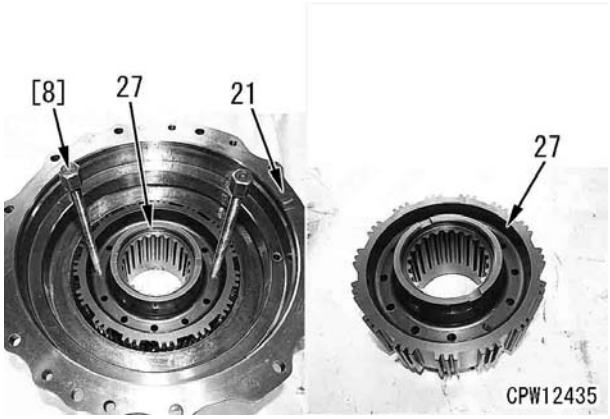


2) Using push tool [7], remove inner race (26) from spacer (25).



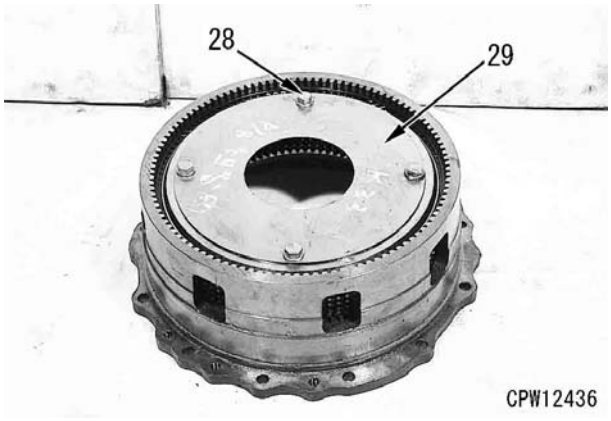
9. Gear

Using eyebolts [8] (M12, P = 1.75 mm), remove gear (27) from housing (21).



10. Plate

1) Reverse the housing.
2) Remove 4 mounting bolts (28) and plate (29).



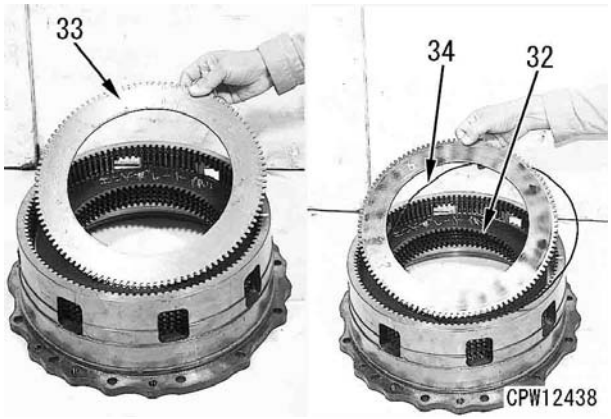
11. Snap ring and end plate

Remove snap ring (30) and end plate (31).



12. Plates, discs and wave springs

Remove 8 plates (32), 7 discs (33) and 7 wave springs (34) alternately.

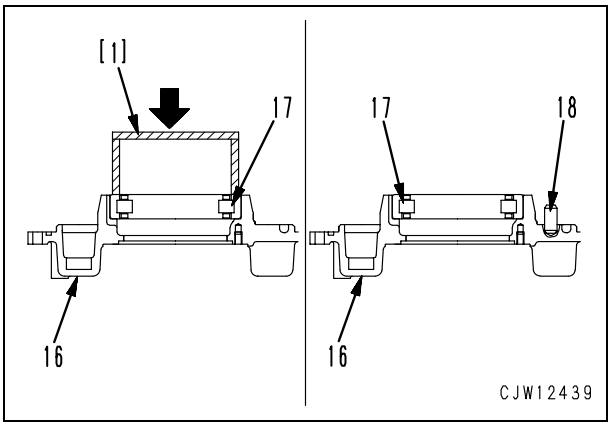


Assembly

1. Cover

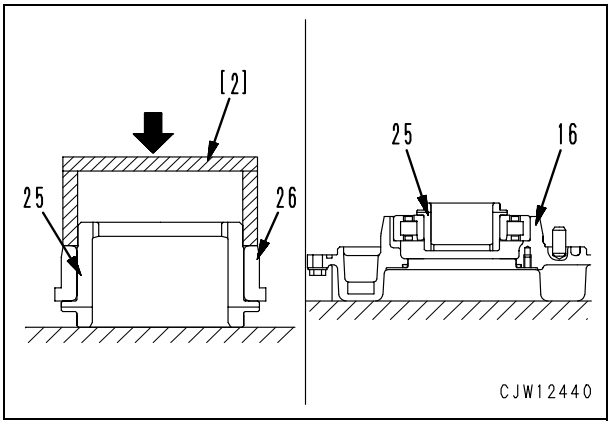
Assemble the cover assembly according to the following procedure.

1) Using push tool [1] (Outside diameter: 189 mm), press fit bearing (17) to cover (16).
2) Install 2 dowel pins (18).



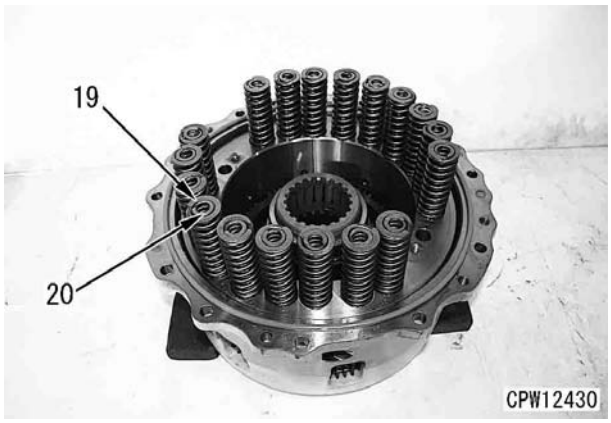
2. Spacer assembly

1) Using push tool [2] (Inside diameter: 106 mm), press fit inner race (26) to spacer (25).
2) Press fit spacer assembly (25) to cover assembly (16).



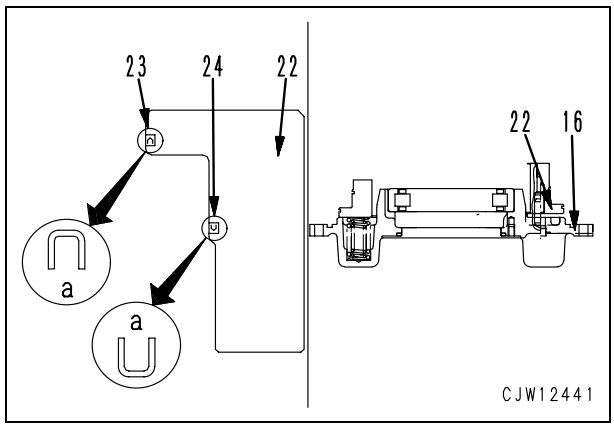
3. Springs

Install 18 outer springs (19) and 18 inner springs (20).



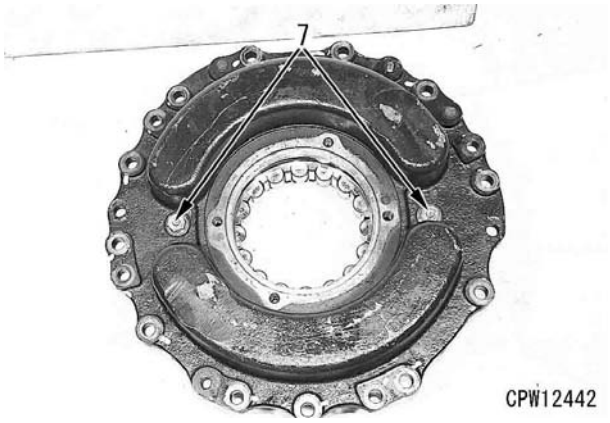
4. Piston

1) Install seal rings (23) and (24) to piston (22).
   ★ Set grooves (a) of the seal rings as shown below.
   Seal ring: **Grease (G2-LI)**
2) Install piston (22) to cover (16).



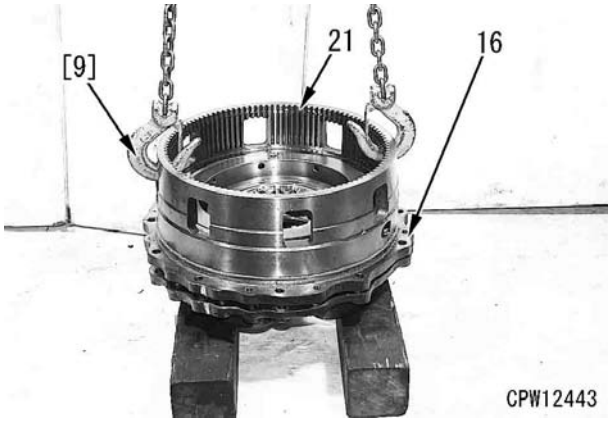
5. Plugs

1) Remove 2 plugs (7).
2) Fit the washers to 2 parking brake assembly mounting bolts and tighten them into the plug holes.
   ★ Tighten the bolts alternately little by little.
   ★ Tighten the bolts to pull the piston.

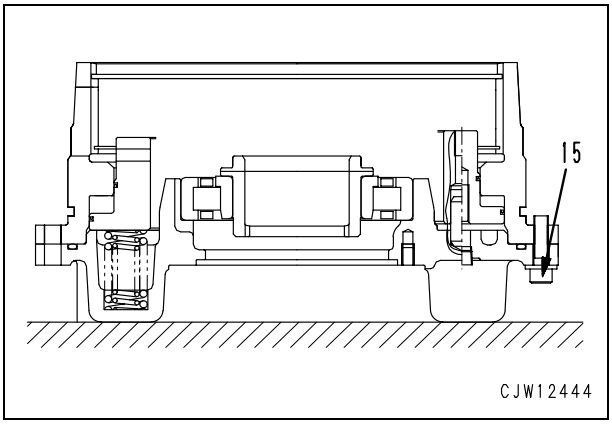


6. Housing

1) Fit the O-ring to cover (16) and install housing (21), using sling [9].
   O-ring: **Grease (G2-LI)**

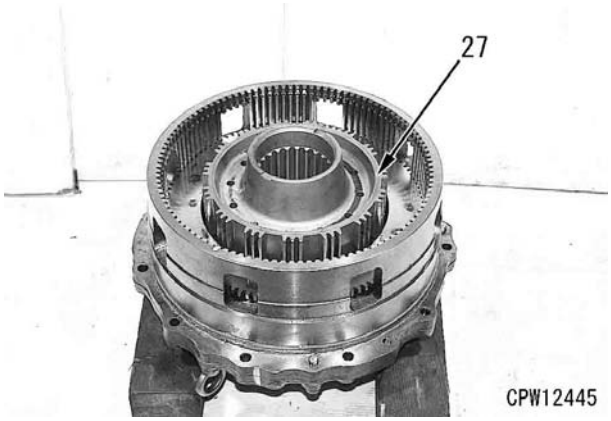


2) Tighten 4 hexagon socket head bolts (15).



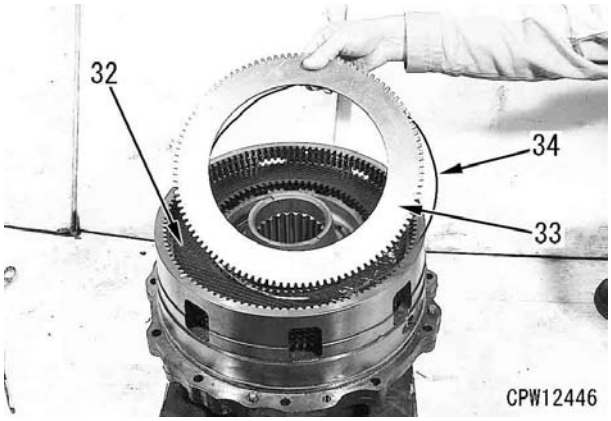
7. Gear

Install gear (27).



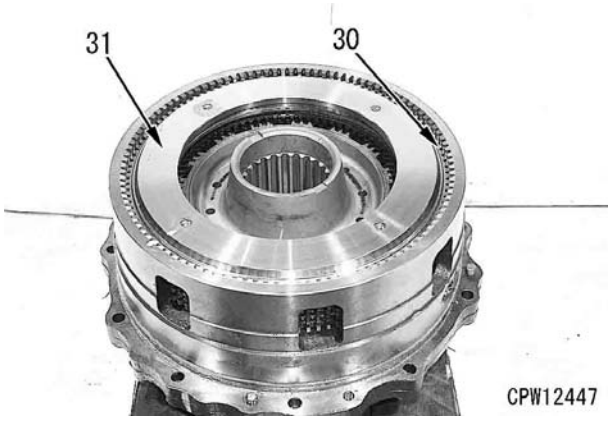
8. Plates, discs and wave springs

Install 8 plates (33), 7 discs (32) and 7 wave springs (34) alternately.



9. Snap ring and end plate

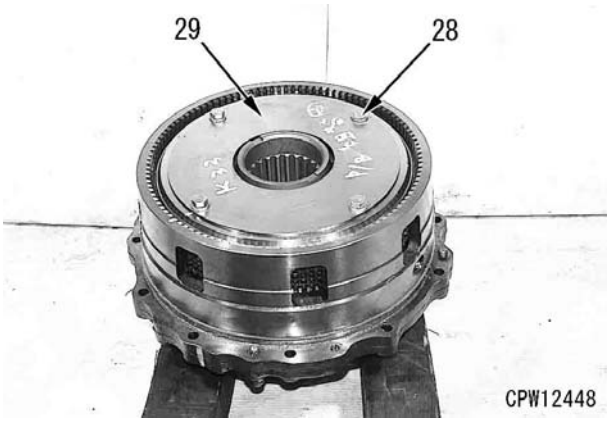
Install end plate (31) and fix it with snap ring (30).



10. Plate

Install plate (29) and tighten mounting bolts (28).

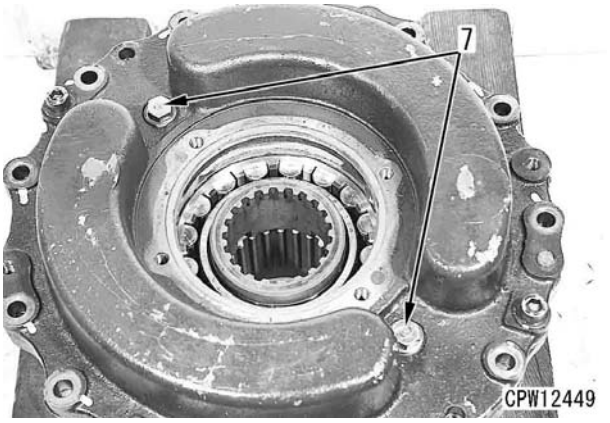
Mounting bolt: **Adhesive (LT-2)**



11. Plugs

1) Reverse the parking brake assembly.
2) Remove the 2 bolts used to install the springs and install plugs (7).

Plug: **Adhesive (LT-2)**



12. Seal cage

1) Press fit oil seal (12) and dust seal (13) to seal cage (11).

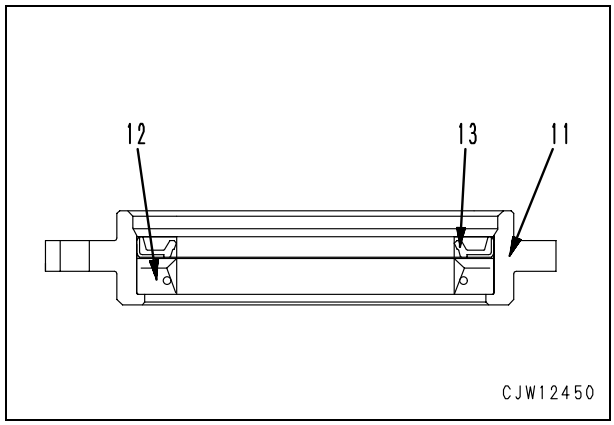
Oil seal: **Grease (G2-LI)**

Press fitting face of oil seal: **Gasket sealant (LG-5)**

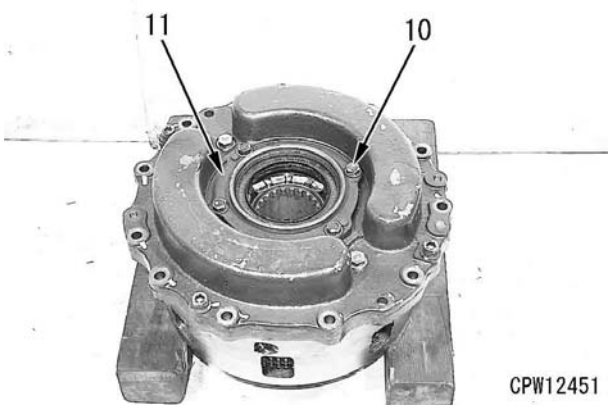
Dust seal: **Grease (G2-LI)**

Mating faces of oil seal and dust seal: **Grease (G2-LI)**

★ Apply the gasket sealant thinly to the inside of the oil seal fitting section of the cover and wipe off the projected part.

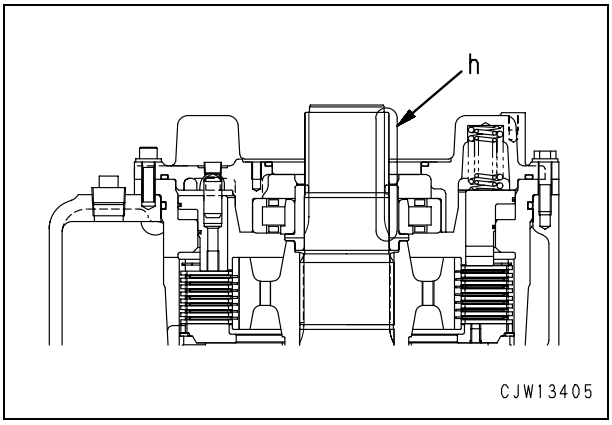


2) Install seal cage (11) and tighten mounting bolts (10).

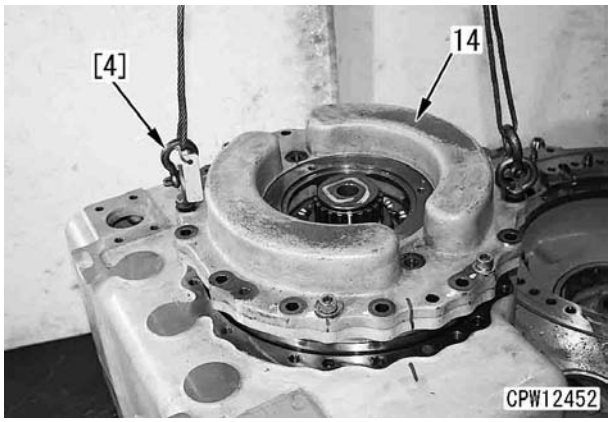


13. Parking brake assembly

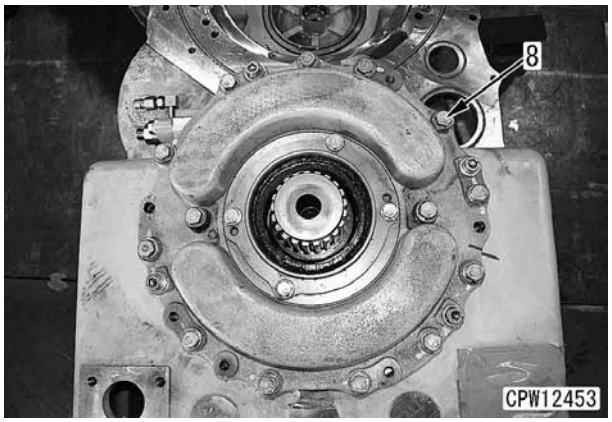
1) Apply grease to spline (h) of the shaft.
   Spline (h) of shaft: **Grease (LM-G)**



2) Using eyebolts [4], install parking brake assembly (14).



3) Install 12 mounting bolts (8).
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt:
   98 – 123 Nm {10.0 – 12.5 kgm}

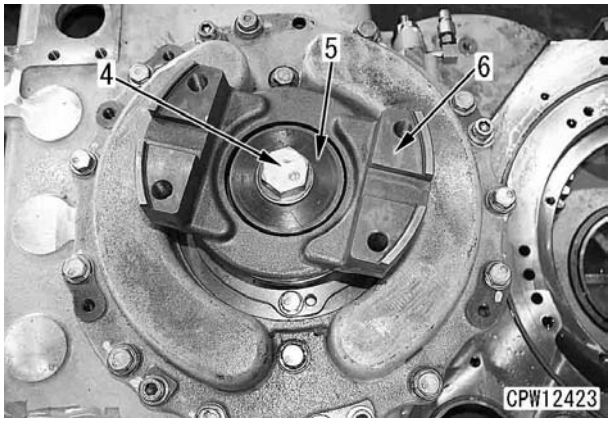


14. Coupling (rear side)

Fit the O-ring and install coupling (6), holder (5) and bolt (4).

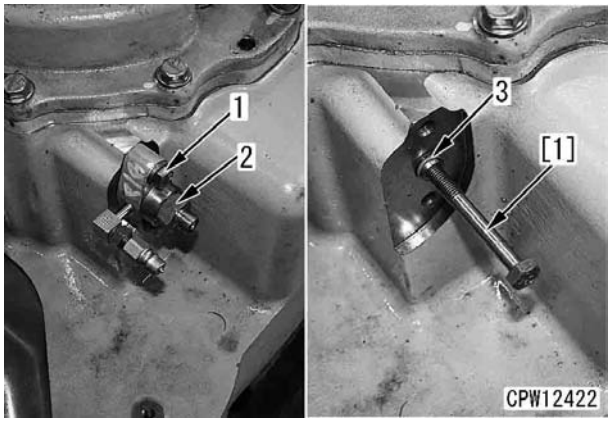
★ Set coupling (6) to the position of the coupling on the opposite side.

O-ring: **Grease (G2-LI)**
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt:
824 – 1,030 Nm {84 – 105 kgm}



15. Parking brake emergency release valve

1) Fit the O-ring and install sleeve (3), using forcing screws [1].
   O-ring: **Grease (G2-LI)**
2) Fit the O-ring, install parking brake emergency release valve (2), and tighten mounting bolts (1).
   O-ring: **Grease (G2-LI)**



16. Related work

Connect the transmission assembly to the transfer assembly. For details, see “Disassembly and assembly of transmission assembly”.

WA600-6 Wheel loader

Form No. SEN01162-00

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Printed in Japan 10-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

Power train, Part 3

Power train, Part 3 2
Removal and installation of front axle assembly 2
Removal and installation of rear axle assembly 4
Removal and installation of center support assembly 6
Disassembly and assembly of center support assembly 8
Disassembly and assembly of differential assembly 12

Power train, Part 3

Removal and installation of front axle assembly

Removal

- ⚠ **Park the machine on level ground.**
- ⚠ **Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**
- ⚠ **Release the remaining pressure in the brake accumulator system, referring to "Releasing remaining pressure in the hydraulic system" in Testing and adjusting.**

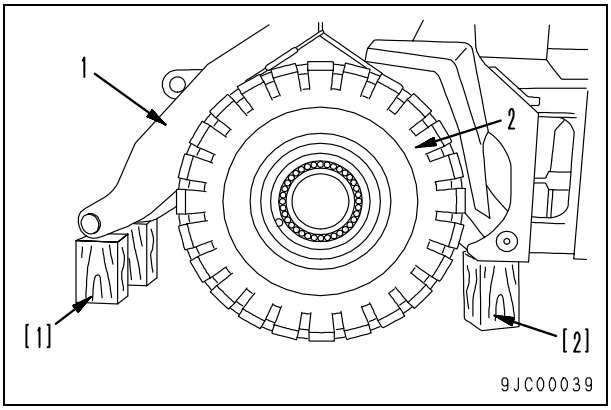
1. Remove the bucket assembly, referring to "Removal and installation of work equipment assembly."

2. Place the lift arm (1) to the support stand [1]. Operate the work equipment control lever to lift the machine body and set the block [2] to the front frame.
   - ★ Release the parking brake since the machine body moves forward.
   - ★ Lift the lift arm high enough to allow the front axle to hang and be withdrawn, lock the work equipment control lever, apply parking brake and stop the engine.

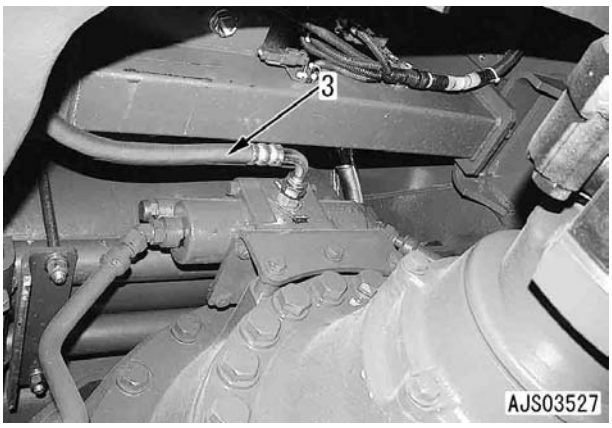
   ⚠ **Set the lock bar to the frame and put the blocks under the rear wheels.**

3. Lift and remove tire assembly (2). [*1]

   Tire assembly: **1,550 kg**

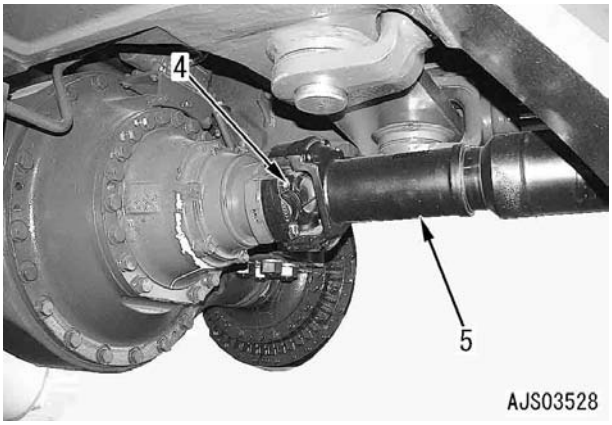


4. Disconnect brake hose (3).



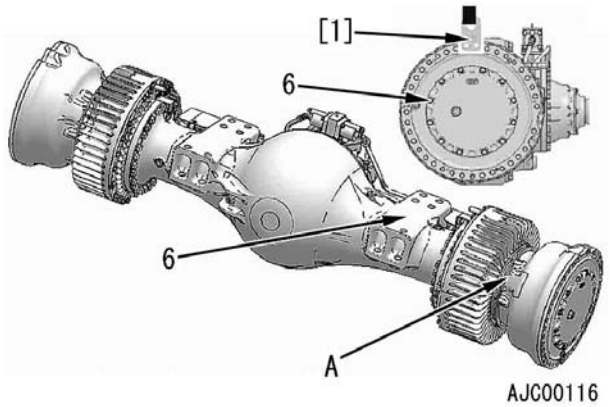
5. Remove mounting bolts (4) and disconnect front drive shaft (5). [*2]
   - ★ Lift the drive shaft with rope, etc. to prevent falling.

   Front drive shaft: **65 kg**



6. Lift front axle assembly (6) temporarily and remove the mounting bolts. [*3]
   ★ Don't lift by section (A) as it has floating seal. To lift, mount plate [1], etc. to the tapped holes for the wheel hub rim mounting bolts.

7. Gently lift and remove front axle assembly (6).
   Front axle assembly: **3,700 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]
Hub nut: **824 – 1,030 Nm {84 – 105 kgm}**
[*2]
Mounting bolt:
245 – 309 Nm {25 – 31.5 kgm}
[*3]
Mounting bolt:
2,890 – 3,630 Nm {295 – 370 kgm}

- Bleeding air from the brake circuit
  Bleed air from the front brake, referring to “Bleeding air from various system” in Testing and adjusting.

Removal and installation of rear axle assembly

Removal

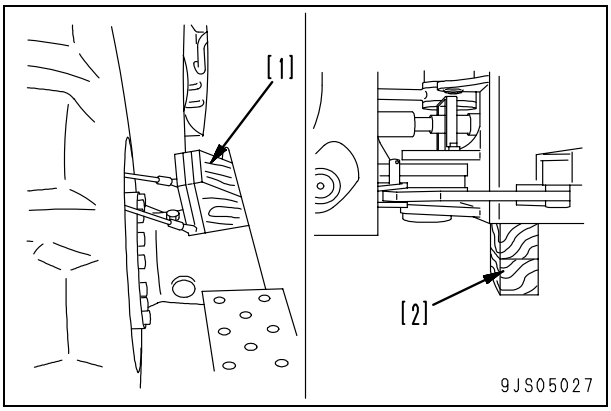
⚠ **Park the machine on level ground. Set the the lock bar to the frame and put the blocks under the wheels.**

⚠ **Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**

⚠ **Release the remaining pressure in the brake accumulator system, referring to "Releasing remaining pressure in the hydraulic system" in Testing and adjusting.**

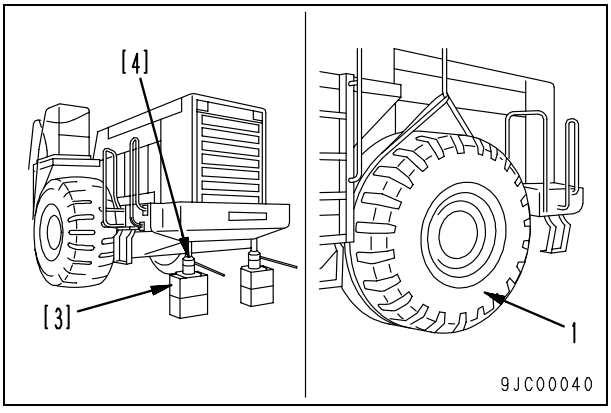
1. Set the rear axle on block [1] to the left and right.
   ★ To prevent the rear axle from jumping upward when the tires are removed.

2. Lift the machine body with the work equipment and set the axle assembly on block [2].



3. Hold the work equipment level and lift the machine body with block [3] and jack (50 ton) [4].
4. Set support stand [5] and block [6] under the counterweight.
5. Sling tire assembly (1) temporarily and remove the hub nuts.
6. Lift and remove tire assembly (1). [*1]

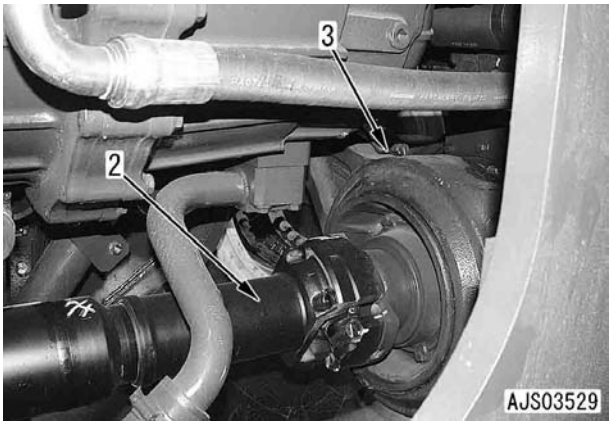
   Tire assembly: **1,550 kg**



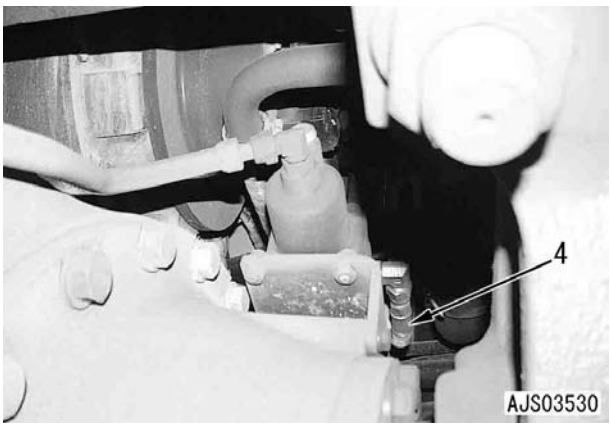
7. Disconnect rear drive shaft (2). [*2]
   ★ Lift the drive shaft with rope, etc. to prevent falling.

   Rear drive shaft assembly: **65 kg**

8. Disconnect front support lubrication tube (3).
   ★ Disconnect the clamp on the frame.

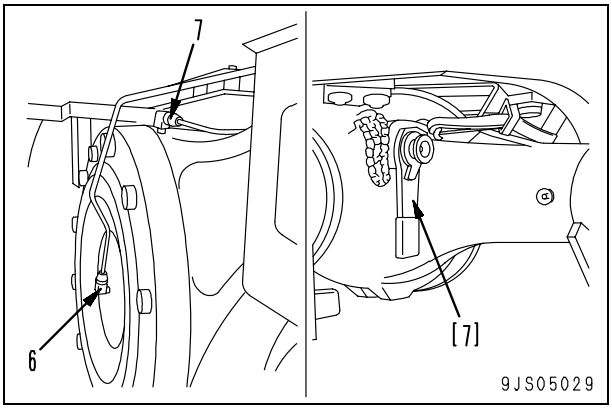


9. Disconnect brake hose (4) from the slack adjustor. [*3]



10. Disconnect rear support lubrication tubes (6) and (7).

11. Fasten the axle support and rear axle using chain, etc. and tightening with lever block [7].

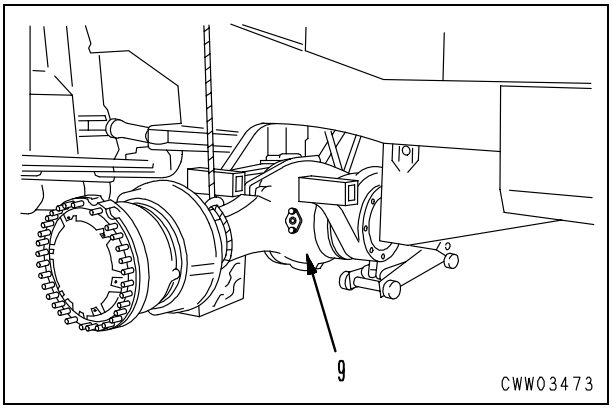


12. Lift one side temporarily and set a garage jack to the other side to remove the support mounting bolt. [*4]

13. Gently lower rear axle assembly (9) by holding the left and right sides balanced.

    Rear axle assembly: **3,900 kg**

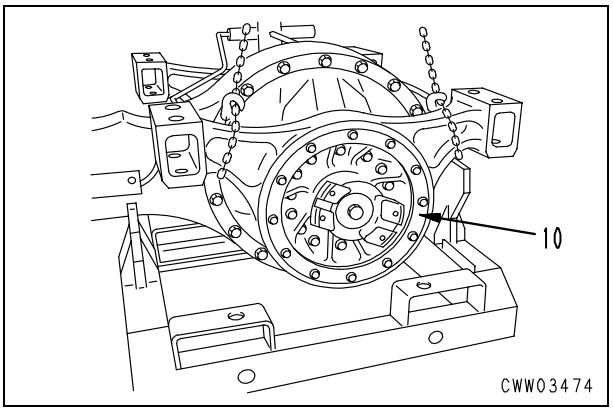
    ★ Pull out the rear axle assembly from the bottom of the frame, using the crane and the garage jack.



14. Lift and remove support (10) (front and rear) from the rear axle.

    Front support: **140 kg**

    Rear support: **230 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]
Hub nut: **824 – 1,030 Nm {84 – 105 kgm}**

[*2]
Mounting bolt: **245 – 309 Nm {25 – 31.5 kgm}**

[*3]
★ Bleed air from the slack adjustor, referring to “Bleeding air from various systems” in Testing and adjusting.

[*4]
Support mounting bolt:
2,450.0 – 3,038.0 Nm {250.0 – 310.0 kgm}

Removal and installation of center support assembly

Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
H	12	793T-620-1410	Centering tool	■	1	N	○

Removal

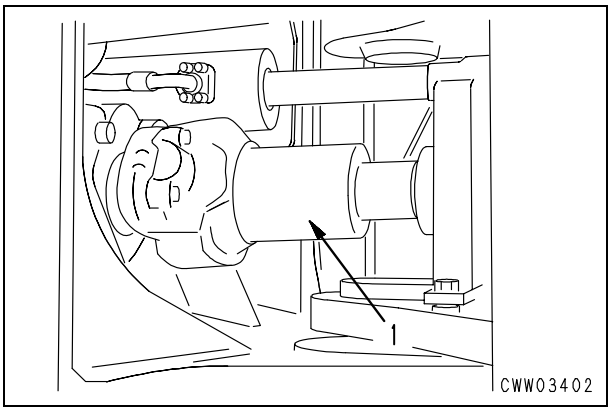
⚠ **Park the machine on level ground. Turn the steering wheel fully to the left, set the work equipment completely on to the ground and put the blocks under the wheels.**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Disconnect center drive shaft (1). [*1]

   Center drive shaft: **65 kg**

   ★ When removing the drive shaft, lift the drive shaft with a rope, etc. to prevent falling.



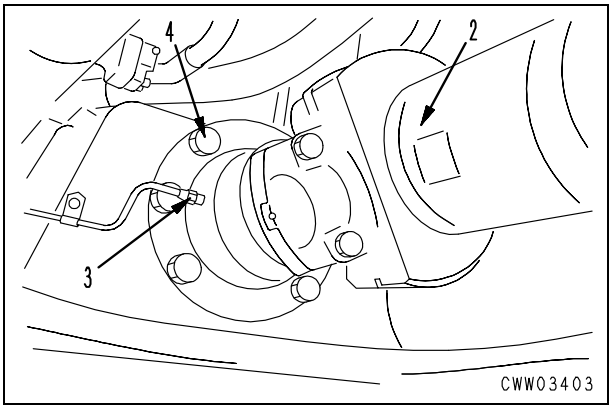
2. Remove front drive shaft (2). [*2]

   Front drive shaft: **65 kg**

   ★ When removing the drive shaft, lift the drive shaft with a rope, etc. to prevent falling.

3. Disconnect lubrication tube (3).

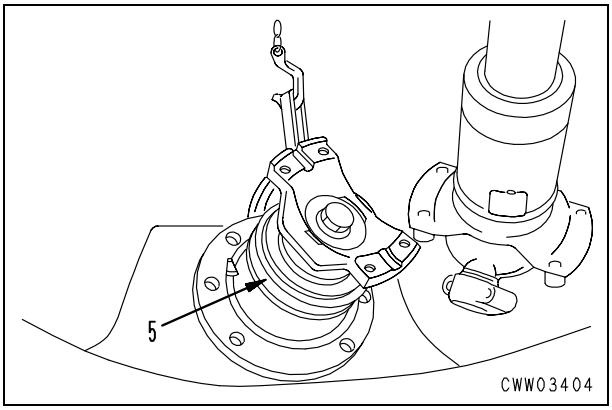
4. Lift the center support temporarily and remove mounting bolts (4). [*3]



5. Lift and remove center support assembly (5).

   Center support assembly: **47 kg**

   ★ Check the number of shims, if any, between the center support and the frame for assembling data.



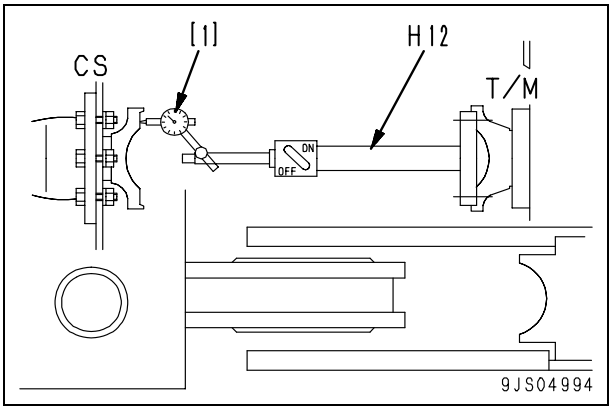
Installation

- Carry out installation in the reverse order to removal.

[*1]
Mounting bolt:
245 – 309 Nm {25 – 31.5 kgm}

[*2]
Mounting bolt:
245 – 309 Nm {25 – 31.5 kgm}

[*3]
★ To make the transmission coupling surface and the center support (CS) coupling surface parallel, mount tool **H12** and a dial gauge [1] to the transmission (T/M). Adjust parallelism and radial runout by turning the coupling on the side of center support (CS).
★ Install shims to the center support mounting face for adjustment.
★ Tighten the mounting bolts after shim adjustment.
Mounting bolt:
490.0 – 608.0 Nm {50.0 – 62 kgm}
★ Parallelism: Max. 0.1



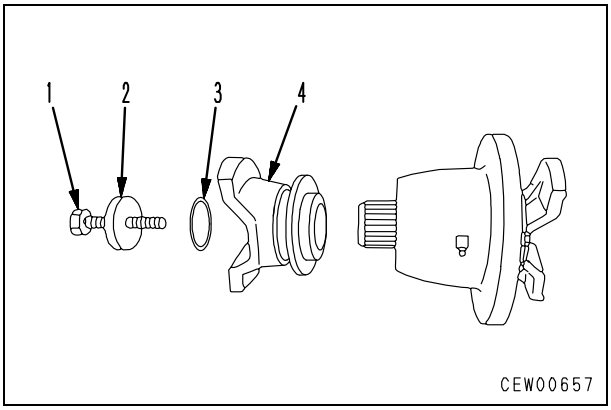
Disassembly and assembly of center support assembly

Disassembly

1. Coupling

Remove center bolt (1) and then remove retainer (2), O-ring (3) and coupling (4).

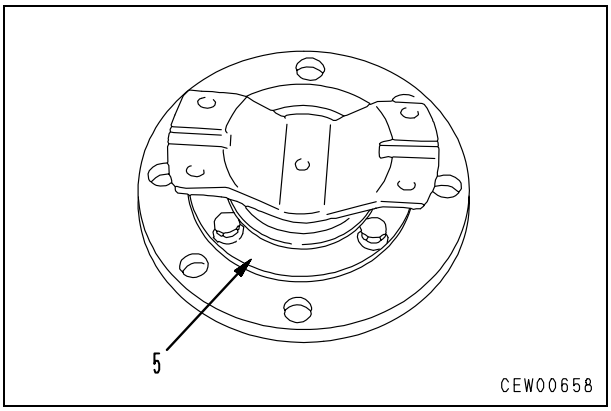
★ Make match marks to coupling (4) and the shaft end surface.



2. Retainer

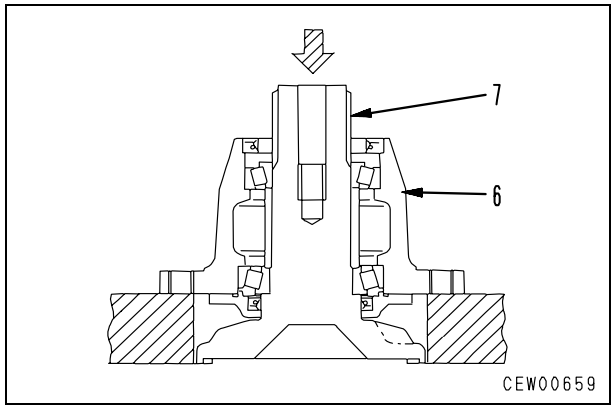
Remove the mounting bolts of retainer (5).

★ Remove all mounting bolts by rotating the shaft.

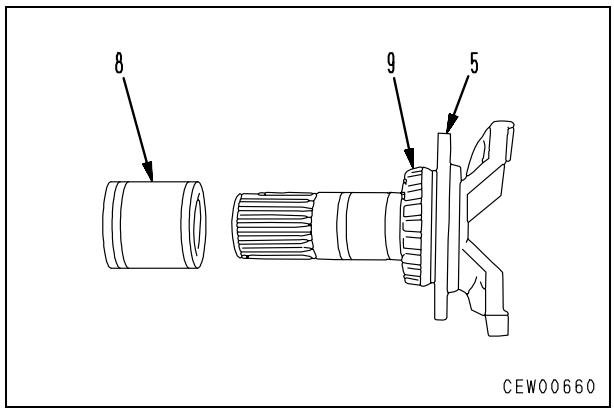


3. Shaft

1) Set shaft case assembly (6) on the press.
2) Pull out shaft (7) using the press.
   ★ Cover the floor with wood chips so that the shaft may not be damaged should it fall off.

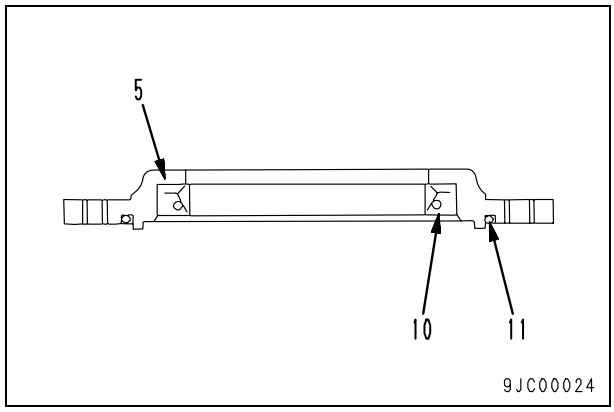


3) Remove spacer (8), bearing (9) and retainer (5) from the shaft.



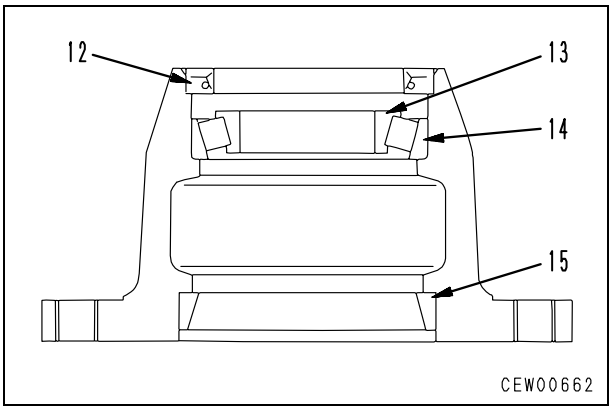
4. Oil seal

Remove oil seal (10) and O-ring (11) from retainer (5).



5. Case

1) Remove oil seal (12) from the case.
2) Remove bearing (13), bearing outer races (14) and (15) from the case.

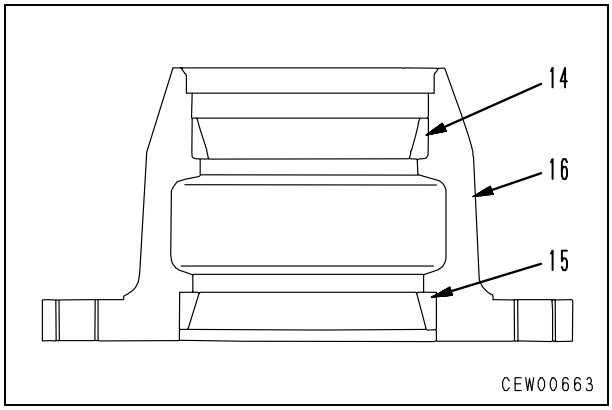


Assembly

1. Bearing outer race

Install bearing outer races (14) and (15) to case (16).

★ Make sure that there is no clearance between the outer races and the case end.

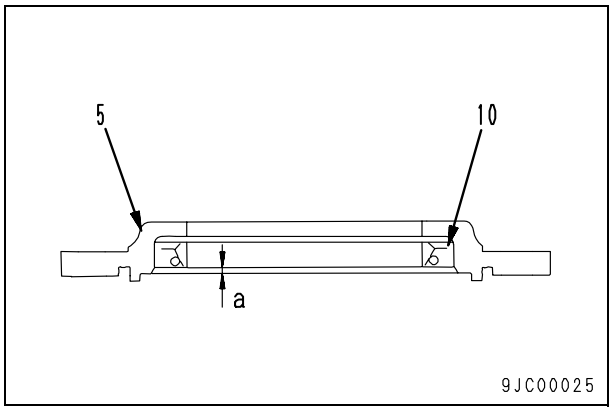


2. Oil seal

Install oil seal (10) to retainer (5).

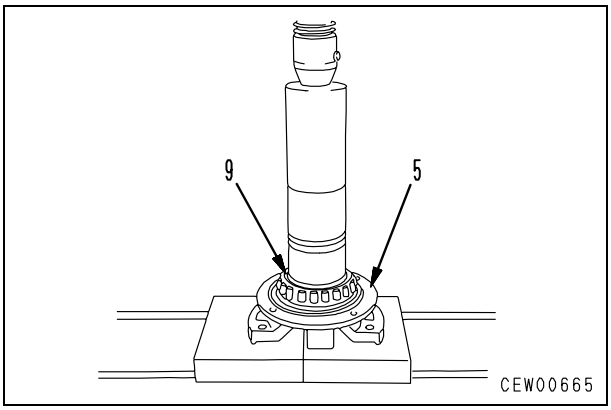
Oil seal lip surface: **Grease (G2-LI)**

★ Driven dimension of oil seal:
(a) = 2 ± 0.5 mm



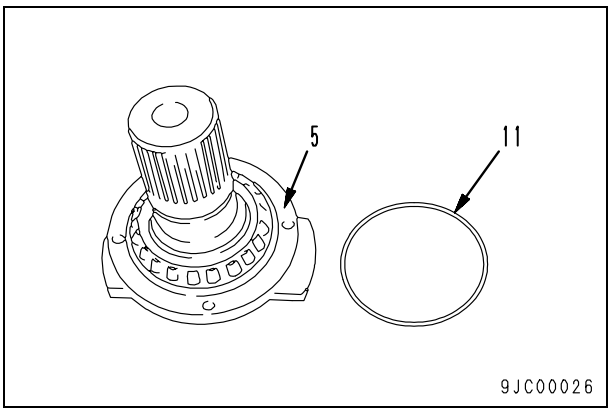
3. Bearing

1) Install retainer (5) to the shaft and press fit bearing (9).
   ★ After installing the bearing, check that no clearance is present between the shaft end.
2) Install the spacer.
   Bearing inner circumference:
   Grease (G2-LI)

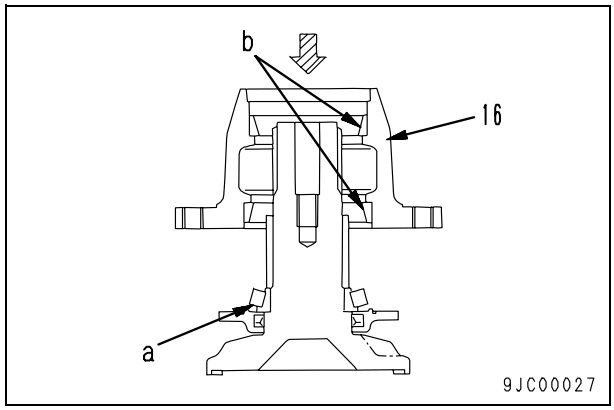


4. Case

1) Install O-ring (11) to retainer (5).
   ★ Fit the O-ring securely to the groove.

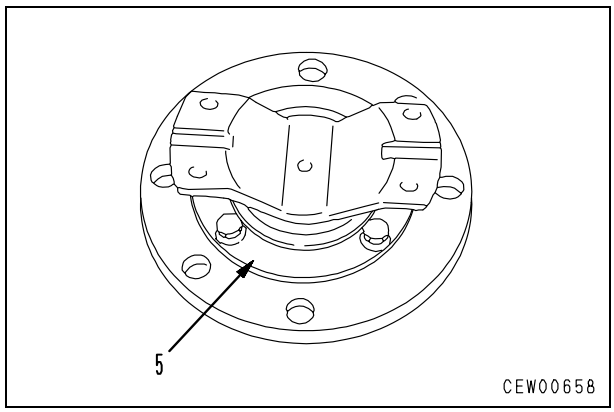


2) Hold the shaft upright and insert the case (16).
   ★ Apply grease amply to (a) portion of the retainer and the rolling surfaces (b) of the bearing.
   ★ Take care that the O-ring is not engaged.



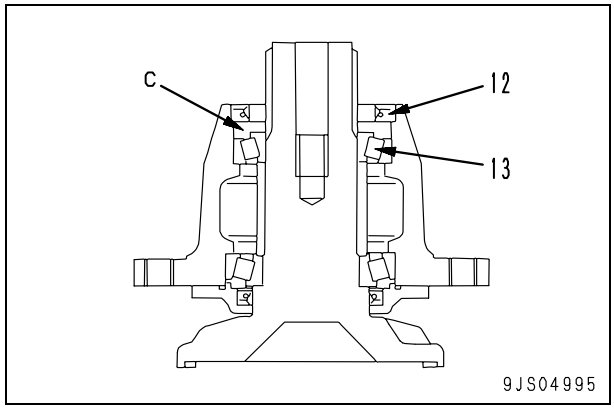
5. Retainer

Fix retainer (5) to the case.
Mounting bolt:
59 – 73.5 Nm {6 – 7.5 kgm}



6. Bearing seal

1) Press fitting bearing (13) in the shaft.
   Bearing (13): **Grease (G2-LI)**
2) Install oil seal (12) to the case.
   ★ Seal press fit dimension: ±0.5 mm from the case end
   Seal lip surface and portion (C) of the case:
   Grease (G2-LI)



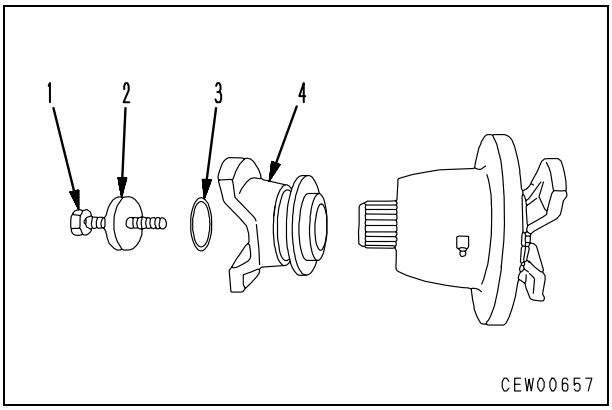
7. Coupling

Assembly coupling (4) and install O-ring (3) and retainer (2), and then fix with center support (1).

★ Install coupling (4) by matching to the match mark.

Center bolt:

824 – 1,030 Nm {84 – 105 kgm}



8. Testing

Check that end play is within the specified range.

★ End play: Max. 0.22 mm

★ If end play is 0, check that free rotational torque reads 3.9 Nm {0.4 kgm} maximum with grease applied to the seal and bearing.

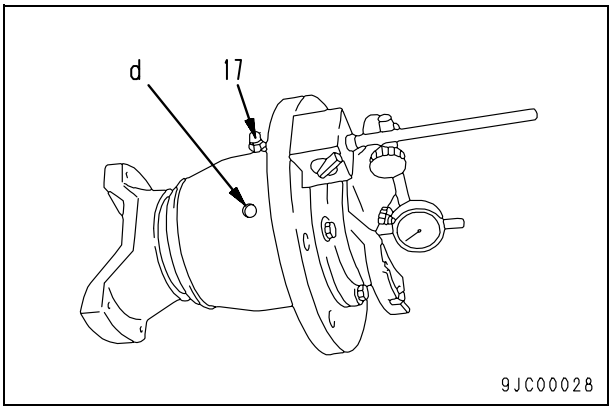
9. Filling grease

Fill grease through tapped hole (d) of the case.

★ Fill grease until it comes out of the breather (17).

Inside the case:

Grease (G2-LI) (900 mℓ)



Disassembly and assembly of differential assembly

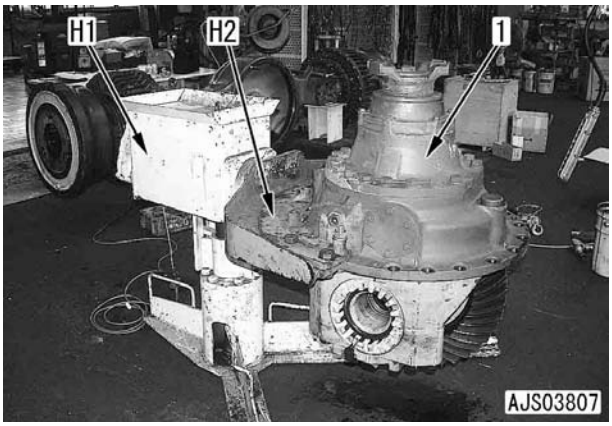
Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
H	1	790-501-5200	Unit repair stand	■	1		
		790-901-4110	Bracket	■	1		
	2	793T-622-1810	Plate	■	1	N	○
	3	792-103-0901	Wrench	■	1		
	4	793T-622-1180	Push tool	■	1		○
	5	793T-622-1840	Push tool	■	1	N	○
	6	790-201-2460	Plate	■	1		
		790-201-2690	Plate	■	1		
	7	790-101-5621	Plate	■	1		
		790-101-5421	Grip	■	1		
		01010-81240	Bolt	■	1		
	8	790-201-2860	Spacer	■	1		
	9	792-525-1000	Micrometer	■	1		
		792-525-1220	Adapter	■	1		
	10	793T-622-1820	Push tool	■	1	N	○
	11	793T-622-1830	Push tool	■	1	N	○
		790-101-5221	Grip	■	1		
		01010-81240	Bolt				

Disassembly

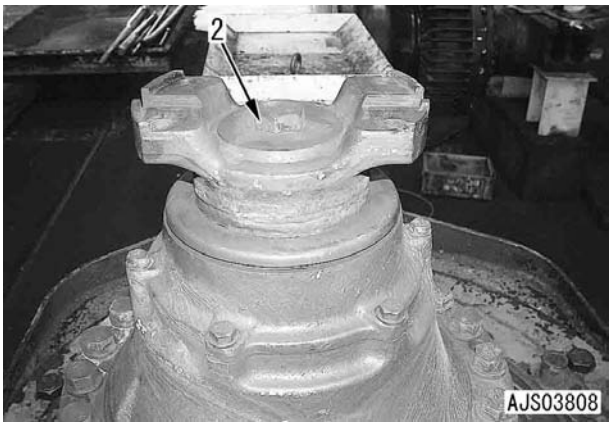
1. Differential gear assembly

1) Install tool **H2** to tool **H1**.
2) Set differential gear assembly (1) to tool **H2**.
   ★ Considering the weight of the differential gear assembly, maintain the balance of the assembly after setting it to tool **H1**.
   Differential gear assembly: **560 kg**

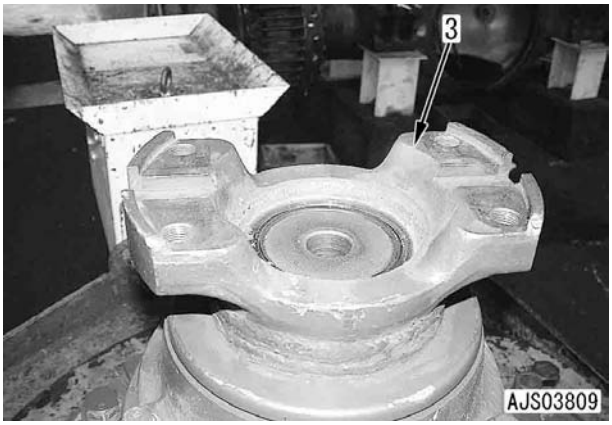


2. Coupling

1) Remove the bolt and remove holder (2).

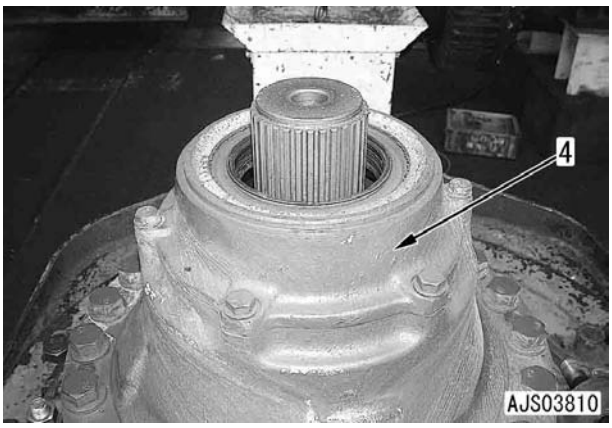


2) Remove O-ring and remove coupling (3).

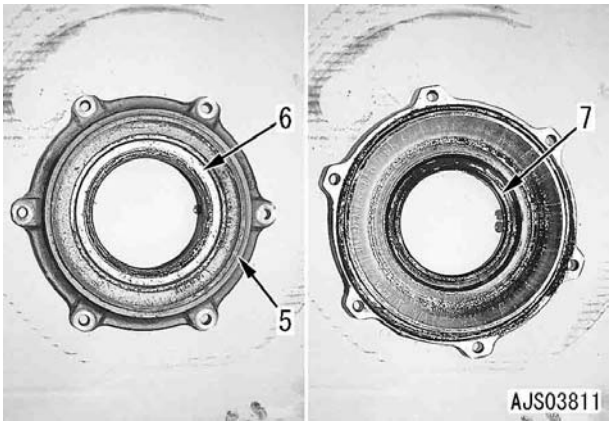


3. Cage assembly

1) Remove 6 bolts and remove cage assembly (4).

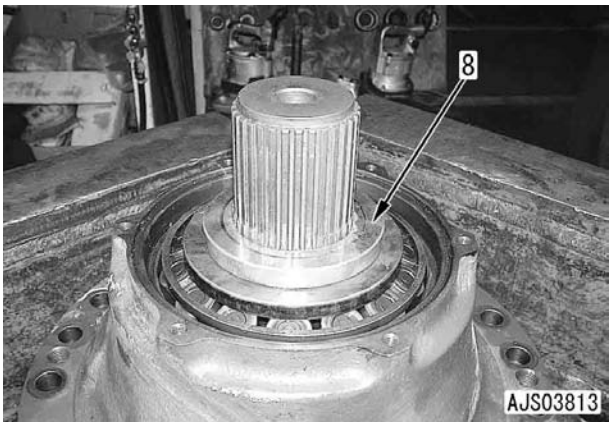


2) Remove oil seal (6), dust seal (7) and the O-ring from cage (5).



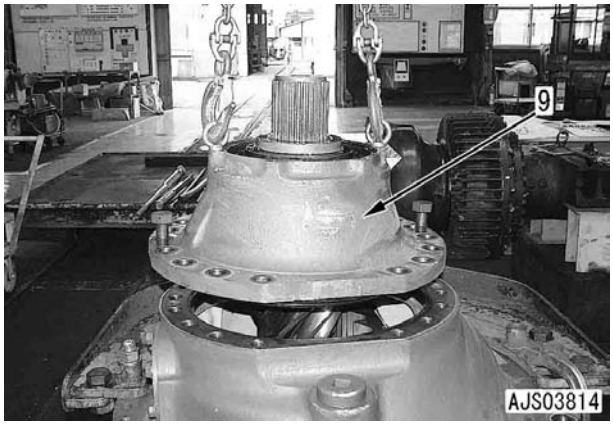
4. Support bevel pinion assembly

1) Remove retainer (8) from the pinion shaft.



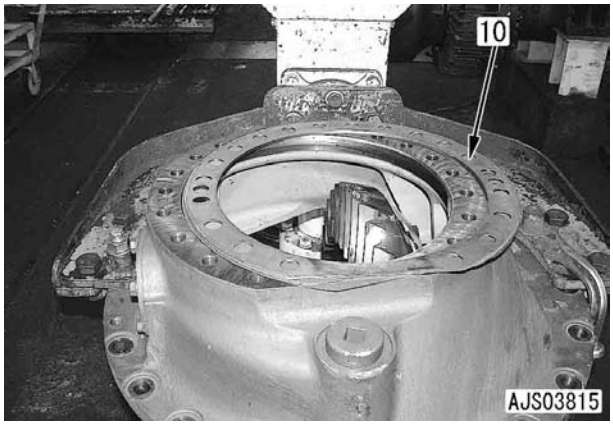
2) Remove 20 bolts and lift and remove support bevel pinion assembly (9).

Support bevel pinion assembly: **100 kg**



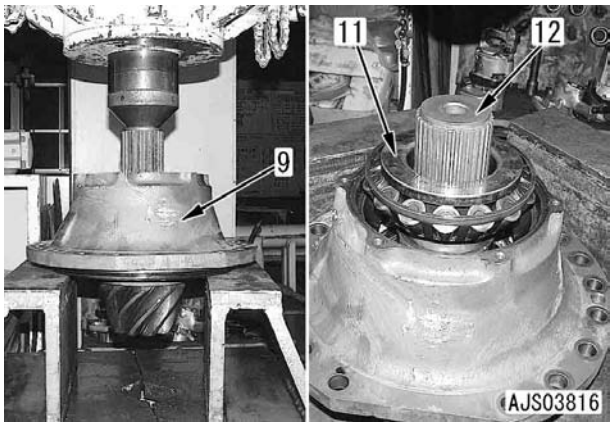
3) Remove shim (10).

★ Check the number of the shims in advance.



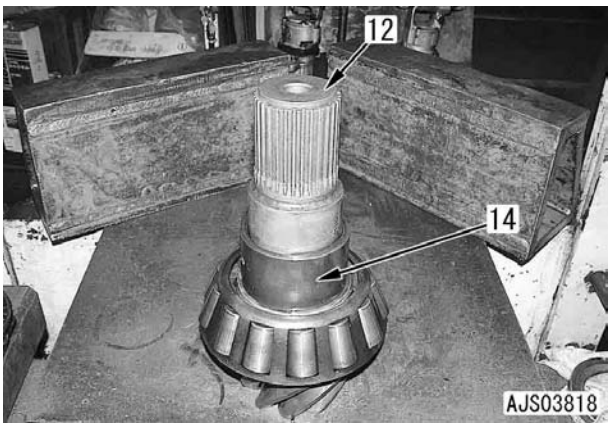
4) Push down support bevel pinion assembly (9) using a press. Remove bevel pinion assembly (12) together with bearing (11) from support assembly (13).

★ Set the blocks, etc, under the bevel pinion assembly to prevent falling to the floor.

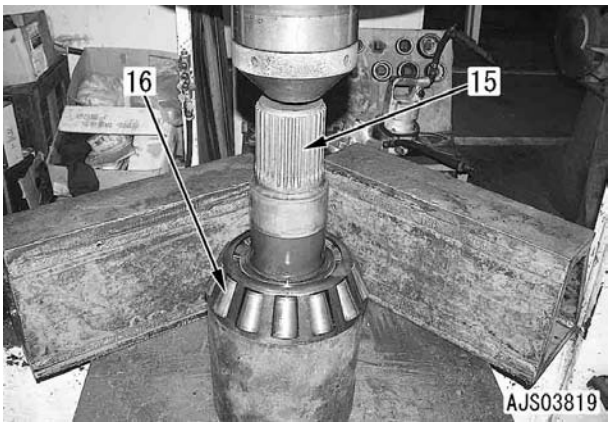


5. Disassembly of bevel pinion assembly

1) Remove spacer (14) from bevel pinion assembly (12).

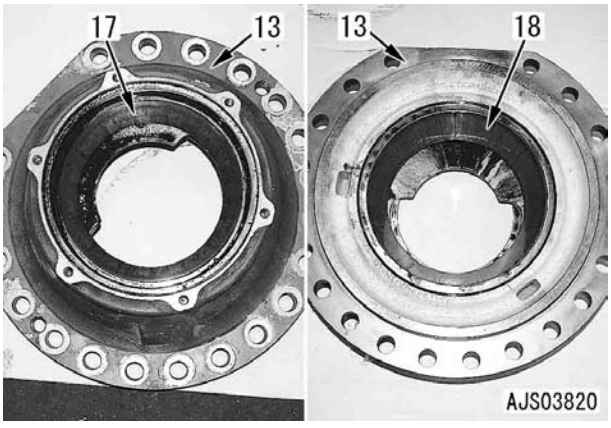


2) Remove bearing (16) from bevel pinion shaft (15), using a press.



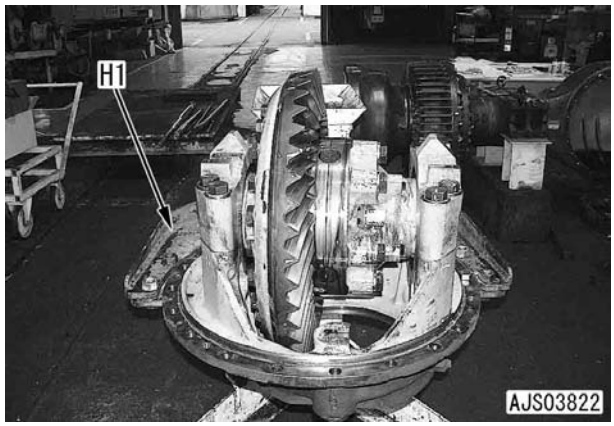
6. Disassembly of support assembly

Remove bearing outer races (17) and (18) from support assembly (13).



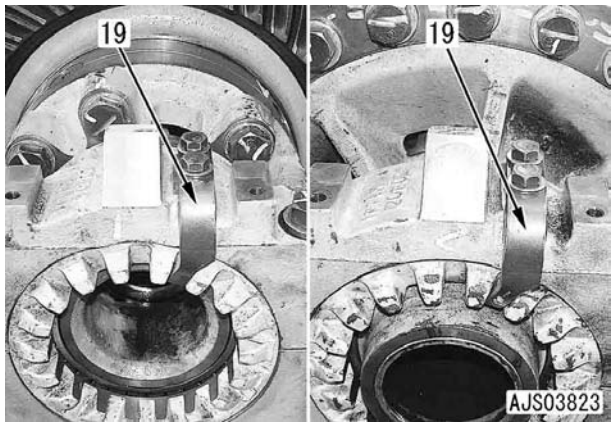
7. Differential gear assembly

1) Invert the bracket of tool **H1**.

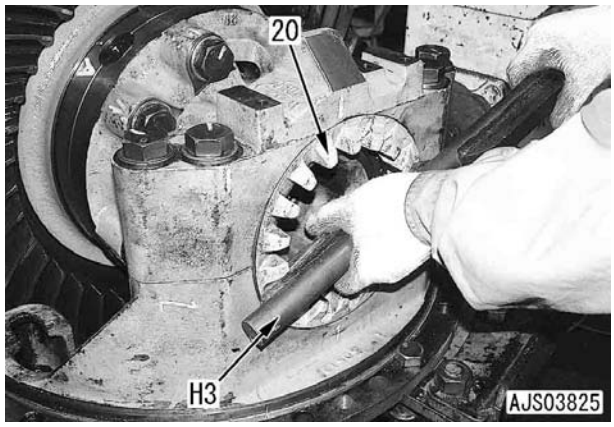


2) Remove right and left locks (19).

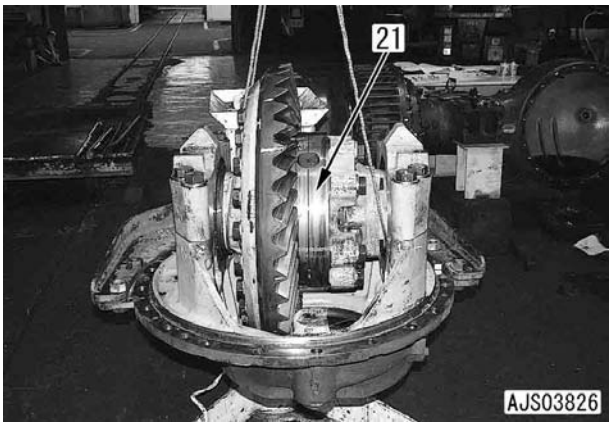
★ After removing the lock, mark the lock position on the adjustment nut.



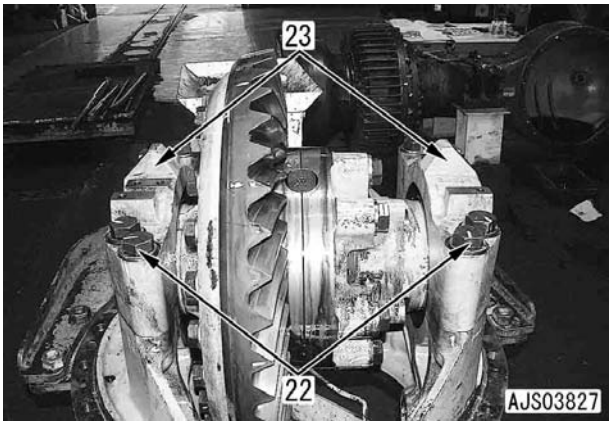
3) Loosen the adjustment nut (20) using tool **H3** until the nut can be turned manually.



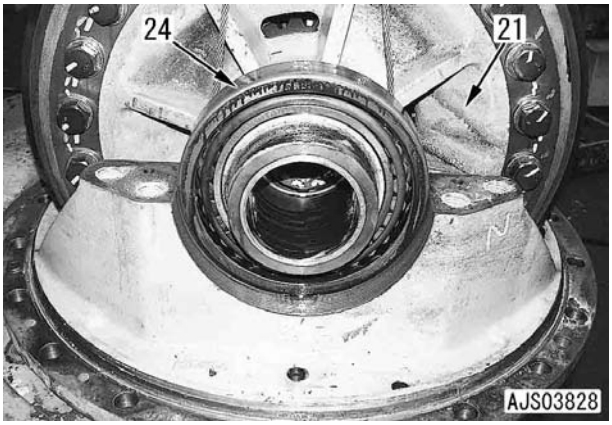
4) Lift differential gear assembly (21) temporarily.



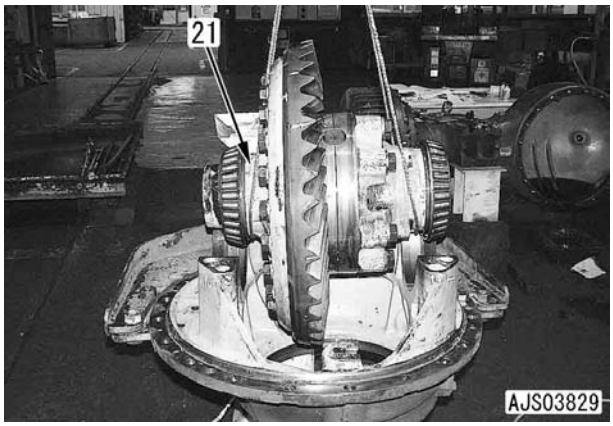
5) Remove 4 bearing cap mounting bolts (22) each to the left and right.
6) Remove left and right bearing caps (23).
   ★ Separate the left and right bearing cap.



7) Lift off differential gear assembly (21) slightly to remove the left and right bearings (24).
   ★ Care should be taken not to drop the bearing when lifting.
   ★ Separate the left and right bearings.

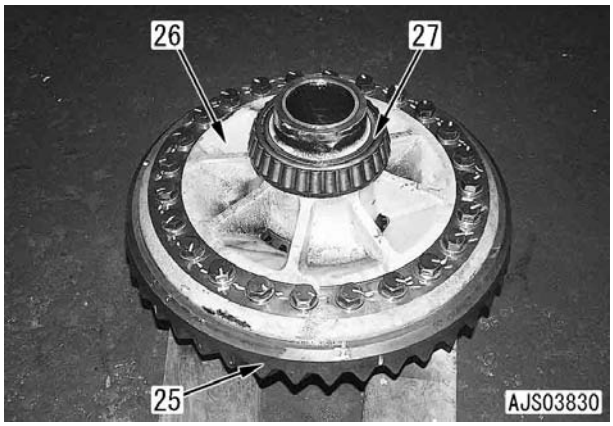


8) Lift and remove differential gear assembly (21).

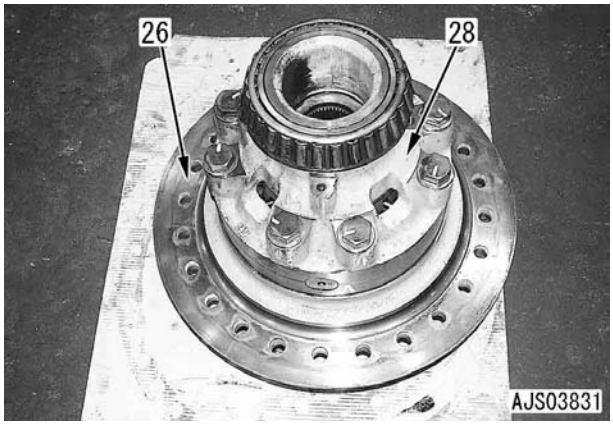


8. Disassembly of differential gear assembly

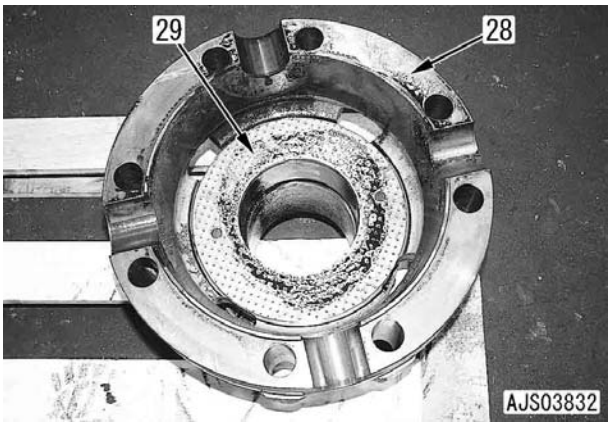
1) Remove 24 bolts and remove bevel gear (25) from case (26).
   ★ Make match marks to the bevel gear and the case before disassembling.
2) Remove bearing (27).



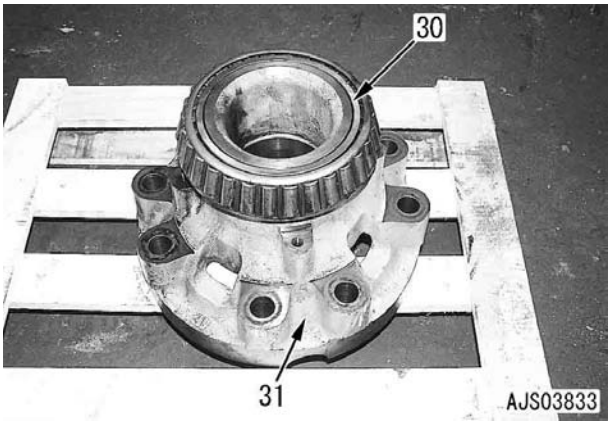
3) Remove 8 bolts and remove case assembly (28) from case (26).
   ★ Make match marks to the case before disassembling.



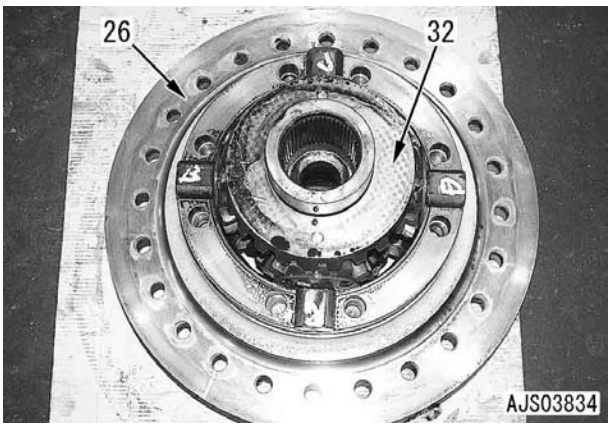
4) Remove washer (29) from the inside of case assembly (28).



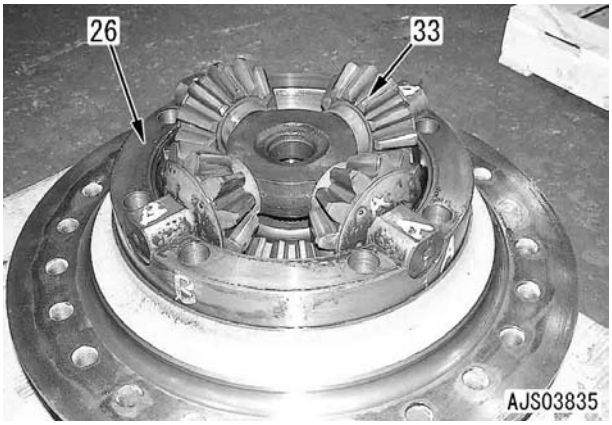
5) Remove bearing (30) from case (31).



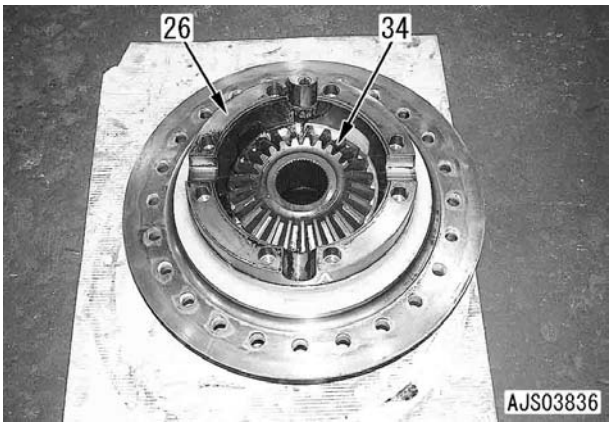
6) Remove side gear (32) from case (26).



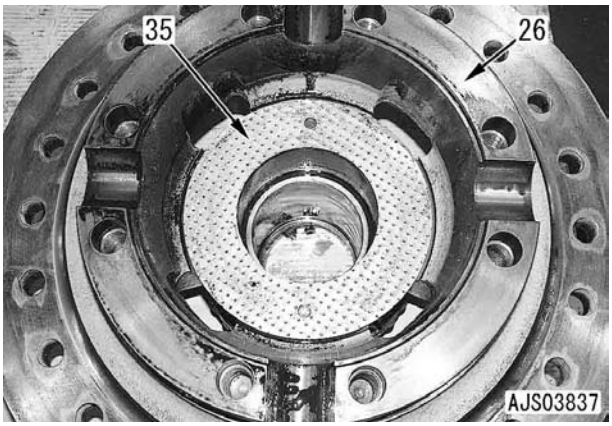
7) Remove cross shaft pinion gear assembly (33) from case (26).
★ Make match marks to the cross shaft and case before disassembling.



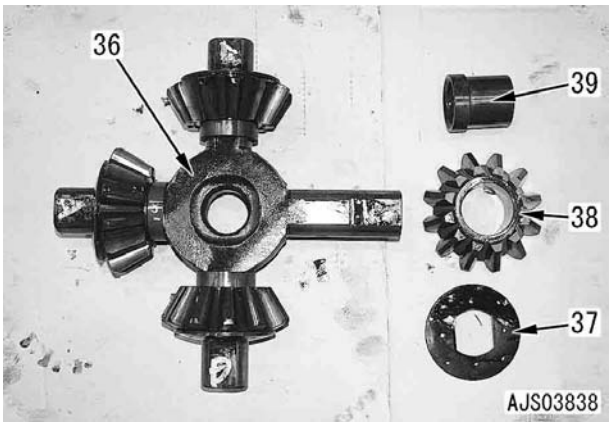
8) Remove side gear (34) from case (26).



9) Remove washer (35) from the inside of case (26).

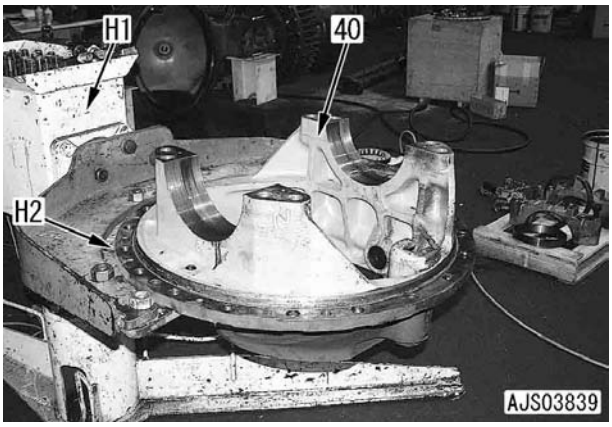


10) Remove washer (37), pinion gear (38) and bushing (39) from cross shaft (36).



9. Carrier case

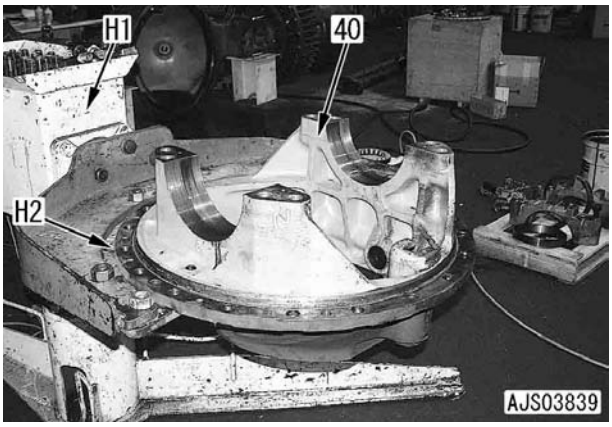
1) Remove carrier case (40) from tool **H2**.
2) Remove tool **H2** from tool **H1**.



Assembly

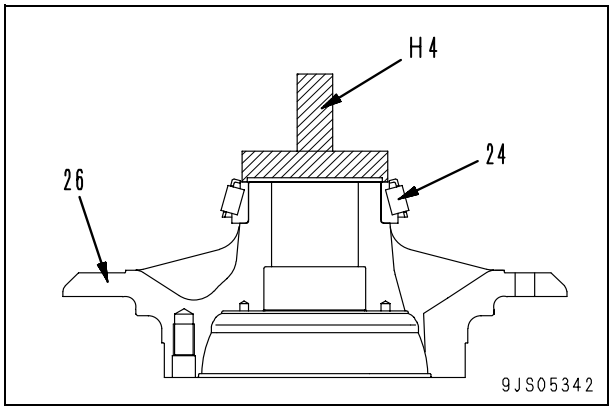
1. Carrier case

1) Install tool **H2** to tool **H1**.
2) Set carrier case (45) to tool **H2**.

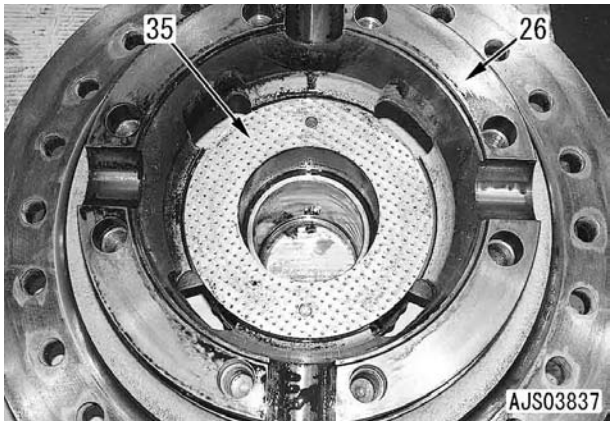


2. Assembly of differential gear assembly

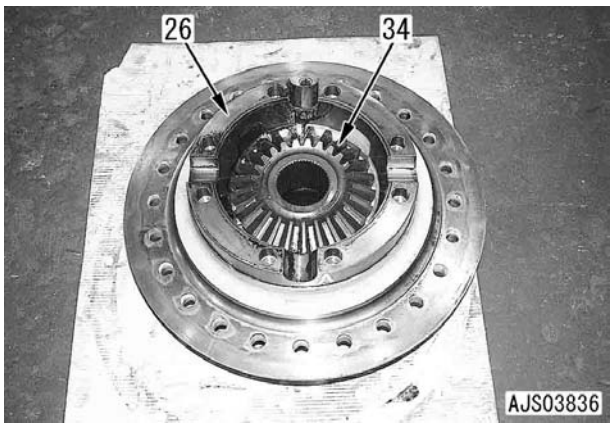
1) Use tool **H4** to press fit bearing (24) to case (26).



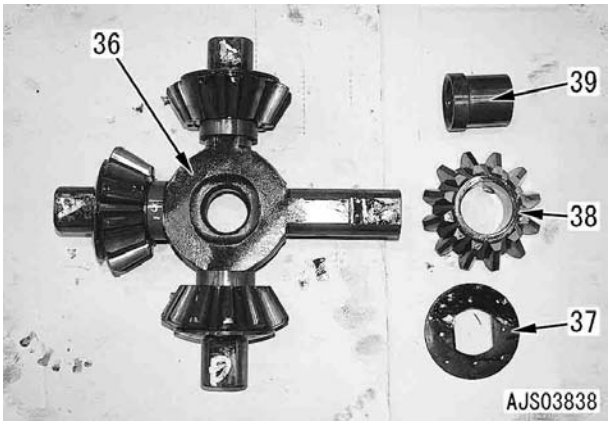
2) Install washer (35) to the inside of case (26).



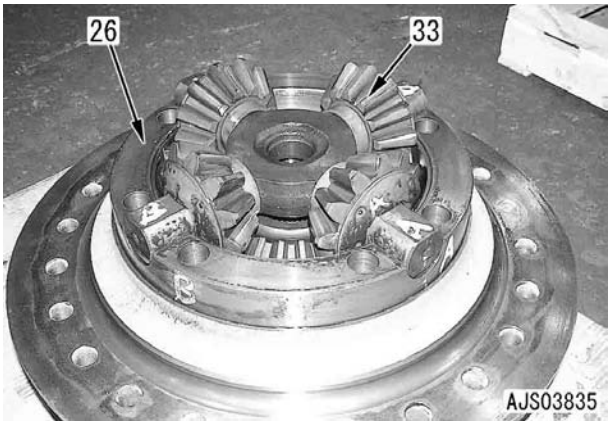
3) Install side gear (34) to case (26).



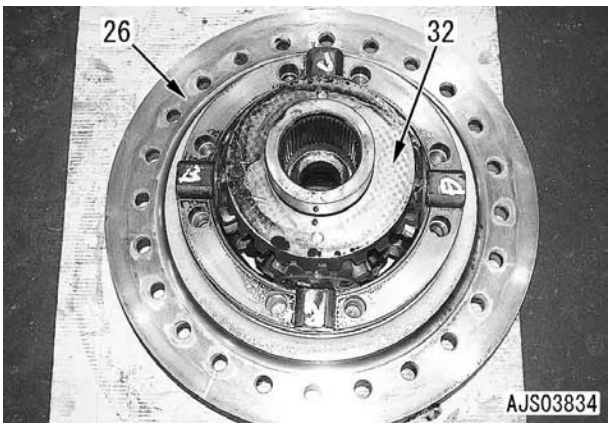
4) Install bushing (39), pinion gear (38) and washer (37) in this order to cross shaft (36).



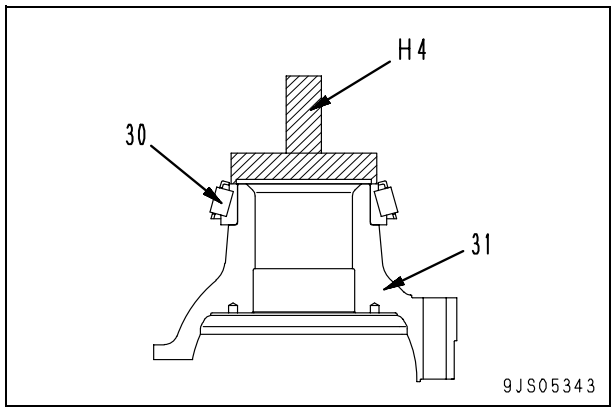
5) Install cross shaft and pinion gear assembly (33) to case (26).
★ Match the markings on the cross shaft and the case.



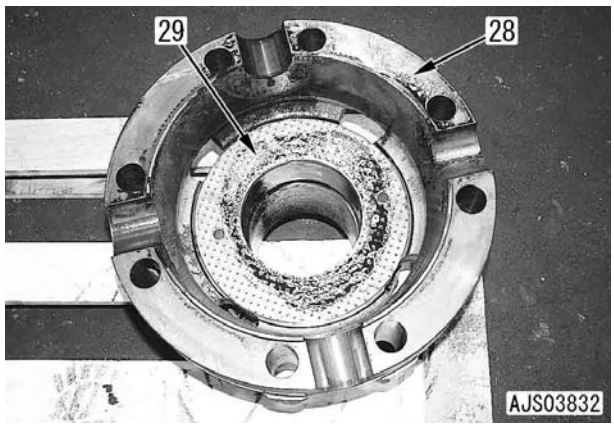
6) Install side gear (32) to case (26).



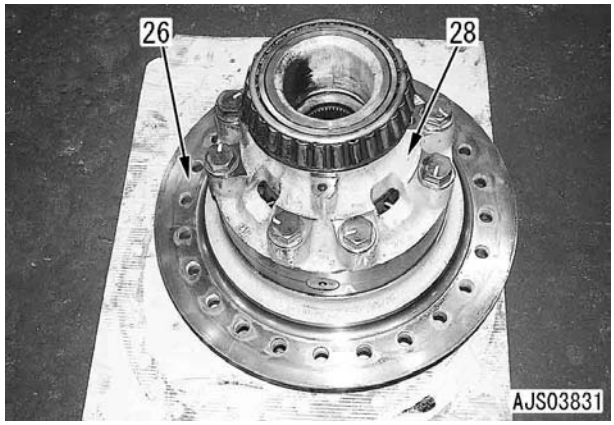
7) Use tool **H4** to press fit bearing (30) to case (31).



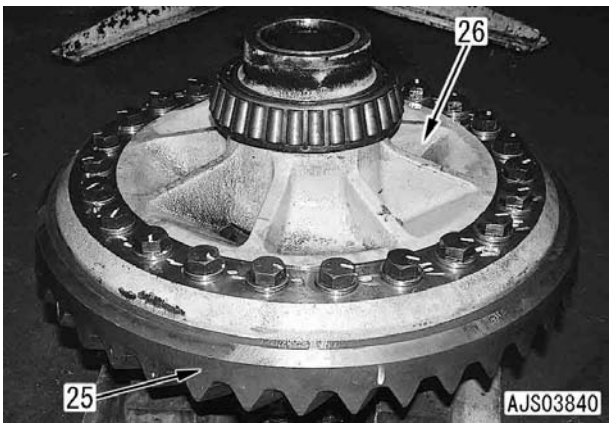
8) Install washer (29) to the inside of case assembly (28).



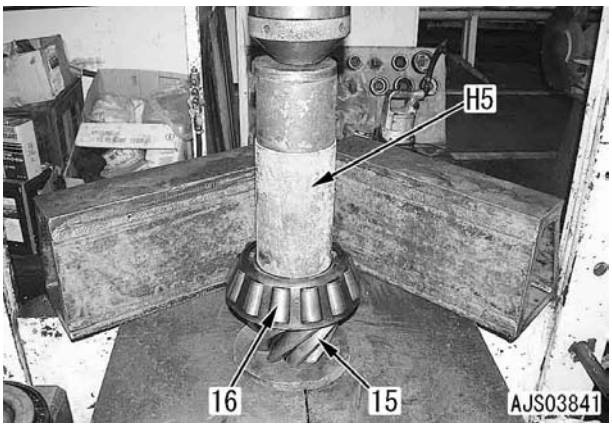
9) Install case assembly (28) to case (26).
★ Match the marking on the case.
Mounting bolt:
824 – 1,030 Nm {84 – 105 kgm}



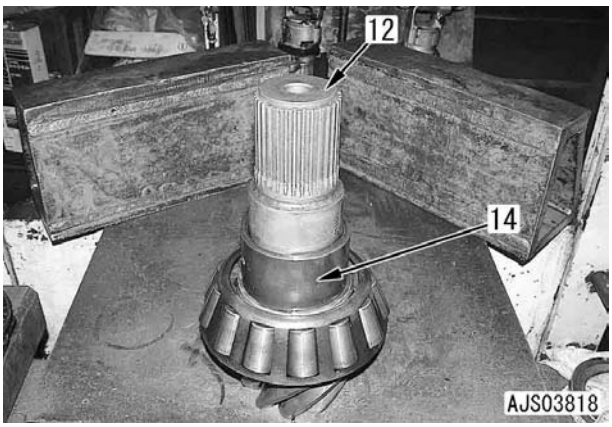
10) Install bevel gear (25) to case (26).
★ Match the markings on the bevel gear and the case.
Mounting bolt:
Liquid adhesive (LT-2)
Mounting bolt:
490 – 608 Nm {50 – 62 kgm}



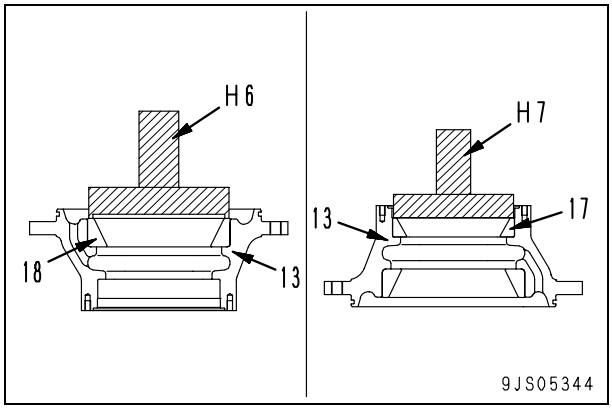
3. Assembly of bevel pinion assembly
1) Use tool **H5** to press fit bearing (16) to bevel pinion shaft (15).



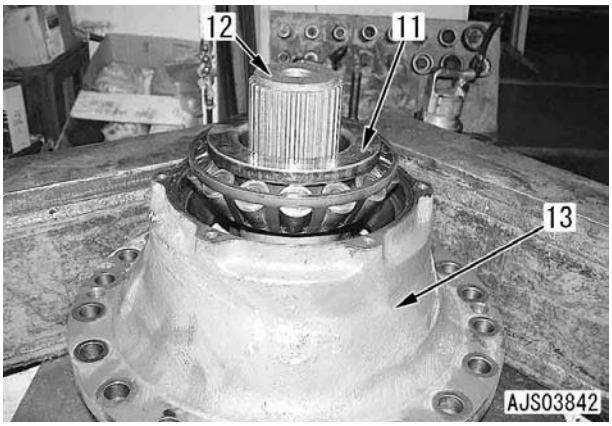
2) Install spacer (14) to bevel pinion assembly (12).



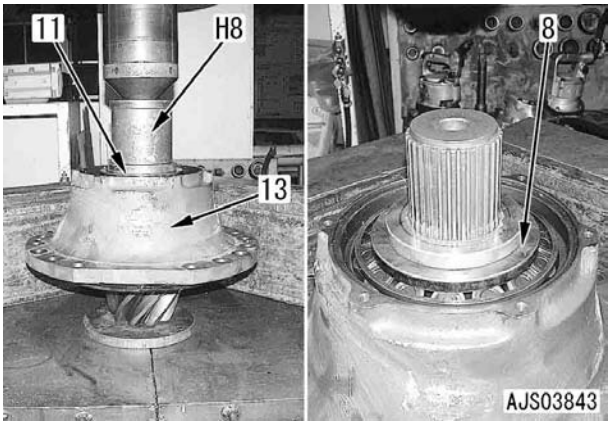
4. Assembly of support assembly
1) Use tool **H6** to install bearing outer race (18) to support assembly (13).
2) Use tool **H7** to install bearing outer race (17) to support assembly (13).
★ Press fit outer race until it comes in contact with the support.



5. Assembly of support and bevel pinion assembly
1) Install support assembly (13) and bearing (11) to bevel pinion assembly (12).

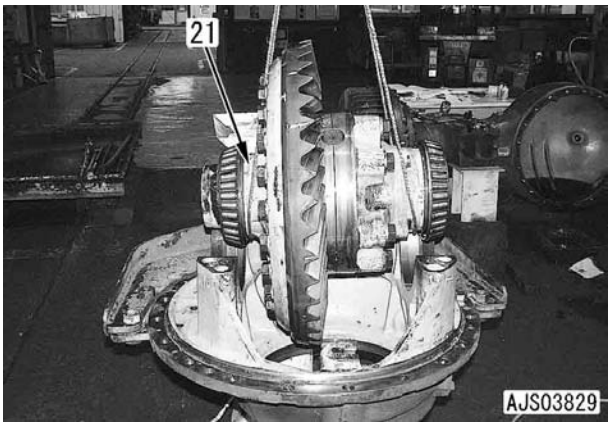


2) Use tool **H8** to press fit bearing (11) to support assembly (13).
3) Install retainer (8) to the pinion shaft after press fitting.

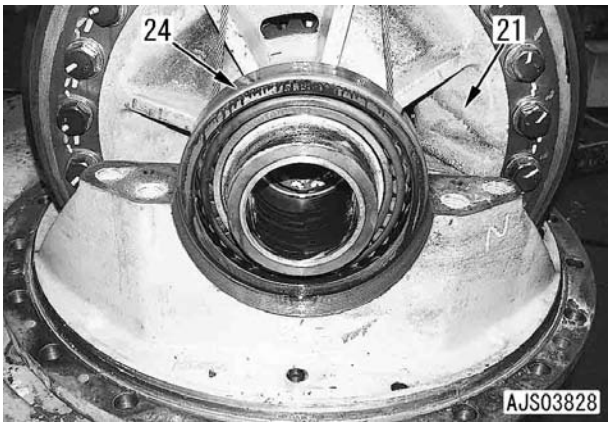


6. Installation of differential gear assembly.

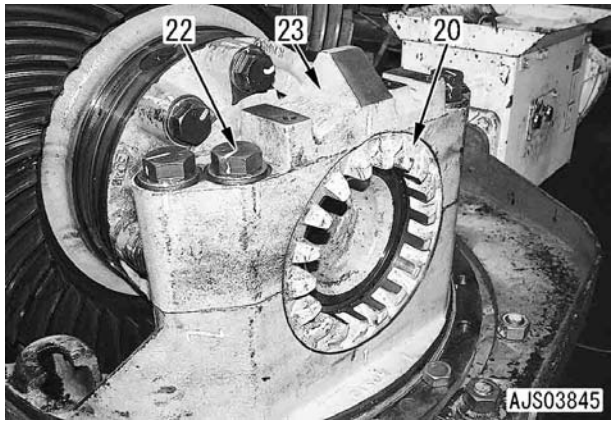
1) Lift differential gear assembly (21) to the installation position of the carrier case.
   ★ Keep the gear assembly off the carrier case.



2) Install bearing outer races (24) to the left and right of the differential gear.
   ★ Match the left and right bearings by checking the match marks on the left and right inner races.



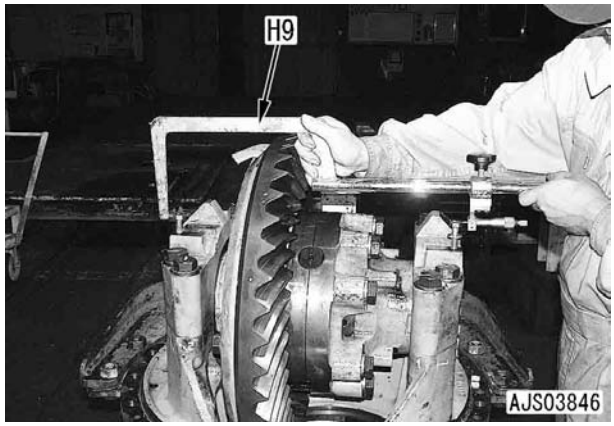
3) Tighten adjustment nut (20) to the carrier case temporarily.
4) Install left and right bearing caps (23).
   ★ Check the markings on the left and right bearing caps and match them to the dowel pins.
5) Tighten 4 bearing cap mounting bolts (22) each to the left and right.
   ★ Tighten the bolts after rotating the bevel gear 20 to 30 rounds to run in the bearing.
   Mounting bolt:
   Liquid adhesive (LT-2)
   Mounting bolt:
   824 – 1,030 Nm {84 – 105 kgm}



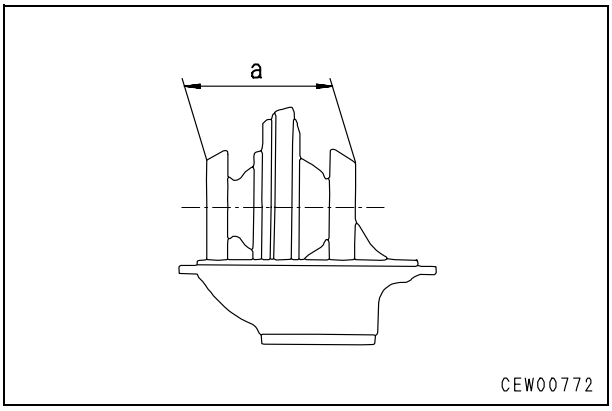
   ★ Install the left and right locks for the adjustment nut after completing the “Pre-load adjustment of bearing”, “Backlash adjustment” and “Testing and adjusting of tooth contact.”

7. Pre-load adjustment of bearing

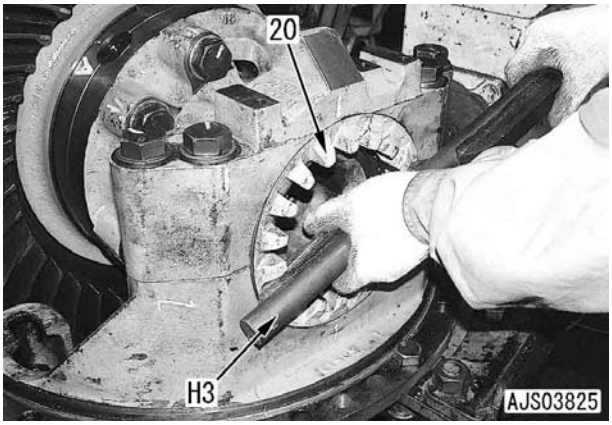
1) Match tool **H9** to the caps on both sides.



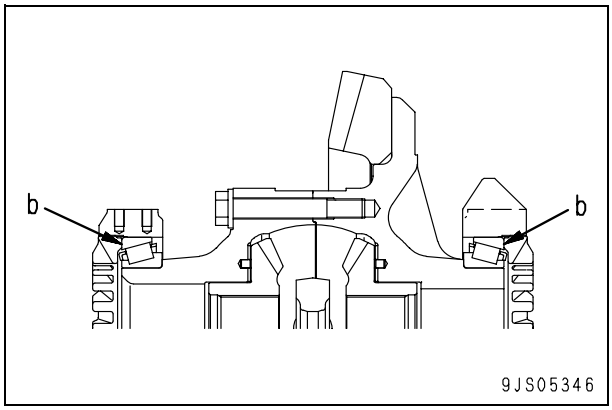
2) Use tool **H9** to measure dimensions (a).



3) Add 0.47 ± 0.09 mm to measured dimension (a) and set the graduations of tool **H9**.
   - ★ The added dimension will be the deflection of the case before and after applying the pre-load.
   - ★ Tighten adjustment nut (20) using tool **H3** so that the increment will be 0.47 ± 0.09 mm.

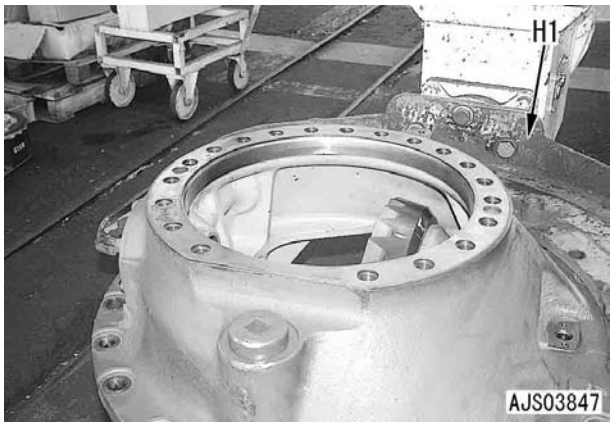


   - ★ Precautions in adjusting pre-load
     If the deflection should exceed the standard dimension due to overtightening of the adjustment nut, return the nut to the position before the adjustment.
     To do this, lightly hit the bearing cap and bevel gear with a plastic hammer, etc. while rotating the bevel gear. Make sure that no clearance exists in (b) portion and then make adjustment again.

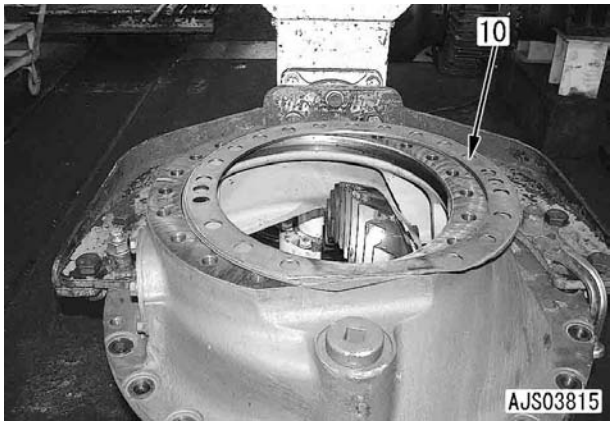


8. Installation of bevel pinion assembly

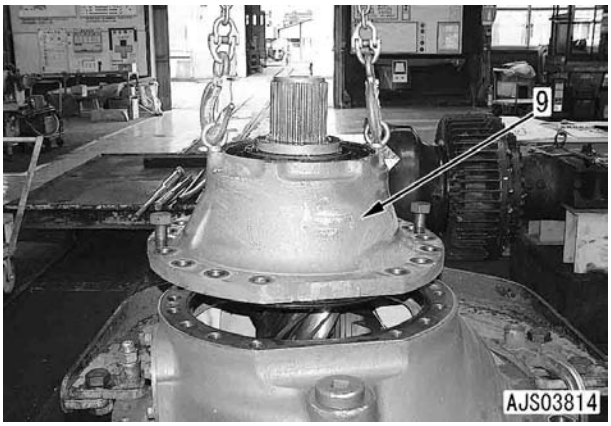
1) Invert the tool **H1**.



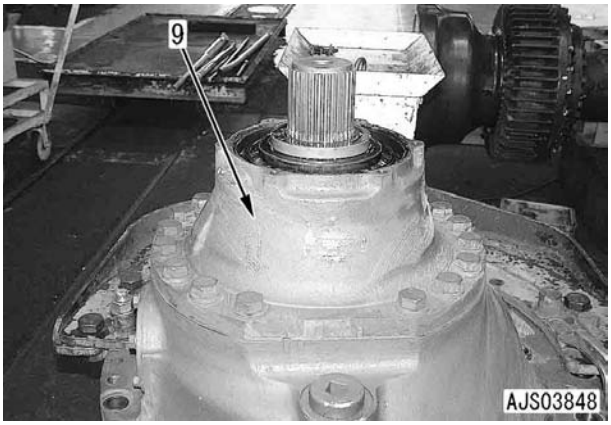
2) Install shim (10).
   - ★ Install the shim removed during disassembly.
   - ★ Standard shim thickness: 1.45 mm
   - ★ Shim margin for adjustment: 0.8 – 2.1 mm



3) Install O-ring, and then lift and install support bevel pinion assembly (9).

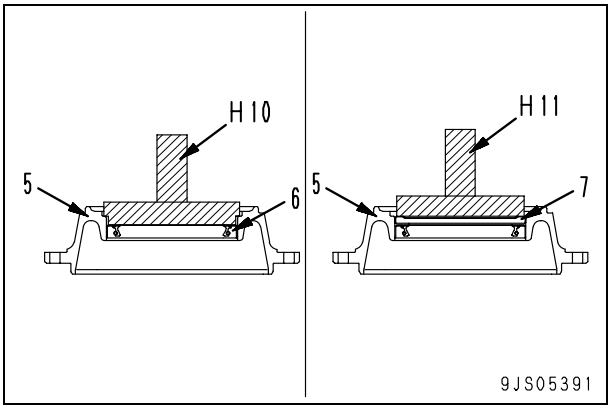


4) Tighten support bevel pinion assembly (9) with 20 bolts.
Mounting bolt:
490 – 608 Nm {50 – 62 kgm}

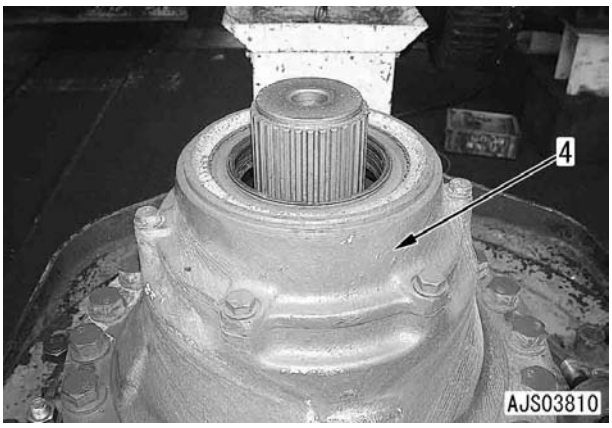


9. Installation of cage assembly

1) Use tool **H10** press fit dust seal (7) to cage (5), using oil seal (6) and tool **H11**.
Oil seal lip surface:
Grease (G2-LI)
Dust seal lip surface:
Grease (G2-LI)

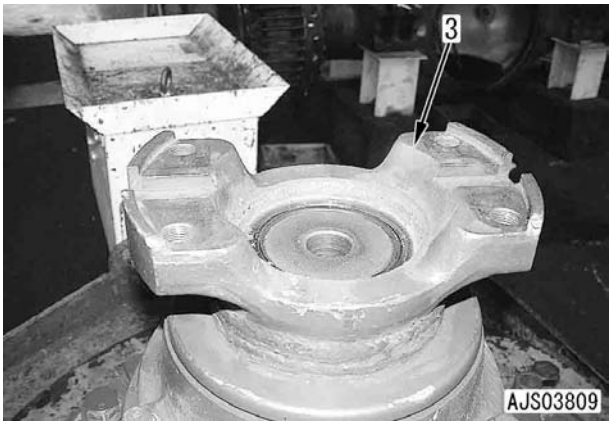


2) Install cage assembly (4) with 6 bolts.
Mounting bolt:
59 – 74 Nm {6 – 7.5 kgm}

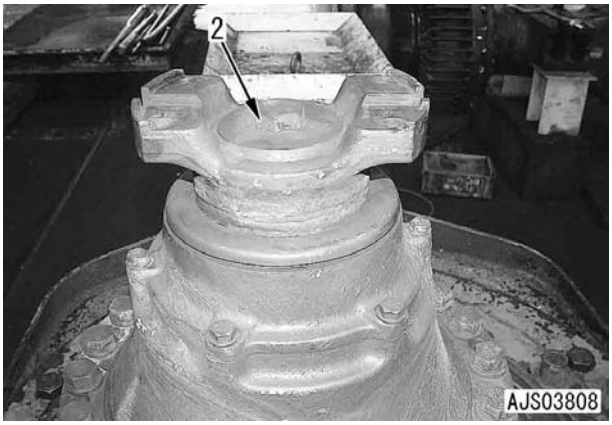


10. Installation of coupling

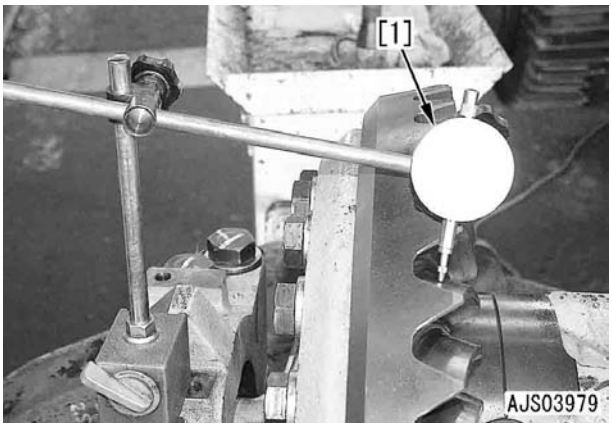
1) Install O-ring and coupling (3).
Contact surface of the retainer and coupling: **LM-G or LM-P**



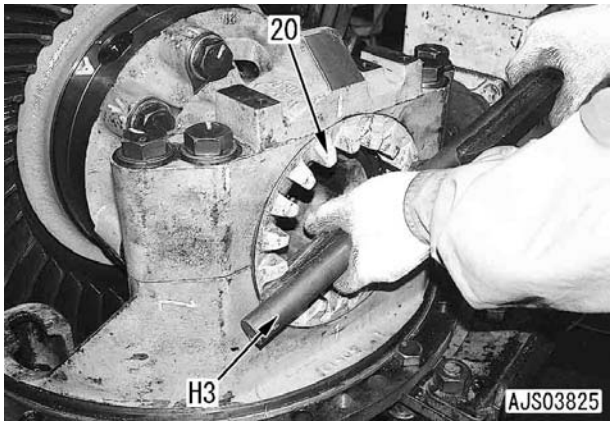
2) Install holder (2) and tighten bolt.
   ★ Tighten the bolts gradually after rotating the bevel gear and bevel pinion 20 to 30 rounds.
   Mounting bolt:
   Liquid adhesive (LT-2)
   Mounting bolt:
   824 – 1,030 Nm {84 – 105 kgm}



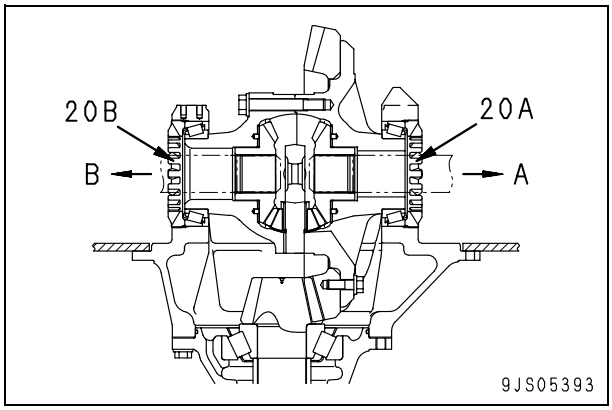
11. Backlash adjustment
1) Hold the probe of dial gauge [1] to the tip of the bevel gear tooth at a right angle.
2) Read the scale when the bevel gear is turned in the right direction of rotation with the bevel pinion fixed.
   ★ Measure at 3 to 4 points.
   ● Backlash reference value:
   0.41 – 0.56 mm



3) If backlash is off the reference value, shift the bevel gear for adjustment.
   ★ Adjust bevel gear shifting with adjustment nut (20), using tool **H3**.



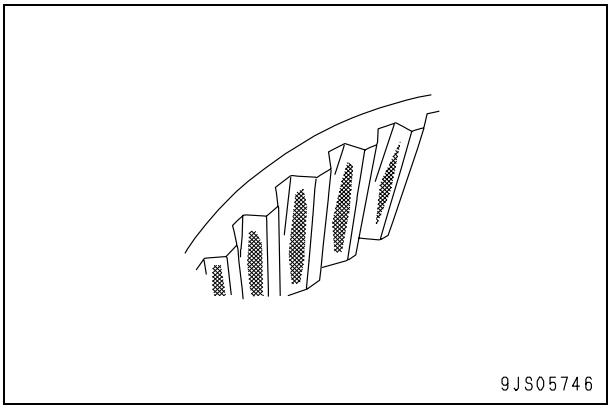
4) To keep the pre-load given to bearing (24) unchanged, turn the nuts on both sides by the same quantity and in the same direction.
   ★ In the case backlash is in short of the reference value
   Loosen adjustment nut (20A) on the side of the bevel gear and tighten adjustment nut (20B). (Direction A)
   ★ In the case backlash is in excess of the reference value
   Loosen adjustment nut (20B) on the side of the bevel gear and tighten adjustment nut (20B). (Direction B)



12. Testing of tooth contact

Apply thin layer of red lead on the tooth surface of the bevel gear. Turn the bevel gear in the forward and backward directions and check the contact mark left on the bevel gear.

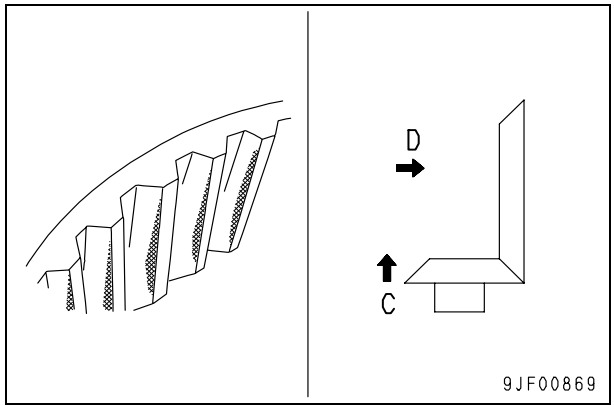
★ Proper tooth contact
Fifty percent of the total length of a tooth is in contact centering around the pitch line toward the heel with approx.
5 mm of the toe side remaining unmarked or not in contact.



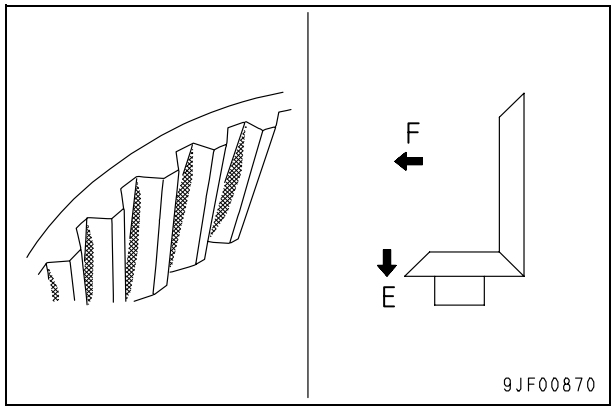
13. Adjusting of tooth contact

1) If proper tooth contact mark was not obtained upon checking, proceed to a tooth adjustment.
   ★ Make adjustment by shifting the bevel gear and increasing/decreasing the number of shims (shifting of bevel pinion gear) of the cage assembly.
   ★ After adjustment, check the backlash again.
   ★ When making adjustment by shifting the bevel gear, don't change pre-load given the bearing. Accordingly, turn the respective left and right adjustment nuts by the same quantity (check with the shifting of the notch) and in the same direction.
   ★ Shim thickness: 0.05, 0.2, 0.3 and 1.0 mm

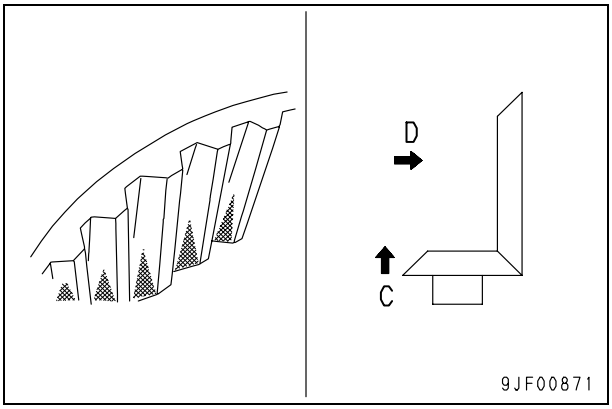
2) If the bevel pinion is excessively away from the bevel gear, the contact mark will be as shown in the following figure. Make correction according to the following procedure:
   - Reduce the number of shims of the cage assembly (on the bevel pinion side) and shift it in the direction of (C).
   - Adjust the bearing adjustment nut and shift the bevel gear in the direction of (D) away from the bevel pinion.



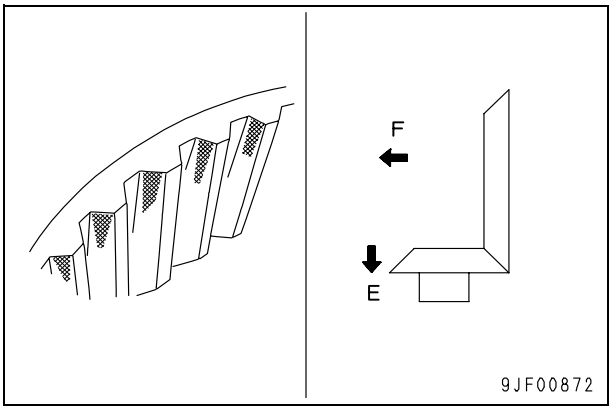
3) If the bevel pinion is excessively close to the bevel gear, the contact mark will be as shown in the following figure. Make correction according to the following procedure:
   - Increase the number of shims of the cage assembly (on the bevel pinion side) and shift it in the direction of (E).
   - Adjust the bearing adjustment nut and shift the bevel gear in the direction of (F) closer to the bevel pinion.



4) If the bevel gear is excessively close to the bevel pinion, the contact mark will be as shown in the following figure. Make correction according to the following procedure:
   - Decrease the number of shims of the cage assembly (on the bevel pinion side) and shift it in the direction of (C).
   - Adjust the bearing adjustment nut and shift the bevel gear in the direction of (D) away from the bevel pinion.



5) If the bevel gear is excessively away from the bevel pinion, the contact mark will be as shown in the following figure. Make correction according to the following procedure:
   - Increase the number of shims of the cage assembly (on the bevel pinion side) and shift it in the direction of (E).
   - Adjust the bearing adjustment nut and shift the bevel gear in the direction of (F) closer to the bevel pinion.

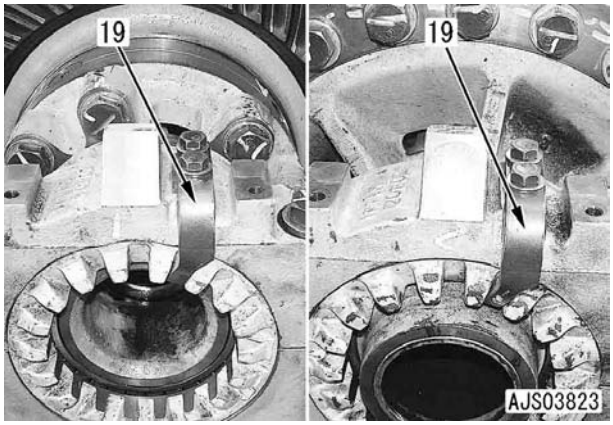


14. Lock

Install lock (17) of adjustment nut (20).

Mounting bolt:

98 – 123 Nm {10 – 12.5 kgm}



WA600-6 Wheel loader

Form No. SEN01164-00

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Printed in Japan 06-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

Power train, Part 4

Power train, Part 4 2
Removal and installation of final drive carrier assembly 2
Disassembly and assembly of final drive carrier assembly 4
Removal and installation of front final drive brake assembly 5
Disassembly and assembly of final drive assembly 7

Power train, Part 4

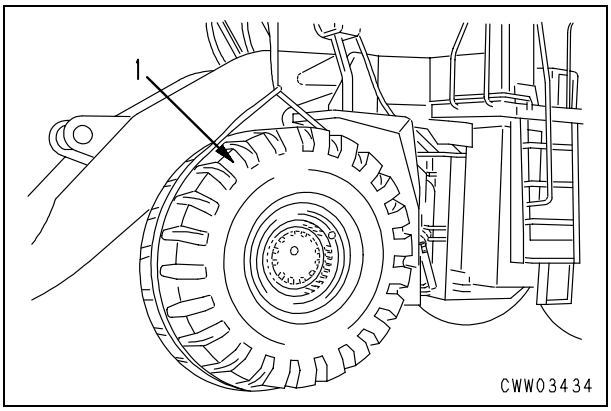
Removal and installation of final drive carrier assembly

Removal

⚠ Park the machine on level ground. Set the work equipment completely on to ground and put the blocks under the wheels.

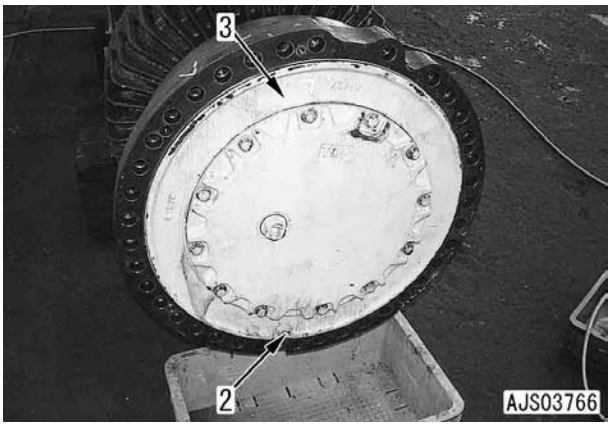
⚠ Disconnect the negative terminal (–) of the battery before starting with the work.

1. Lift the machine body with the work equipment, set a support stand under the axle. Lift the tire assembly temporarily and remove the hub mounting bolts.
   Operate the crane to remove the tire assembly (1). [*1]
   Tire assembly: **1,450 kg**

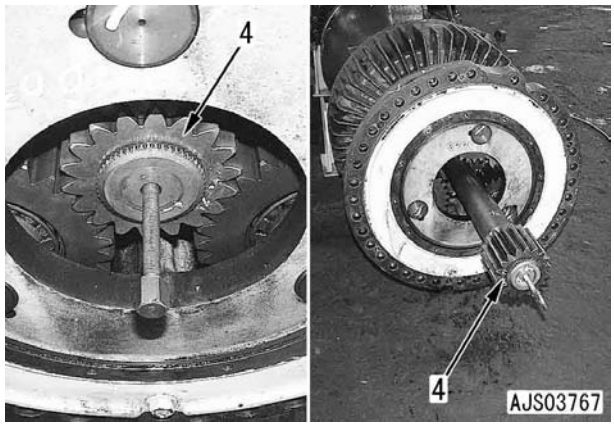


2. Remove drain plug (2) from the cover and drain oil from the final drive case. [*2]
   Final drive case: **approx. 25 ℓ**

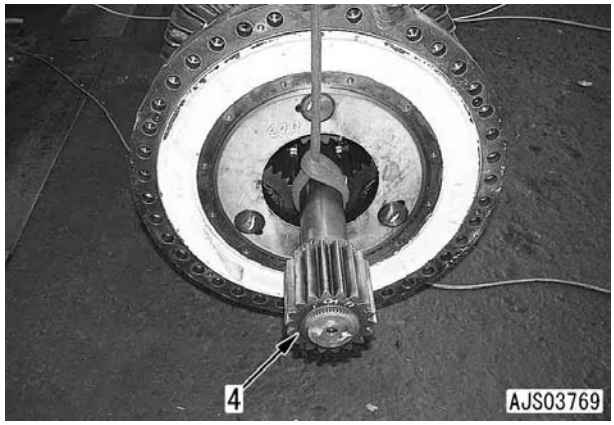
3. Remove 12 bolts and remove cover (3), then remove the O-ring. [*3]



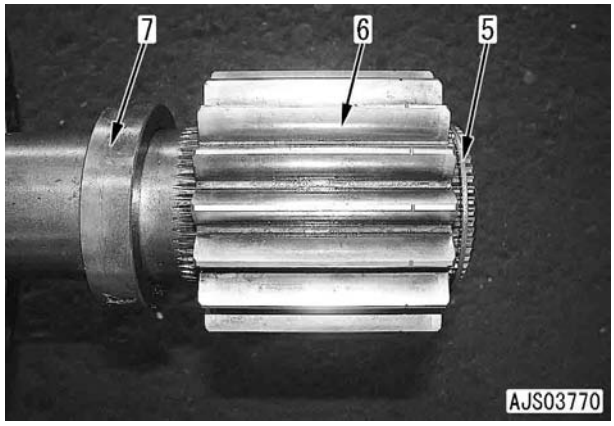
4. Pull out drive shaft (4).
   ★ To make it easier to pull out, attach an eyebolt, etc. to the end of the drive shaft to pull it out with.



5. Sling and remove the drive shaft (4).
   Drive shaft: **60 kg**

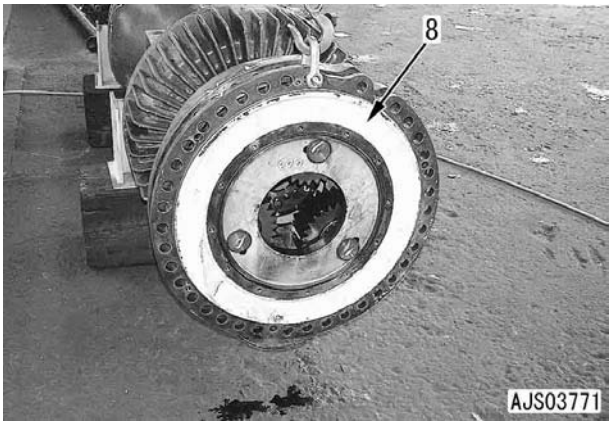


6. Remove snap ring (5) and then remove sun gear (6) and spacer (7).



7. Remove 3 hexagonal socket head bolts and sling the final drive carrier assembly (8) to remove. [*4]
   ★ Hold the assembly parallel to the ring gear using a bar, etc., remove the carrier assembly.

   Final drive carrier assembly: **160 kg**



Installation

- Installation is done in the reverse order of removal.

[*1]
Hub mounting bolt:
824.0 – 1,030.0 Nm {84.0 – 105.0 kgm}

[*2]
Oil pressure pickup plug:
127.4 – 176.4 Nm {13 – 18 kgm}
Drain plug (2): **58.8 – 78.4 Nm {6 – 8 kgm}**

[*3]
Mounting bolt: **98 – 123 Nm {10 – 12.5 kgm}**

[*4]
Carrier assembly mounting bolt (with hexagonal socket head):
98 – 123 Nm {10 – 12.5 kgm}

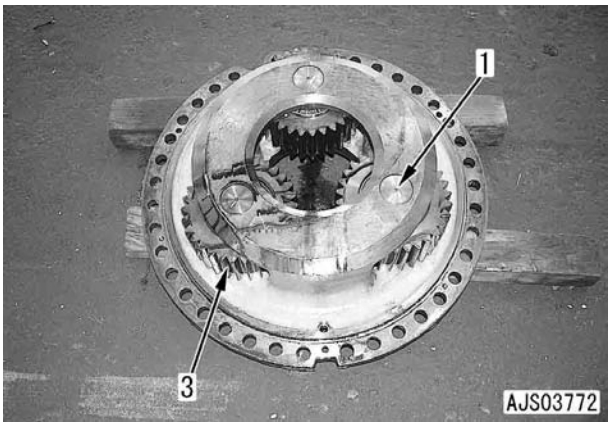
- **Refilling with oil**

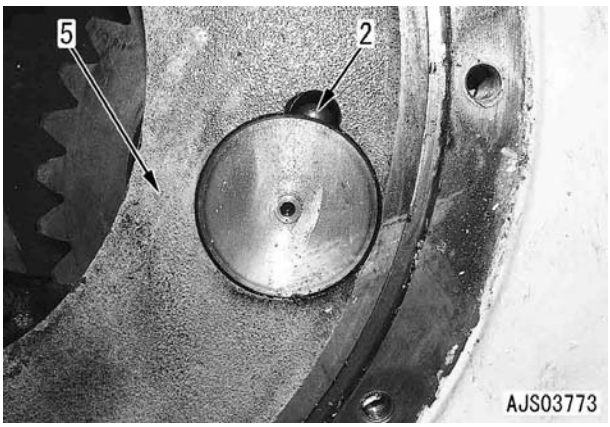
  Final drive case (one side): **25 ℓ (AXO80)**

Disassembly and assembly of final drive carrier assembly

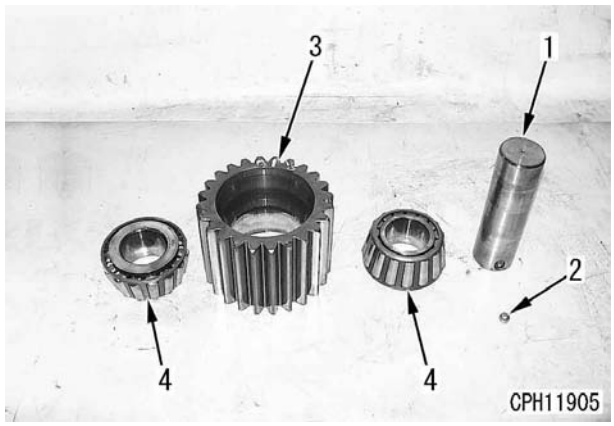
Disassembly

1. Using the press, pull out the shaft (1) and remove planetary gear (3).
   - ★ When the shaft is pushed out, lock ball (2) falls for which care should be taken not to lose it.
   - ★ Enter a number to case (5). Care should be taken not to mix removed parts with others.





2. Remove 2 bearings (4) from planetary gear (3).
   - ★ Store the bearing, etc. that has developed a run-in in a separate group of the bearings (2 bearings), shaft and a ball to prevent them from being re-assembled with other parts.

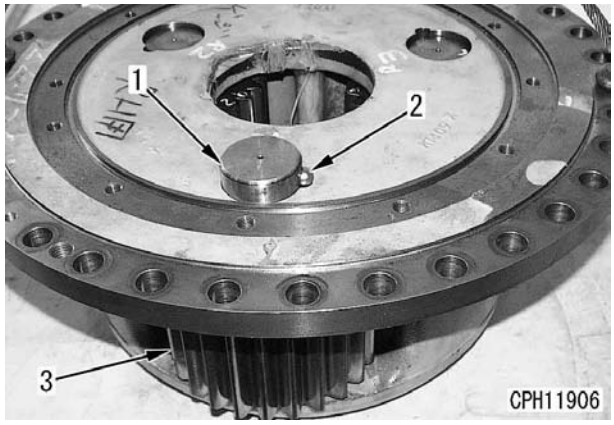


Assembly

1. Install 2 bearings (4) to the planetary gear (3) and set them to carrier case (5).
   - ★ Match the position exactly to the hole on the case.

2. Align the notch hole for the ball on the side of carrier case (5) to the ball hole of shaft (1). Press fit the shaft in until the ball hole makes contact with the case end.

3. Install ball (2) to the hole and press fit shaft (1).

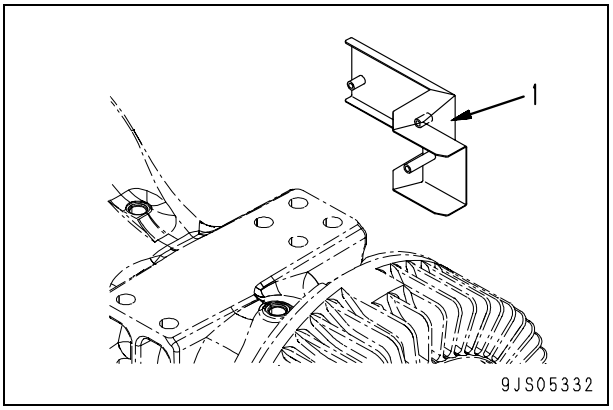


Removal and installation of front final drive brake assembly

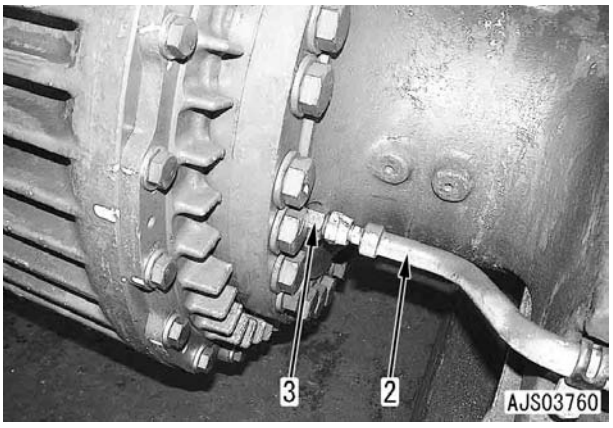
Removal

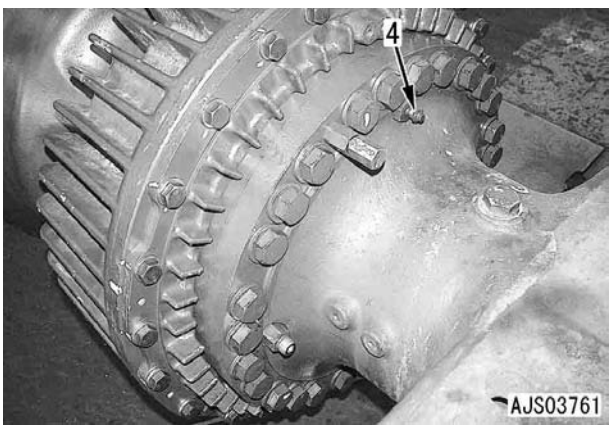
1. Remove the final drive shaft assembly, referring to section 1 to 6, “Removal and installation of final drive carrier assembly.”

2. Remove 3 bolts and remove the brake tube cover (1). [*1]



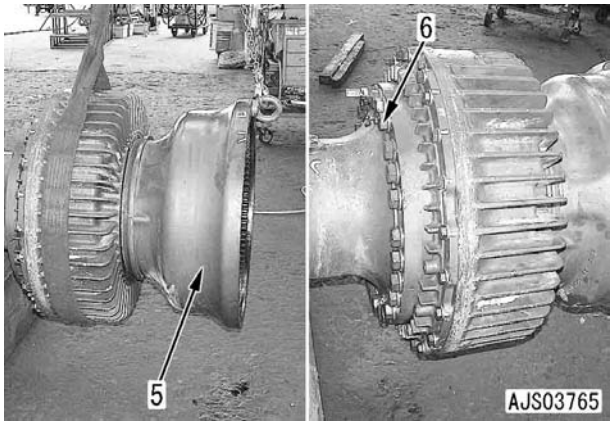
3. Remove the clamp, brake tube (2) and nipple (3). [*2]
   - ★ Remove the brake tube on the side of the slack adjuster too.
   - ★ Leave the piston air bleeder plug (4) installed as it is not removable.



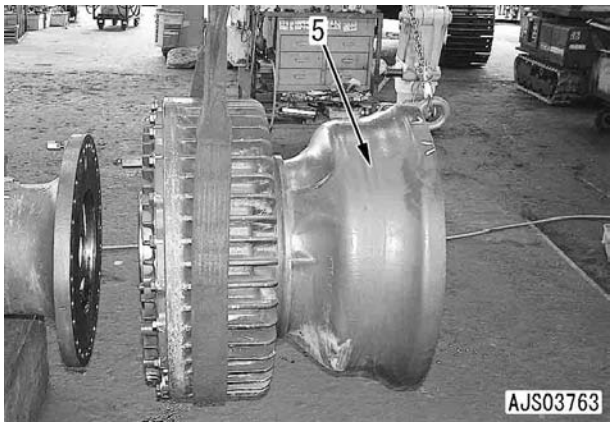


4. Sling the final drive brake assembly (5) temporarily and remove 28 bolts (6). [*3]
   - ★ Don't hook on the floating seal retainer directly for slinging.
   - ★ When removing the final drive brake assembly, use chain block on one side to balance the assembly.

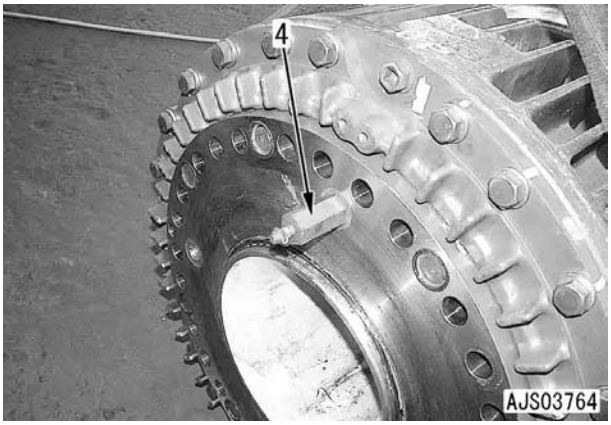
   Final drive brake assembly: **850 kg**



5. Sling and remove the final drive brake assembly (5).
   - ★ Carefully remove the piston air bleeder plug (4) to prevent damages.



6. Remove the piston air bleeder plug (4). [*4]



Installation

- Installation is done in the reverse order of removal.

[*1]
Mounting bolt: **59 – 74 Nm {6 – 7.5 kgm}**

[*2]
Clamp mounting bolt:
59 – 74 Nm {6 – 7.5 kgm}
Nipple (3): **84 – 132 Nm {8.5 – 13.5 kgm}**

[*3]
Mounting bolt: **824 – 981 Nm {84 – 100 kgm}**

[*4]
Air bleeder plug (4):
84 – 132 Nm {8.5 – 13.58 kgm}

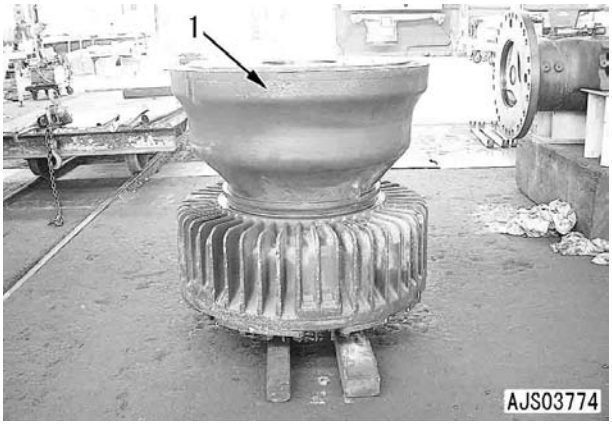
Disassembly and assembly of final drive assembly

Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/remodel	Sketch
J	1	793T-622-1910	Fixture	■	3	N	○

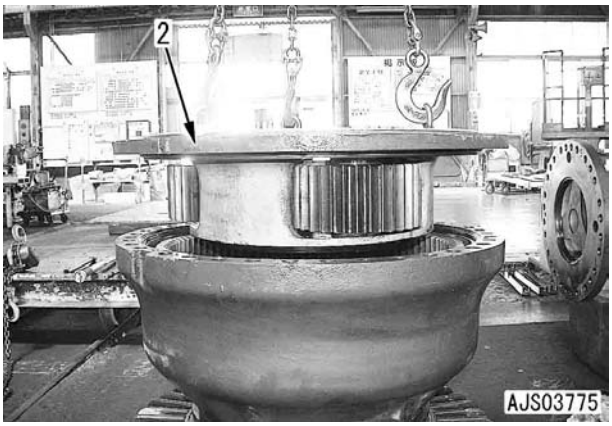
Disassembly

1. Set final drive brake assembly (1) on a flat place with the final drive side on top.



2. Remove 3 hexagonal socket head bolts and sling final drive carrier assembly (2) to remove.

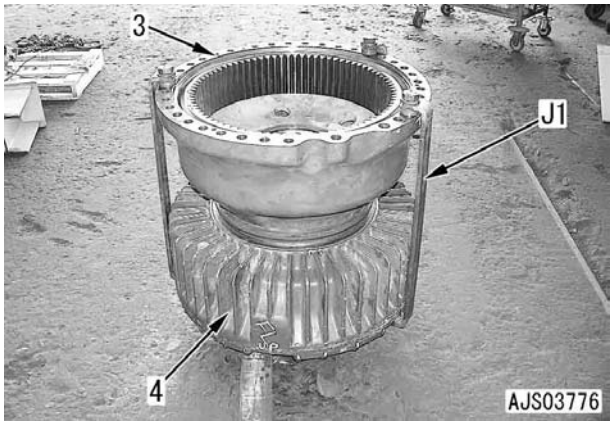
Final drive carrier assembly: **160 kg**



3. Fix the final drive assembly (3) and brake assembly (4) using jig **J1**.

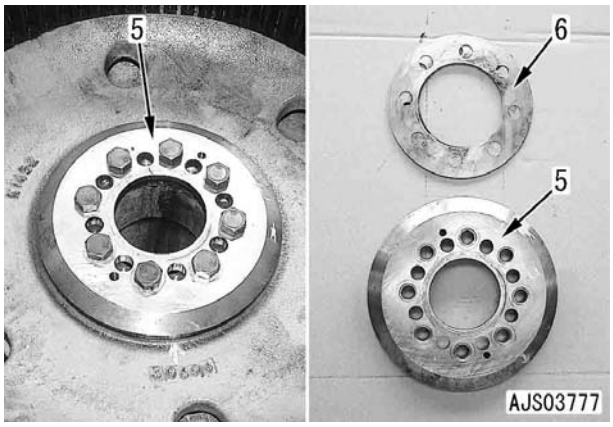
★ Install the tool at 3 points.

● Install the jig **J1** until the final drive assembly is assembled.



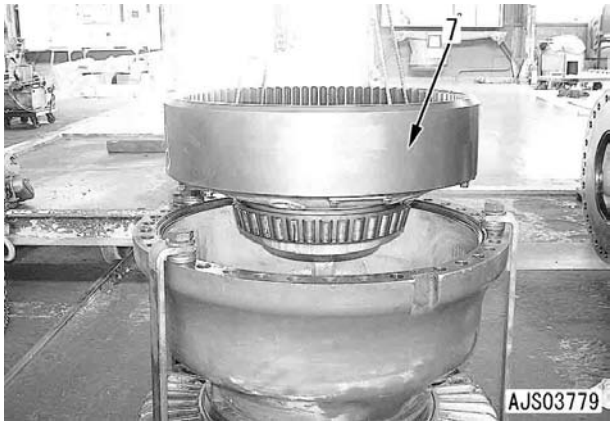
4. Remove 8 mounting bolts, and then retainer (5) and shim (6).

★ Check the thickness and quantity of the shims in advance.



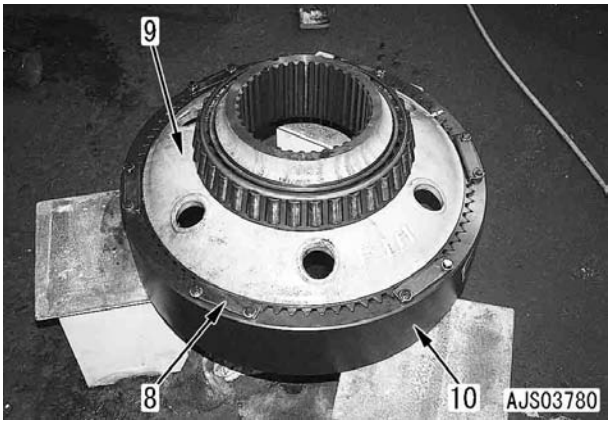
5. Sling the ring gear assembly (7) to remove.

Ring gear assembly: **110 kg**



6. Disassembly of carrier assembly
For details on disassembly of carrier assembly (2), referring to “Disassembly and assembly of final drive carrier assembly.”

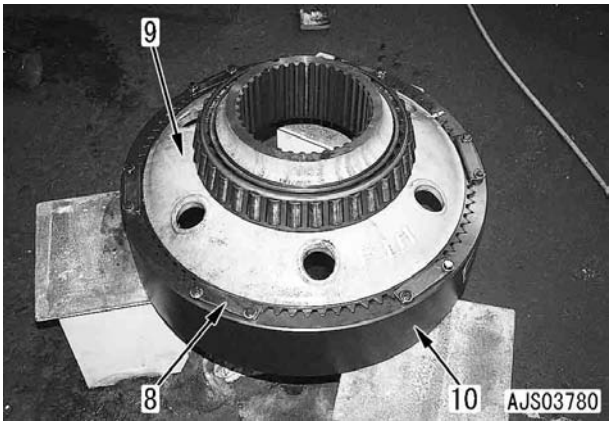
7. Disassembly of ring gear assembly (7)
1) Remove 6 lock plates (8) and then remove ring gear hub (9) from the ring gear (10).
2) Remove bearing (11) from the ring gear hub (9).



Assembly

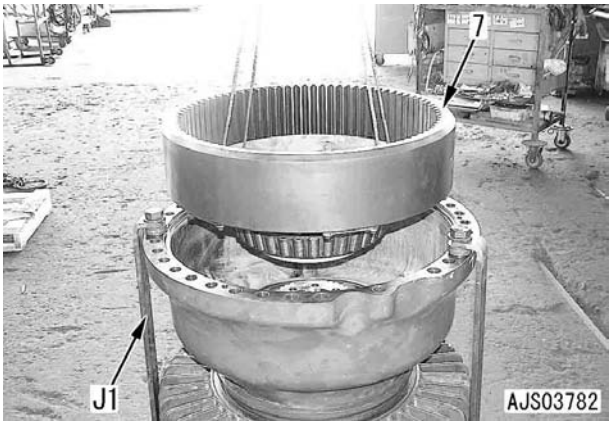
★ Before assembly, check that every part is washed clean and not attached with dirt or damaged.

1. Assembly of ring gear assembly (7)
1) Press fit bearing (11) in to ring gear hub (9).
   ★ Make sure that there is no clearance between the hub after press fitting the bearing.
2) Engage ring gear hub (9) to the ring gear (10) and install 6 lock plates (8).
   ★ When assembling, hold the lock plate with the wider portion to the inside.
   ★ Fully degrease tapped holes.
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt:
   27 – 34 Nm {2.8 – 3.5 kgm}

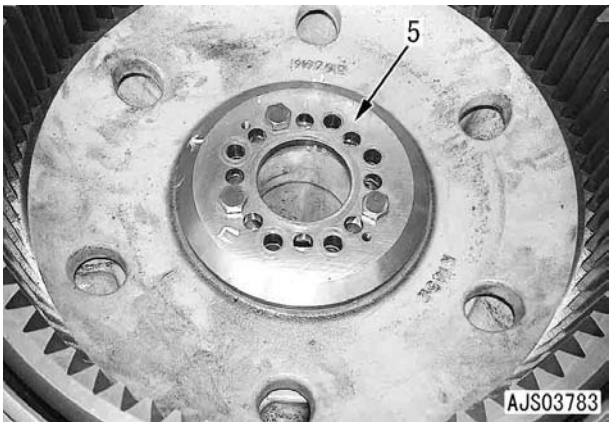


2. Assembly of final drive carrier assembly (2)
For details on assembly of carrier assembly (2), referring to “Disassembly and assembly of final drive carrier assembly.”

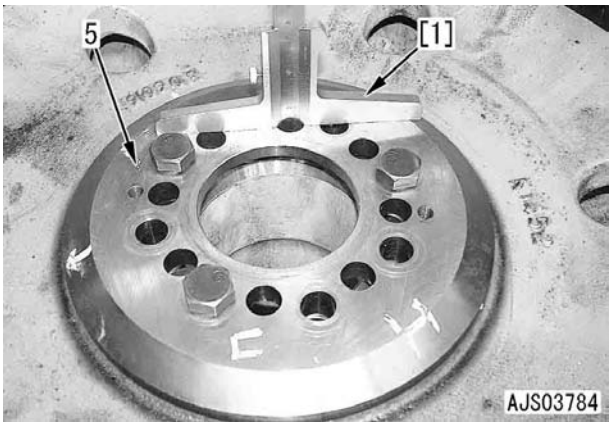
3. Insert ring gear assembly (7) and remove jig **J1**.



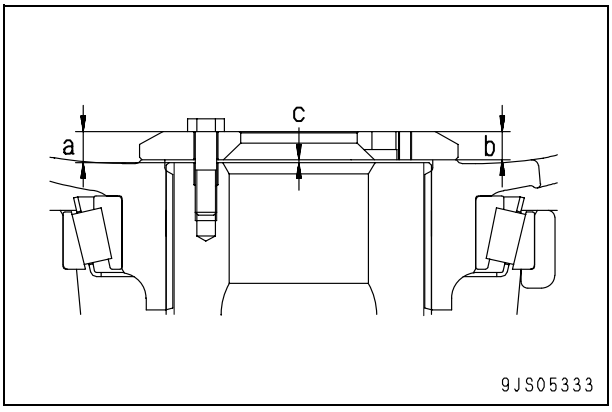
4. How to adjust wheel bearing
1) Temporarily tighten retainer (5) with 3 mounting bolts with specified torque without installing shim (6).
   Temporary tightening torque
   57.9 – 67.7 Nm {5.9 – 6.9 kgm}
   ★ While rotating wheel hub 5 to 6 times, tighten the retainer evenly until a specified torque is reached.



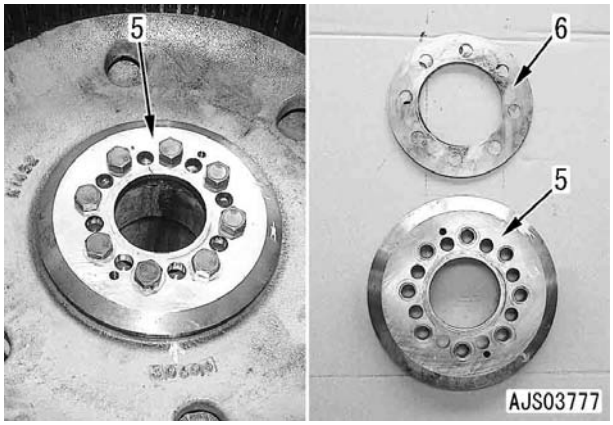
2) Measure the dimension (a) between the retainer end and the tube (12) end using a depth gauge [1] or depth micro gauge through the measuring hole of retainer (5).
   ★ Take measurement at 2 locations and calculate the mean.



3) Remove the retainer (5) and measure the thickness (b) of the retainer.
   ★ Take measurement at 2 locations and calculate the mean.
4) Calculate the thickness (c) of shim (6) using the following equation:
   Thickness of shim (c) (mm) =
   (a) – (b) +0.3 (mm)
   ★ Obtain necessary thickness with a minimum number of shim.
   ★ Thickness of shim:
   0.2, 0.3 and 1.0 (mm)

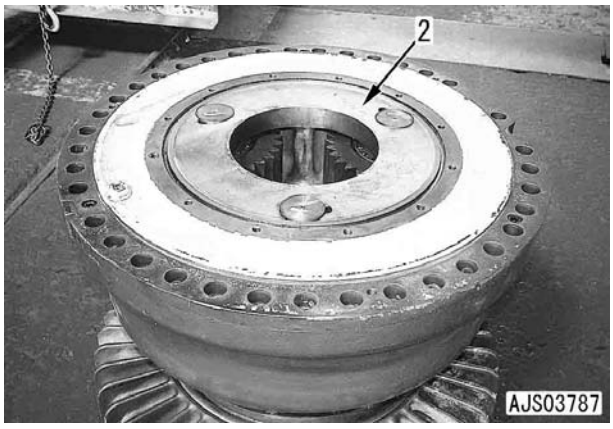


5) Assemble the calculated shim (6) and retainer (5) and tighten them to a specified torque with all of the mounting bolts.
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt:
   245 – 289 Nm {25 – 29.5 kgm}
   ★ While rotating wheel hub 5 to 6 times, tighten the retainer evenly until a specified torque is reached.



6) Rotate the wheel hub again and check that the rotation is normal.

5. Install the final drive carrier assembly (2) with 3 bolts with hexagonal socket head.
   Carrier assembly mounting bolt (with hexagonal socket head):
   98 – 123 Nm {10 – 12.5 kgm}



WA600-6 Wheel loader

Form No. SEN01165-00

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Printed in Japan 06-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

Brake system

Brake system 2
Disassembly and assembly of brake assembly 2
Removal and installation of brake valve assembly 10
Disassembly and assembly of accumulator and charge valve assembly 11
Disassembly and assembly of slack adjustor assembly 14

Brake system

Disassembly and assembly of brake assembly

Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
J	1	793T-622-1910	Fixture	■	3	N	○
	2	792-520-2110	Installer	■	1		
		792-530-1600	Push tool	■	1		
	3	792T-422-1220	Plate	■	1		○
		790-101-5421	Grip	■	1		
		01010-81240	Bolt	■	1		

Disassembly

⚠ **Remove internal parts (such as piston, disc, plate, floating seal, etc.) with care to prevent them from being damaged by impact, falling, etc.**

1. Remove the final drive brake assembly, referring to “Removal and installation of final drive brake assembly.”

★ For details on disassembly of final drive assembly, refer to “Disassembly and assembly of final drive assembly.”

2. Final drive brake assembly

Install jig **J1** to final drive brake assembly (1), invert to hold the brake assembly side on top.

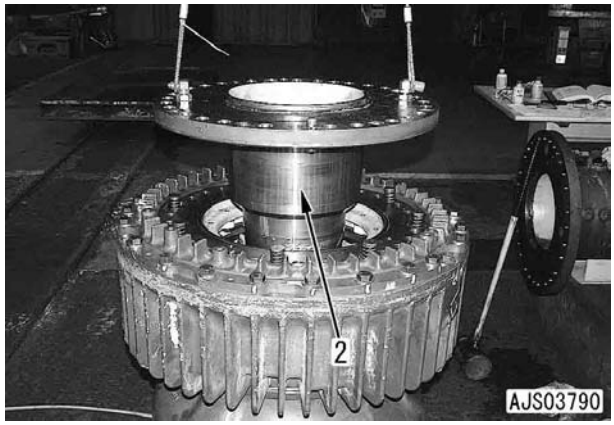
★ After placing the assembly on a flat place, remove the jig **J1**.

3. Tube assembly

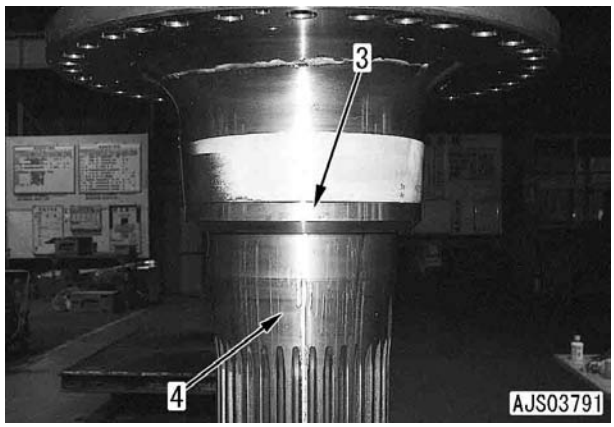
1) Remove 2 hexagonal socket head bolts and lift off tube assembly (2).

★ Take care not to drop the assembly since bearing inner race may be removed together.

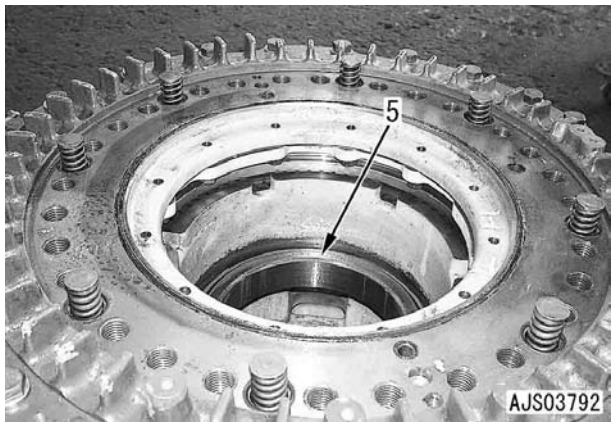
Tube assembly: **115 kg**



2) Remove retainer (3) from tube (4).

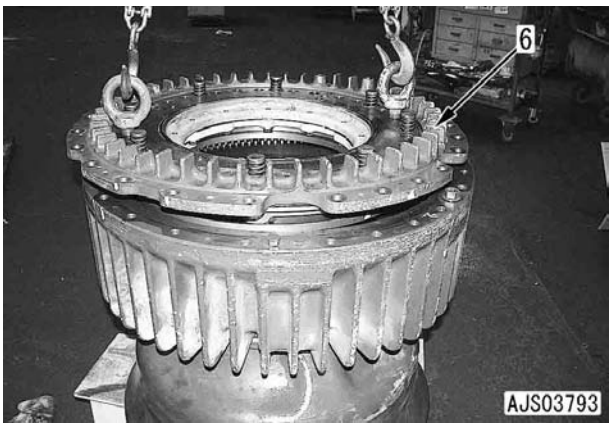


3) Remove bearing inner race (5).

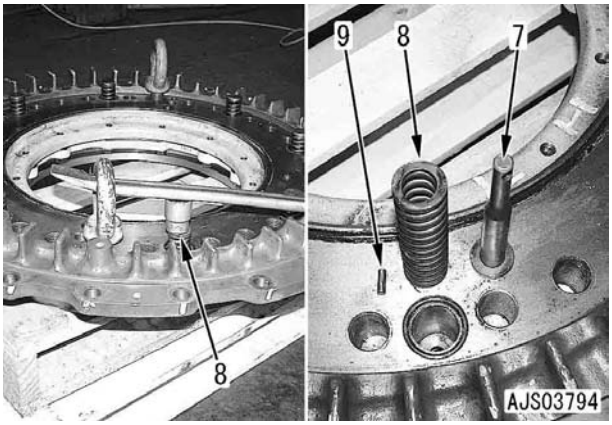


4. Cylinder assembly

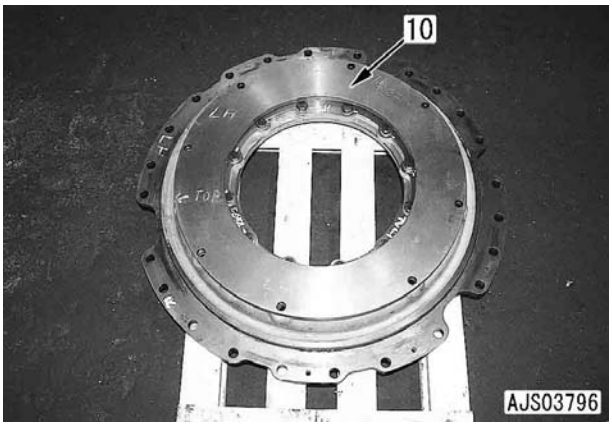
1) Remove 24 mounting bolts and lift off cylinder assembly (6).



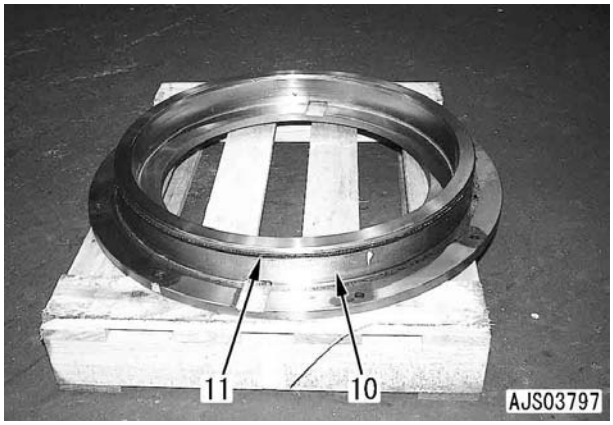
2) Use an eyebolt, bar, etc. to push in spring (8), pull out lower pin (7).
3) Remove spring (8) and guide (9).



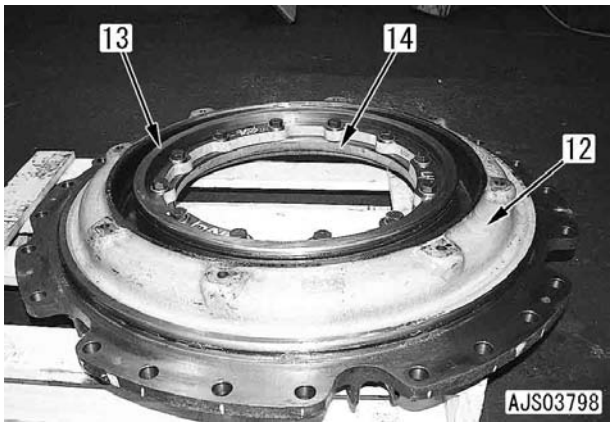
4) Remove piston (10).



5) Remove seal ring (11) from piston (10).

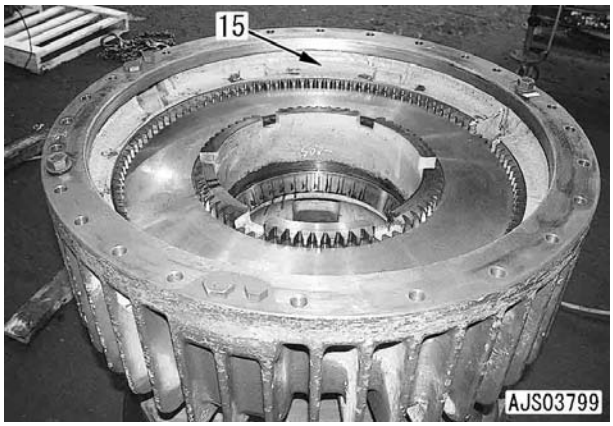


6) Remove seal ring (13) from cylinder (12).
7) Remove 12 mounting bolts, and then remove sleeve (14) from cylinder (12).

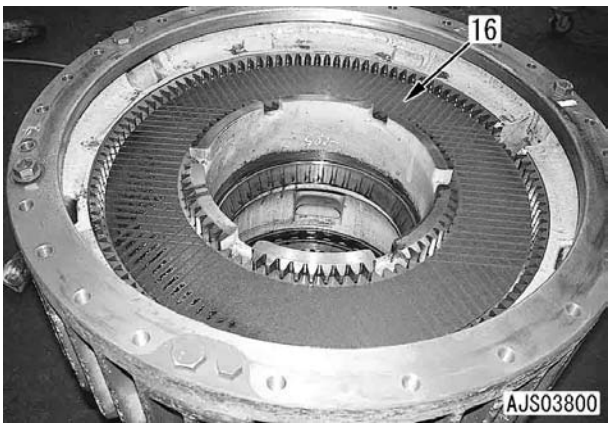


5. Plate disc

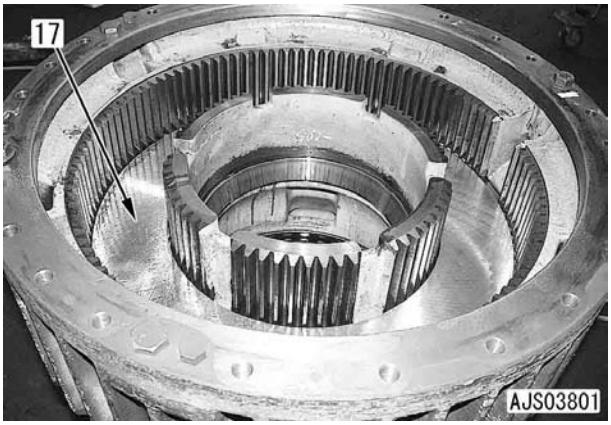
1) Remove plate (15).
   ★ Before removing the plate and disc, provide the plate and outer gear, and the disc and wheel hub with counter marks.



2) Remove disc (16).
★ Remove disc carefully, avoiding damages as it is made of a soft material.



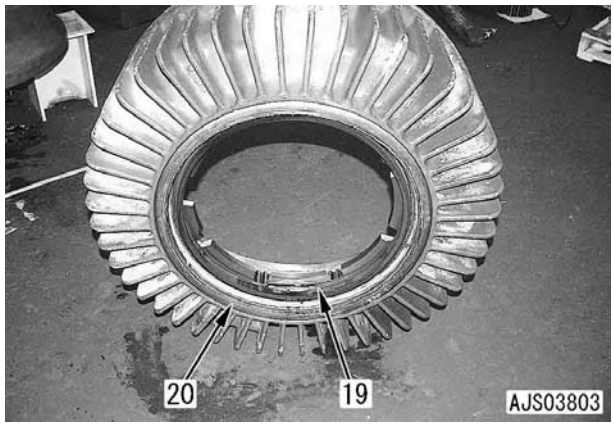
3) Remove 12 plates (15) and 11 discs (16) alternately.
4) Remove plate (17) at the end.
★ Thickness of plate (17) is 10 mm.



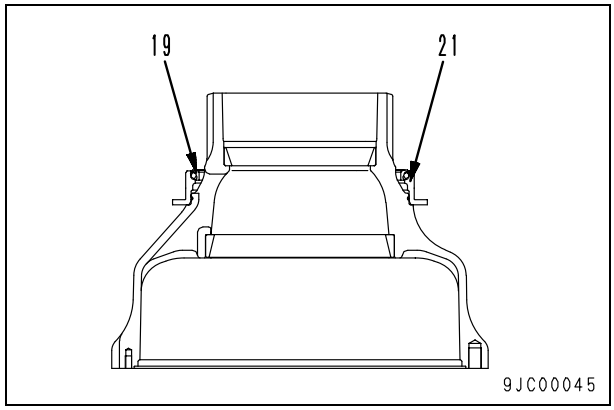
6. Outer gear
1) Remove outer gear (18).
★ Take care not to drop the floating seal on the bottom.



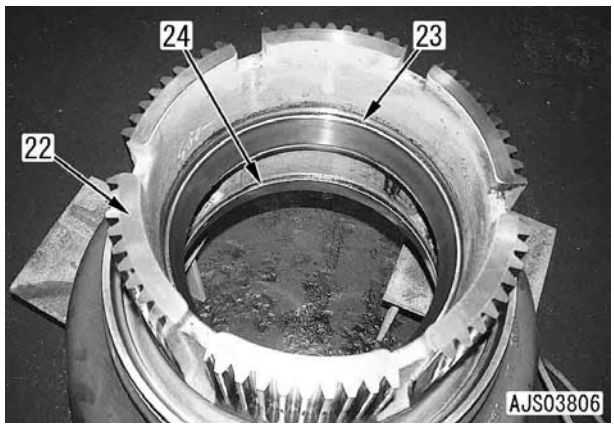
2) Remove floating oil seal (19) and oil seal (20) from the outer gear.



7. Retainer
1) Remove floating seal (19) from retainer (21).
2) Remove 6 mounting bolts and retainer (21).



8. Wheel hub assembly
Remove outer races (23) and (24) from the wheel hub (22).



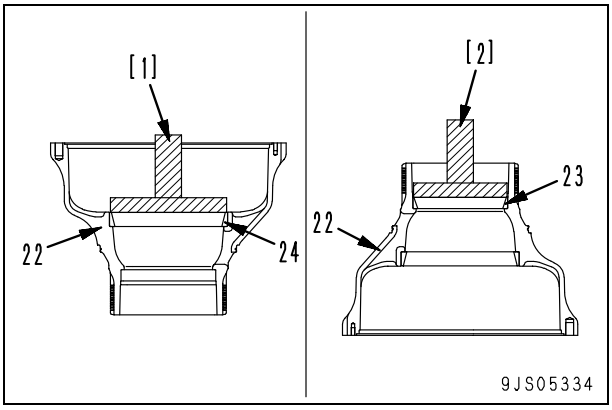
Assembly

★ Before assembly, check that every part is washed clean and not attached with dirt or damaged.
★ Before assembly, apply engine oil to the sliding surfaces of each part.
★ Completely remove white powder on the surface of the O-ring of floating seal using engine oil, etc.

⚠ **Install floating seal carefully as a flaw, however minor, on the floating seal due to impact or falling may cause oil leakage.**

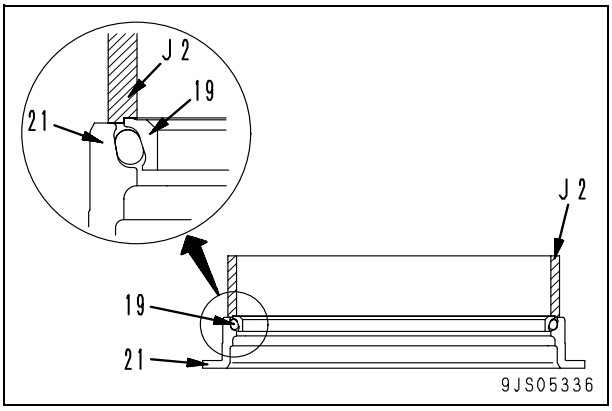
1. Wheel hub

1) Use tool [1] to press fit outer race (24) to wheel hub (22).
2) Use tool [2] to press fit outer race (23) to wheel hub (22).

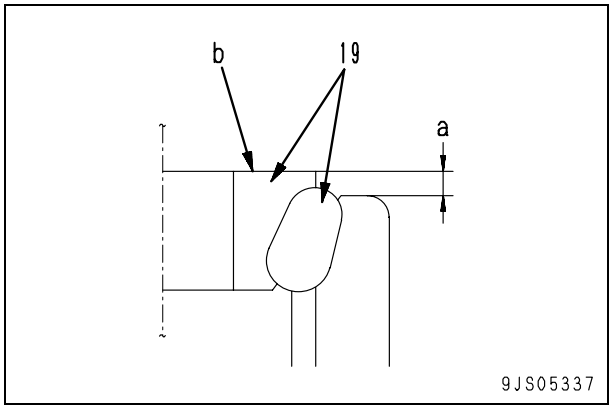


2. Retainer

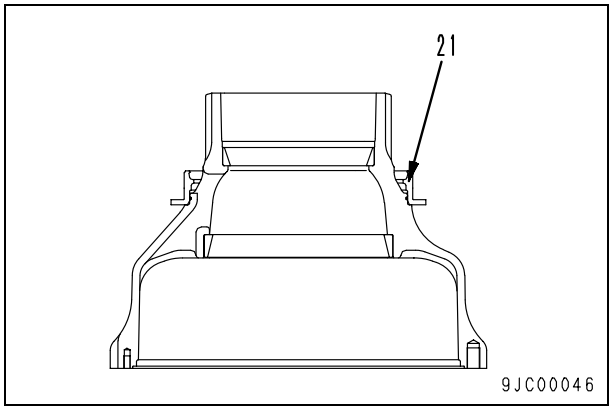
1) Use tool **J2** to install floating seal (19) to retainer (21).
   ★ Fully degrease the contact surface between floating seal and the hub O-ring.
   ★ Use tool **J2** to evenly tighten O-ring of the floating seal by avoiding twist.



2) After installation measure the height (a) at 4 points on the circumference and check that dimensional difference reads within 1 mm.
   ★ Apply a thin layer of axle oil (AXO80) to the top end surface (b) of the floating seal.

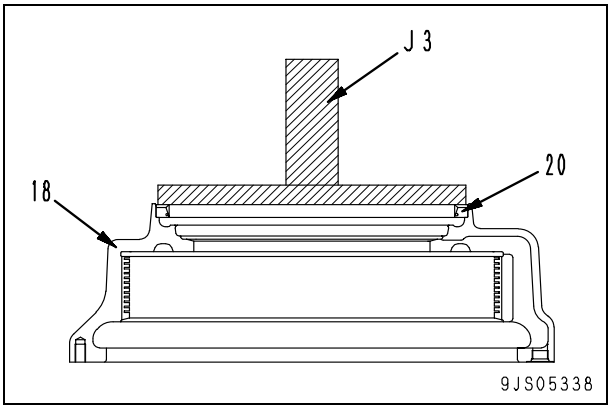


3) Install retainer (21).
   Mounting bolt:
   59 – 74 Nm {6 – 7.5 kgm}

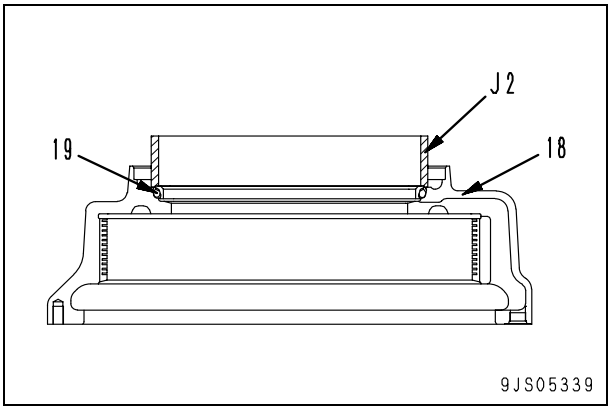


3. Outer gear

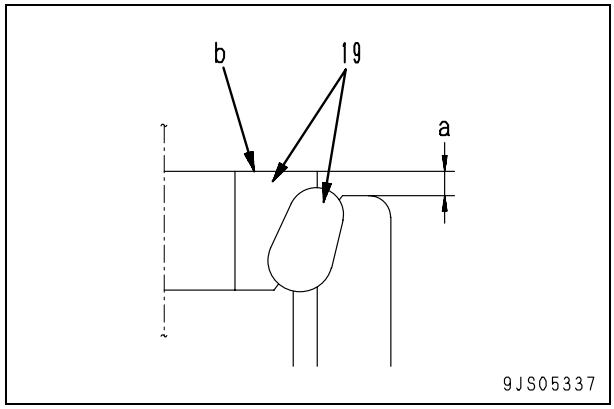
1) Use tool **J5** to press fit oil seal (20) to outer gear (18).
   ★ Press fit oil seal to be flush with the outer gear case end surface.
   Oil seal lip surface:
   Grease (G2-LI)



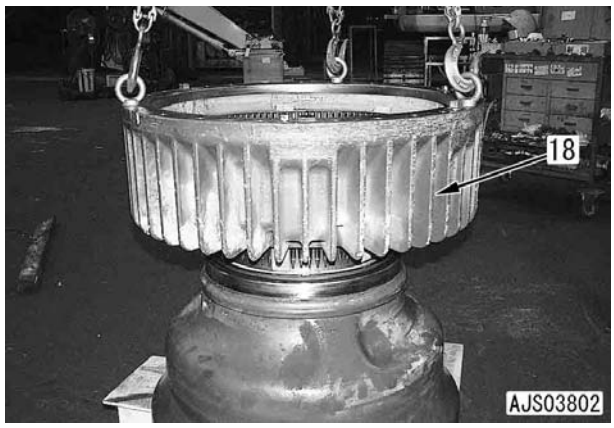
2) Use tool **J2** to install floating seal (19) to outer gear (18).
   ★ Fully degrease the contact surface between floating seal and the O-ring of outer gear.
   ★ Use tool **J2** to evenly tighten O-ring of the floating seal by avoiding twist.



3) After installation measure the height (a) at 4 points on the circumference and check that dimensional difference reads within 1 mm.
   ★ Apply a thin layer of axle oil (AXO80) to the top end surface (b) of the floating seal.

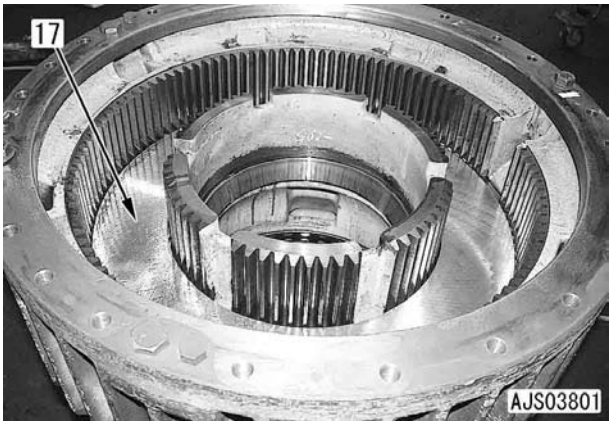


4) Install outer gear (18).
   ★ Take care not to drop the floating seal on the bottom.
   ★ Install the outer gear avoiding oil seal at the bottom to ride up.

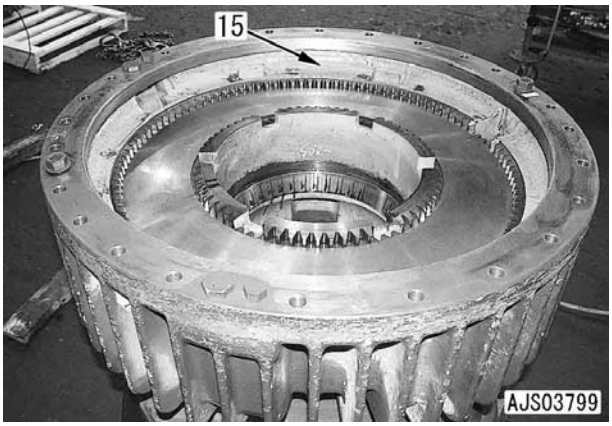


4. Plate and disc

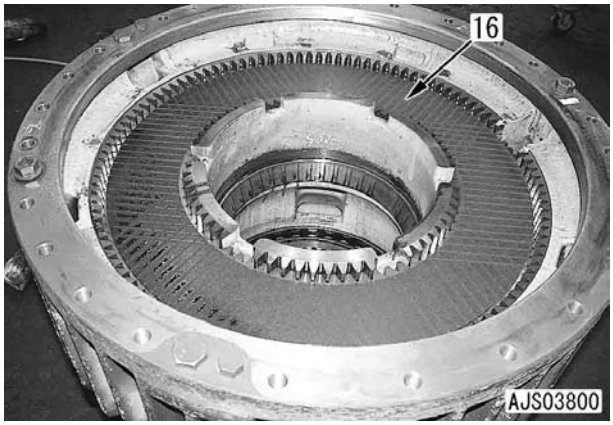
1) Install plate (17) first.
   - ★ Thickness of plate (17) is 10 mm.
   - ★ Plate may be used either on the front or back side.



2) Install plate (15).
   - ★ Install by matching the counter marks on the plate and outer gear.

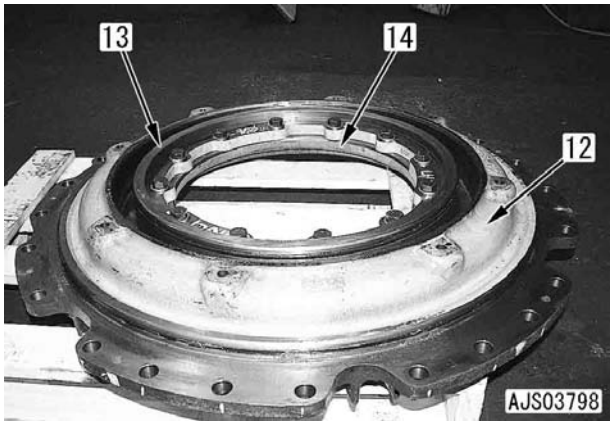


3) Install disc (16).
   - ★ Install disc carefully, avoiding damages as it is made of soft material.
   - ★ Install by matching the counter marks on the disc and wheel hub.
4) Install plate (15) and disc (16) alternately in this order from the bottom up.
   - ★ 12 plates (15) and 11 discs (16)

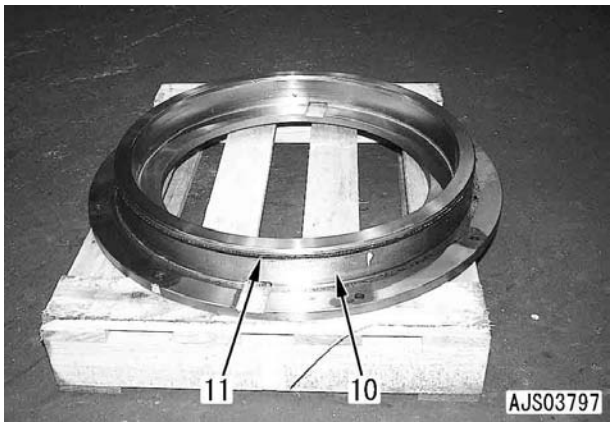


5. Cylinder assembly

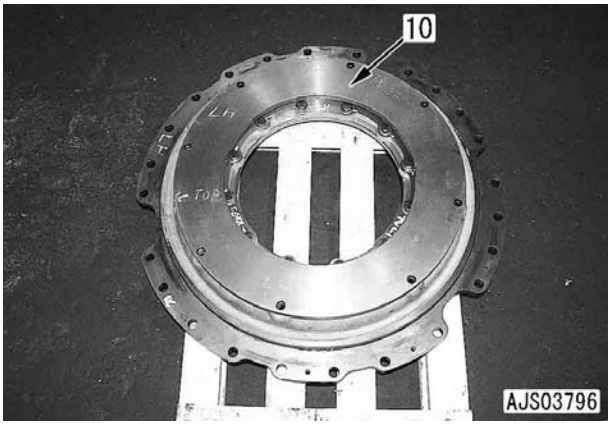
1) Install sleeve (14) to cylinder (12).
   - Mounting bolt:
     58.8 – 78.4 Nm {6 – 8 kgm}
2) Install seal ring (13) to cylinder (12).
   - Outer circumference of seal ring:
     Grease (G2-LI)



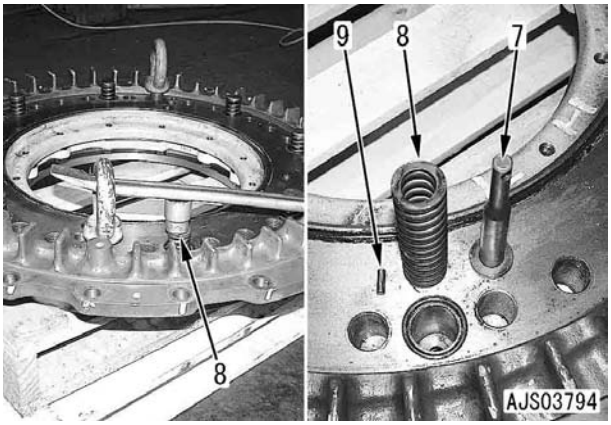
3) Install seal ring (11) to piston (10).
   - Outer circumference of seal ring:
     Grease (G2-LI)

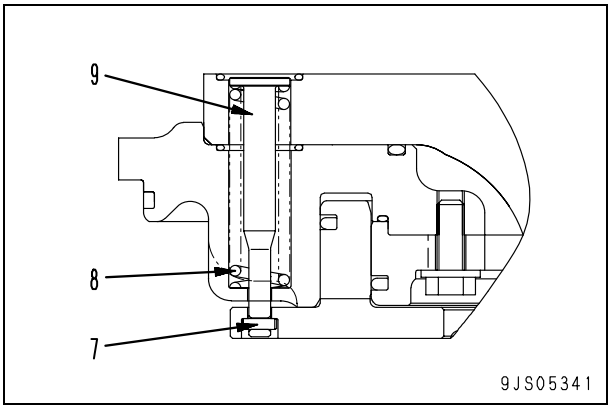


4) Install piston (10).

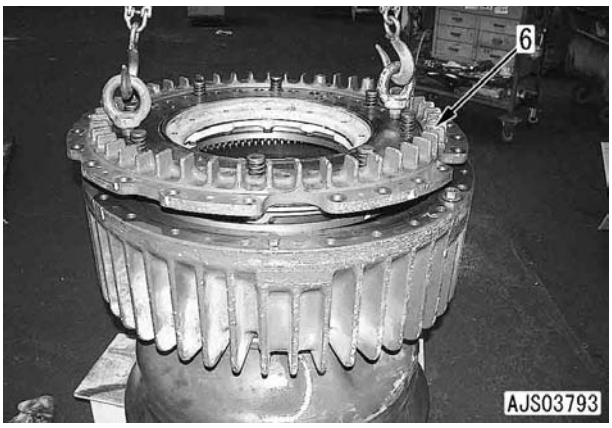


5) Place guide (9) through spring (8) and install them to piston (7).
6) Use the eyebolt and bar to push in spring and fix it to the lower side of guide (9) through pin (7).



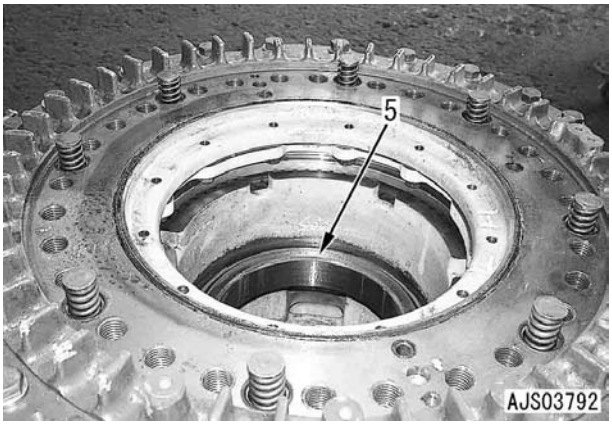


7) Install cylinder assembly (6).
Mounting bolt:
245 – 289 Nm {25 – 29.5 kgm}

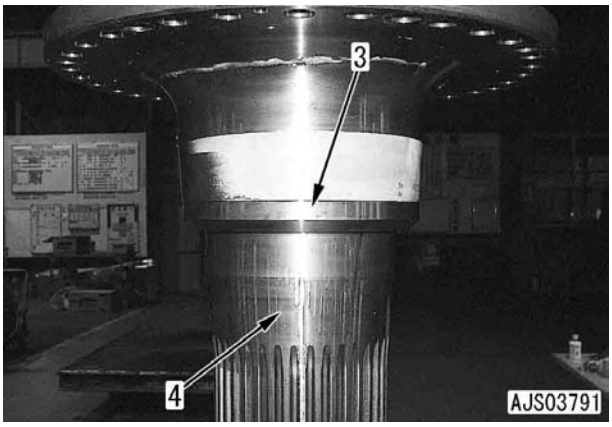


6. Tube assembly

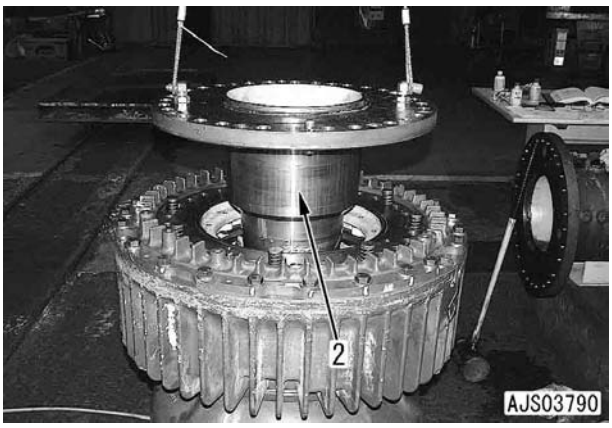
1) Install bearing inner races (5) to the wheel hub.



2) Install retainer (3) to the tube (4).

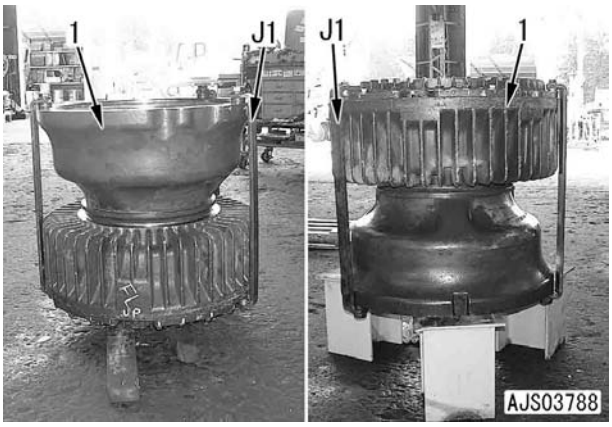


3) Install tube assembly (2).
   Hexagonal socket head bolt:
   98 – 123 Nm {10 – 12.5 kgm}



7. Final drive and brake assembly

1) Install jig **J1** to final drive and brake assembly (1), invert to hold the final drive assembly side on top.
2) After placing the assembly on a flat place, remove the jig **J1**.



★ Assemble final drive assembly, referring to “Disassembly and assembly of final drive assembly.”

Removal and installation of brake valve assembly

Removal

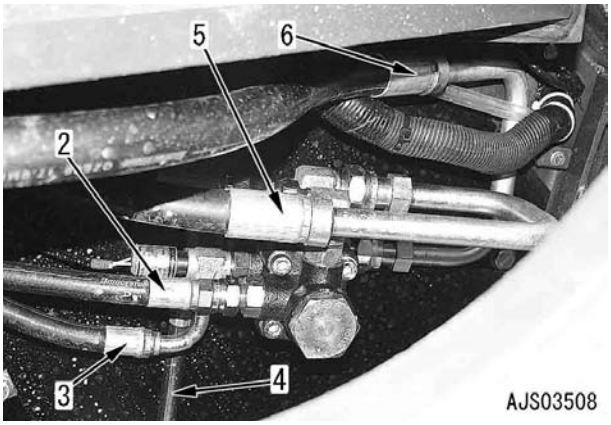
- ⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- ⚠ **Set the frame lock bar.**
- ⚠ **Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**
- ⚠ **Release the remaining pressure in the brake accumulator system, referring to "Releasing remaining pressure in the hydraulic system" in Testing and adjusting.**
- ⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Remove cover (1).

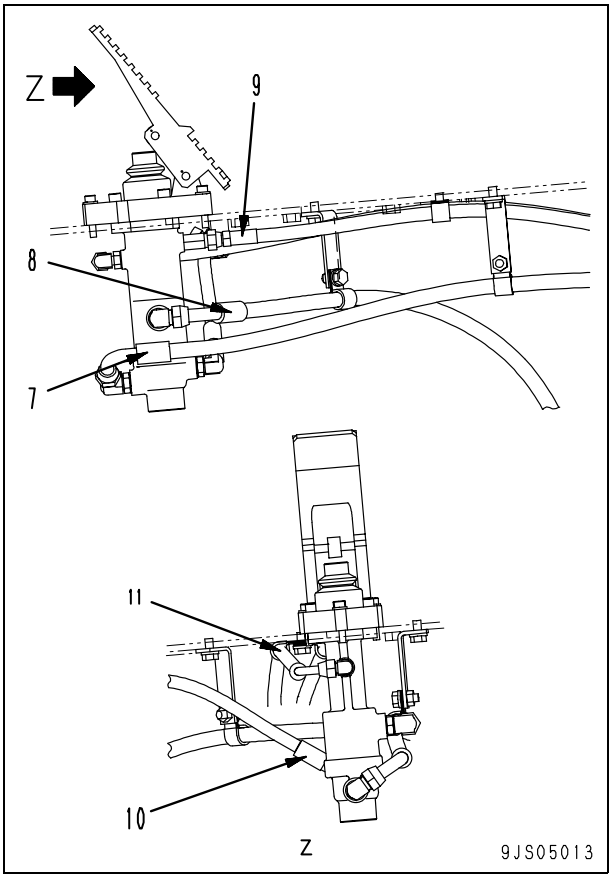


2. Disconnect hoses (2) to (5) from the right brake valve.
3. Disconnect drain hose (6).
   ★ Remove each nipple.

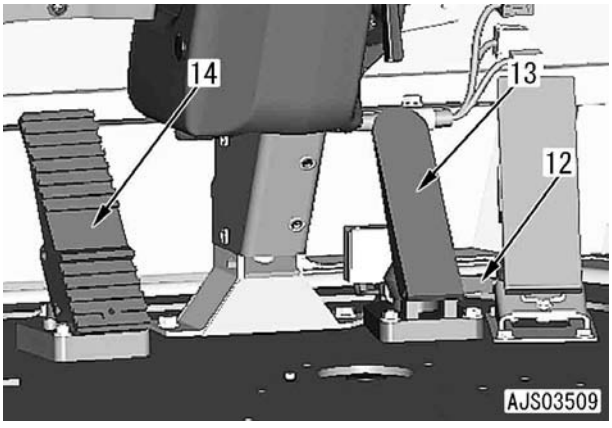
★ Bottom view



4. Disconnect hoses (7) to (11) from the left brake valve.
   ★ Remove each nipple.



5. Disconnect connector C18 (12) from the right brake valve.
6. Remove 3 mounting bolts, and remove right brake valve (13).
7. Remove 3 mounting bolts, and remove left brake valve (14).



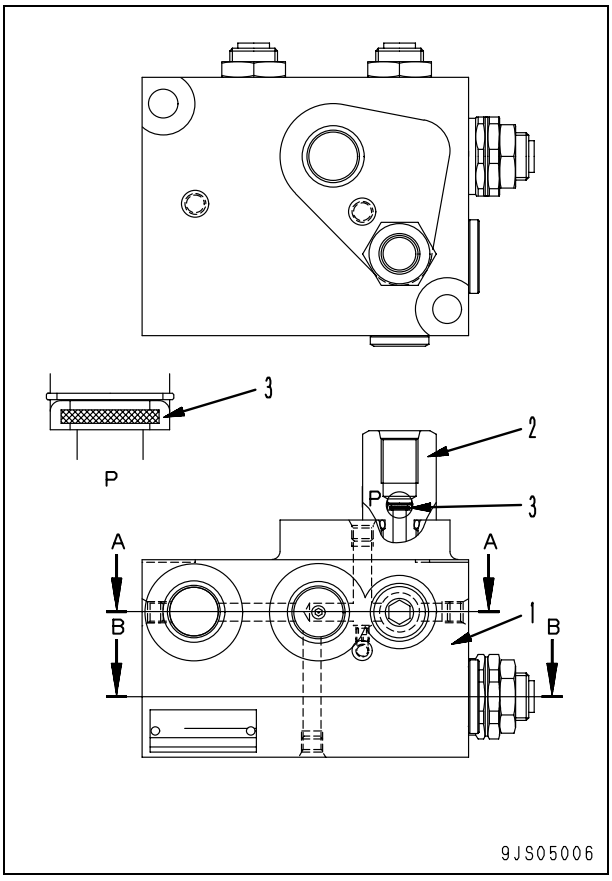
Installation

- Installation is done in the reverse order of removal.
- After installing brake valves, check the brake performance.

Disassembly and assembly of accumulator and charge valve assembly

Disassembly

1. Remove bushing (2) from body (1).
2. Remove filter (3) from bushing (2).
   ★ Remove the ring.



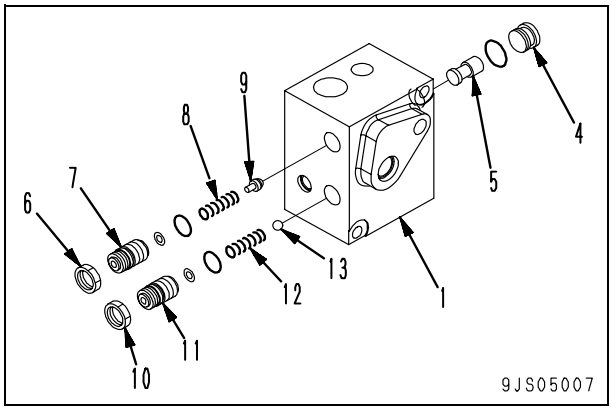
3. Remove plug (4).
4. Remove retainer (5).

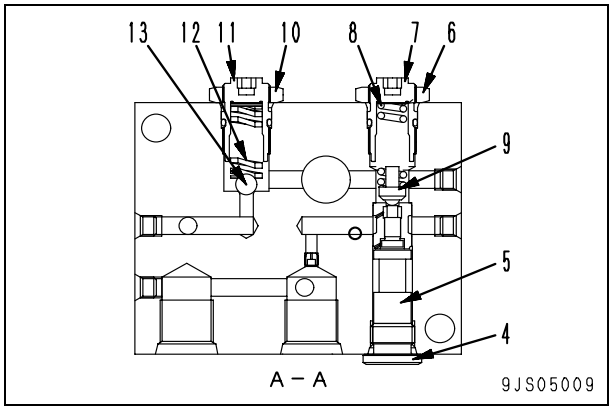
5. Remove nut (6).
6. Remove screw (7).
   ⚠ **Remove carefully by holding the mating faces pressed together by hand as the inside is tensioned by spring.**

7. Remove spring (8) and retainer (9).

8. Remove nut (10).
9. Remove screw (11).
   ⚠ **Remove carefully by holding the mating faces pressed together by hand as the inside is tensioned by spring.**

10. Remove spring (12) and ball (13).

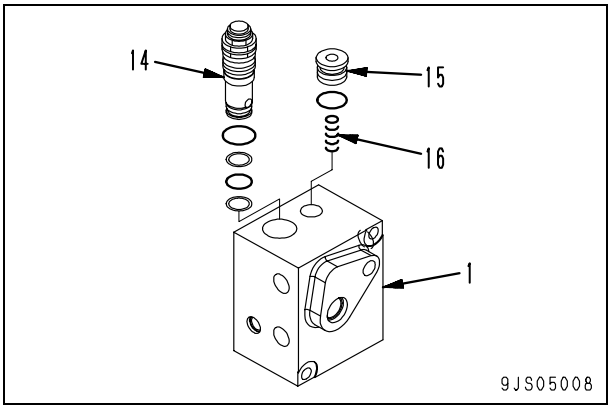


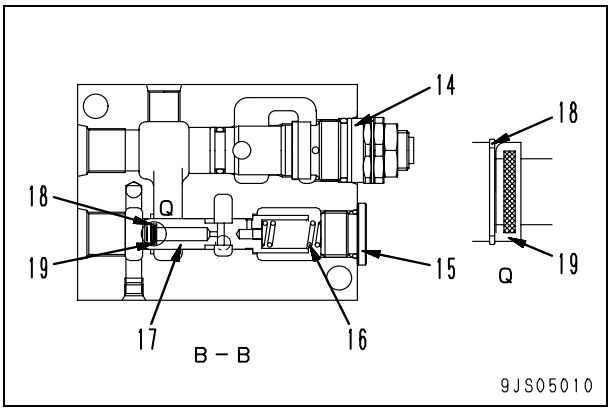


11. Remove relief valve (14).

12. Remove plug (15).
    ⚠ **Remove carefully by holding the mating faces pressed together by hand as the inside is tensioned by spring.**

13. Remove spring (16).
14. Remove spool (17).
15. Remove ring (18) from spool (17).
16. Remove filter (19).

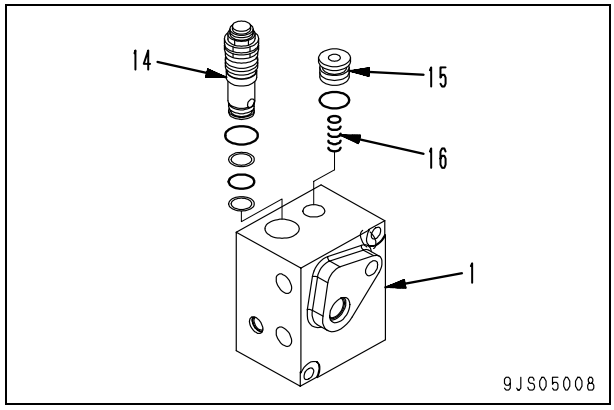


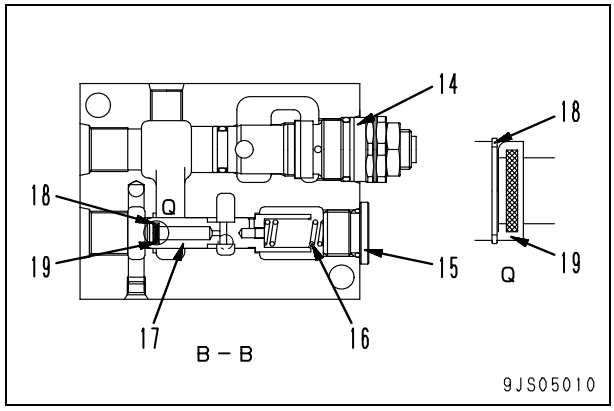


Assembly

1. Install relief valve (14).
   Relief valve:
   78.5 – 88.3 Nm {8 – 9 kgm}

2. Install filter (19) to spool (17).
   ★ Take care of the mounting direction of the filter (angled portion to the back).
3. Install ring (18).
4. Install spool (17).
5. Install spring (16).
6. Install plug (15).
   Plug: **53.9 – 68.6 Nm {5.5 – 7 kgm}**

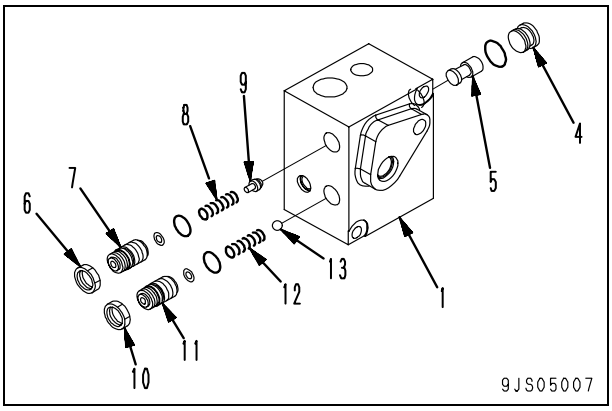


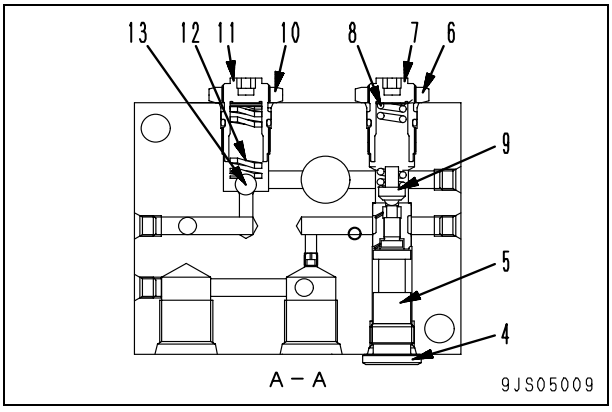


7. Install ball (13) and spring (12).
8. Install screw (11).
9. Install nut (10).
   Nut: **9.8 – 11.8 Nm {1 – 1.2 kgm}**

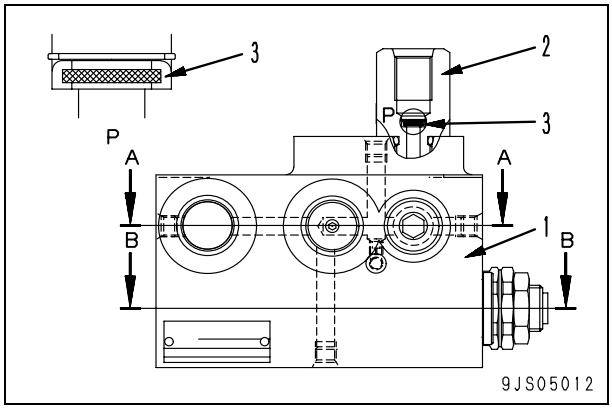
10. Install retainer (9) and spring (8).
11. Install screw (7).
12. Install nut (6).
    Nut: **9.8 – 11.8 Nm {1 – 1.2 kgm}**

13. Install retainer (5).
14. Install plug (4).
    Plug: **30.4 – 37.3 Nm {3.1 – 3.8 kgm}**





15. Install filter (3) to bushing (2).
    ★ Take care of the mounting direction of the filter (angled portion to the back).
    ★ Fix with the ring.
16. Install bushing (2) to body (1).
    Bushing:
    29.4 – 39.2 Nm {3.0 – 4.0 kgm}

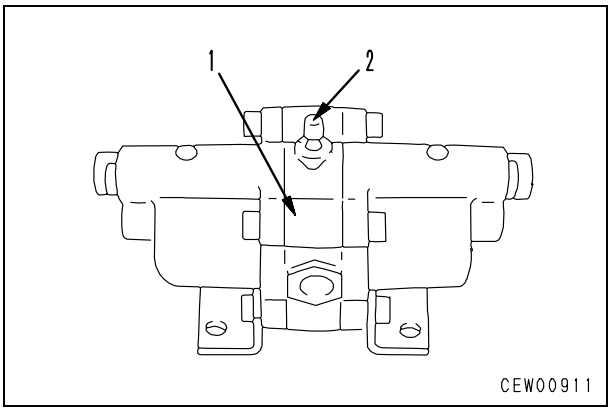


Disassembly and assembly of slack adjustor assembly

Disassembly

1. Bleeder

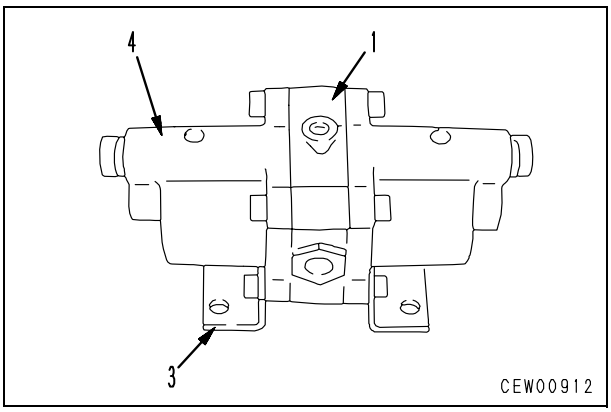
Remove bleeder (2) from body (1).



2. Cylinder

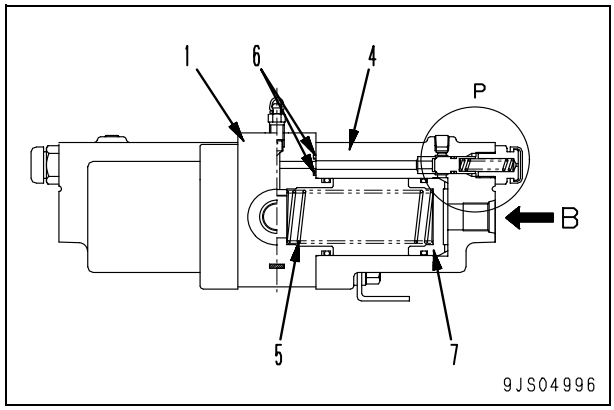
Remove the mounting bolt and disconnect body (1) from cylinder (4) together with bracket (3).

⚠ **Remove carefully by holding the mating faces pressed together by hand as the inside is tensioned by spring.**



3. Piston

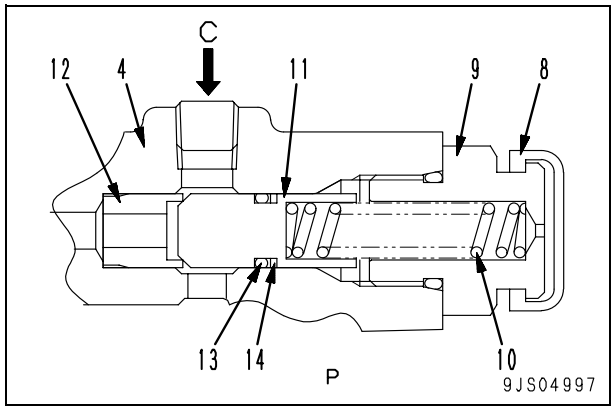
1) Remove O-ring (6) from body (1).
2) Remove spring (5) from cylinder (4).
3) Push out piston (7) and remove O-ring.
   - ★ Remove the piston gently by pressing it with a rod of 10 mm diameter from (B).
   - ★ Take care not to damage the threaded portion with the rod.



4. Valve

- ★ Don't disassemble valve unless necessary. If disassembled, replace with whole cylinder assembly.

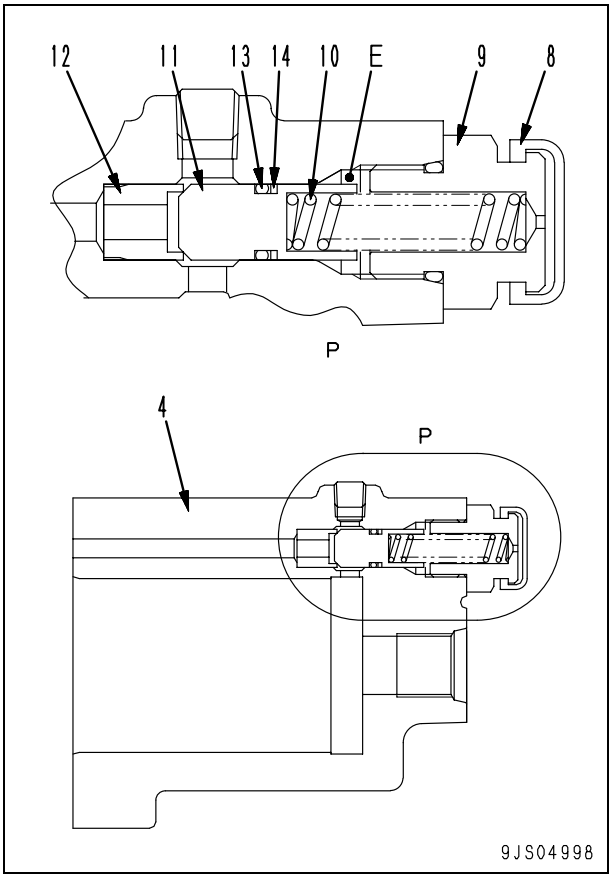
1) Remove cover (8) from cylinder (4) and remove plug (9), spring (10), valve (11) and seat (12).
   - ★ To remove the valve, blow air through the oil hole of the cylinder and the body.
   - ★ Cover the cylinder oil port with hand to prevent the air from being blown into rapidly.
   - ★ Care should be taken not to change the combination of valve (11) and cylinder (4). To replace, replace by the valve and cylinder assembly as a set. (Because of diameter clearance of 0.04 to 0.10 (mm) between the cylinder and the valve))
2) Remove O-ring (13) and ring (14) from valve (11).



Assembly

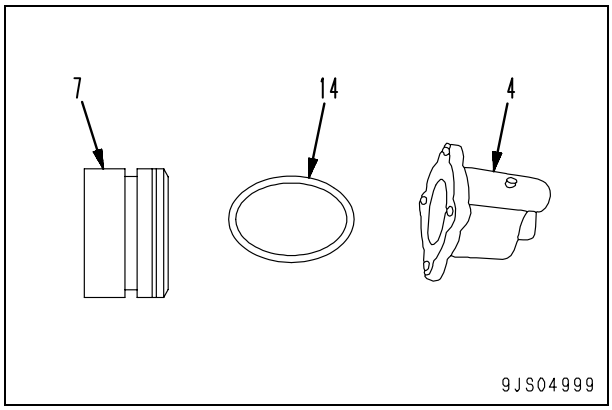
1. Valve

1) Install O-ring (13) and ring (14) to valve (11).
2) Install seat (12) and valve (11) in this order, to cylinder (4).
3) Fill area (E) with grease (G2-LI).
   Area (E): **Grease (G2-LI)**
4) Install spring (10), plug (9) and cover (8) in the order.
   Plug (9) threaded portion: **Cemedine 366**
   Plug (9): **49 – 63 Nm {5 – 6.5 kgm}**



2. Piston

1) Install O-ring (14) to piston (7).
2) Insert piston (7) to cylinder (4).
   ★ Make sure that the piston moves smoothly.

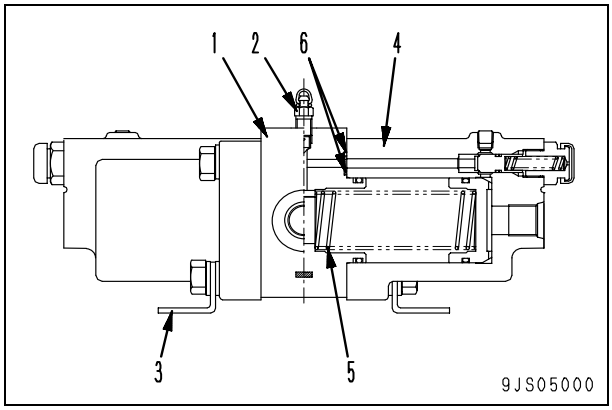


3. Cylinder

1) Install O-ring (6) to body (1).
2) Install spring (5) to cylinder (4).
3) Install body (1) and cylinder (4) together with bracket (3).

4. Bleeder

Install bleeder (2).
Bleeder screw: **10 – 20 Nm {1 – 2 kgm}**



WA600-6 Wheel loader

Form No. SEN01167-00

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Printed in Japan 06-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

Undercarriage and frame

Undercarriage and frame 2
Removal and installation of center hinge pin 2
Removal and installation of counterweight assembly 9

Undercarriage and frame

Removal and installation of center hinge pin

Special tools

Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
		790-101-2300	Push tool	■	1		
		• 790-101-2310	• Block		1		
		• 790-101-2320	• Screw		1		
		• 790-101-2330	• Nut		2		
		• 790-101-2340	• Washer		1		
		• 790-101-2350	• Leg		2		
	1	• 790-101-2360	• Plate		4		
		• 790-101-2410	• Joint		2		
		• 02215-11622	• Nut		2		
		793-520-2640	Push tool	■	1		
		790-438-1030	Guide	■	1		
		790-438-1050	Bar	■	2		
		790-101-2102	Puller (30-ton)	■	1		
		790-101-1102	Pump	■	1		
K		790-101-2300	Push tool	■	1		
		• 790-101-2310	• Block		1		
		• 790-101-2330	• Nut		1		
		• 790-101-2340	• Washer		1		
		• 790-101-2350	• Leg		2		
		• 790-101-2360	• Plate		4		
		• 790-101-2410	• Joint		2		
	2	• 02215-11622	• Nut		2		
		790-438-1050	Bar	■	2		
		01580-12016	Nut	■	2		
		790-438-1010	Push tool	■	1		
		790-438-1020	Guide	■	1		
		790-438-1040	Screw	■	1		
		790-101-2102	Puller	■	1		
		790-101-1102	Pump	■	1		

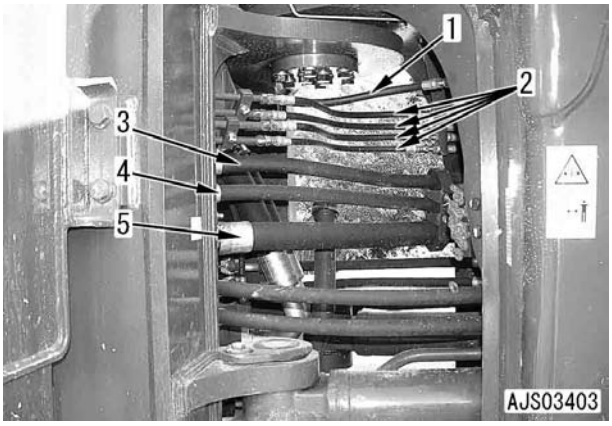
Removal

⚠ Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.
⚠ Set the frame lock bar.
⚠ Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.
⚠ Lower the work equipment to the ground completely. Release the remaining pressure in the piping, referring to "Releasing remaining pressure" in work equipment cylinder in Testing and adjusting.
⚠ Disconnect the negative terminal (–) of the battery before starting with the work.

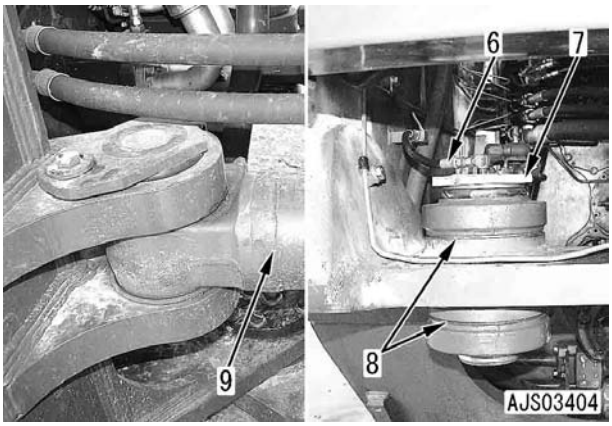
1. Remove the work equipment assembly, referring to "Removal and installation of work equipment assembly."

2. Remove the floor frame assembly, referring to "Removal and installation of floor frame assembly."

3. Disconnect brake hose (1).
4. Disconnect 4 pressure inspection hoses (2).
5. Disconnect valve hoses (3) and (4) of the work equipment.
6. Disconnect valve drain hose (5) of the work equipment.

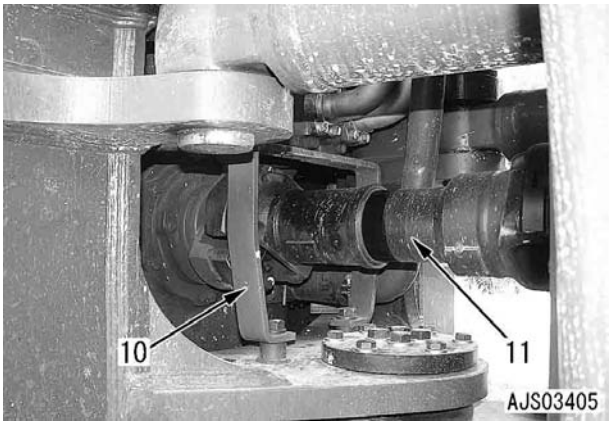


7. Disconnect the left and right grease hoses (6).
8. Remove pin (7) on the side of the left and right steering cylinder heads. [*1]
   ★ Check the number and the position of the shims (8) in advance.
   ★ Contract the rod of steering cylinder (9).

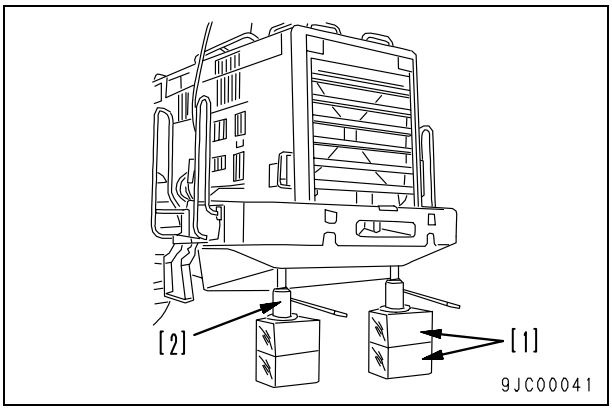


9. Remove drive shaft guard (10).
10. Remove drive shaft (11). [*2]

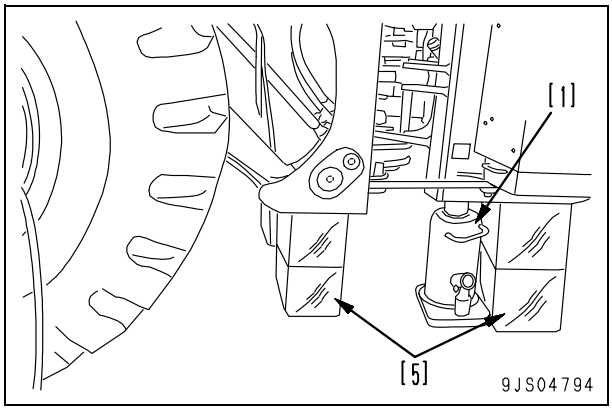
Drive shaft: **65 kg**



11. Set jacks (50-ton × 2) [1] and blocks [2] to the counterweight.

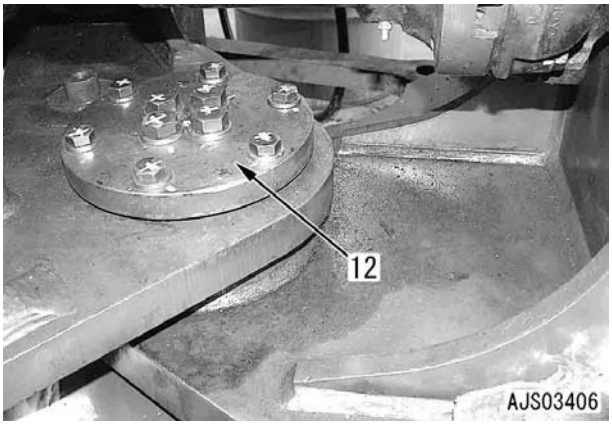


12. Use the jacks (50-ton × 2) [1] to the front and rear frames to adjust height and set block [5].

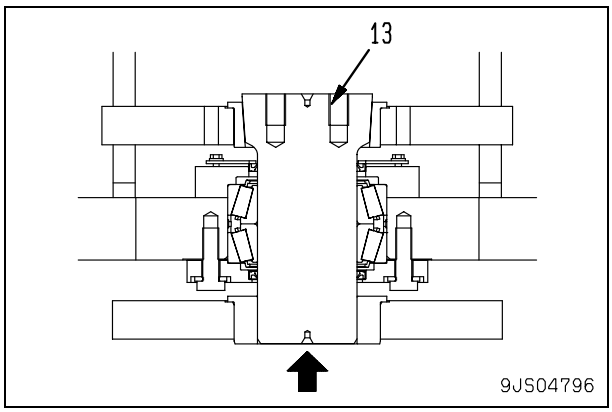


- Lower hinge pin

13. Remove retainer (12).

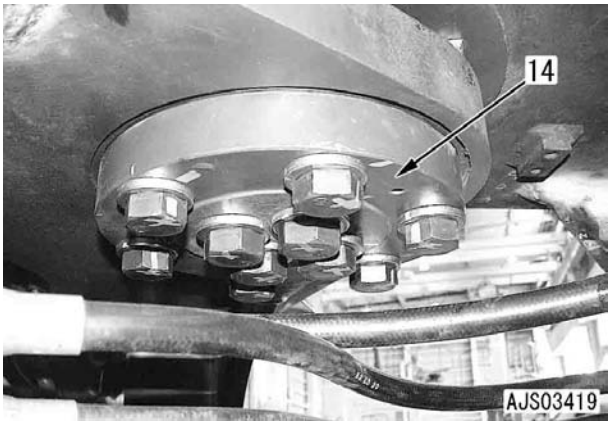


14. Use the puller to remove the lower hinge pin (13).

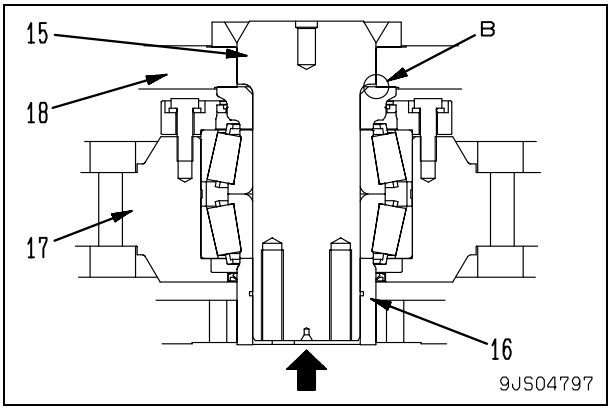


● **Upper hinge pin**

15. Remove retainer (14).
    ★ Check the number of the shims in advance.

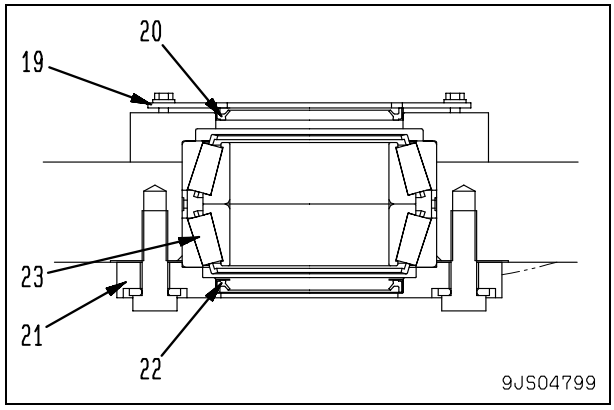


16. Remove the upper hinge pin (15), using the puller.
17. Remove bushing (16).
18. Remove the frame lock bar, pull front frame (17) forward and disconnect the frame.
    ★ Upper bushing of the upper hinge pin is caught by the rear frame (18) (part B). Lift rear frame (18) slightly and disconnect the frame.



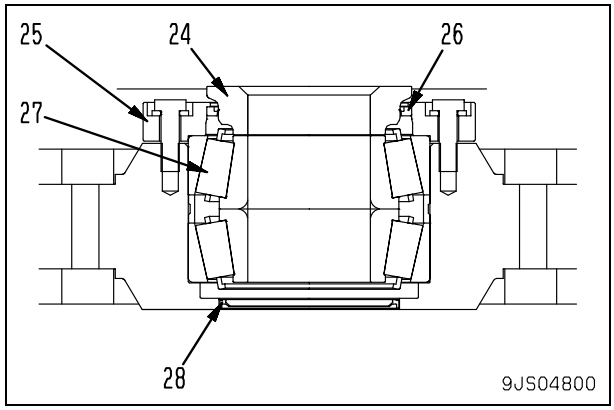
● **Lower side front frame**

19. Remove plate (19).
20. Remove dust seal (20).
21. Remove retainer (21).
22. Remove dust seal (22) from retainer (21).
23. Remove bearing (23).



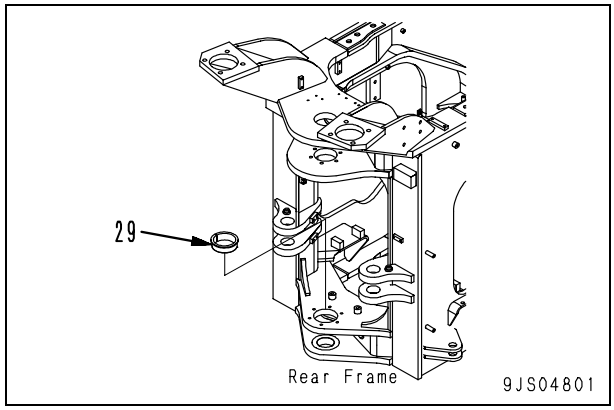
● **Upper side front frame**

24. Remove bushing (24). [*7]
25. Remove retainer (25).
26. Remove dust seal (26) from retainer (25).
27. Remove bearing (27).
28. Remove dust seal (28).



● **Lower side rear frame**

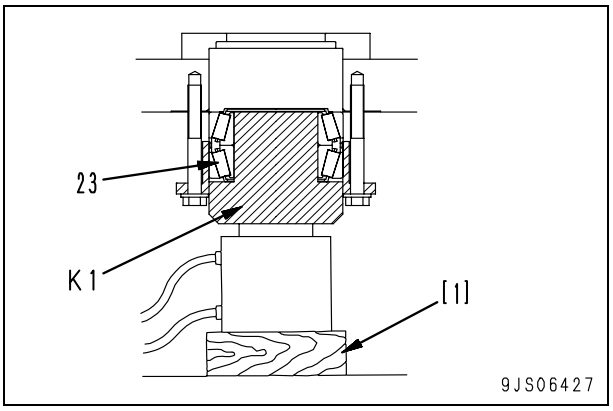
29. Remove bushing (29).



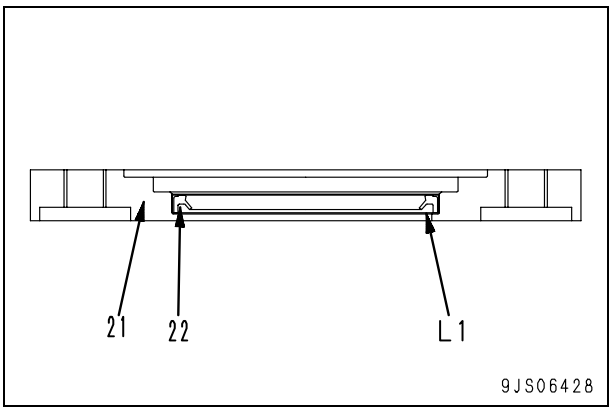
Installation

- **Lower side front frame**

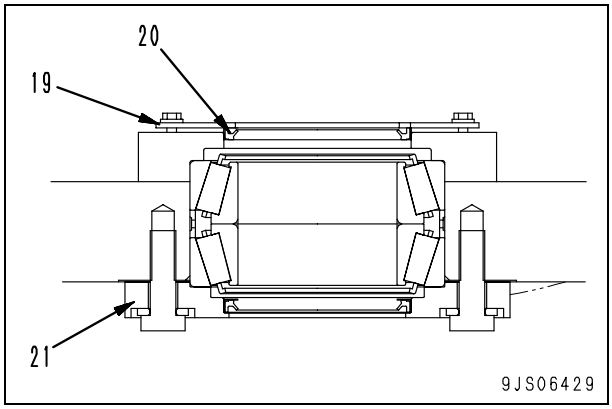
1. Use push tool **K1** and block [1] to press fit bearing (23) to the front frame.
   ★ Don't change the bearing and spacer combination as the bearing clearance has been adjusted.
   Bearing:
   Molybdenum disulfide lubricant (LM-P)



2. Install dust seal (22) to retainer (21).
   ★ Install dust seal lip (L1) so as to face outside.
   Dust seal lip surface:
   Molybdenum disulfide lubricant (LM-P)

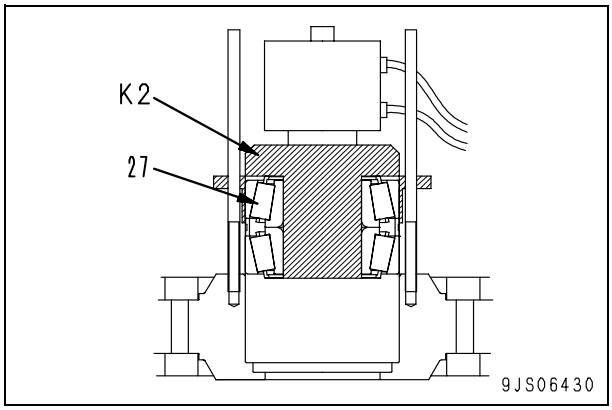


3. Install dust seal (20).
   Dust seal lip surface:
   Molybdenum disulfide lubricant (LM-P)
4. Install plate (19).
5. Install retainer (21) in the following order.
   1) Install retainer (21) avoiding one-sided tightening.
      Mounting bolt:
      34.3 ± 3.4 Nm {3.5 ± 0.4 kgm}
   2) Loosen retainer (21) mounting bolt.
   3) Install retainer (21) again avoiding one-sided tightening.
      Mounting bolt:
      34.3 ± 3.4 Nm {3.5 ± 0.4 kgm}
   4) Measure the clearance between retainer (21) and the hinge plate clearance at 4 equally divided points on the circumference.
   5) Total of shim thickness
      Select shim combination (shim pack) so that measured value will be –0.18 to –0.08 (mm).
      ★ Thickness of shim: **0.1, 0.5 mm**
   6) Install the shim pack and tighten retainer (21) permanently.
      Mounting bolt:
      Adhesive (Loctite No.262)
      Mounting bolt:
      235 – 285 Nm {23.5 – 29.5 kgm}

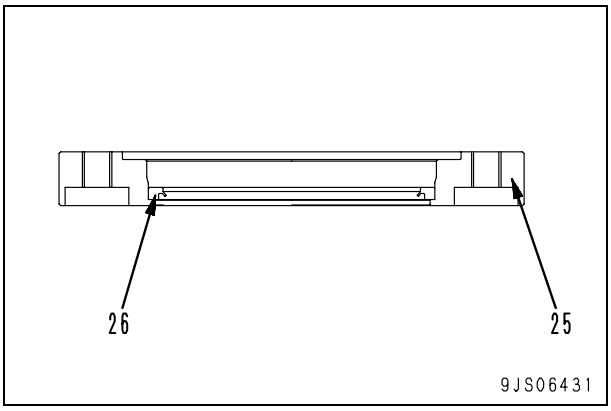


- **Upper side front frame**

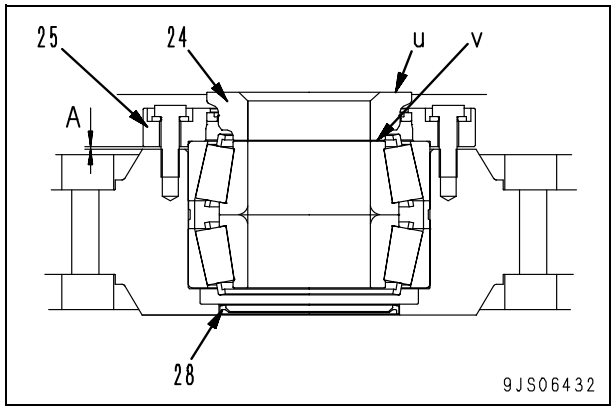
6. Use push tool **K2** and press fit bearing (27) to the front frame.
   Bearing:
   Molybdenum disulfide lubricant (LM-P)



7. Install dust seal (26) to retainer (25).
   ★ Install the dust seal lip so as to face outside.
   Dust seal lip surface:
   Molybdenum disulfide lubricant (LM-P)

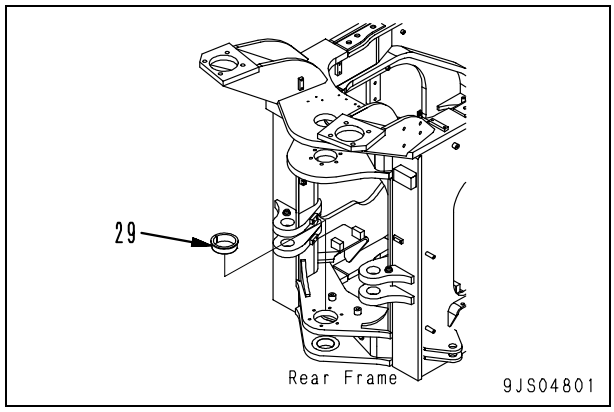


8. Install retainer (25) in the following order.
   1) Install retainer (25) at every other position avoiding one-sided tightening.
      Mounting bolt:
      34.3 ± 3.4 Nm {3.5 ± 0.4 kgm}
   2) Loosen retainer (25) mounting bolt.
   3) Install retainer (25) again at every other position avoiding one-sided tightening.
      Mounting bolt:
      34.3 ± 3.4 Nm {3.5 ± 0.4 kgm}
   4) Measure clearance (A) between retainer (25) and the front frame at 4 equally divided points on the circumference.
   5) Total of shim thickness
      Select shim combination (shim pack) so that measured value will be –0.18 to –0.08 (mm).
      ★ Standard shim thickness: **2.2 mm**
      ★ Thickness of shim: **0.1, 0.5 mm**
   6) Install the shim pack and tighten retainer (25) permanently.
      Mounting bolt:
      Adhesive (Loctite No.262)
      Mounting bolt:
      235 – 285 Nm {23.5 – 29.5 kgm}
9. Install bushing (24).
   (u), (v) face:
   Molybdenum disulfide lubricant (LM-P)
10. Install dust seal (28).
    Dust seal lip surface:
    Molybdenum disulfide lubricant (LM-P)



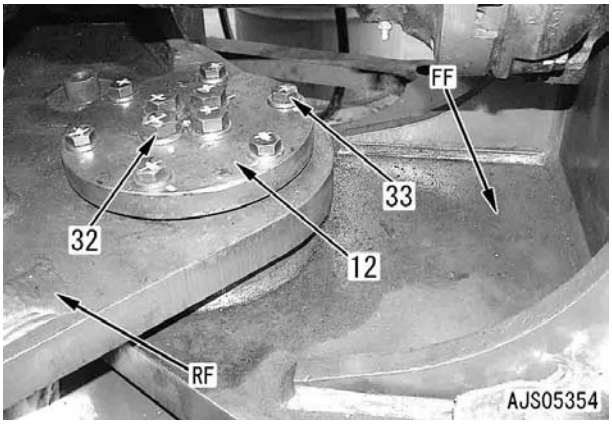
- **Lower side rear frame**

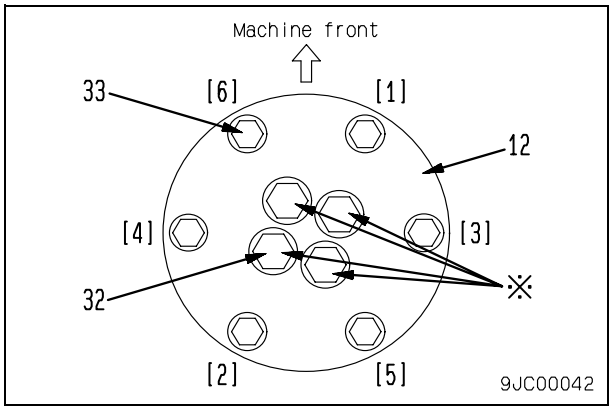
11. Install bushing (29).



● **Lower hinge pin**

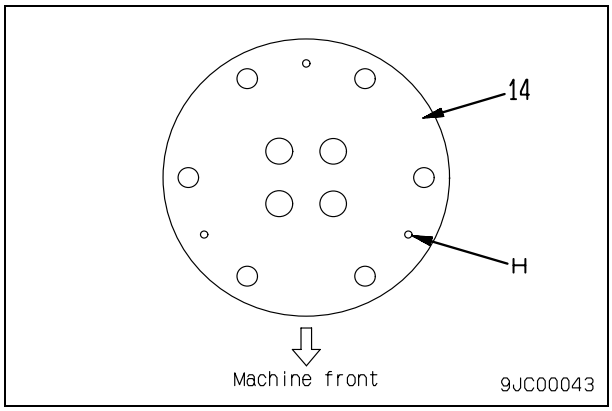
12. Install retainer (12) to lower hinge pin with 4 bolts (32).
    - Tapped hole side of the mounting bolt (32): **Liquid adhesive (Loctite No. 262)**
    - Mounting bolt (32): **455 – 565 Nm {46.5 – 58 kgm}**
13. Align the center of front frame (FF) and rear frame (RF).
14. Install the lower hinge pin by taking care about the position (*) of mounting bolt (32).
    - Lower hinge pin: **Molybdenum disulfide lubricant (LM-P)**
    - ★ Degrease the tapered portion (bushing contact surface). Don't allow grease and other lubricant to be attached.
15. Install retainer (12) with 6 bolts (33) to the following procedure.
    - Tapped hole side of the mounting bolt (33): **Liquid adhesive (Loctite No. 262)**
    1) Tighten bolts (33) in order of [1] to [6].
       - Mounting bolt (33): **235 – 285 Nm {23.5 – 29.5 kgm}**
    2) Tighten bolts (33) clockwise in the order of [3], [5], [2], [4], [6], [1].
       - ★ Tighten bolts (33) in repetition until they become immobile.
       - Mounting bolt (33): **235 – 285 Nm {23.5 – 29.5 kgm}**



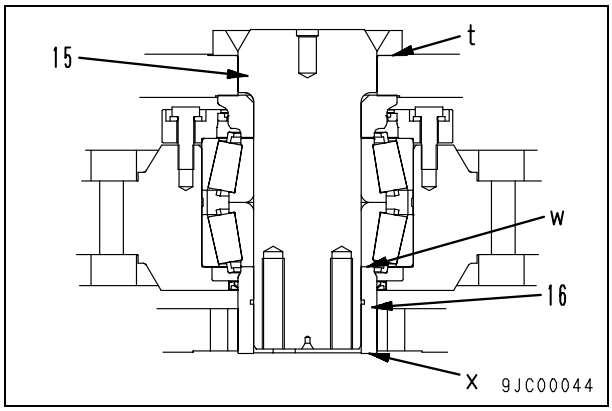


● **Upper hinge pin**

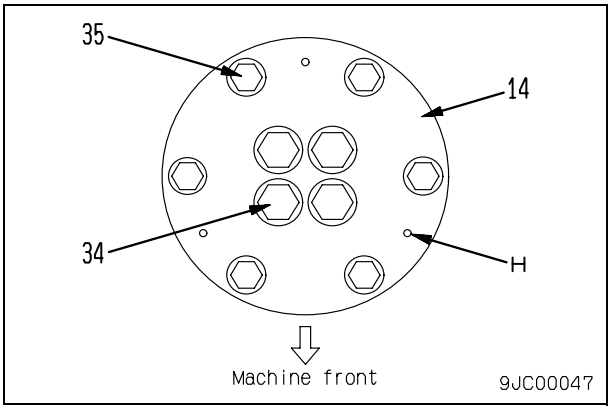
16. Measure the thickness of retainer (14) at 3 hole (H) locations.



17. Install upper hinge pin (15) by paying attention to the bolt hole position (see figure above).
    - Upper hinge pin: **Molybdenum disulfide lubricant (LM-P)**
    - (t) face: **Molybdenum disulfide lubricant (LM-P)**
18. Install bushing (16) from lower.
    - (w), (x) face: **Molybdenum disulfide lubricant (LM-P)**



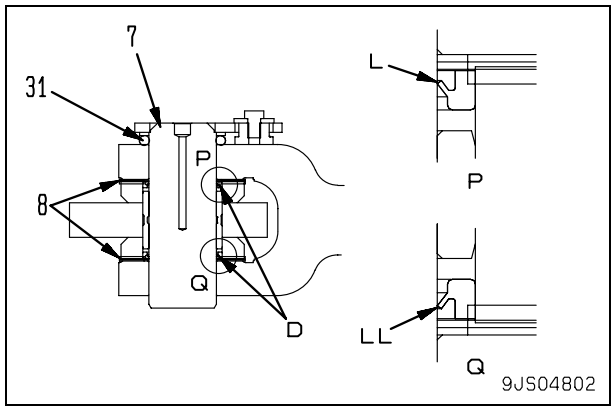
19. Install retainer (14) to the upper hinge with mounting bolts (34).
    Mounting bolt (34):
    610 – 765 Nm {62.5 – 78 kgm}
20. Tighten mounting bolts (35) of retainer (14) according to the following procedure.
    1) Tighten mounting bolts (35) of retainer (14) with specified torque.
       ★ Take care of the tilting of retainer and uneven bolt tightening.
       ★ Tighten bolts (35) in repetition until they all become immobile.
       Mounting bolt (35):
       455 – 565 Nm {46.5 – 58 kgm}
    2) Measure the clearance between retainer (14) and the rear frame at 3 hole (H) locations.
    3) Total of shim thickness:
       Measured value – thickness of retainer (14) – 0.18 to Measured value – thickness of retainer (14) – 0.08 (mm).
       Select shim combination (shim pack) so that the sum will be as stated above.
       ★ Thickness of shim: **0.3, 0.4, 0.5 mm**
    4) Remove mounting bolts (34) and (35) of retainer (14).
       Tapped hole side of the mounting bolts (34) and (35):
       Liquid adhesive (Loctite No. 262)
    5) Assemble the shim pack and install retainer (14) to the upper hinge pin with mounting bolts (34).
       Mounting bolt (34):
       610 – 765 Nm {62.5 – 78 kgm}
    6) Tighten mounting bolts (35) of retainer (14) with specified torque.
       ★ Tighten bolts (35) in repetition until they all become immobile.
       ★ Take care of the tilting of retainer and uneven bolt tightening.
       Mounting bolt (35):
       455 – 565 Nm {46.5 – 58 kgm}



- Carry out the succeeding installation in the reverse order of removal.

[*1]

1. Install O-ring (31) and pin (7).
   ★ When replacing dust seal (D), install it so that lips (L) and (LL) will be facing outside.
   Dust seal lip: **Lubricant (LM-P)**
   ★ (8): Shim
   Thickness of shim: **0.2, 0.5, 1.5, 3 mm**



[*2]

Drive shaft mounting bolt:
245 – 309 Nm {25.0 – 31.5 kgm}

Removal and installation of counterweight assembly

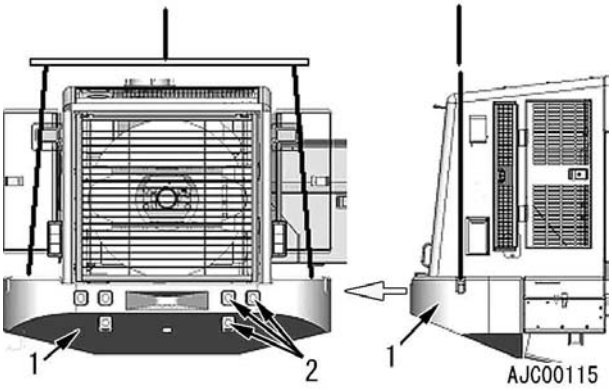
Removal

⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**

⚠ **Set the frame lock bar.**

1. Lift the counterweight assembly (1) temporarily.
2. Remove mounting bolts (2) and lift counterweight assembly (1) to remove. [*1]

Counterweight assembly: **2,320 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]
Counterweight mounting bolt:
2,450 – 3,040 Nm {250 – 310 kgm}

WA600-6 Wheel loader

Form No. SEN01169-00

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Printed in Japan 06-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

Hydraulic system

Hydraulic system 2
Removal and installation of hydraulic tank assembly 2
Removal and installation of hydraulic pump assembly 4
Removal and installation of control valve assembly 8
Disassembly and assembly of control valve assembly 10
Removal and installation of steering valve assembly 15
Removal and installation of ECSS accumulator assembly 16
Disassembly and assembly of hydraulic cylinder assembly 17

Hydraulic system

Removal and installation of hydraulic tank assembly

Removal

- **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- **Set the frame lock bar.**
- **Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**
- **Release the remaining pressure in the piping, referring to "Releasing remaining pressure in work equipment cylinder" in Testing and adjusting.**
- **Disconnect the negative terminal (–) of the battery before starting with the work.**

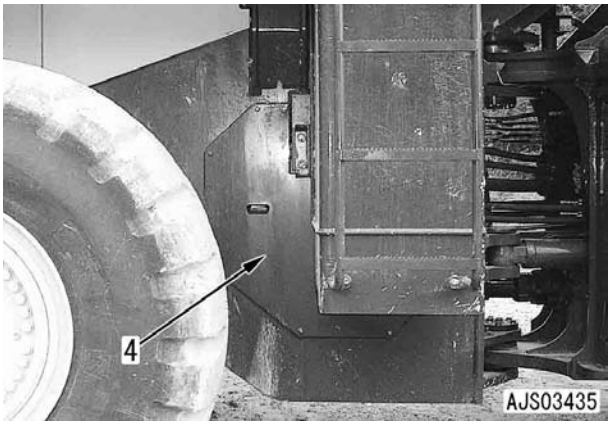
1. Drain the oil from the hydraulic tank.

   Hydraulic tank: **approx. 443 ℓ**

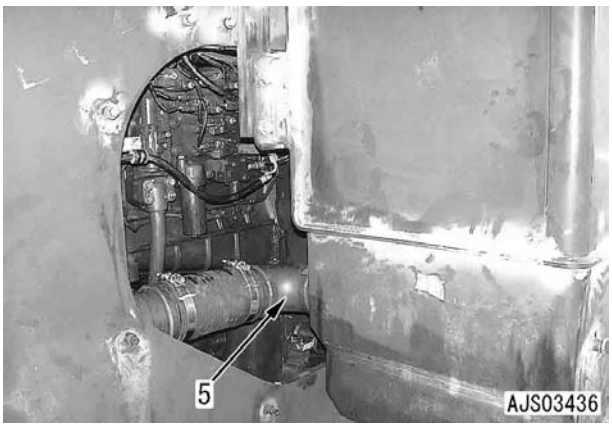
2. Raise fender (1).
3. Lift and remove the handrail and step assembly (2).
   - (3): Hydraulic tank assembly



4. Remove cover (4).



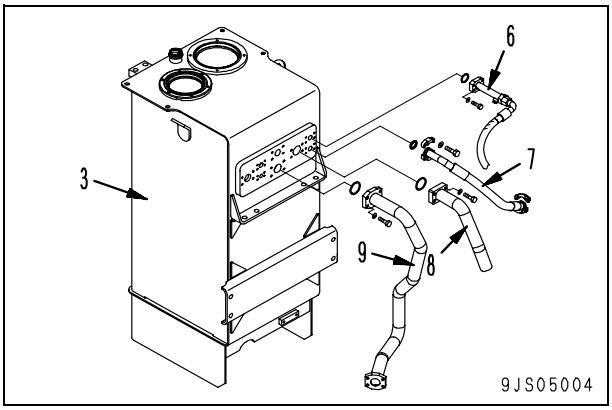
5. Disconnect suction tube (5). [*1]

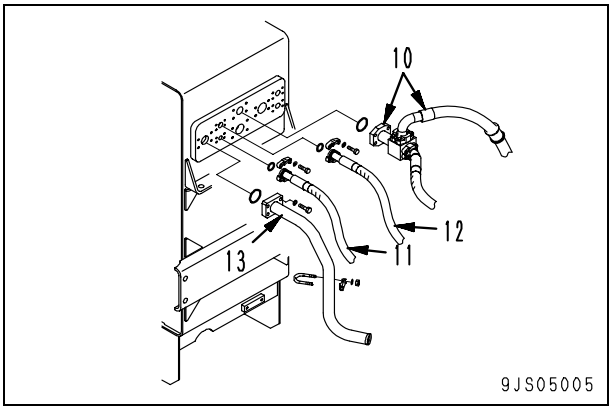


6. Disconnect hoses and tubes from the top of the hydraulic tank.
   - (6) : Steering drain
   - (7) : Pump drain
   - (8) : EPC suction
   - (9) : Main return
   - (10): Cooler and steering return
   - (11): Brake drain
   - (12): Emergency steering return
   - (13): Emergency steering suction

7. Lift and remove hydraulic tank assembly (3).[*2]

   Hydraulic tank assembly: **490 kg**



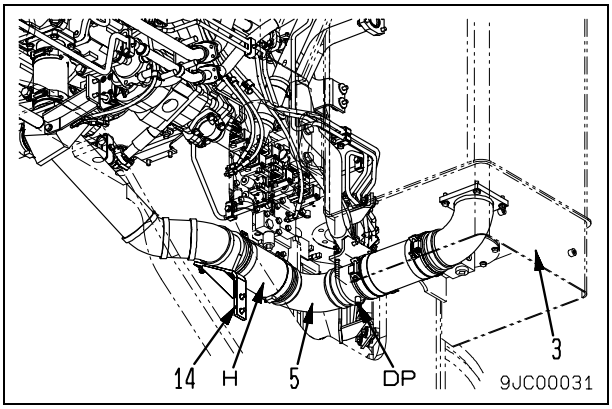


Installation

- Carry out installation in the reverse order to removal

[*1]

1. Install suction tube (5) with the drain port (DP) facing downward.
   - ★ Loosen bracket (14) and install suction tube (5) so that hose (H) will be level (no step between the left and right side of the hose (H)).
   - (3): Hydraulic tank assembly



[*2]

Mounting bolt:
490 – 608 Nm {50 – 62.0 kgm}

- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

  Hydraulic tank: **approx. 443 ℓ**

- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, “Bleeding air of various parts.”

Removal and installation of hydraulic pump assembly

Removal

- **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- **Set the frame lock bar.**
- **Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**
- **Disconnect the negative terminal (–) of the battery before starting with the work.**

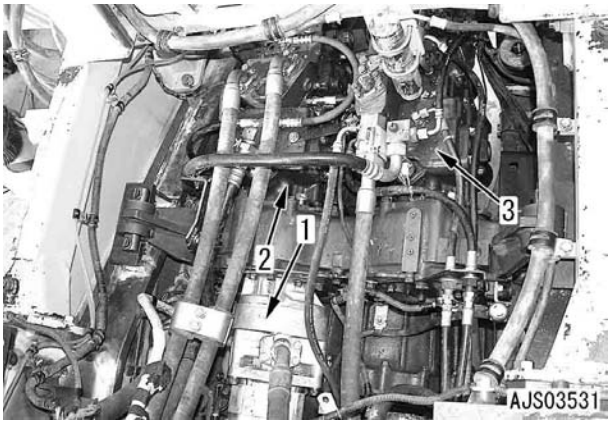
1. Drain the oil from the hydraulic tank.
   Hydraulic tank: **approx. 443 ℓ**

2. Remove covers (51) and (52).



General view

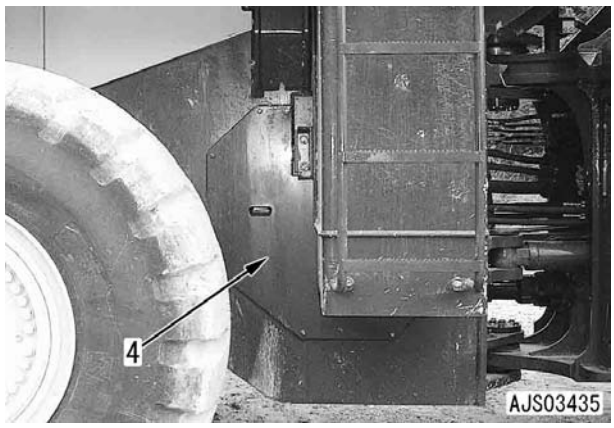
- (1) : Power train, hydraulic oil cooler, EPC and brake pump assembly
- (2) : Work equipment hydraulic pump assembly
- (3) : Steering fan pump assembly



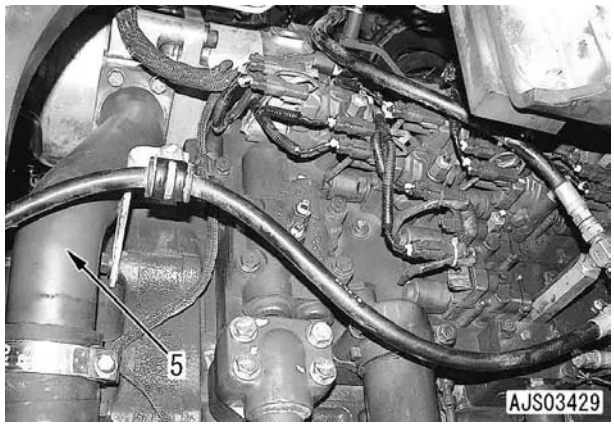
- **(1) : Power train, hydraulic oil cooler, EPC and brake pump assembly**

3. Remove the floor frame assembly, referring to “Removal and installation of floor frame assembly.“

4. Remove cover (4).

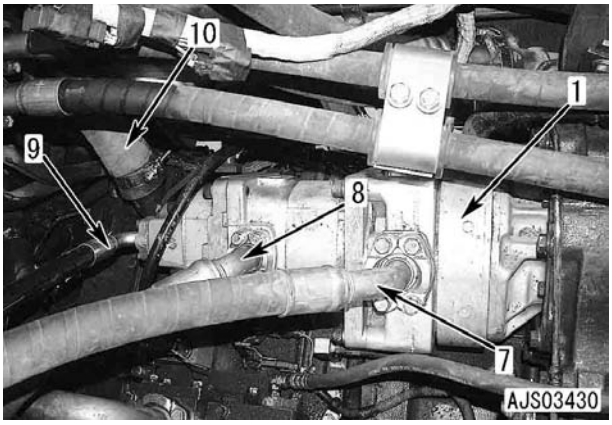


5. Remove suction tube (5).



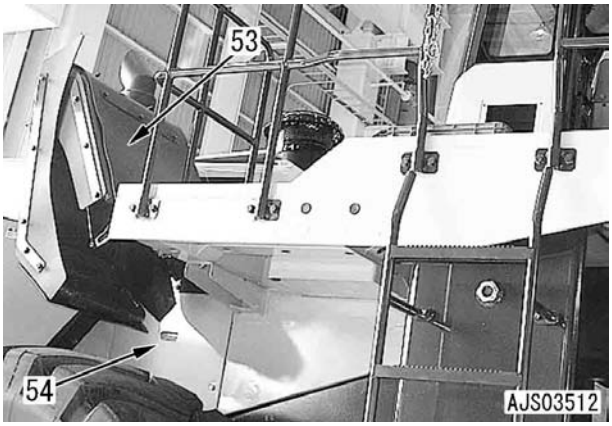
6. Disconnect hose (7) to the brake component box.
7. Disconnect the hydraulic oil cooler hose (8).
8. Disconnect hose (9) to the charge valve.
9. Remove suction hose (10).
10. Lift and remove the power train, hydraulic cooler, EPC and brake pump assembly (1).

    Power train, hydraulic oil cooler, EPC and brake pump assembly**: 50 kg**

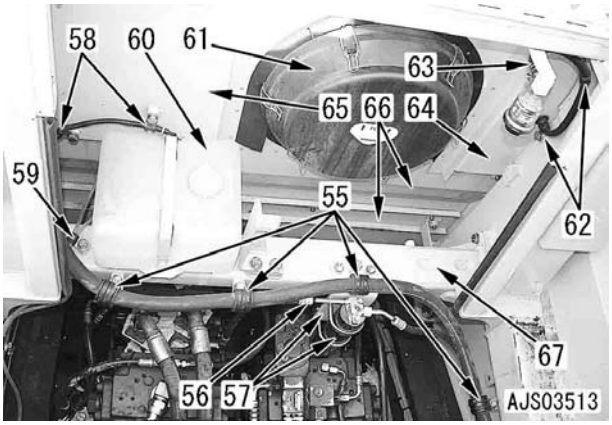


- **(2) : Work equipment hydraulic pump assembly, (3): steering fan pump assembly are commonly applied**

11. Remove fender (53).
12. Remove cover (54).
    ★ A hook is provided at the top on the back of cover (54). A pin located at the bottom of side hood prevents cover (54) from falling when the mounting bolt is removed. Referring to the “Removal and installation of bulkhead assembly.“

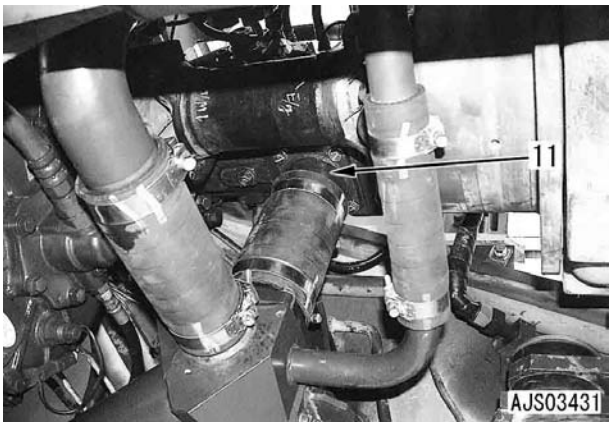


13. Disconnect air conditioner hose clamp (55).
14. Disconnect air conditioner hose (56).
15. Disconnect receiver drier bracket assembly (57) from the frame.
16. Disconnect clamps (58) and (59).
17. Remove washer tank (60).
    ★ Disconnect connectors BL1 and BL3 from the back.
18. Remove the air cleaner cover (61).
19. Disconnect hose clamp (62).
20. Disconnect dust indicator hose (63).
21. Remove covers (64) to (66).
22. Remove frame (67).

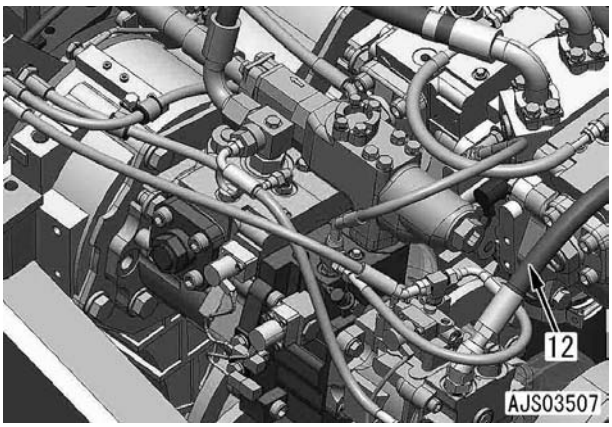


- **(2) : Work equipment hydraulic pump assembly**

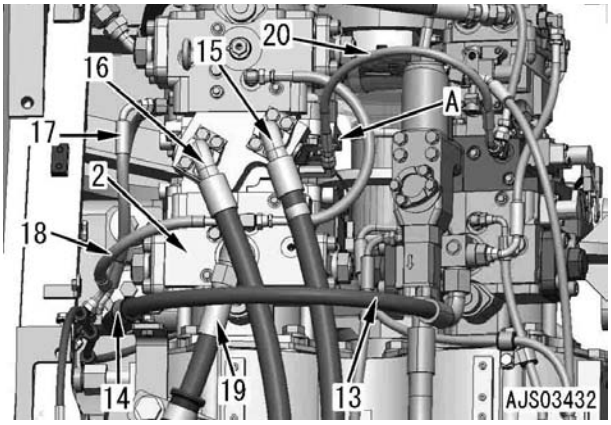
23. Disconnect suction tube (11).



24. Disconnect fan pump injection hose (12).

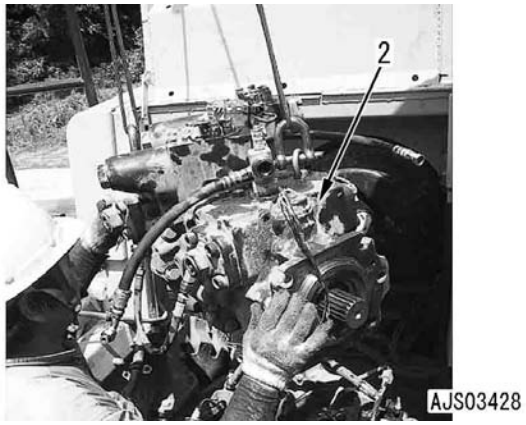


25. Disconnect hose (13).
26. Disconnect clamp (14).
27. Disconnect valve hoses (15) and (16) of the work equipment.
28. Disconnect load pressure input port hose (17).
29. Disconnect pump pressure input port hose (18).
30. Disconnect return hose (19).
31. Disconnect EPC basic pressure port hose PEPC (20).
32. Disconnect connectors DT2 from portion (A).



33. Lift and remove work equipment hydraulic pump assembly (2). [*1]

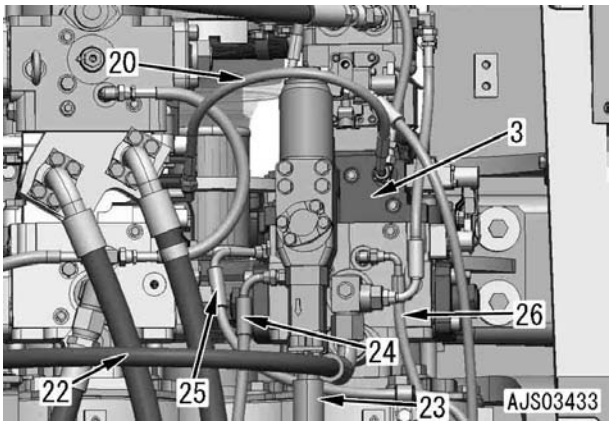
Work equipment hydraulic pump assembly: **180 kg**

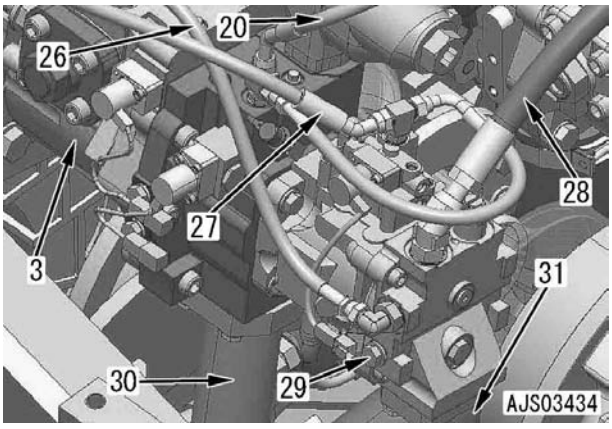


- **(3): Steering fan pump assembly**

34. Disconnect EPC basic pressure port hose PEPC (20).
35. Disconnect drain hose (22).
36. Disconnect injection hose (23) to steering valve.
37. Disconnect load pressure input hose PLS (24).
38. Disconnect load pressure pick-up port hose (25).
39. Disconnect pump pressure input port hose (26) (band color: green).
40. Disconnect EPC basic pressure port hose PEPC (27).
41. Disconnect fan injection hose (28).
42. Disconnect connector R12 (29).
43. Disconnect suction tubes (30) and (31).
44. Lift and remove the steering fan pump assembly (3). [*2]

Steering fan pump assembly: **130 kg**





Installation

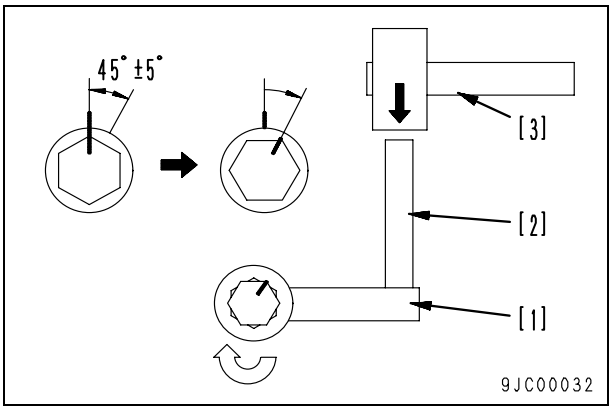
- Carry out installation in the reverse order to removal.

[*1], [*2]

Upper side mounting bolt:
456 – 568 Nm {46.5 – 58 kgm}

★ Since a long tool cannot enter the lower side, first tighten with a small torque wrench. Use wrench [1], bar [2] and hammer [3] for angle tightening for the second time.

Lower side mounting bolt
First time: **33.3 ± 2.9 Nm {3.4 ± 0.3 kgm}**
Second time:**45 ± 5°** retightening



- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

  Hydraulic tank: **approx. 443 ℓ**

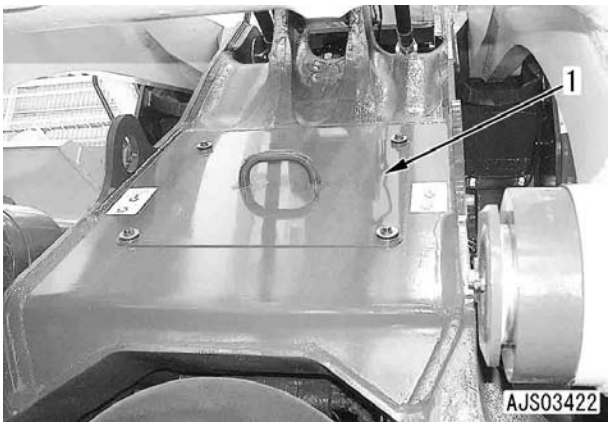
- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, “Bleeding air of various parts.”

Removal and installation of control valve assembly

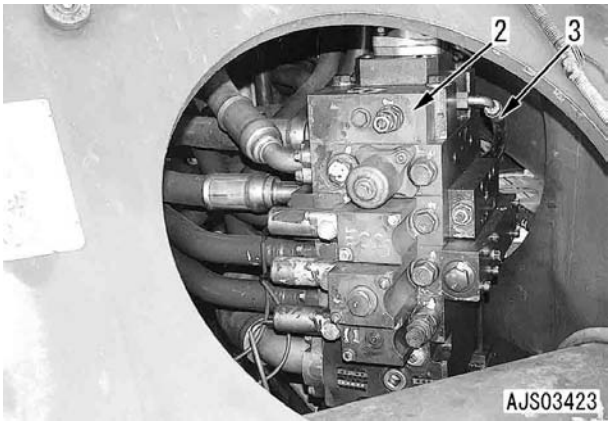
- ⚠ **Park the machine in a flat place. Apply parking brake and apply chocks to the tires.**
- ⚠ **Set the boom on the stand and check that it does not descend.**
- ⚠ **Set the frame lock bar.**
- ⚠ **Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**
- ⚠ **Release the remaining pressure in the piping, referring to section "Releasing remaining pressure in work equipment cylinder" in "Testing and adjusting."**
- ⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

Removal

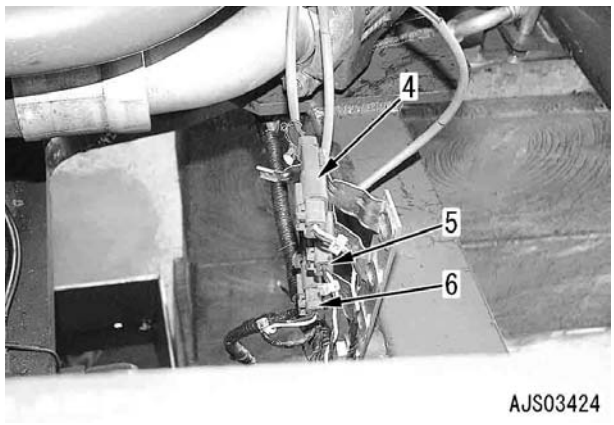
1. Drain the oil from the hydraulic tank.
   Hydraulic tank: **approx. 443 ℓ**
2. Remove cover (1).



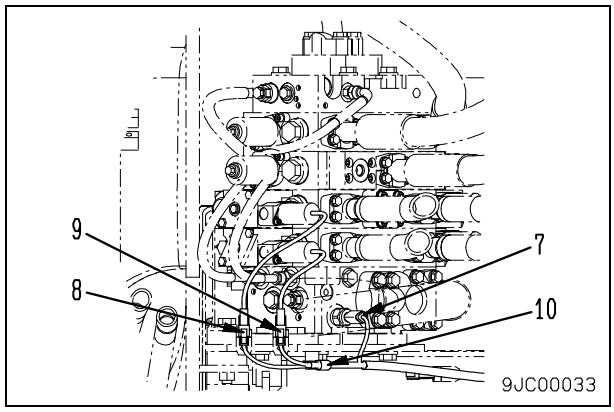
3. Disconnect hose (3) between the work equipment and hydraulic pump from control valve assembly (2).



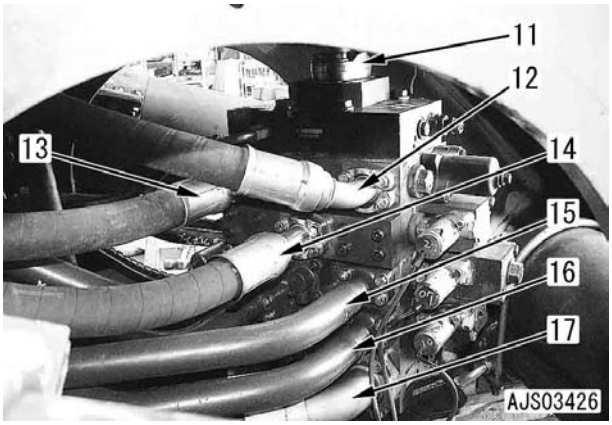
4. Disconnect EPC valve connectors F24 (4), F07 (5) and F10 (6) from the right side of control valve assembly.



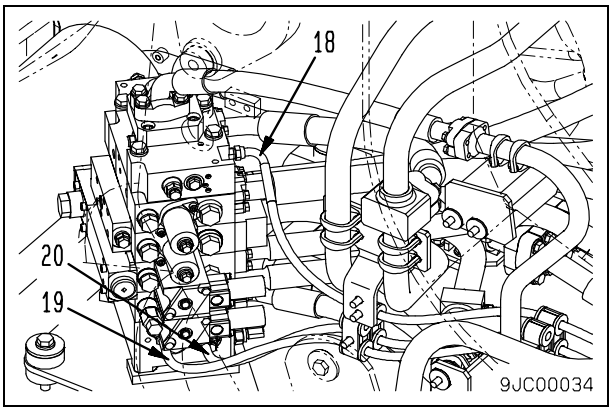
5. Disconnect hydraulic oil pressure sensor connector F16 (7), EPC valve connectors F08 (8) and F09 (9) from the bottom of control valve assembly.
6. Disconnect clamp (10).



7. Disconnect the following hoses from rear side of the control valve assembly:
   - (11): From work equipment hydraulic pump
   - (12): To bucket cylinder bottom
   - (13): To lift arm cylinder bottom
   - (14): To ECSS accumulator
   - (15):To lift arm cylinder head
   - Left side of (15): To lift arm cylinder bottom
   - (16): To bucket cylinder bottom
   - Left side of (16): To bucket cylinder head
   - (17): Drain port (to hydraulic tank)
   - Left side of (17): From work equipment hydraulic pump

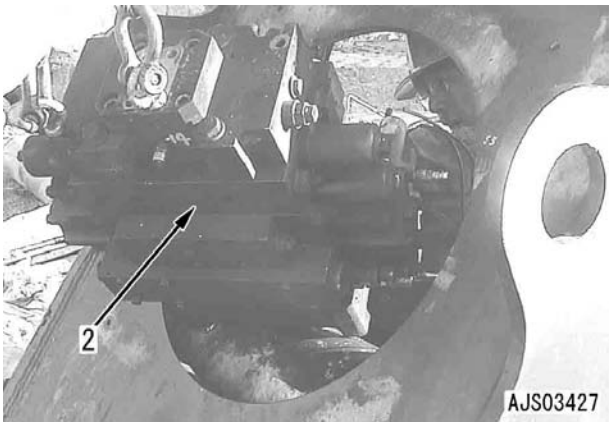


8. Disconnect the following hoses.
   - (18): Marked with 2 red lines
   - (19): Marked with 1 white line
   - (20): Marked with 2 white lines



9. Lift control valve assembly (2) temporarily and remove the mounting bolts.
10. Lift and remove control valve assembly (2).
    ★ Rotate and remove control valve assembly (2) from the hole.

    Control valve assembly:
    120 kg (STD)
    140 kg (ECSS)



Installation

- Carry out installation in the reverse order to removal.

- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

  Hydraulic tank: **approx. 443 ℓ**

- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, “Bleeding air of various parts.”

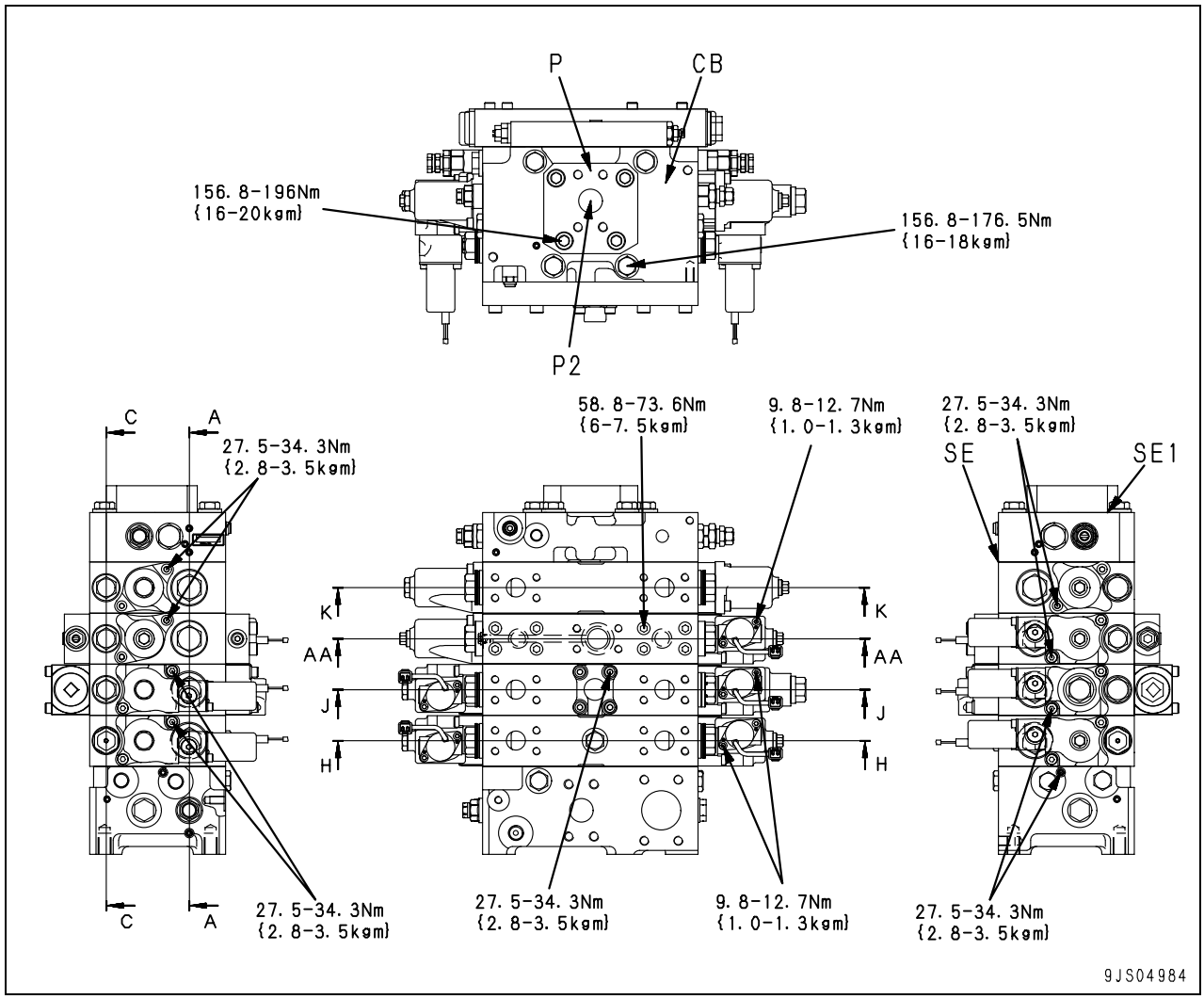
Disassembly and assembly of control valve assembly

★ This section deals with only precautions to be followed when reassembling the control valve assembly.

Special tools

Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
T	2	796-946-1310	Guide	■	1		
		(For 723-46-40100)					
	3	796-946-1320	Guide	■	1		
		(For 723-46-40100)					
	4	796-946-1330	Sleeve	■	1		
		(For 723-46-40100)					

★ The sectional view shows the 4-spool valve (with ECSS control valve).

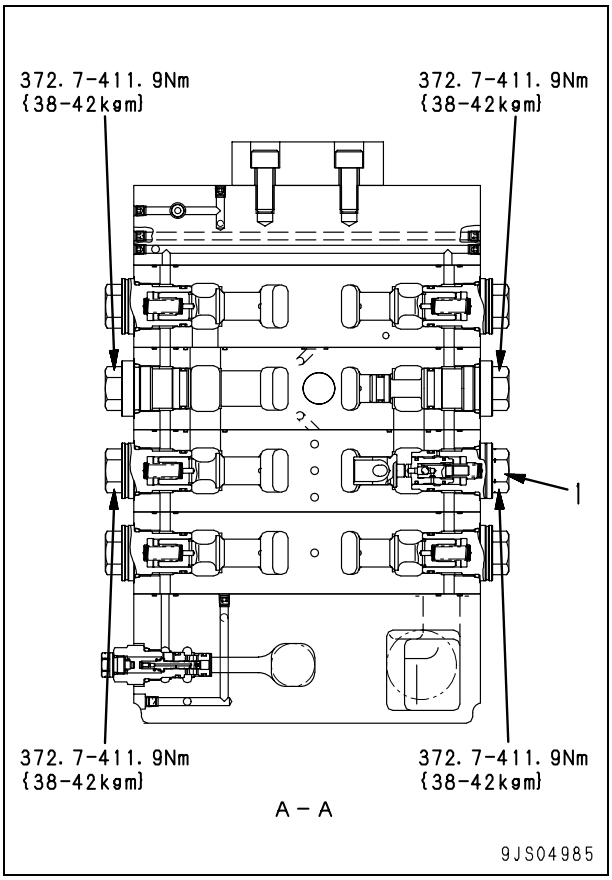


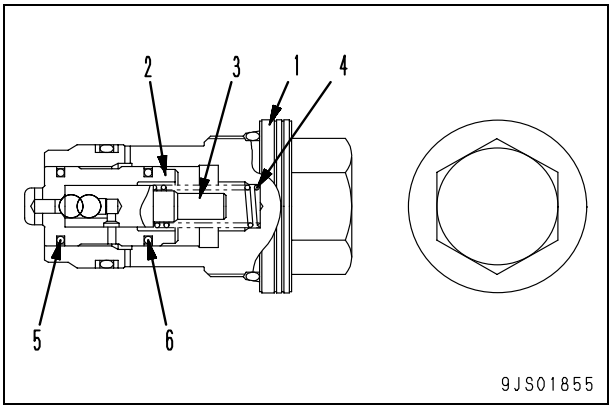
Procedures for replacing pressure compensation valve seal

★ Since there are many types of pressure compensation valve, mark the positions when removing to correspond to the original.

1. Remove piston (2), plug (3) and spring (4) from pressure compensation valve (1).

2. Remove piston (2) from seals (5) and (6).

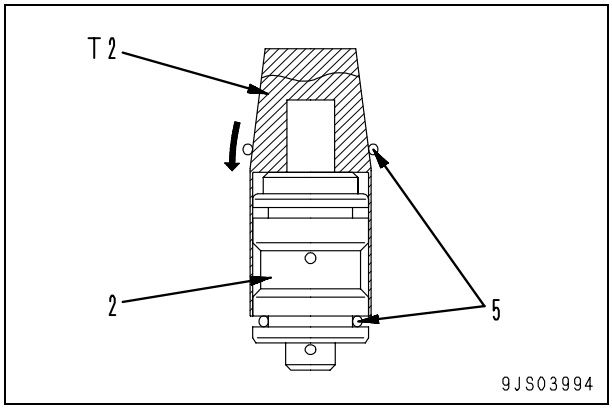




★ There are many types of piston.

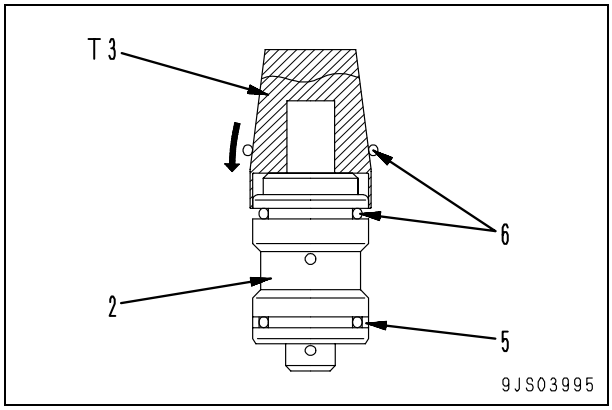
3. Set tool **T2** to piston (2) and push it in slowly by hand so that seal (5) may spread out evenly.

★ The seal may be also fitted by pushing it down to the flat surface of the tool and then pushing it in with the tool fitted to the piston.

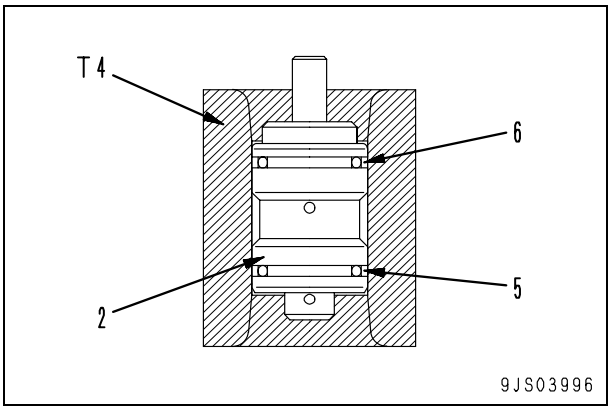


4. Likewise, set tool **T3** to piston (2) in the same direction and push it slowly by hand so that another seal (6) may be spread out evenly.

★ The seal may be also fitted by pushing it down to the flat surface of the tool and then pushing it in with the tool fitted to the piston.

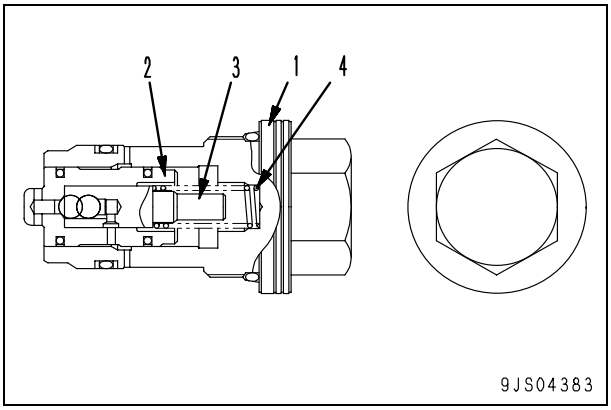


5. Keep compensation tool **T4** fitted to piston (2) for about one minutes so that seals (5) and (6) are adapted well.
   ★ Check that there is no protrusion or cut on the seal.



6. Assemble the piston in the sleeve.
   ★ If it is found difficult to install the piston, do not attempt to push it in forcibly, but set it to compensation tool **T4** again and install the piston to the sleeve after adapting the seal.

7. Fit plug (3) and spring (4) to piston (2), then assemble pressure compensation valve (1).
   ★ After the installation, push the piston by hand and check that the piston reacts only with spring force.



Assembly of control valve assembly

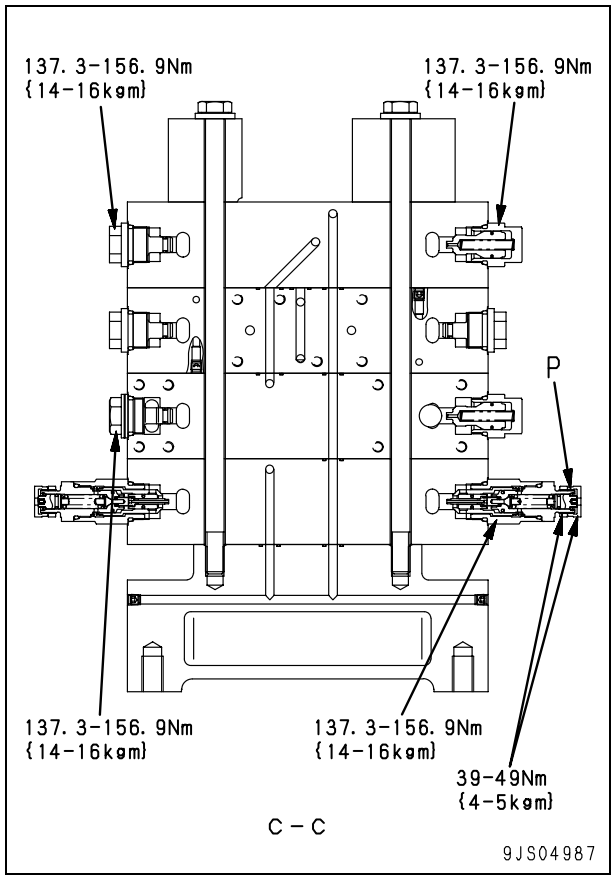
- Coat the sliding surface with engine oil and then reassemble the control valve assembly.

- **Section C-C**

Portion (P): **Seal end 242 (20% diluted alcohol) or equivalent**

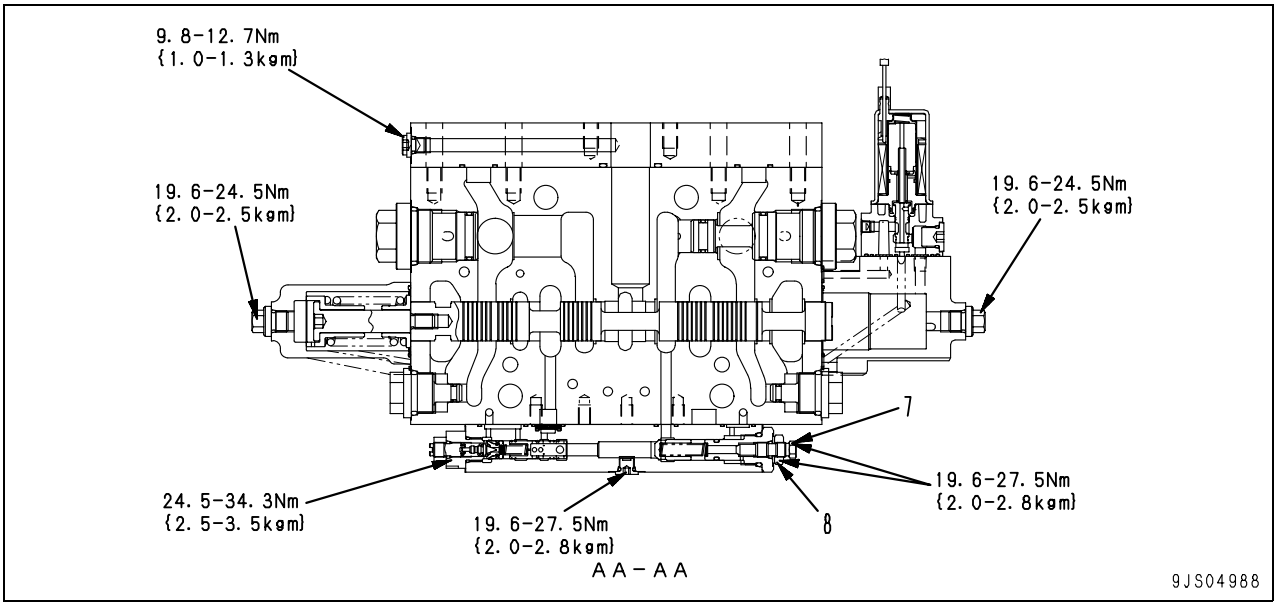
★ One rotation of adjustment screw changes pressure by approx. 20.5 MPa {209 kg/cm^2}.

★ Identical for the left and right



- **Section AA-AA**

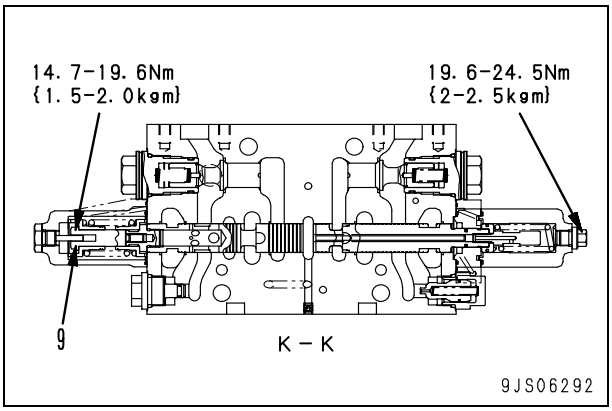
★ **Care required for the order of tightening**
After tightening plug (7), tighten nut (8).
(To seal oil with the tapered portion at the tip of plug (7).)

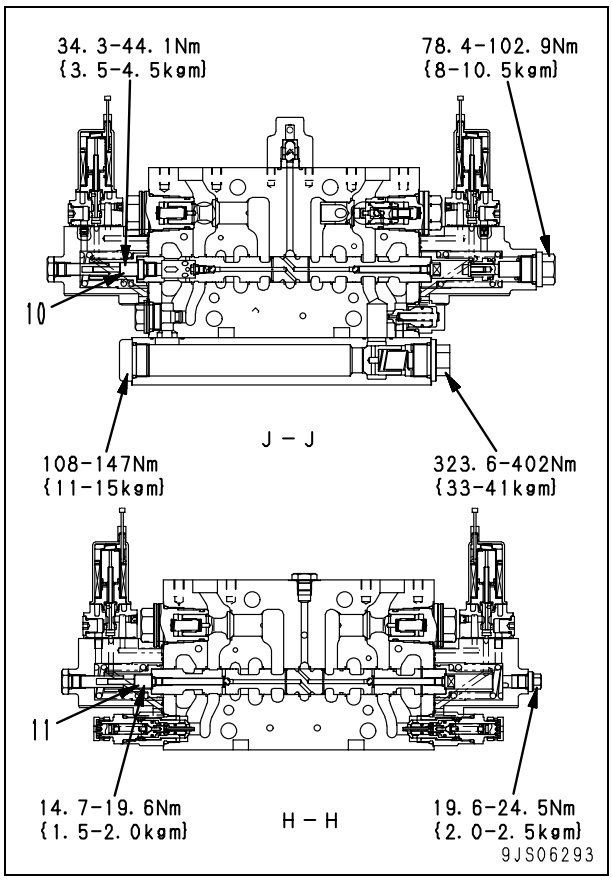


- **Sections K-K, J-J and H-H**

★ Apply one drip (approx. 0.02 g) of Loctite No. 638 to plugs (9), (10) and (11) and tighten them.

Plugs (9), (10) and (11):
Apply one drip (approx. 0.02 g) of Loctite No. 638





- Control valve cover block (CB)

★ Referring to the sectional view.

Mating face of upper and lower control valve cover block (SE):

SEALEND 242 or equivalent

- Tighten the control valve cover block mounting bolts according to the order shown in the figure. (A → D → C → B)

Control valve cover block mounting bolt:

156.9 – 176.5 Nm {16 – 18 kgm}

- Plate (P)

★ Referring to the sectional view.

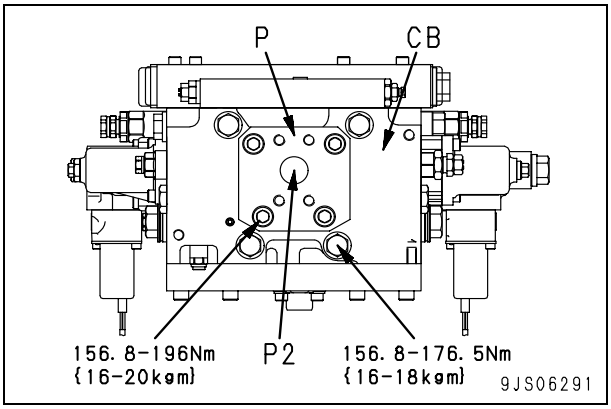
Mating face (SE1) of control valve plate (P):

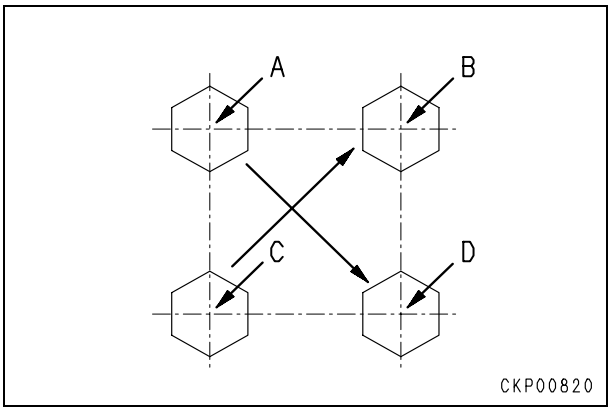
SEALEND 242 or equivalent

- Tighten the plate mounting bolts according to the order shown in the figure (A → D → C → B)

Plate mounting bolt:

156.9 – 176.5 Nm {16 – 18 kgm}





- Pressure compensation valve
  - ★ Install by checking the mark provided when respective pressure compensation valves were removed.

- Main relief valve assembly
  After installation to the control valve, referring to “Testing and adjusting of work equipment oil pressure” in Testing and adjusting.

Removal and installation of steering valve assembly

Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
T	1	793T-664-1110	Bracket	■	1	N	○

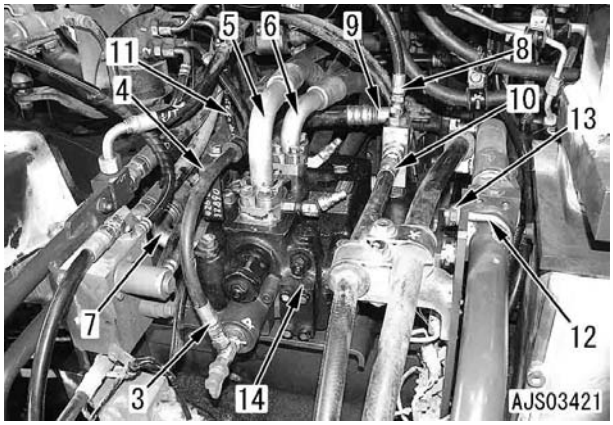
Removal

- ⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- ⚠ **Set the frame lock bar.**
- ⚠ **Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**
- ⚠ **Release the remaining pressure in the piping, referring to "Releasing remaining pressure in work equipment cylinder" in Testing and adjusting.**
- ⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

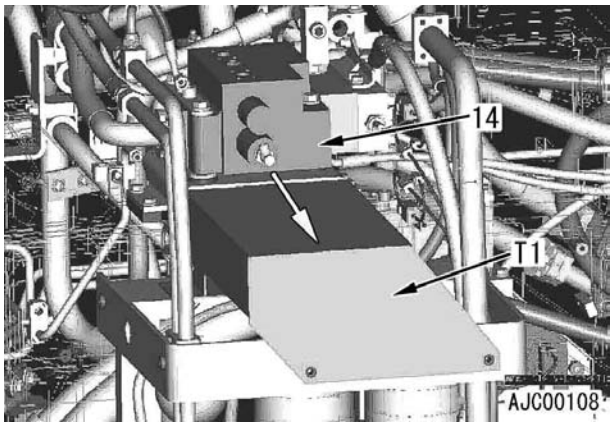
1. Drain the oil from the hydraulic tank.
   Hydraulic tank: **approx. 443 ℓ**
2. Disconnect clamp (1).
3. Lift and remove the handrail and step assembly (2).
   ★ Disconnect connector of light (L).
4. Lift and remove box assembly (20).



5. Disconnect pilot hose (3) from steering valve assembly (14).
6. Disconnect bracket (4).
7. Disconnect steering cylinder hoses (5) and (6).
8. Disconnect drain hose (7).
9. Disconnect hoses (8) to (10) from (Tp) port.
10. Disconnect pilot hose (11) from the back.
11. Remove U-bolt (12).
12. Disconnect steering pump hose (13) from the back.



13. Using box assembly (20) mounting hole, install tool **T1**.
14. Remove 3 mounting bolts, and remove steering valve assembly (14).
15. Slide steering valve assembly (14) to lift and remove it.
    Steering valve assembly: **70 kg**



Installation

- Carry out installation in the reverse order to removal

- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.
  Hydraulic tank: **approx. 443 ℓ**

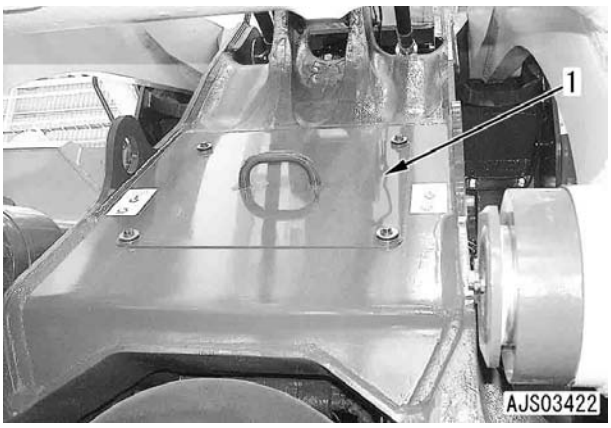
- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, "Bleeding air of various parts."

Removal and installation of ECSS accumulator assembly

Removal

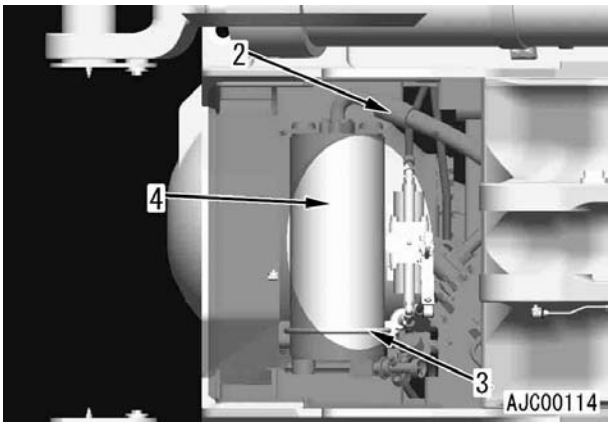
- ⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- ⚠ **Set the frame lock bar.**
- ⚠ **Loosen the filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.**
- ⚠ **Release the remaining pressure in the piping, referring to "Releasing remaining pressure in work equipment cylinder" in Testing and adjusting.**
- ⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Remove cover (1).



2. Disconnect fuel hose (2).
3. Remove clamp (3), lift and remove ECSS accumulator assembly (4).

   ECSS accumulator assembly: **130 kg**



Installation

- Carry out installation in the reverse order to removal

- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, "Bleeding air of various parts."

Disassembly and assembly of hydraulic cylinder assembly

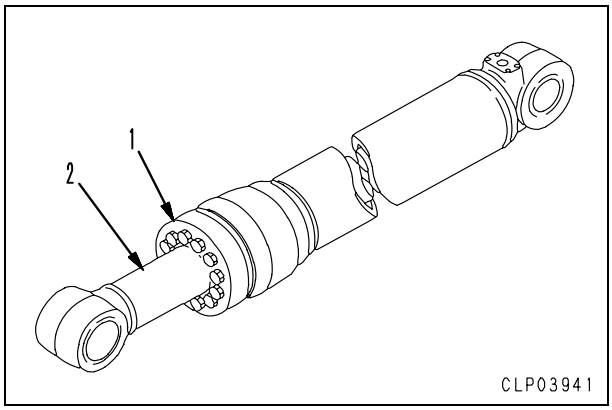
Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
U	1	790-502-1003	Cylinder repair stand	●	1		
		790-101-1102	Pump	●	1		
	2	790-102-4300	Wrench assembly	■	1		
		790-102-4310	Pin	■	2		
	3	790-720-1000	Expander	●	1		
	4	796-720-1690	Ring (For lift arm)	●	1		
		07281-02169	Clamp	●	1		
		796-720-1720	Ring (For bucket)	●	1		
		07281-02429	Clamp	●	1		
		796-720-1660	Ring (For steering)	●	1		
		07281-01159	Clamp	●	1		
	5	790-201-1702	Push tool kit	■	1		
		• 790-201-1881	• Push tool (For lift arm and bucket)		1		
		• 790-201-1821	• Push tool (For steering)		1		
		• 790-101-5021	• Grip		1		
		• 01010-50816	• Bolt		1		
	6	• 790-201-1500	Push tool kit	●	1		
		• 790-101-5021	• Grip		1		
		• 01010-50816	• Bolt		1		
		790-201-1690	Plate (For lift arm and bucket)	●	1		
		790-201-1630	Plate (For steering)	●	1		

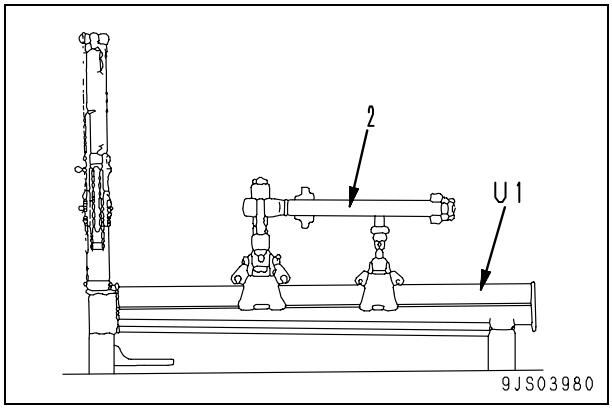
DISASSEMBLY

1. Piston rod assembly

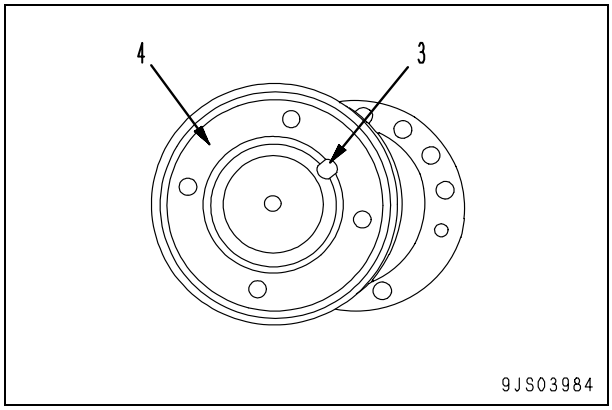
1) Remove piping from the cylinder assembly.
2) Remove the mounting bolts and then disconnect head assembly (1).
3) Pull out piston rod assembly (2).
   ★ Place a container under the cylinder to catch the oil.



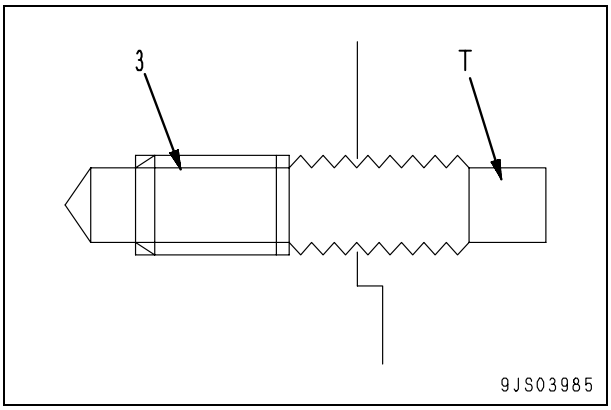
4) Disassemble the piston rod assembly as follows.
   1] Set piston rod assembly (2) in tool **U1**.



   2] Remove stopper screw (3) of piston assembly (4).
   ★ Common for the lift arm, arm and bucket cylinders
   Screw size: **M12 × pitch 1.75**

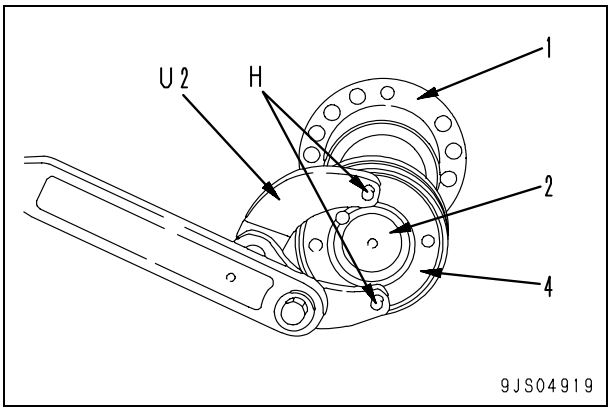


★ If the caulking of screw (3) is too strong and it cannot be removed, tighten the screw fully, then fit tap (T) to the thread and remove the screw.

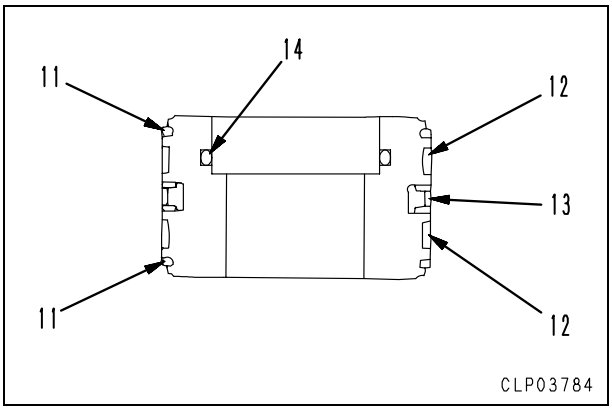


3] Using tool **U2**, remove piston assembly (4).
- When not using tool **U2**, use the drill holes (H) (ϕ10: 2 places) and loosen piston assembly.

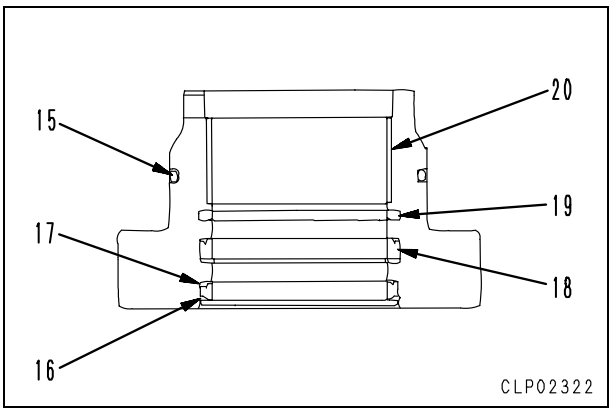
4] Remove head assembly (1) from piston rod assembly (2).



2. Disassembly of piston assembly
1) Remove ring (11).
2) Remove wear ring (12).
3) Remove piston ring (13).
4) Remove O-ring and backup ring (14).



3. Disassembly of cylinder head assembly
1) Remove O-ring and backup ring (15).
2) Remove snap ring (16) and then remove dust seal (17).
3) Remove rod packing (18).
4) Remove buffer ring (19).
5) Remove busing (20).

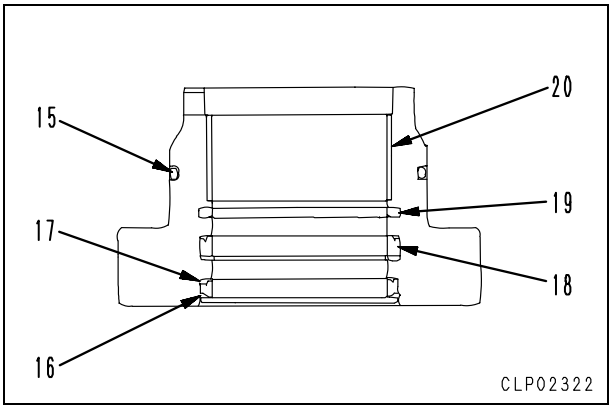


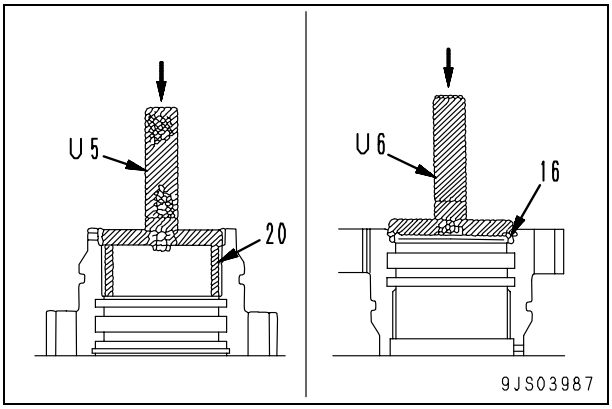
Assembly

★ Be careful not to damage the packing, dust seals, and O-rings.
★ Clean each part, then cover the piping ports and pin-inserting hole to prevent dust from entering them.
★ Do not try to force the backup ring into position. Warm it in warm water (50 – 60°C) before installing it.

1. Disassembly of head assembly

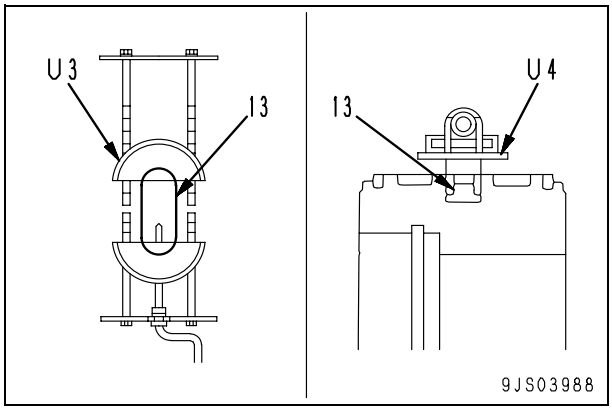
1) Using tool **U5**, press fit bushing (20).
2) Assemble buffer ring (19).
3) Assemble rod packing (18).
4) Using tool **U6**, install dust seal (17), and secure with snap ring (16).
5) Install the backup ring and O-ring (15).



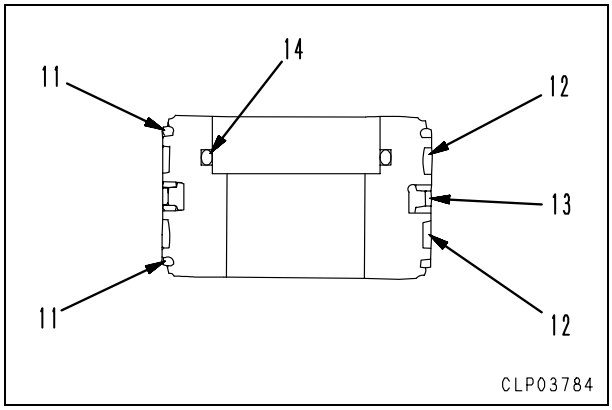


2. Disassembly of piston assembly

1) Using tool **U3**, expand piston ring (13).
★ Set the piston ring on tool **U3**, and turn the handle 8 – 10 times to expand the ring.
2) Set tool **U4**, and compress piston ring (13).

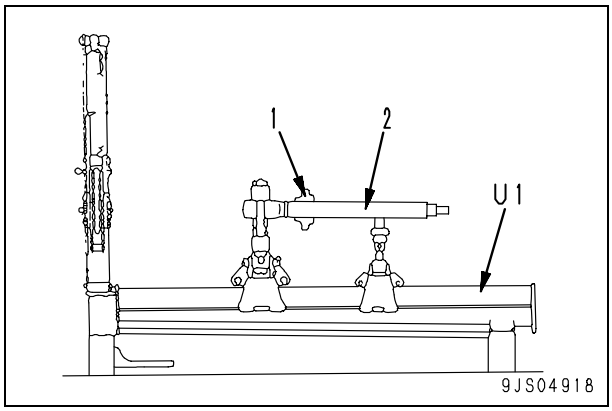


3) Install the backup ring and O-ring (14).
4) Assemble wear ring (12).
5) Assemble ring (11).
★ Be careful not to open the end gap of the ring too wide.
Ring groove: **Grease (G2-LI)**



3. Piston rod assembly

1) Install head assembly (1) to piston rod assembly (2).
2) Set piston rod assembly (2) in tool **U1**.



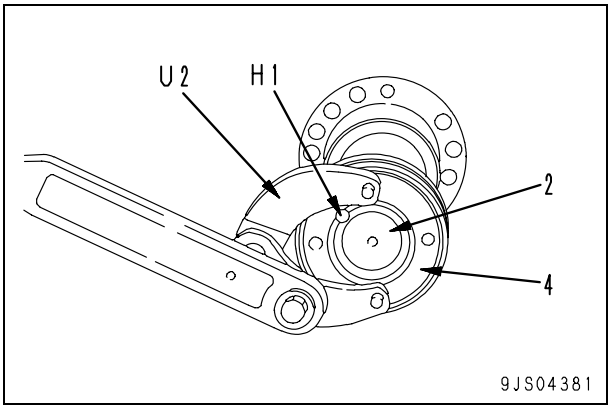
3) Assemble piston assembly (4) as follows.

- **When using piston rod assembly (2) and piston assembly (4) again**

★ Wash thoroughly and remove all metal particles and dirt.

1] Screw in piston assembly (4) by using tool **U2**, and tighten piston assembly (4) until the position of the screw thread hole (H1) which is in piston rod assembly (2) halfway matches.

★ Remove all burrs and flashes on the threaded portion with a file.

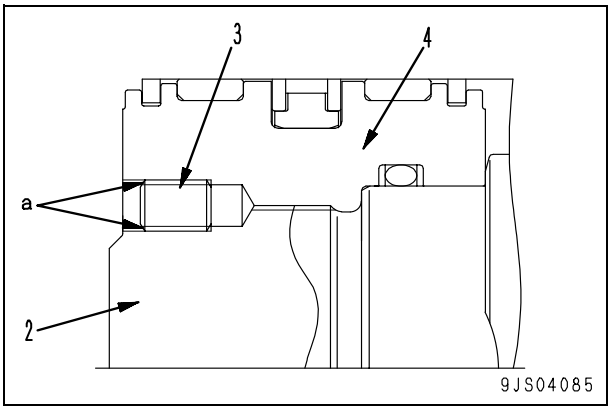


2] Tighten screw (3).

Screw part female screw side:
Loctite No.262

Screw:
58.9 – 73.6 Nm {6 – 7.5 kgm}

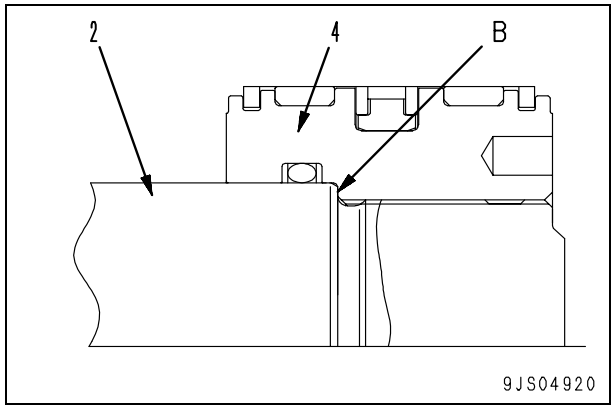
3] Caulk thread at four places (a) of screw (3) with punch.



- **When using a new part for either or both of piston rod assembly (2) and piston assembly (4)**

1] Screw in piston assembly (4) until it makes contact with the rod end surface (B). Use tool **U2** (noted in the foregoing) to tighten it.

Piston assembly:
294 ± 29.4Nm {30 ± 3.0kgm}



2] Machine one of the holes used to install screw (3).

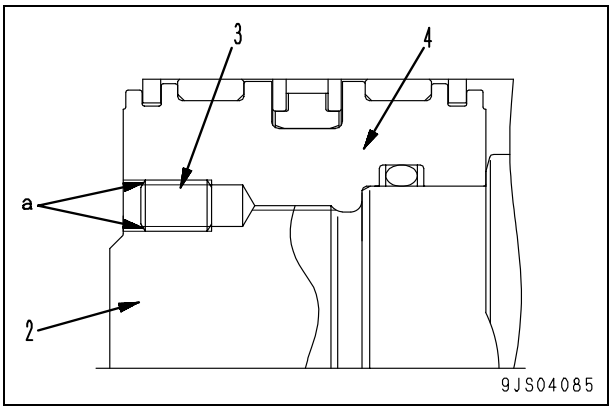
★ Align a drill horizontal with the V-groove of the thread of piston rod assembly (2) and piston assembly (4), then carry out machining.

- Screw machining dimension (mm)

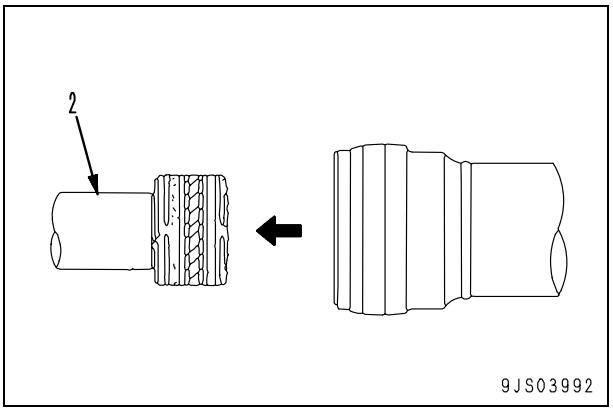
Preparation hole drill diameter	Preparation hole depth	Screw size	Tapping depth
10.3	24 *1	12 × 1.75	20 *1
	43 *2		36 *2

*1: Steering cylinder
*2: Bucket cylinder and lift arm cylinder

3] After machining, wash thoroughly to remove all metal particles and dust.
4] Tighten screw (3).
Screw part female screw side:
Loctite No.262
Screw:
58.9 – 73.6Nm {6 – 7.5kgm}
5] Caulk thread at four places (a) of screw (3) with punch.

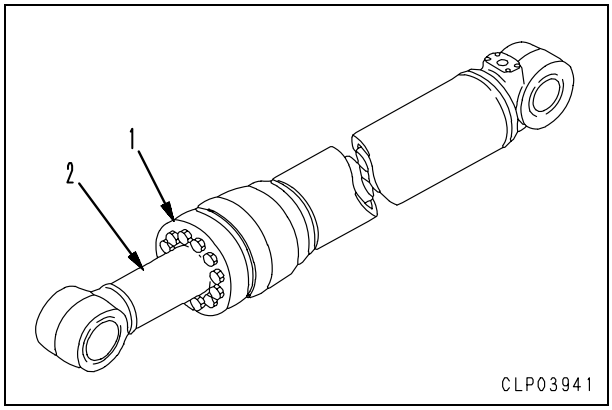


4) Assemble the cylinder tube to piston rod assembly (2).
★ Align axial center of the cylinder tube, then insert.
★ Check that the ring is not broken and has not come out, then push in fully.



5) Tighten head assembly (1) with mounting bolts.
Mounting bolt:

Cylinder name	Tightening torque
Steering	270 ± 39 Nm {27.5 ± 4.0 kgm}
Bucket	1,670 ± 250 Nm {170 ± 25 kgm}
Lift arm	1,270 ± 200 Nm {130 ± 20 kgm}



6) Install piping.

WA600-6 Wheel loader

Form No. SEN01171-00

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Printed in Japan 06-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

Work equipment

Work equipment 2
Removal and installation of work equipment assembly 2

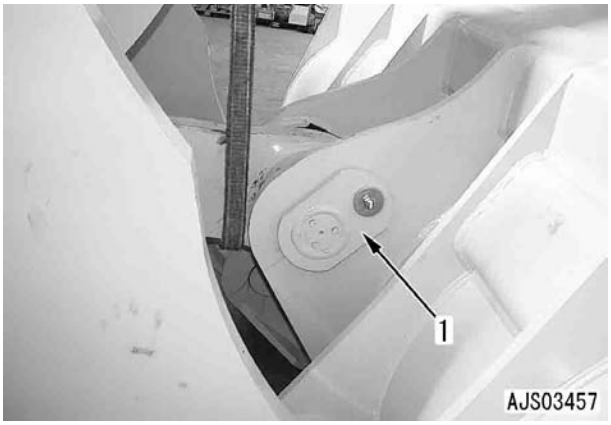
Work equipment

Removal and installation of work equipment assembly

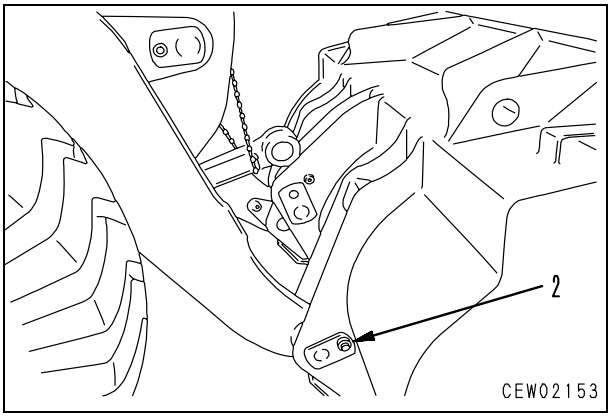
Removal

- ⚠ **Park the machine on flat ground and set the safety bar to the frame.**
- ⚠ **Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.**
- ⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Lift the bucket link temporarily, and remove bucket link pin (1). [*1]
   - Bucket link pin: **35 kg**
   - ★ Fix the bucket link to the bell crank using a wire.
   - ★ Check the thickness and number of the shims in advance.

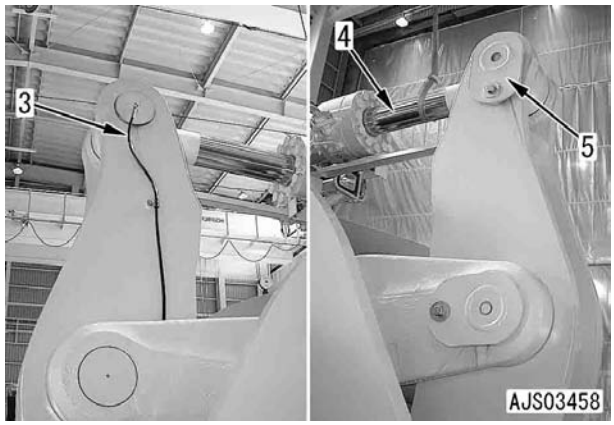


2. Remove bucket hinge installing pin (2). [*2]
   - ⚠ **Absolutely do not insert fingers into the pin hole.**
   - ★ Check the thickness and number of the shims in advance.
   - Bucket hinge pin: **35 kg**

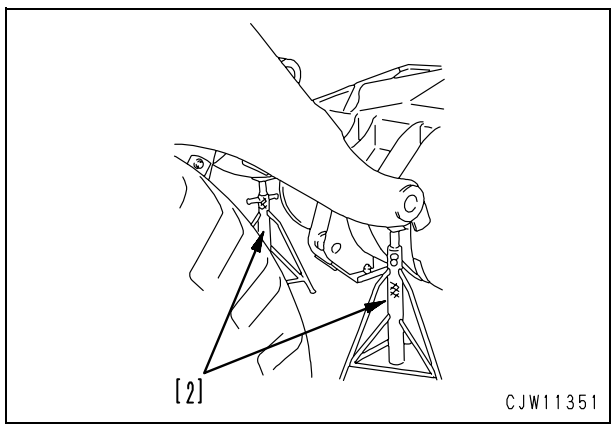


3. Move the machine to backward and disconnect the bucket.

4. Disconnect pin lubrication hose (3).
5. Lift bucket cylinder assembly (4) temporarily, pull out rod pin (5). Then disconnect the cylinder rod and bell crank. [*3]
   - ★ Install block [1] between the cylinder bottom and frame.
   - ★ Check the thickness and number of the shims in advance.
   - Rod pin: **40 kg**
   - Bucket cylinder assembly: **530 kg**



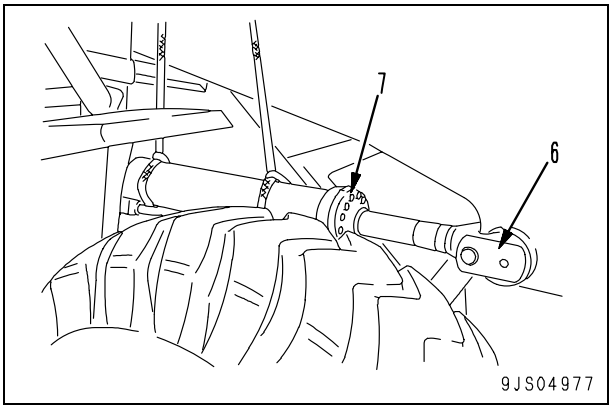
6. Install support stands [2] at the end of the lift arm, and release the remaining pressure in the hydraulic piping.



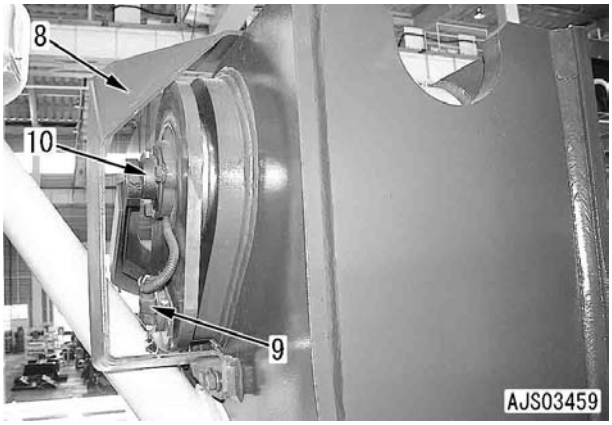
7. Sling lift arm cylinder assembly (7) temporarily and remove installing pin (6). [*4]
   ★ Check the thickness and number of the shims in advance.
   ★ When lowering the lift arm cylinder assembly, put the block into the top of the axle.

   Rod pin: **35 kg**

   Lift arm cylinder assembly (1 piece): **530 kg**



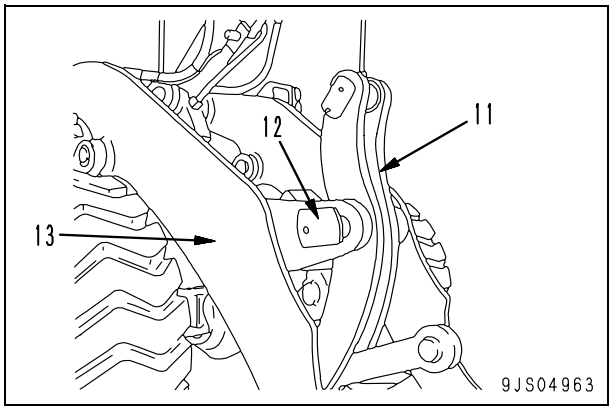
8. Remove cover (8).
9. Disconnect lift arm angle sensor connector F13 (9).
10. Remove lift arm angle sensor assembly (10). [*5]



11. Lift bell crank and bucket link assembly (11) temporarily.
12. Remove installing pin (12) and disconnect from lift arm assembly (13). [*6]

    Mounting pin: **65 kg**

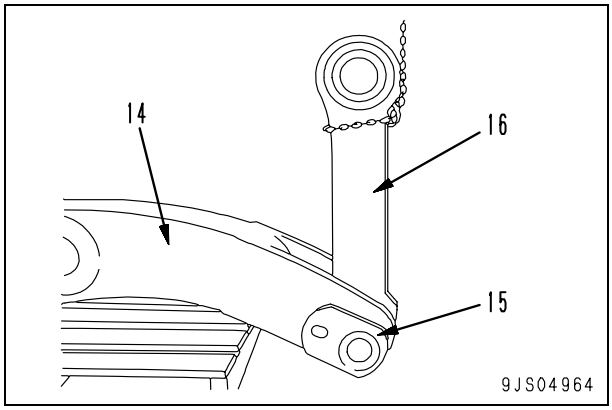
    Bucket link and bell crank: **1,650 kg**



13. Lift bucket link assembly (16) temporarily.
14. Remove installing pin (15) and remove bucket link (16) from bell crank (14). [*7]
    ★ Check the thickness and number of the shims in advance.

    Bucket link pin: **35 kg**

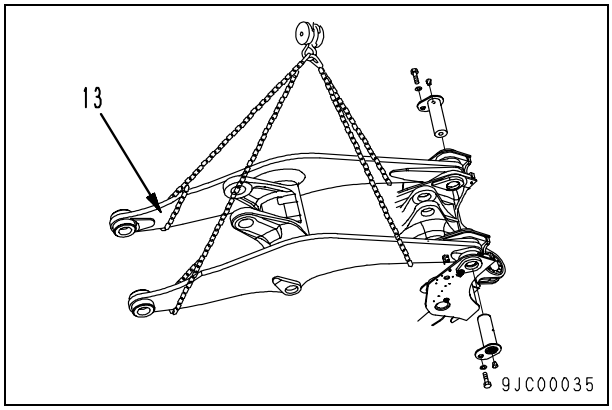
    Bucket link: **300 kg**



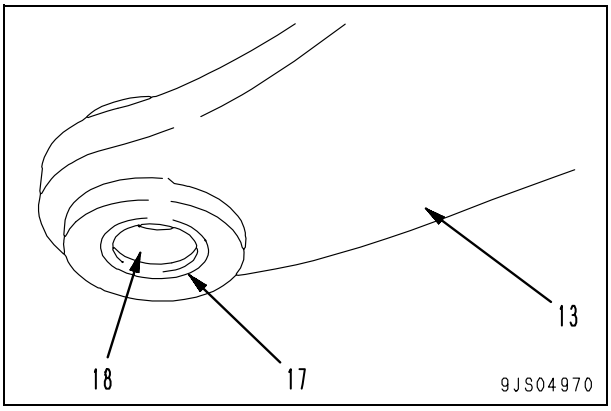
15. Lift lift arm assembly (13) temporarily.
16. Remove lift arm installing pin, lift and remove lift arm assembly (13). [*8]

    Mounting pin: **45 kg**

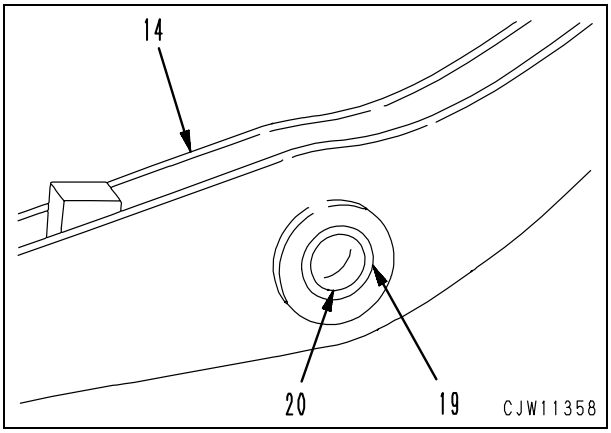
    Lift arm assembly: **3,950 kg**



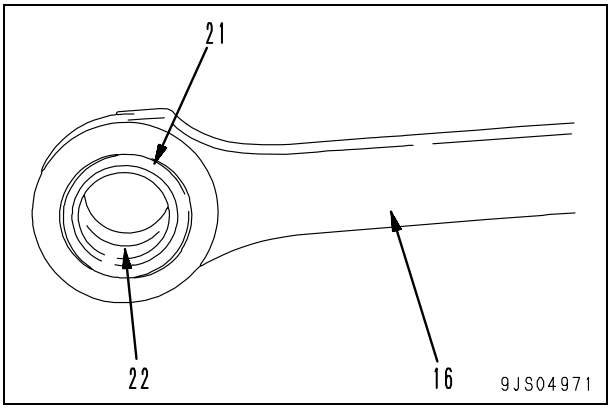
17. Pull out dust seal (17) and bushing (18) from lift arm (13). [*9]



18. Pull out dust seal (19) and bushing (20) from bell crank (14). [*9]



19. Pull out dust seal (21) and bushing (22) from bucket link (16). [*9]



Installation

- Carry out installation in the reverse order to removal

⚠ Use a bar to mach the pin holes. Absolutely do not insert fingers.

★ Apply specified lubricant to the seal. Take care not to damage seal when installing the pin.
★ Supply grease to each pin until it comes out through the joint.

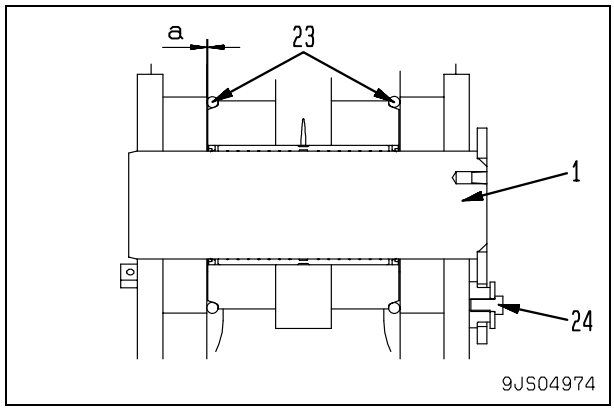
[*1]
Installation of bucket link pin

★ Apply lubricant to inside the bushing and seal before installing the pin.
Inside bushing and seal:
Molybdenum disulfide lubricant (LM-P or equivalent) or Hyper white (G2-T)

1. Lift the bucket link, align the hole of installing pin (1) and install cord ring (23).
   ★ Apply lubricant or grease to the cord ring groove.
   Cord ring groove:
   Molybdenum disulfide lubricant (LM-G or equivalent) or Grease (G2-LI)

2. Insert shims so that clearance (a) is equal on the left and right.
   - Clearance (a) (each left and right):
     Max. 1.5 mm
   - Shim thickness and type: **1.5 mm**

3. Assemble installing pin (1) and tighten bolt (24) to lock it.
   ⚠ Absolutely do not insert fingers into the pin hole.
   ★ Take care not to damage the pin and seal.
   ★ Take care that the cord ring is not engaged.

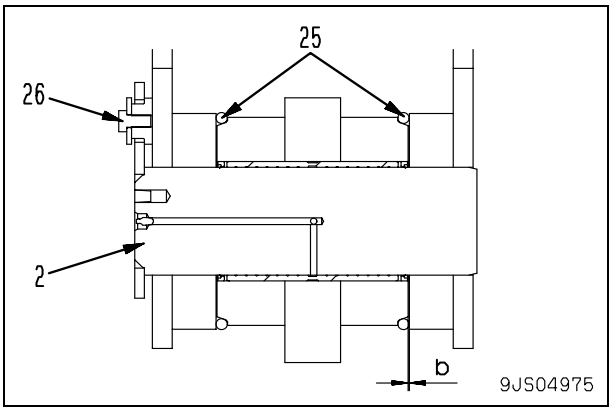


★ Apply lubricant after installing the pin.
Greasing
Molybdenum disulfide lubricant (LM-G or equivalent) or Hyper white (G2-T)

[*2]
Installation of bucket hinge pin

★ Apply lubricant to inside the bushing and seal before installing the pin.
Inside bushing and seal:
Molybdenum disulfide lubricant (LM-P or equivalent) or Hyper white (G2-T)

1. Operate the control lever, align the hole of bucket installing pin (2) and install cord ring (25).
   ★ Apply lubricant or grease to the cord ring groove.
   Cord ring groove:
   Molybdenum disulfide lubricant (LM-G or equivalent) or Grease (G2-LI)
2. Install shim to clearance (b).
   - Clearance (b) (each left and right):
     Max. 1.5 mm
   - Shim thickness and type: **1.5 mm**
3. Assemble installing pin (2) and tighten bolt (26) to lock it.
   ⚠ **Absolutely do not insert fingers into the pin hole.**
   ★ Take care that the cord ring is not engaged.
   ★ Take care not to damage the pin and seal.

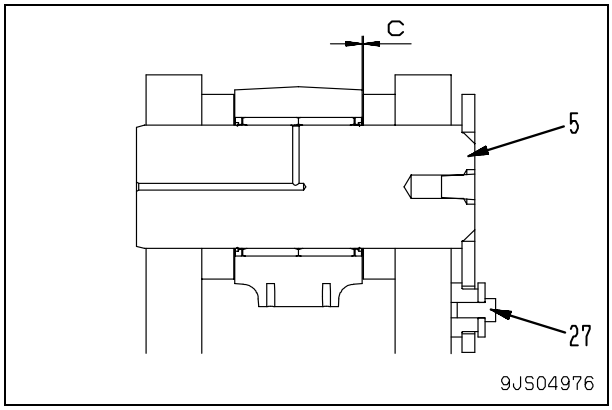


★ Apply lubricant after installing the pin.
Greasing
Molybdenum disulfide lubricant (LM-G or equivalent) or Hyper white (G2-T)

[*3]
Installation of bucket cylinder pin (rod side)

★ Apply lubricant to inside the bushing and seal before installing the pin.
Inside bushing and seal:
Molybdenum disulfide lubricant (LM-P or equivalent) or Hyper white (G2-T)
★ Shim not required for clearance (c)

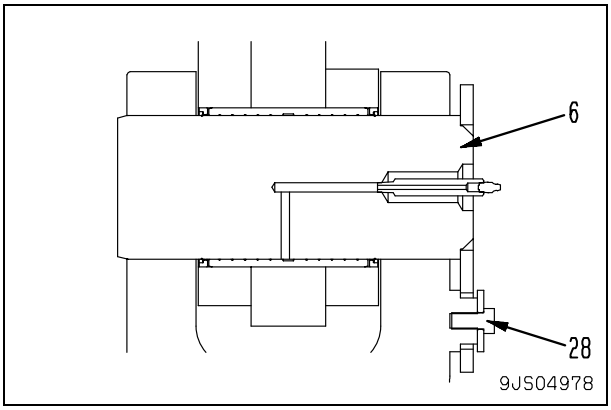
1. Assemble installing pin (5) and tighten bolt (27) to lock it.
   ⚠ **Absolutely do not insert fingers into the pin hole.**
   ★ Take care not to damage the pin and seal.



2. Adjust the bucket positioner, referring to section “Testing and adjusting bucket positioner” in “Testing and adjusting.”

[*4]
Installation of lift arm cylinder pin (rod side)

★ Apply lubricant to inside the bushing and seal before installing the pin.
Inside bushing and seal:
Molybdenum disulfide lubricant (LM-P or equivalent) or Hyper white (G2-T)
★ Shim is not required.
1. Assemble installing pin (6) and tighten bolt (28) to lock it.
⚠ Absolutely do not insert fingers into the pin hole.
★ Take care not to damage the pin and seal.

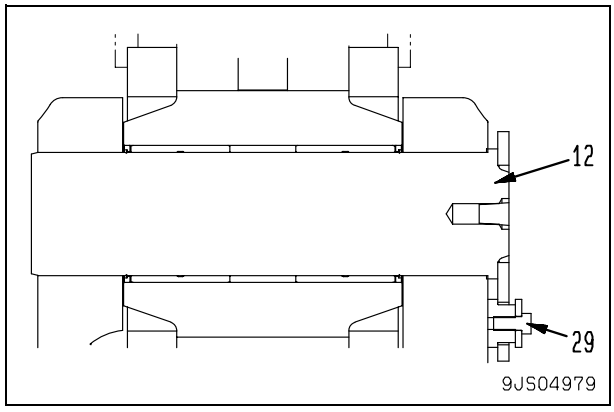


★ Apply lubricant after installing the pin.
Greasing
Molybdenum disulfide lubricant (LM-G or equivalent) or Hyper white (G2-T)

[*5]
★ Adjust the lift arm position detecting lever, referring to section “Testing and adjusting lift arm position detecting lever” in “Testing and adjusting.”

[*6]
Installation instructions for bell crank center pin

★ Apply lubricant to inside the bushing and seal before installing the pin.
Inside bushing and seal:
Molybdenum disulfide lubricant (LM-P or equivalent) or Hyper white (G2-T)
★ Shim is not required.
1. Assemble installing pin (12) and tighten bolt (29) to lock it.
⚠ Absolutely do not insert fingers into the pin hole.
★ Take care not to damage the pin and seal.



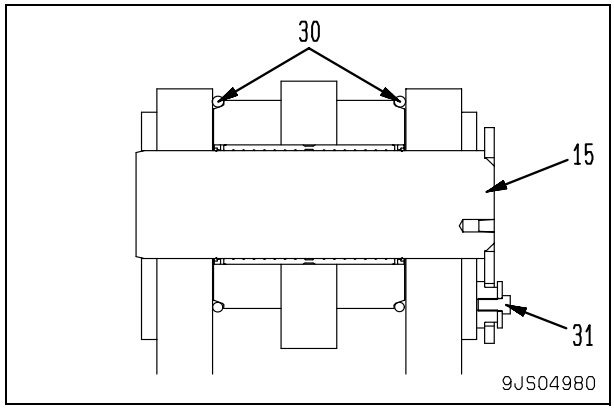
★ Apply lubricant after installing the pin.
Greasing
Molybdenum disulfide lubricant (LM-G or equivalent) or Hyper white (G2-T)

[*7]
Installation of bucket link pin

★ Shim is not required.

1. Align the hole of bucket link installing pin (15) and install cord ring (30).
★ Apply lubricant or grease to the cord ring groove.
Cord ring groove:
Molybdenum disulfide lubricant (LM-G or equivalent) or Grease (G2-LI)

2. Assemble installing pin (15) and tighten bolt (31) to lock it.
⚠ Absolutely do not insert fingers into the pin hole.
★ Take care that the cord ring is not engaged.
★ Take care not to damage the pin and seal.
★ Apply lubricant to inside the bushing and seal before installing the pin.
Inside bushing and seal:
Molybdenum disulfide lubricant (LM-P or equivalent) or Hyper white (G2-T)



[*8]

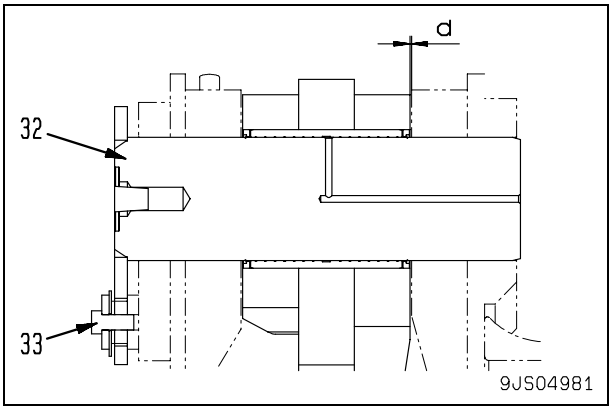
Installation of lift arm pin (Frame side)

★ Apply lubricant to inside the bushing and seal before installing the pin.

Inside bushing and seal:
Molybdenum disulfide lubricant (LM-P or equivalent) or Hyper white (G2-T)

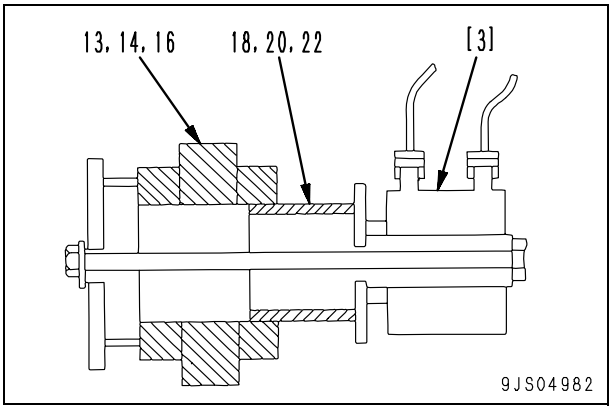
1. Install shim to clearance (d).
   - Clearance (d) (each left and right):
     Max. 1.5 mm
   - Shim thickness class: **1.5 mm**

2. Assemble installing pin (32) and tighten bolt (33) to lock it.
   ⚠ **Absolutely do not insert fingers into the pin hole.**
   ★ Take care not to damage the pin and seal.

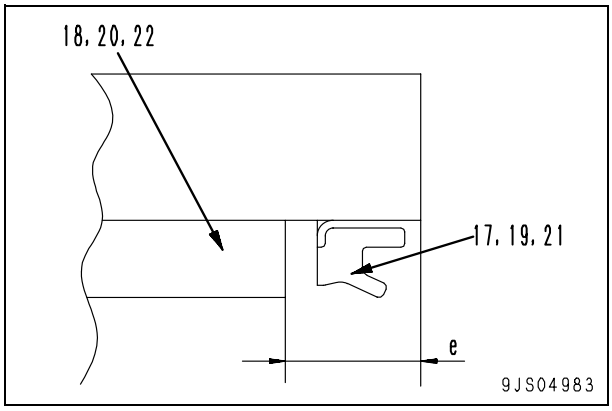


[*9]

1. Using hydraulic cylinder [3], etc., press fit bushings (18), (20) and (22) to lift arm (13), bell crank (14) and bucket link (16) respectively.
   - Bushing mounting dimension (e): **12.5 mm**



2. Assemble dust seals (17), (19) and (21).
   ★ Install dust seal lip so as to face outside.



WA600-6 Wheel loader

Form No. SEN01174-00

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Printed in Japan 06-06 (01)

WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

Cab and its attachments

Cab and its attachments 2
Removal and installation of operator's cab assembly 2
Removal and installation of operator's cab glass (stuck glass) 6
Removal and installation of floor frame assembly 14

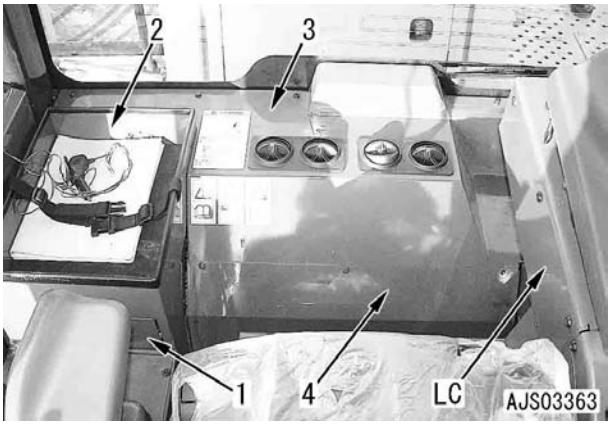
Cab and its attachments

Removal and installation of operator's cab assembly

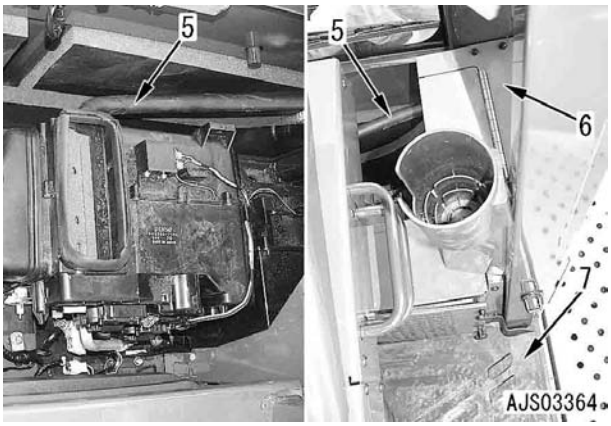
Removal

⚠ Disconnect the negative terminal (–) of the battery before starting with the work.

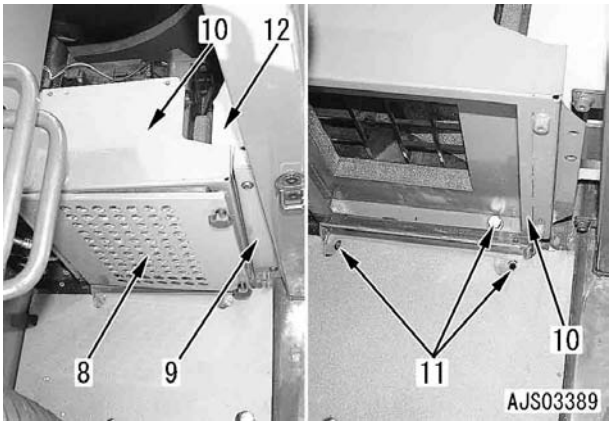
1. Open cover (1).
2. Remove box (2).
3. Remove covers (3) and (4).
   ★ Place the left console (LC) in front.



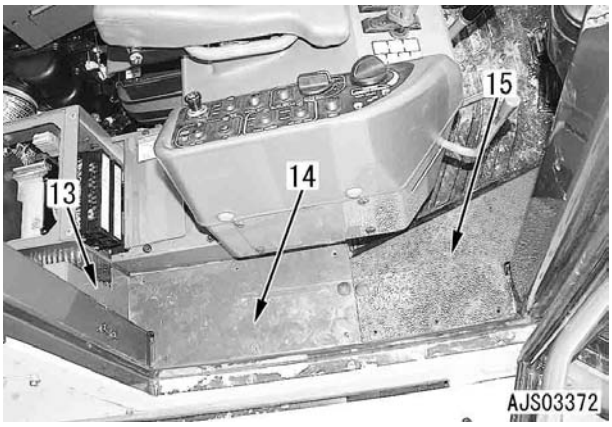
4. Disconnect hose (5) from the side of the air conditioner unit.
5. Remove box (6).
6. Remove mat (7).



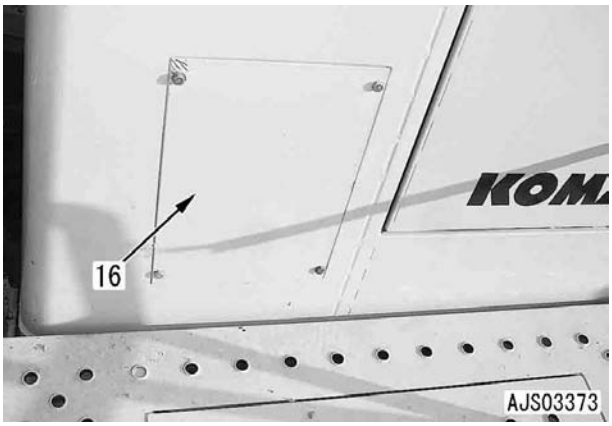
7. Remove cover (8) and internal air filter.
8. Remove plate (9).
9. Remove 3 mounting bolts (11) and remove duct (10).
10. Remove 4 mounting bolts, then remove duct (12).



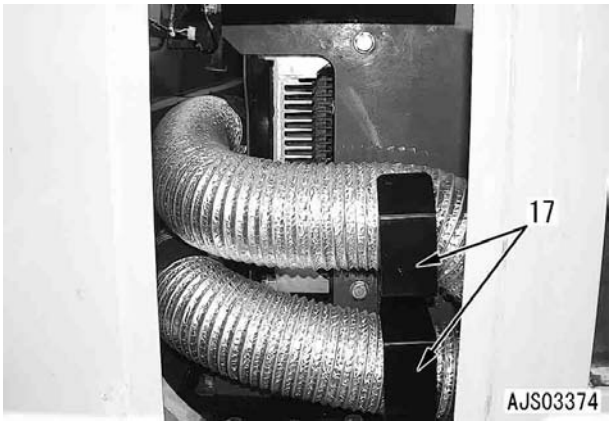
11. Remove covers (13) to (15).



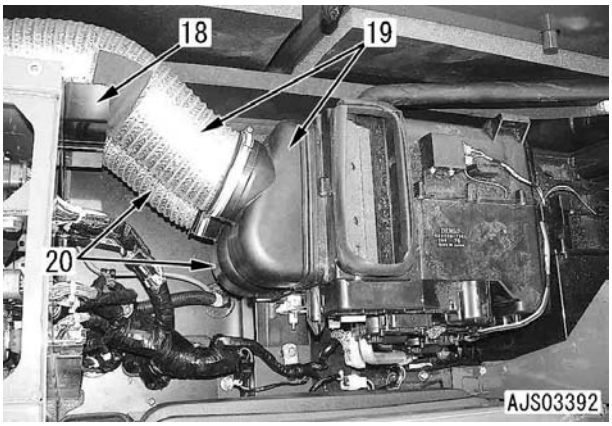
12. Remove cover (16).



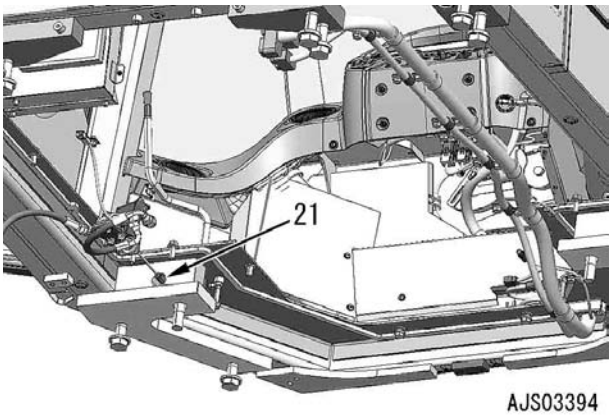
13. Remove bracket (17).



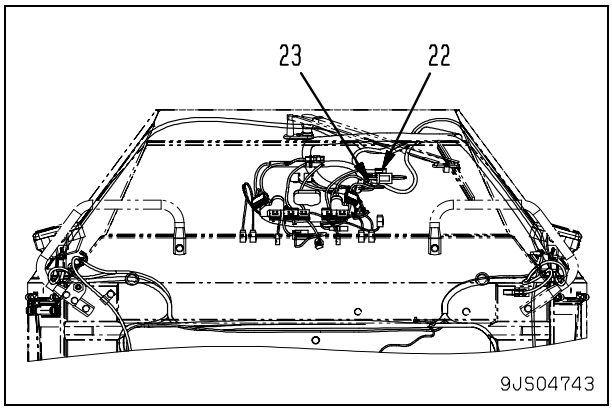
14. Remove bracket (18).
15. Remove hose and duct assemblies (19) and (20).



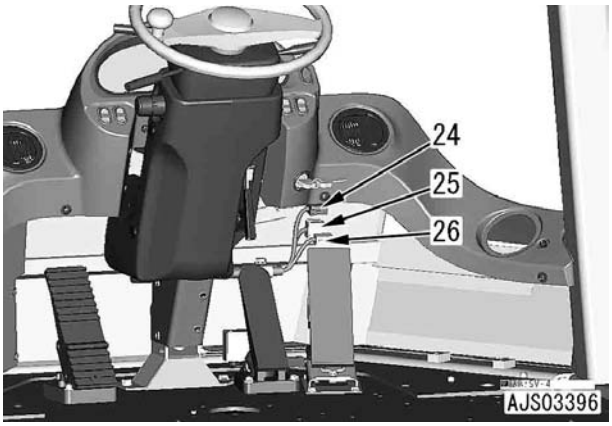
16. Disconnect link (21).
    ★ AJSS specification only (excluding round handle)



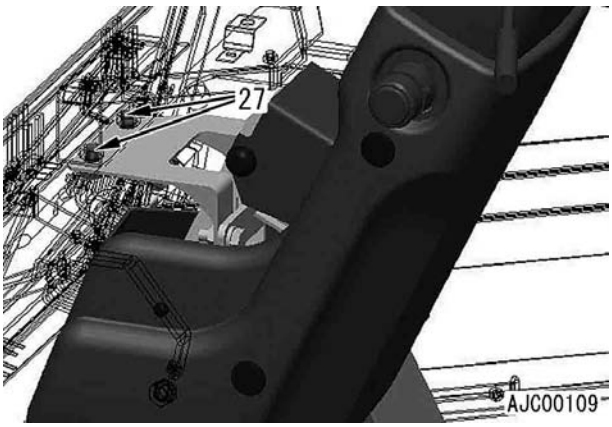
17. Connector CN17 (22): Disconnect accelerator microswitch.
18. Connector CN18 (23): Disconnect brake pedal cancel switch.
    ★ For round handle specification only



19. Disconnect connectors CN CL16 (24), CN CL17 (25) and CN CL18 (26).



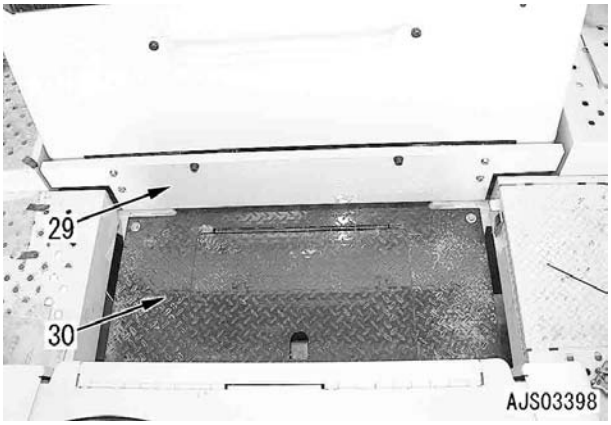
20. Remove bracket mounting bolts (27) between the column and cab.
    ★ For round handle specification only



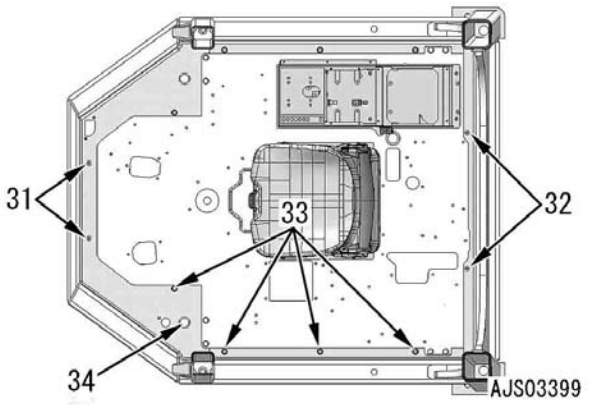
21. Remove left and right covers (28).



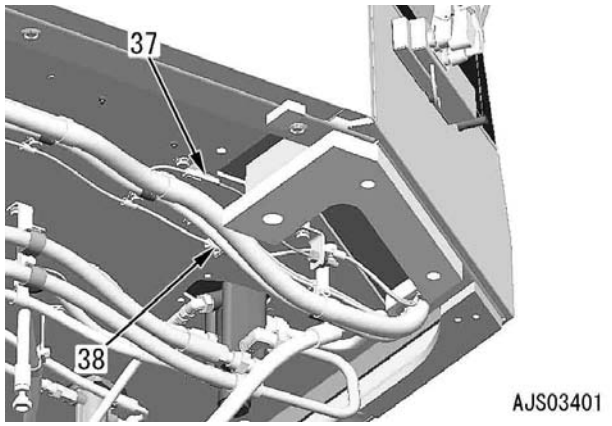
22. Remove covers (29) and (30).



23. Remove mounting bolts (31) and (32) from lower, then remove left and right mounting bolts (33) from top to assemble the operator's cab and floor frame.
24. Remove left and right mounting bolts (34) from top, to disassemble the operator's cab and floor frame. [*1]

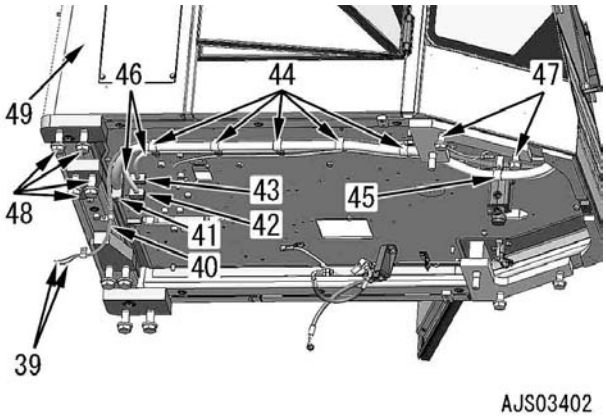


25. Disconnect connector CN C58 (37) from the front right side of the operator's cab.
    ★ For VHMS specification only
26. Disconnect connector CN V34 (38).
    ★ For ORBCOM specification only



27. Disconnect window washer hose (39).
28. Remove the clamp and disconnect window washer hose (40).
29. Disconnect connectors CN CL11 (41), CN CL12 (42) and CN CL13 (43).
30. Remove the clamps (44) and (45) to disconnect wiring harness (46) and window washer hose (40).
31. Remove left and right mounting bolts (47) and (48) from lower. [*2]
32. Lift and remove operator's cab assembly (49). [*3]

Operator's cab assembly: **1,100 kg**



When self-driving without the cab during transportation

Arrange for the following parts:

- Wiring harness:
  426-06-31540
- Descriptive plate in English:
  426-98-33410

Installation

- Carry out installation in the reverse order to removal

[*1]

Operator's cab mounting bolt (34) (2 bolts, upper): **883 – 981 Nm {90 – 100 kgm}**

[*2]

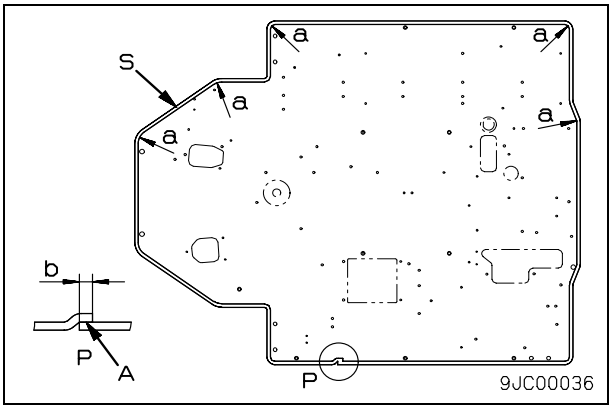
Operator's cab mounting bolt (47) (4 bolts, front): **883 – 981 Nm {90 – 100 kgm}**

Operator's cab mounting bolt (48) (8 bolts, rear): **1,157 – 1,442 Nm {118 – 147 kgm}**

[*3]

Replace seal (S) between the operator's cab and floor frame.

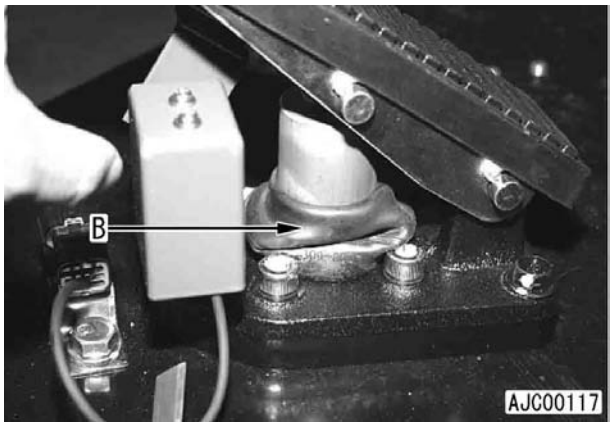
1. Remove greases and dusts from the pasting face.
2. Attach seal (S) aligning the upper circumference of the floor frame.
   - (a): **R10 – 20 mm**
   - ★ Have the seal ends (P) closely adhered mutually without any gap. (Portion A)
   - (b): **20 mm**



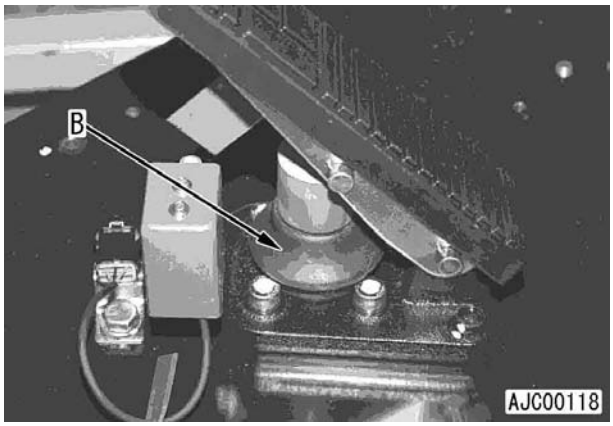
⚠ **After installing the floor mat, check if the brake valve boot (B) is crushed.**

★ Also check if the accelerator pedal boot is crushed.

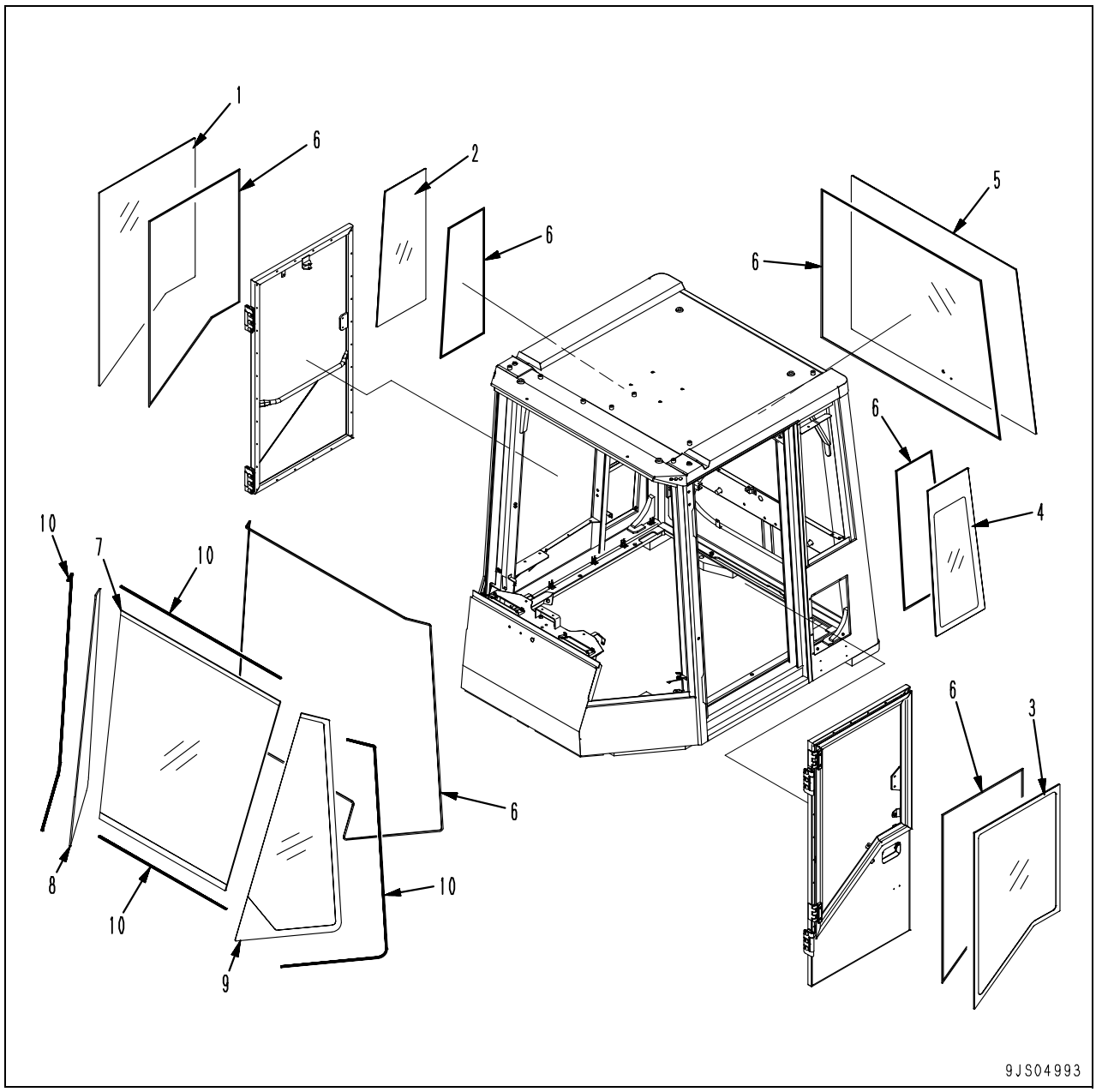
- **Example of bad boot condition** where the boot (B) is crushed



- **Example of good boot condition** where the boot (B) is not crushed



Removal and installation of operator's cab glass (stuck glass)



★ Operator's cab window glass is wholly of stuck glass type.
★ In this section, the procedure for replacing the stuck glasses is explained.

(1): Right door window glass
(2): Rear window glass of right door
(3): Left door window glass
(4): Rear window glass of left door
(5): Rear window glass
(6): Seal (both-sided adhesive tape)
(7): Front window glass
(8): Right front side window glass
(9): Left front side window glass
(10): Weather strip

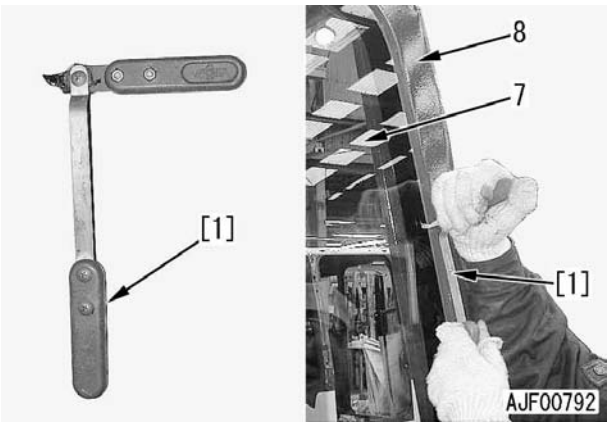
Special tools

Symbol		Part number	Part name	Essentiality	Quantity	New • Remodel	Illustration
X	2	793-498-1210	Lifter (Suction cup)	■	2		
	3	20Y-54-13180	Stopper rubber	■	2		

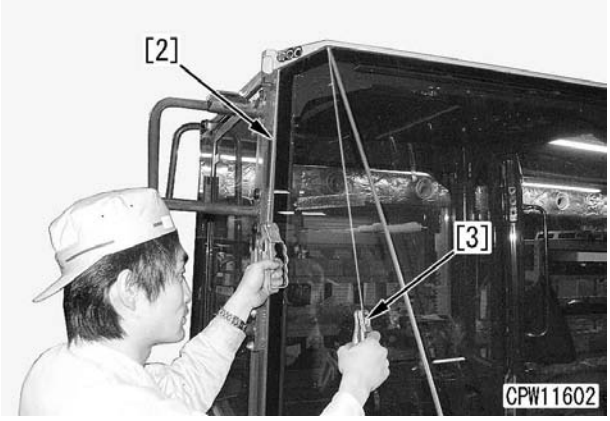
Removal

★ Remove the window glass to be replaced according to the following procedure.

1. Using seal cutter [1], cut the adhesive between broken window glass (7) and operator's cab (metal sheet) (8).



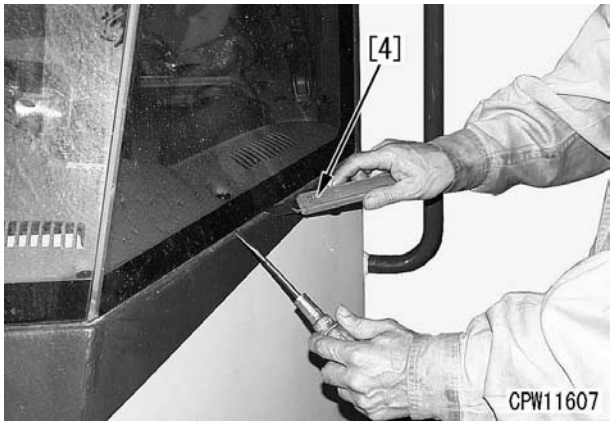
★ If a seal cutter is not available, make holes on the adhesive and dam rubber with a drill and pass a fine wire (piano wire, etc.) [2] through the holes. Then, grip the both ends of the wire with priors [3], etc. (or hold them by winding them onto something) and move the wire to the right and left to cut the adhesive and dam rubber.
Since the wire may be broken by the frictional heat, apply lubricant to the wire.
(The figure shows the operator's cab of a wheel loader.)



★ If the window glass is broken finely, it may be removed with a knife [4] and a screwdriver.

★ Widening the cut with a flat blade screwdriver, cut the dam rubber and adhesive with knife [4].

(The figure shows the operator's cab of a wheel loader.)



2. Remove the window glass.

Installation

Processing sequence

Preparation (cleaning)

↓

Primer coating
- Cab side: **SUNSTAR 435-95**
- Glass side: **SUNSTAR 435-40**

↓ After applying the primer, leave it for at least 5 minutes to dry (proceed to the next step within 24 hours).

Apply both-sided adhesive rubber (on the cab side).

↓

★ Only for the front glass and the front side glass
Install weather strip to the window glass.
Inject the following to between the weather strip and glass:
Silicone sealant (ThreeBond 5211E)

↓

Positioning of window glass

↓

Apply adhesive (**SUNSTAR Industry sealant Peta-Seal 551)** (on the cab side)

↓ Within 5 minutes

Adhere window glass
* Hold the glass pressed for 10 hours minimum.

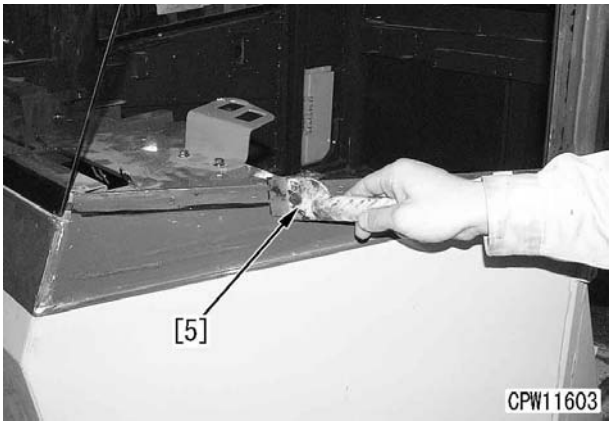
↓ 8 hours minimum (★ Only for the front glass and the front side glass)

Seal between the front glass and front side glass.
Adhesive (**SUNSTAR PENGUINE SEAL No. 2505**)
* Don't move the glass for 24 hours minimum.

Preparation

1. Using a knife and scraper [5], remove the remaining adhesive and dam rubber from the metal sheets (glass sticking surfaces) of the operator's cab.
   ★ Remove the adhesive and dam rubber to a degree that they will not affect adhesion of the new adhesive. Take care not to scratch the painted surfaces.
   (If the painted surfaces are scratched, adhesion will be lowered.)

   (The figure shows the operator's cab of a wheel loader.)



2. Remove oil, dust, and dirt, etc. form the sticking surfaces of cab (8) and window glass (9) with white gasoline.
   ★ If the sticking surfaces are not cleaned well, the glass may not be stuck perfectly.
   ★ Clean the all black part on the back side of the window glass.
   ★ After cleaning the sticking surfaces, leave them for at lease 5 minutes to dry.
   (The figure shows the operator's cab of a wheel loader.)

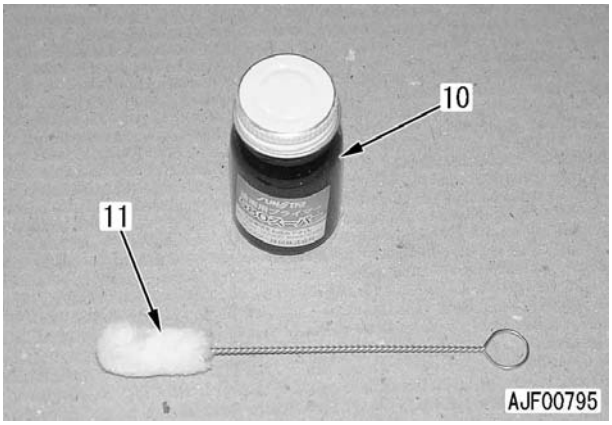


Primer coating

3. Apply primer (10).
   - ★ The using limit of primer is 4 months after the date of manufacture. Do not use the primer after this limit.
   - ★ Use the primer within 2 hours after unpacking it.
   - ★ Even if the primer is packed again just after it is unpacked, use it within 24 hours after it is unpacked for the first time. (Discard the primer 24 hours after it is unpacked.)

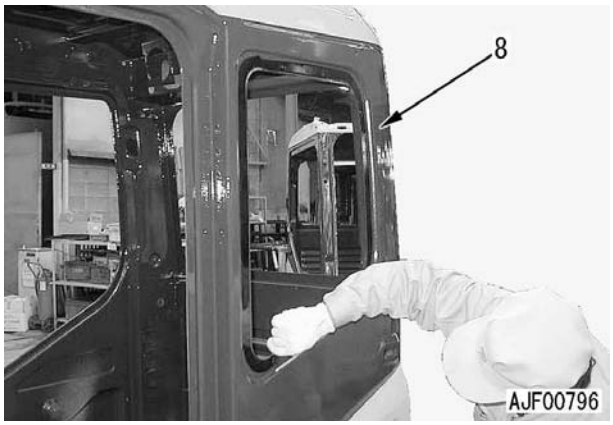
   1) Stir the primers for both of paint and glass sufficiently before using them.
      - ★ If the primer has been stored in a refrigerator, leave it at the room temperature for at least half a day before stirring it. (If the primer is unpacked just after taken out of the refrigerator, water will be condensed. Accordingly, leave the primer at the room temperature for a sufficient time.)

   2) When reusing primer brush (11), wash it in white gasoline.
      - ★ After washing the brush, check it again for dirt and foreign matter.
      - ★ Prepare respective brushes for the paint primer and glass primer.

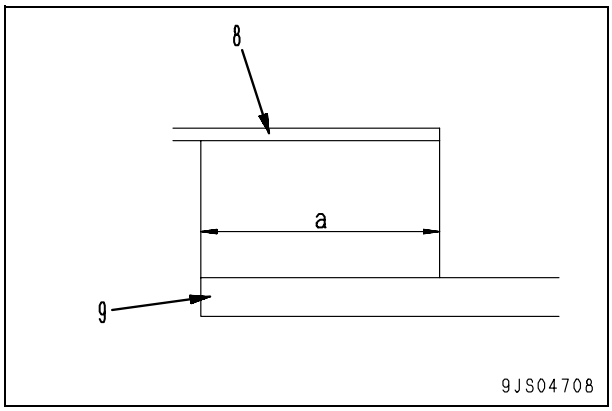


   3) Apply primer for coating evenly around whole of the circumference for coating on operator's cab (8).
      (a)**: Min. 25 mm**
      Paint primer for the cab: **SUNSTAR 435-95**
      - ★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)
      - ★ Never apply the wrong primer. If the glass primer, etc. is applied by mistake, wipe it off with white gasoline.
      - ★ After applying the primer, leave it for at least 5 minutes to dry. Proceed to applying both-sided adhesive tape within 24 hours.

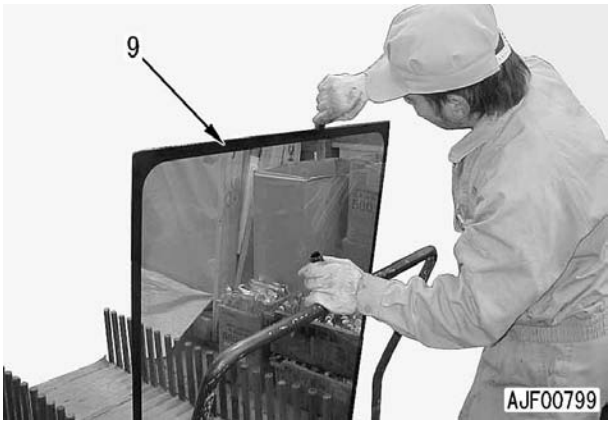
      (The figure shows the operator's cab on a power shovel.)



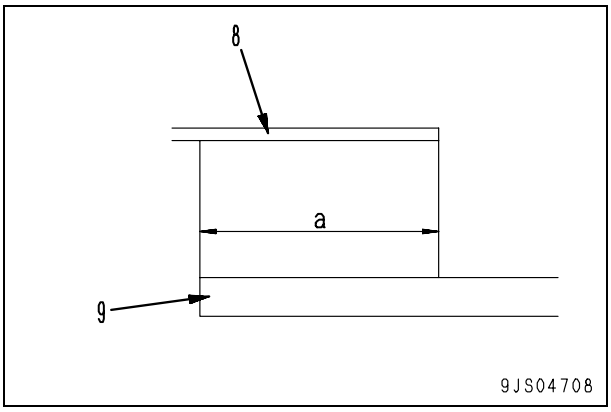
   - ★ (9): Glass



4) Apply primer for coating glass around whole of the inner circumference for black coating of window glass (9).
(a)**: Min. 25 mm**
Glass primer: **SUNSTAR 435-40**
★ Black coating on glass is for protection against optical degradation.
★ Do not apply the primer more than 2 times.
(If it is applied more than 2 times, its performance will be lowered.)



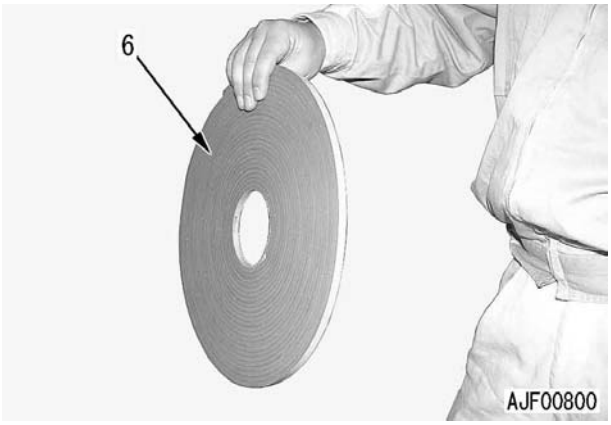
★ (8): Cab



★ Never apply the wrong primer.
If the paint primer, etc. is applied by mistake, wipe it off with white gasoline.

Adhere both-sided adhesive tape

4. Stick both-sided adhesive tape (6) along the inside edge of cab (8).
★ Do not remove the release tape of dam rubber on the glass sticking side before sticking the glass.
★ When sticking the dam rubber, do not touch the cleaned surface to the utmost.
★ Take particular care for preventing the adhesive tape from floating at the corner.

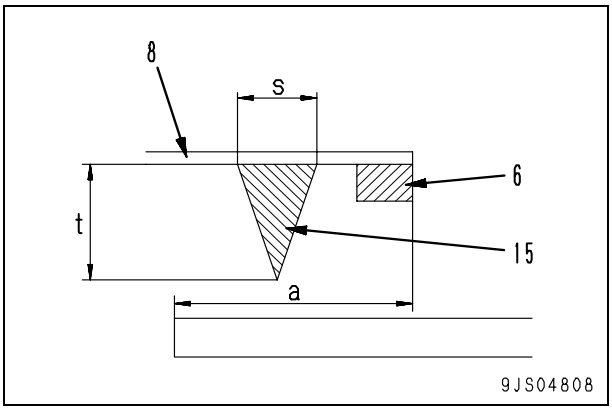


★ When sticking both-sided adhesive tape (6) around the edge completely, don't allow the both ends of the tape to be overlapped when jointed. Or provided a clearance of about 5 mm at the joint (e).

1) Stick dam rubber (6) for right side window glass (1) to the position as shown in the figure.
★ (The figure shows the operator's cab on a power shovel.))



★ (8): Cab
★ (a): Range for applying primer (noted in the foregoing)
★ (15): Adhesive (to be described later)



Positioning of window glass

5. Position the new window glass.
   1) Check the clearance between the window glass and the operator's cab on the right, left, upper, and lower sides, and then position the window glass to be the clearances evenly.
   2) Stick tapes [6] between window glass (9) and operator's cab (8) and draw positioning line (n).
      ★ Apply tape [6] to three locations including the left and right sides and the bottom of glass for precise positioning.
   3) Cut the tape between window glass (9) and operator's cab (8) with a knife, etc. and then remove the window glass.
      ★ Do not remove the release tape of the both-sided adhesive tape before the glass is installed.

   (The figure shows the operator's cab on a power shovel.)

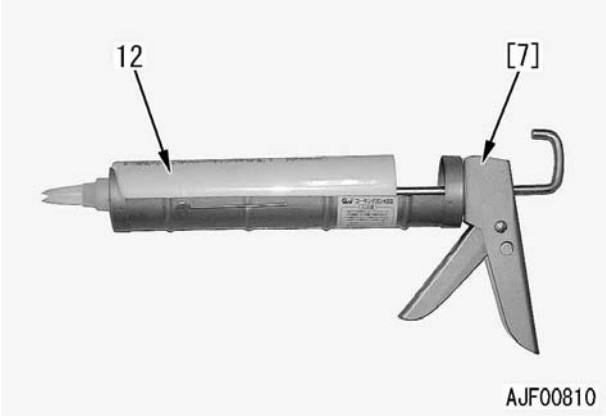


Adhesive coating

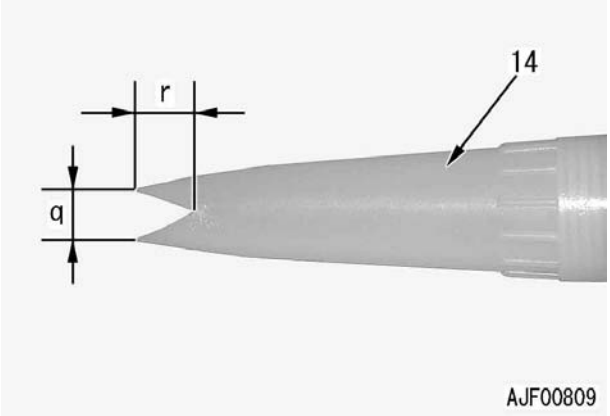
6. Preparation for applying adhesive
   - Adhesive: **SUNSTAR Industry sealant Peta-Seal 551**

   ★ The using limit of the adhesive is 4 months after the date of manufacture. Do not use the adhesive after this limit.
   ★ Keep the adhesive in a dark place where the temperature is below 25°C.
   ★ Never heat the adhesive higher than 30°C.
   ★ When reusing the adhesive, remove the all hardened part form the nozzle tip.

   1) Set adhesive cartridge (12) to caulking gun [7].
      ★ An electric caulking gun is more efficient.



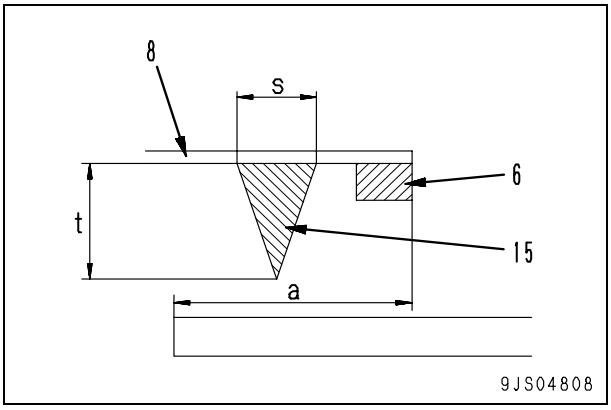
   2) Cut the tip of the adhesive nozzle (14) so that dimensions (q) and (r) will be as follows.
      - Dimension (q): **10 mm**
      - Dimension (r): **15 mm**



   3) Remove the release tape of dam rubber on the glass adhesive side.

7. Apply adhesive.
   - ★ Apply adhesive (15) to dimensions (s) and (t) in the figure to the both-sided adhesive tape (6) of operator's cab (8).
     - Dimension (s): **10 mm**
     - Dimension (t): **15 mm**

   Adhesive:
   SUNSTAR Industry sealant Peta-Seal 551
   - ★ Apply adhesive (15) higher than dam rubber (6).
   - ★ Apply the adhesive evenly with same height level.
   - ★ (a): Range for applying primer (noted in the foregoing)
   - ★ Install window glass within 5 minutes after applying the adhesive.



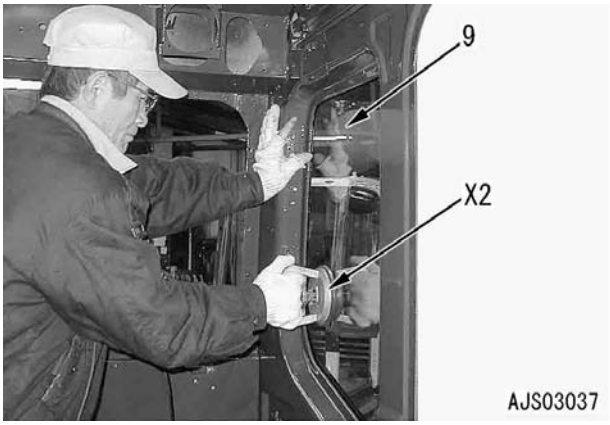
Installation of window glass

8. Install the window glass.
   1) Install window class (9), matching it to the lines of the positioning tapes drawn in step 5.
      - ★ Since the window glass cannot be removed and stuck again, stick it with utmost caution.
   2) After sticking window glass (9), press all around of it until it sticks to the dam rubber closely.
      - ★ Press the corners of the window glass firmly.

      (The figure shows the operator's cab on a power shovel.)

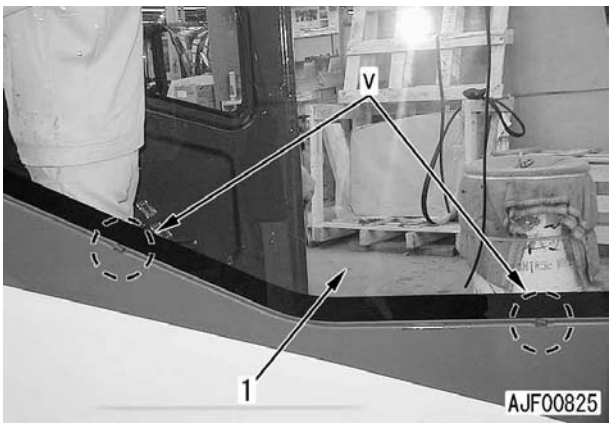


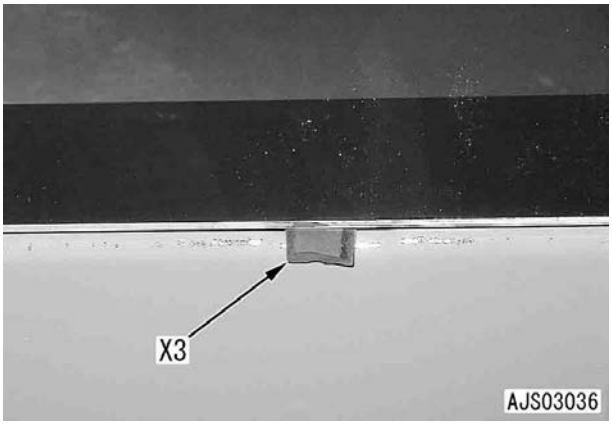
- ★ You can perform this work efficiently by pulling window glass (9) from inside of the operator's cab with suction cup **X2**.



- ★ Wipe off the projected adhesive.

9. Fix the window glass.
   1) After installing right window glass (1) to the operator's cab, insert stopper rubbers **X3** to 2 places (v) at the bottom of the glass to fix the glass.
   (The figure shows the operator's cab on a power shovel.)



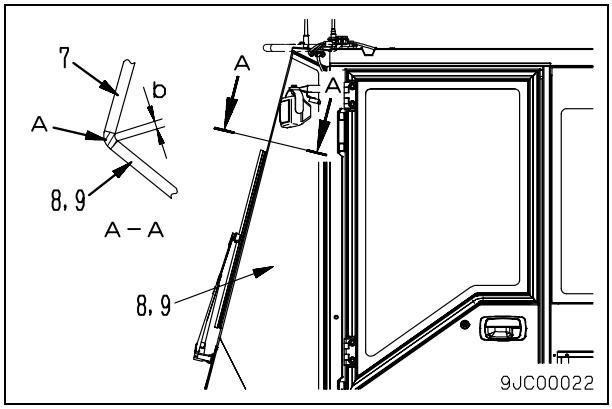


   2) To adhere the window glass and the both-sided adhesive tape completely, use styrofoam [9] and rubber band [10] to fix them tightly for 10 hours minimum to cure.
   (The figure shows the operator's cab on a power shovel.)



10. After installing the window glass, remove any excess of the primer and adhesive from the operator's cab and window glass.
   ★ By using the white gasoline, wipe off the adhesive before it is dried up.
   ★ When cleaning the glass, do not give an impact on it.

   ★ Only for the front glass and the front side glass
11. Seal section (A) between front glass (7) and front side glass (8) and (9).
   Section (A): Adhesive (**SUNSTAR PENGUINE SEAL No. 2505**)
   ● (b): **5mm**
   ★ Don't move the glass for 24 hours minimum.



Removal and installation of floor frame assembly

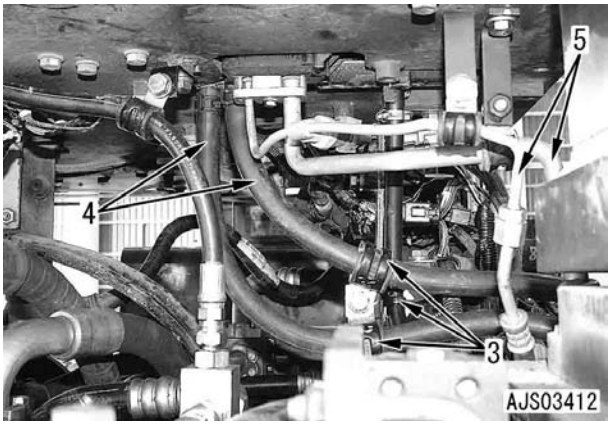
Special tools

Symbol	Part number	Part name	Essentiality	Quantity	New • Remodel	Illustration
X1	799-703-1200	Service tool kit	■	1		
	799-703-1100	Vacuum pump (100V)	■	1		
	799-703-1111	Vacuum pump (220V)	■	1		
	799-703-1121	Vacuum pump (240V)	■	1		
	799-703-1401	Gas leak detector	■	1		

Removal

⚠ Lower the work equipment to the ground completely. Release the remaining pressure in the piping, referring to "Releasing remaining pressure in work equipment cylinder" in Testing and adjusting.
⚠ Disconnect the negative terminal (–) of the battery before starting with the work.
⚠ Collect the air conditioner gas (R134a).
⚠ If the air conditioner gas (R134a) gets inside one's eyes, it may cause blindness. Therefore, make sure to wear protective glasses when collecting or filling the gas. Collecting and filling work must be conducted by a qualified person.

1. Disconnect clamp (3).
2. Disconnect heater hose (4).
   ★ Confirming their destination.
3. Disconnect air conditioner hose (5). [*1]

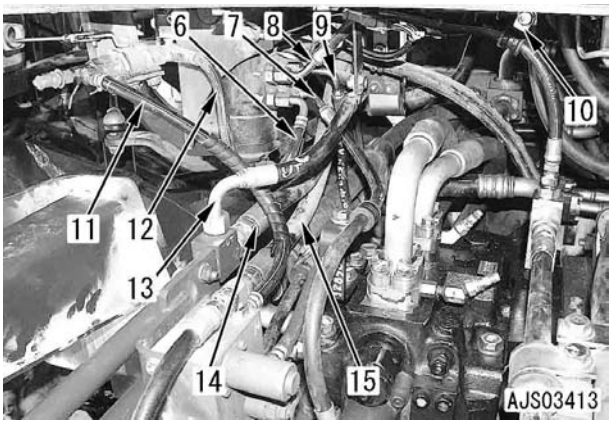


- **AJSS specifications (excluding round handle)**

4. Disconnect hoses (6) to (9) from the AJSS valve (lower left side of floor frame).
5. Disconnect clamp (10).
6. Disconnect hoses (11) (band color: green) and (12) (no band).

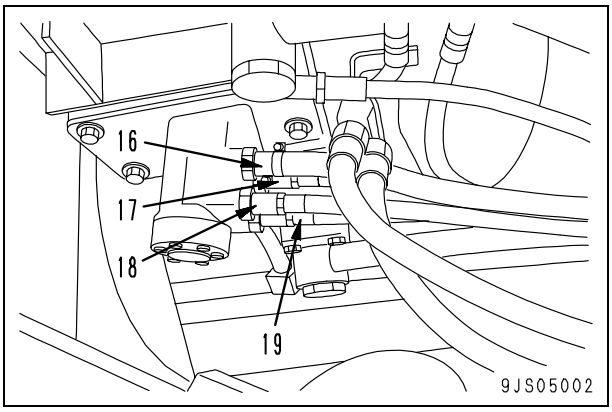
- **Common specifications**

7. Disconnect hoses (13) to (15).

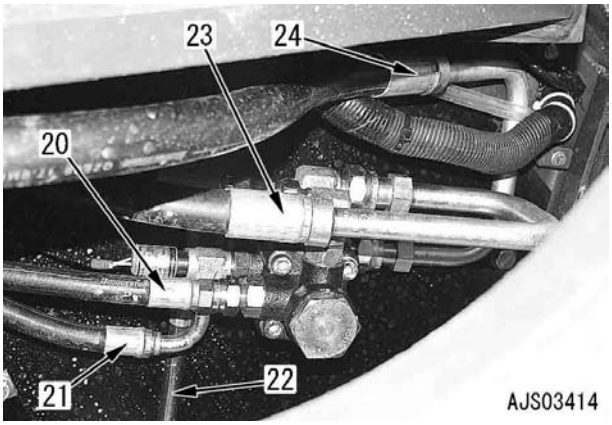


- **Round handle specification**

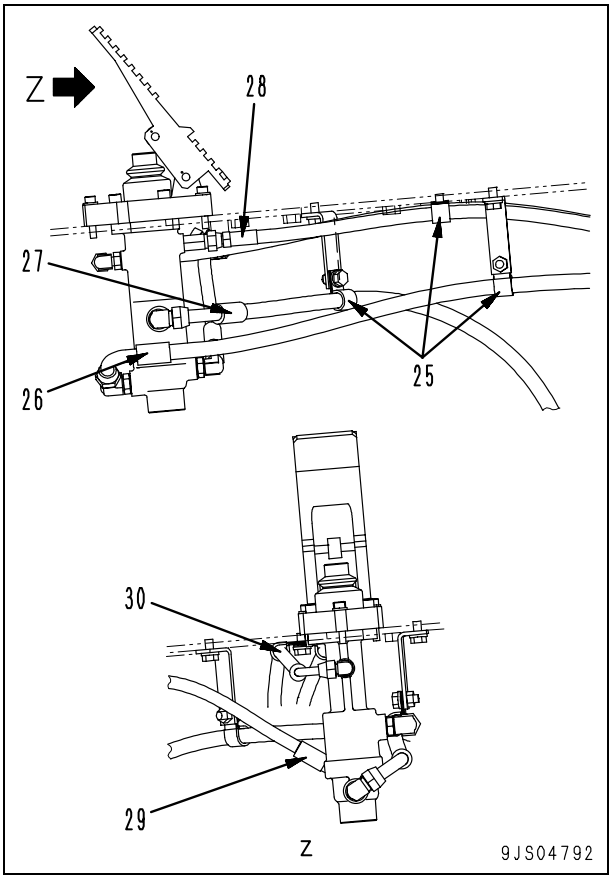
8. Disconnect hoses (16) to (19).



9. Disconnect hoses (20) to (23) from the right brake valve.
10. Disconnect drain hose (24).
    ★ Disconnect the clamp.

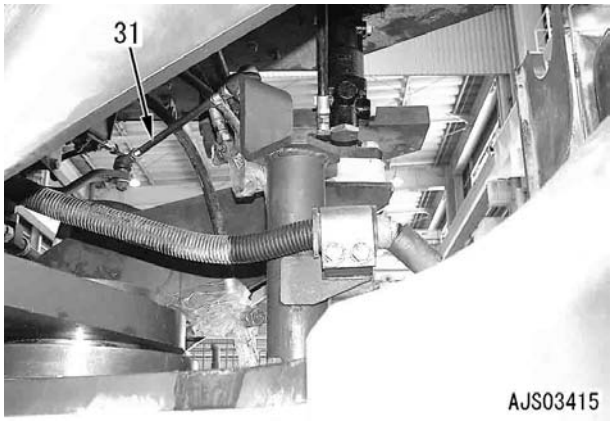


11. Disconnect clamp (25).
12. Disconnect hoses (26) to (30) from the left brake valve.

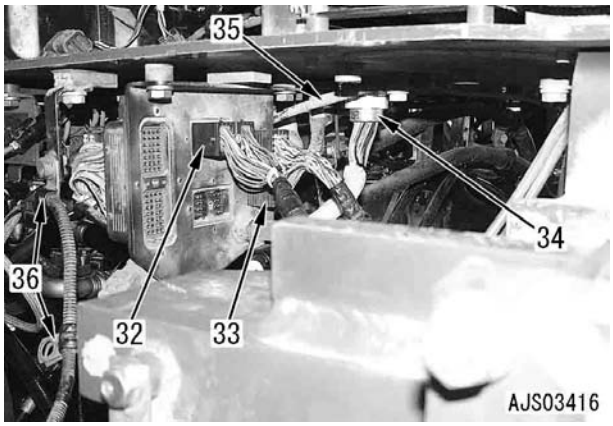


- **AJSS specifications (excluding round handle)**

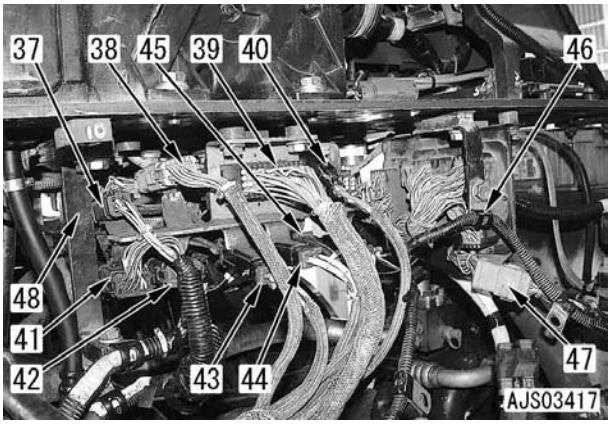
13. Disconnect rod (31).
    ★ Check and record the installed length.



14. Disconnect air conditioner wiring harness connector CL13 (32), front frame wiring harness connector FL11 (33) and transmission wiring harness connector LT1 (34) from the lower right corner of the floor frame.
    ★ Disconnect the clamp.
15. Disconnect grounding wire (35).
16. Disconnect clamp (36).

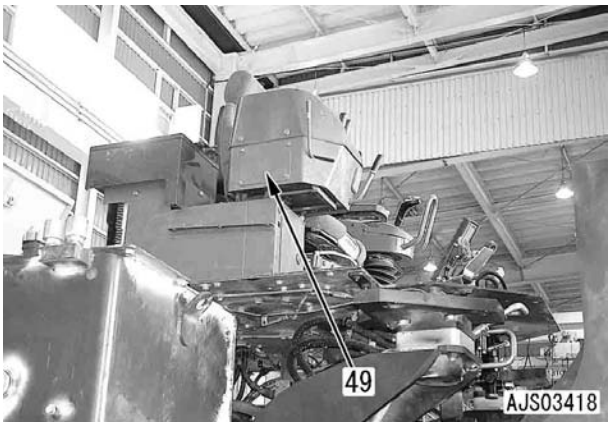


17. Disconnect the following connectors from lower of the rear floor frame:
    - From the upper left section: BV2 (37), LR7 (38), LR11 (39) and LR1 (40)
    - From lower left section: BV1 (41), BL1 (42), LR2 (43), LR3 (44), LR4 (45), FL7 and FL6
18. Disconnect clamp (46).
19. Disconnect connector BL2 (47).
20. Disconnect bracket (48).



21. Remove floor frame assembly (49).
    ★ Lift the floor frame assembly gently while checking for any undisconnected clamp, hose, harness, etc.

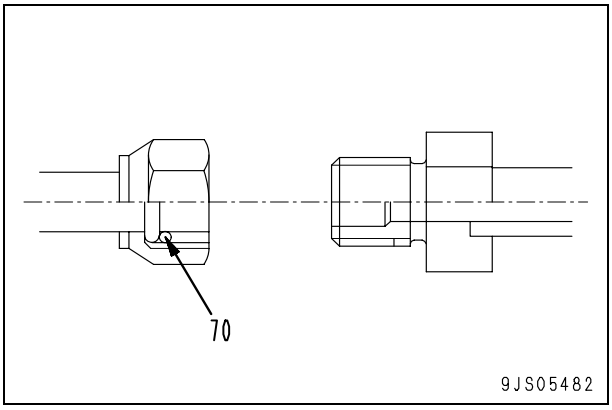
    Floor frame assembly: **320 kg**



Installation

- Carry out installation in the reverse order to removal

[*1]
★ Install hoses without twists.
★ Carefully install the air conditioner hose piping, preventing dirt, dusts, water content, etc. from entering the hoses.
★ Before tightening, make sure O-ring (70) is provided in the air conditioner hose piping connection.
★ Amply apply the compressor oil for **R134a (Denso: ND-OIL8 or Zexel: ZXL100PG (PAG46 or equivalent))** to the O-rings.



Air conditioner gas piping tightening torque

Screw size	Tightening torque
16 × 1.5	11.8 – 14.7 Nm {1.2 – 1.5 kgm}
22 × 1.5	19.6 – 24.5 Nm {2.0 – 2.5 kgm}
24 × 1.5	29.4 – 34.3 Nm {3.0 – 3.5 kgm}

- **Filling of air conditioning gas**
  By using tool **X1**, fill the air conditioner gas **(R134a)** inside the air conditioner circuit.
  ★ Filling quantity: **850 ± 50g**

- **Refilling engine coolant**
  Refill coolant through the coolant filler port up to the specified level. Start the engine and circulate the coolant, and then check the coolant level.

WA600-6 Wheel loader

Form No. SEN01175-00

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

50 Disassembly and assembly

Electrical system

Electrical system 2
Removal and installation of engine controller assembly 2
Removal and installation of transmission controller assembly 4
Removal and installation of loader controller assembly 4
Removal and installation of VHMS controller assembly 5
Removal and installation of monitor assembly 6
Removal and installation of air conditioner unit assembly 9

Electrical system

Removal and installation of engine controller assembly

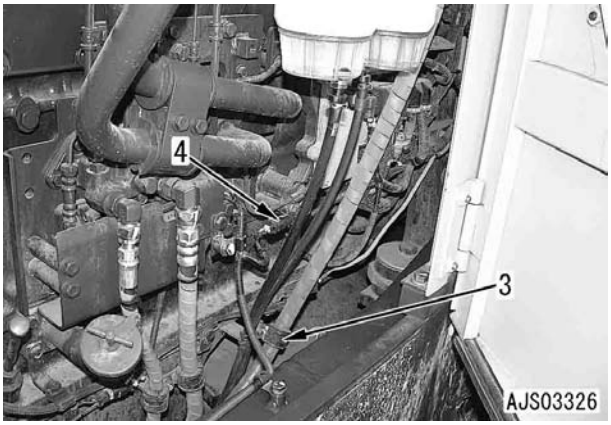
Removal

- ⚠ **Park the machine on level ground. Apply parking brake and put the blocks under the wheels.**
- ⚠ **Set the lock bar to the frame.**
- ⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

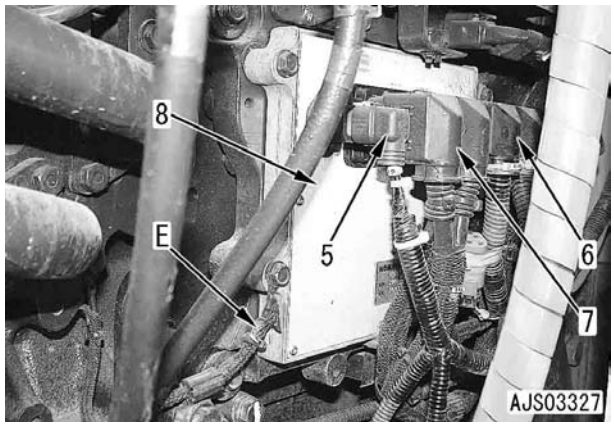
1. Lift fender (1)
2. Open cover (2).



3. Disconnect fuel hose clamp (3).
4. Disconnect connector EP1 (4).



5. Disconnect connector E19 (5), EP18 (6) and ENG (7). [*1]
6. Remove engine controller (8).
   ★ Grounding wire (E) is tightened together.



Installation

- Installation is done in the reverse order of removal.

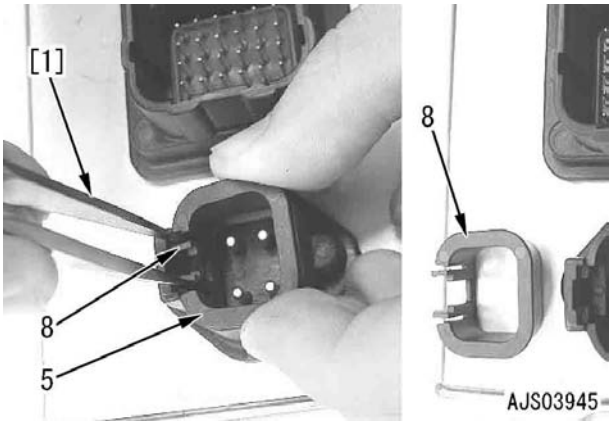
[*1]

- Check for any sands, dusts, water content, etc. inside (particularly lower section) the controller connector. If any, completely remove them with air blow. (Sands, dust and water causes defective contact or inundation.)

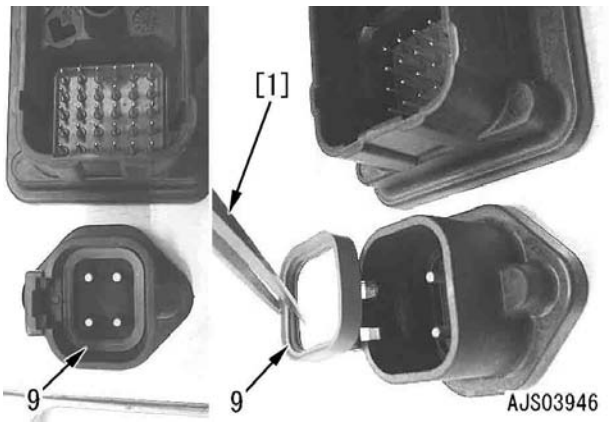
★ **Reference**

- How to replace O-ring seal for power supply connector J3P (5)
  O-ring seal:
  1010-074-0406 (Nihon-Deutsch Ltd.)

1) Use tweezers [1] to catch and hold the stopper to remove the cover (8).



2) Use tweezers [1] to remove O-ring (9).

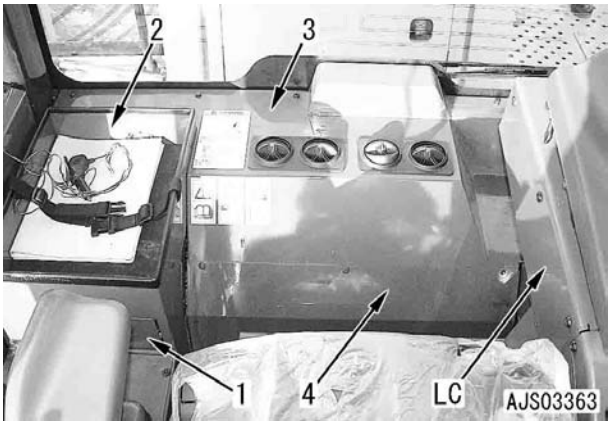


Removal and installation of transmission controller assembly

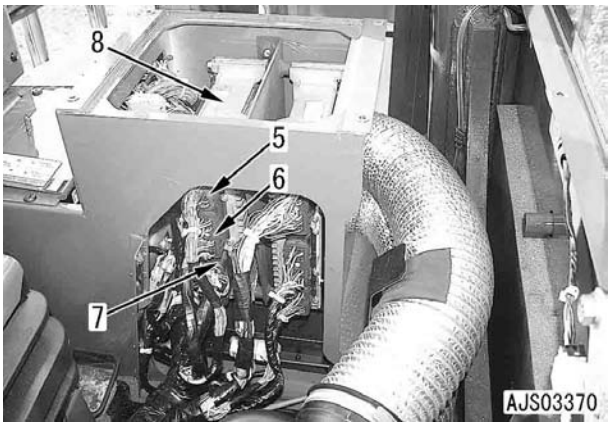
Removal

⚠ **Park the machine on level ground. Apply parking brake and put the blocks under the wheels.**
⚠ **Set the lock bar to the frame.**
⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Open cover (1).
2. Remove box (2).
3. Remove covers (3) and (4).
   ★ Place the left console (LC) in front.



4. Disconnect connectors L02 (5), L03 (6) and L04 (7).
5. Remove transmission controller assembly (8).



Installation

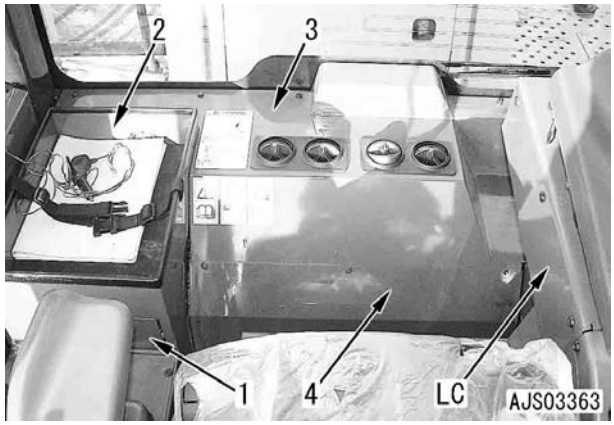
- Carry out installation in the reverse order to removal

Removal and installation of loader controller assembly

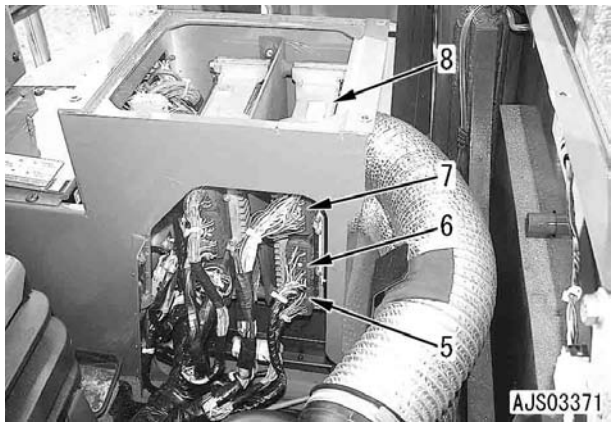
Removal

⚠ **Park the machine on level ground. Apply parking brake and put the blocks under the wheels.**
⚠ **Set the lock bar to the frame.**
⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Open cover (1).
2. Remove box (2).
3. Remove covers (3) and (4).
   ★ Place the left console (LC) in front.



4. Disconnect connectors L05 (5), L06 (6) and L07 (7).
5. Remove loader controller assembly (8).



Installation

- Carry out installation in the reverse order to removal

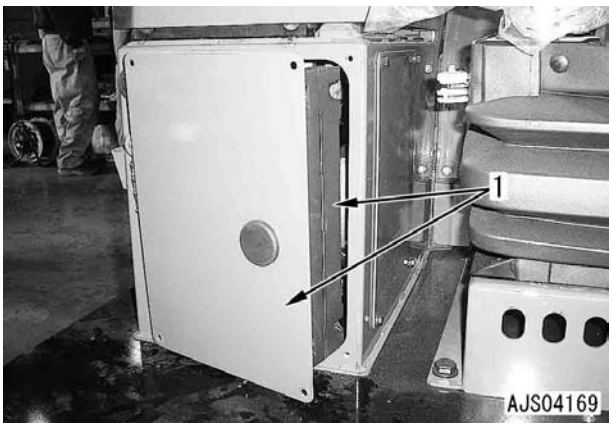
Removal and installation of VHMS controller assembly

Removal

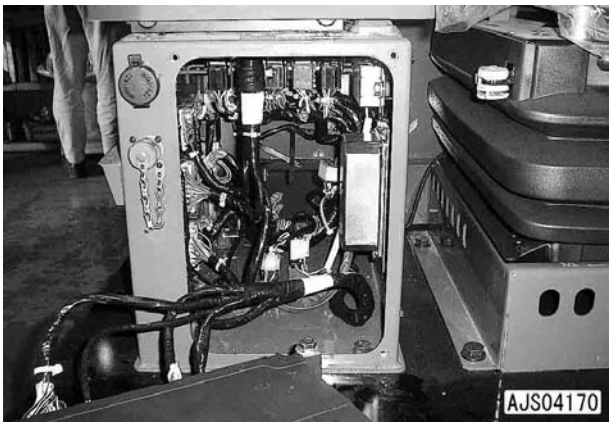
⚠ **Park the machine on level ground. Apply parking brake and put the blocks under the wheels.**
⚠ **Set the lock bar to the frame.**
⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

★ Before removing VHMS controller, download the remaining data of the controller to be removed and check and record the setting information, referring to “Precautions for replacing VHMS controller” in Testing and adjusting.

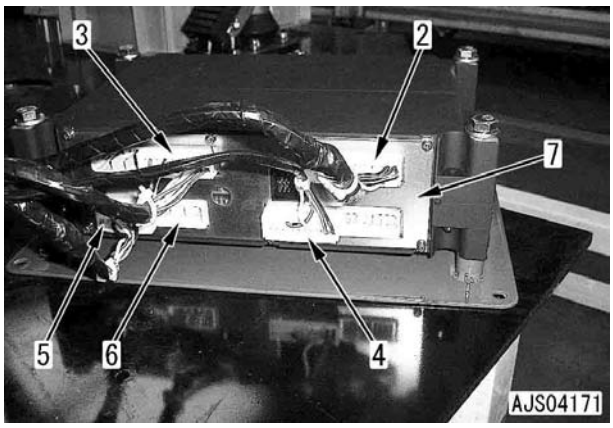
1. Remove cover controller assembly (1) from under the right console.



★ Cover controller assembly has been removed.



2. Disconnect connectors V01 (2), V02 (3), V04 (4) and V06 (5).
★ Color of connector on the side of V02 (3) controller: green
3. Disconnect V07 (6) when ORBCOM controller is installed.
4. Remove VHMS controller assembly (7).



Installation

- Carry out installation in the reverse order to removal

★ After completing the installation of VHMS controller, reset the installed controller referring to “Precautions for replacing VHMS controller” in Testing and adjusting.

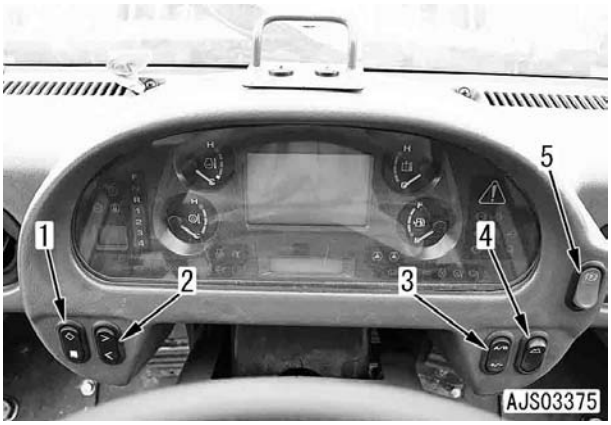
Removal and installation of monitor assembly

Removal

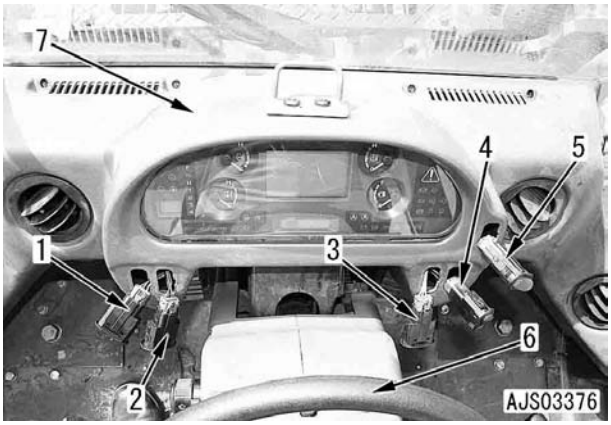
⚠ **Park the machine on level ground. Apply parking brake and put the blocks under the wheels.**
⚠ **Set the lock bar to the frame.**
⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

- **Round handle specification**

1. Pull out switches (1) to (5).

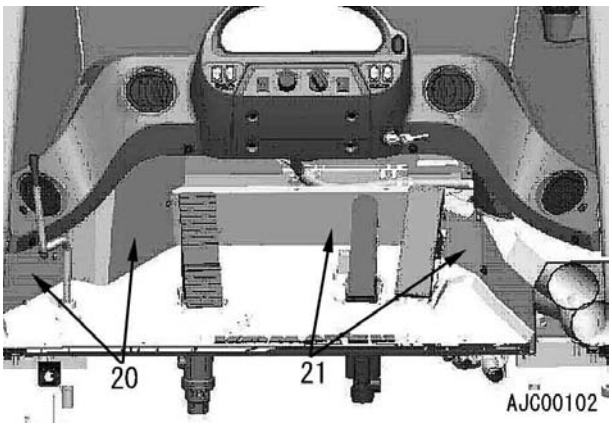


2. Disconnect connectors from switches (1) to (5) respectively.
   ★ Confirming their destination.
3. Tilt handle (6).
4. Remove front console (7). [*1]

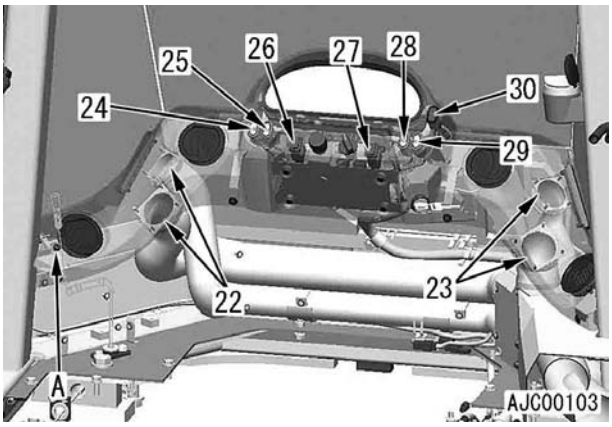


- **AJSS specification**

1. Remove floor mat.
2. Remove covers (20) and (21).

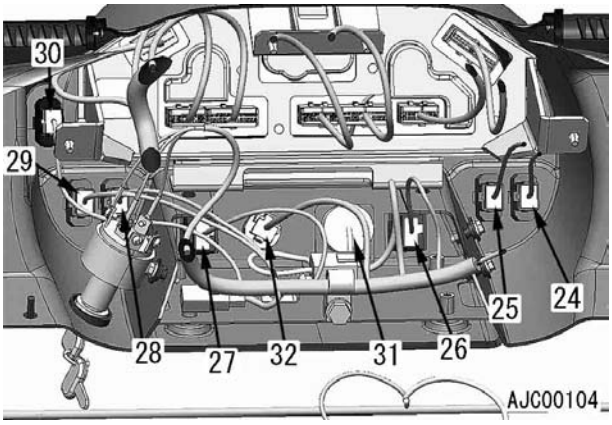


3. Disconnect ducts (22) and (23) of air conditioner hoses.
4. Disconnect connector CN A03 for the air conditioner solar sensor from section (A).
5. Pull out switches (24) to (30). (● Referring to Section 1, Round handle.)



6. Disconnect connectors from switches (24) to (32) respectively.

   ★ Confirming their destination.
   (24): CN C09
   (25): CN C10
   (26): CN C14
   (27): CN C16
   (28): CN C12 (if equipped)
   (29): CN C11 (if equipped)
   (30): CN C08
   (31): CN C13
   (32): CN C15
   ★ See from the back.

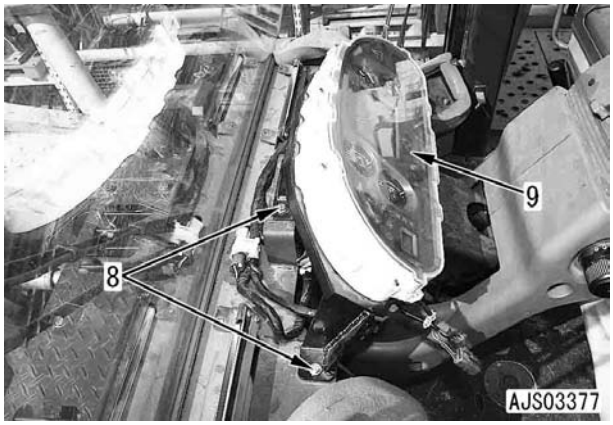


7. Remove cover (33). [*2]
8. Remove front console (34). [*3]

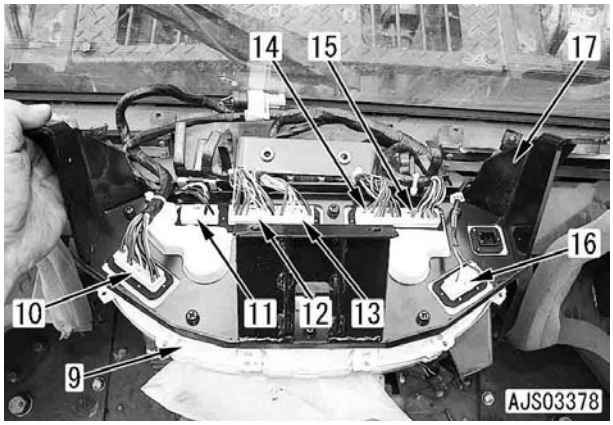


- **Common to Round handle and AJSS specifications.**

9. Remove left and right mounting bolts (8), and invert monitor assembly (9).



10. Disconnect connectors C01 (10), C06 (11), C02 (12), C03 (13), C04 (14) and C05 (16).
11. Remove bracket (17).

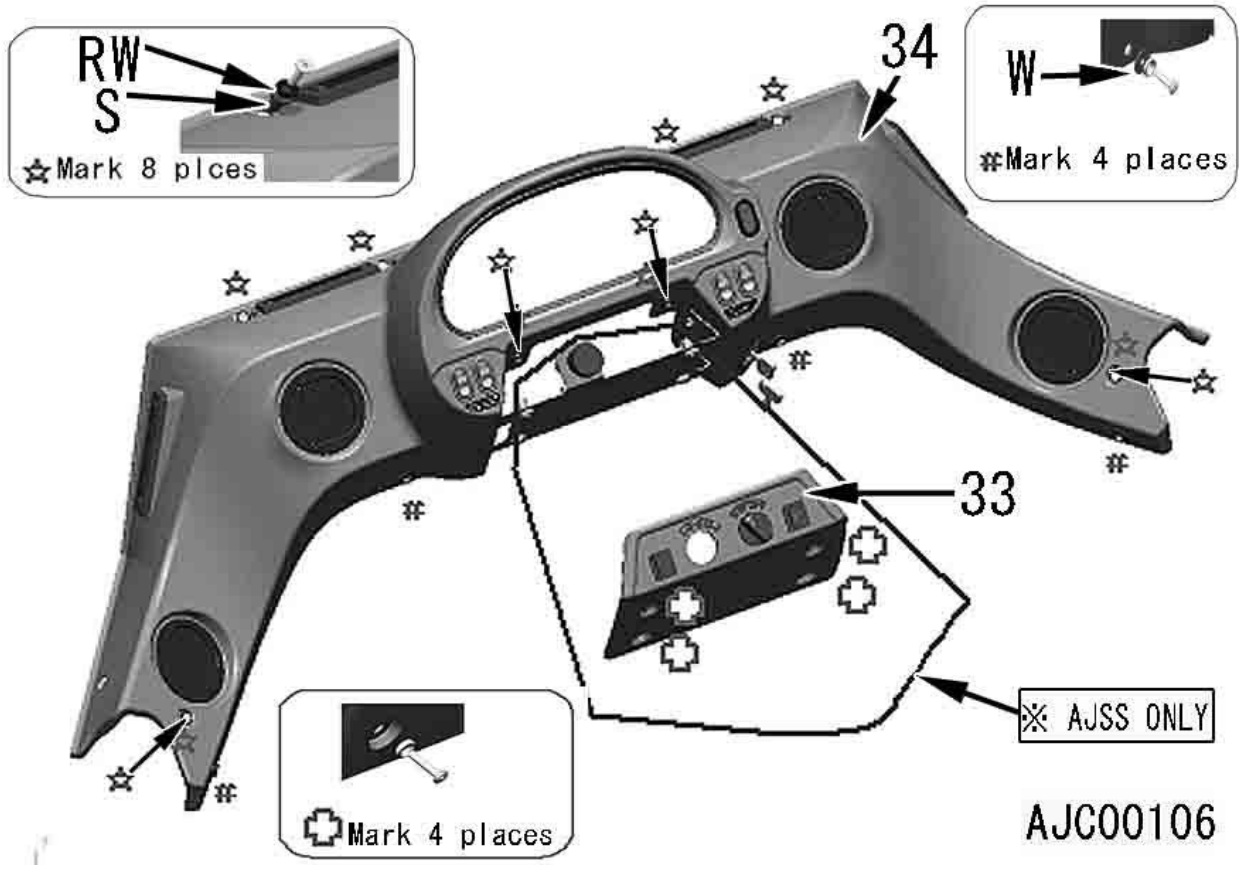


Installation

- Carry out installation in the reverse order to removal

★ If monitor was replaced, reset the radio setting (time, etc.). (Referring to the “Handling of cassette stereo player with AM/FM radio” in the operation and maintenance manual.

[*1], [*2], [*3]
★ Care should be taken for different sections for mounting.
RW: Rubber washer
S: Spacer
W: Washer



Removal and installation of air conditioner unit assembly

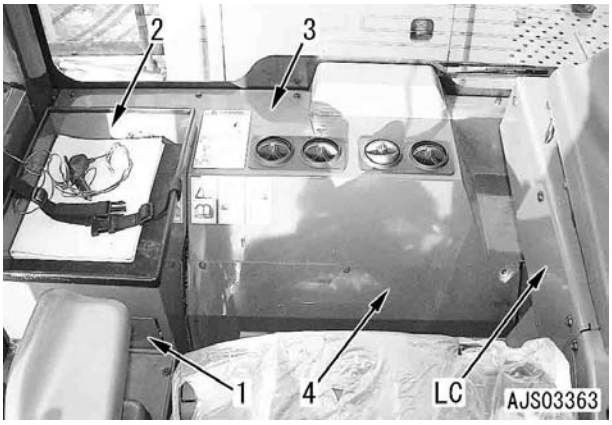
Special tools

Symbol	Part number	Part name	Essentiality	Quantity	New•Remodel	Illustration
X1	799-703-1200	Service tool kit	■	1		
	799-703-1100	Vacuum pump (100V)	■	1		
	799-703-1111	Vacuum pump (220V)	■	1		
	799-703-1121	Vacuum pump (240V)	■	1		
	799-703-1401	Gas leak detector	■	1		

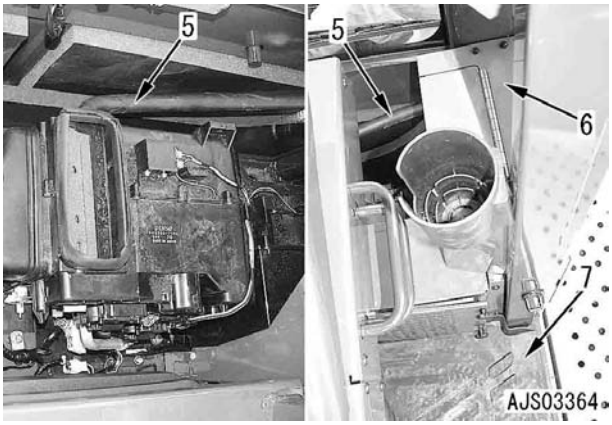
Removal

⚠ Park the machine on level ground. Apply parking brake and put the blocks under the wheels.
⚠ Set the lock bar to the frame.
⚠ Disconnect the negative terminal (–) of the battery before starting with the work.
⚠ Collect the air conditioner gas (R134a).
⚠ If the air conditioner gas (R134a) gets inside one's eyes, it may cause blindness. Therefore, make sure to wear protective glasses when collecting or filling the gas. Collecting and filling work must be conducted by a qualified person.

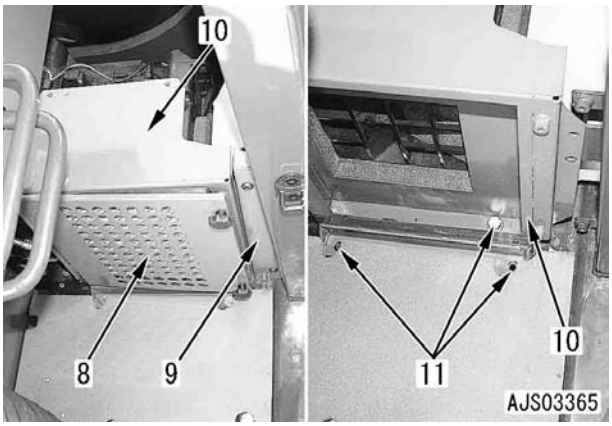
1. Open cover (1).
2. Remove box (2).
3. Remove covers (3) and (4).
   ★ Place the left console (LC) in front.



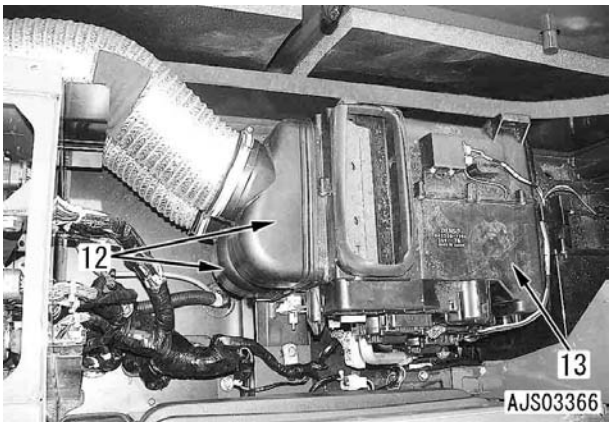
4. Disconnect hose (5) from the side of the air conditioner unit.
5. Remove box (6).
6. Remove mat (7) to the front.



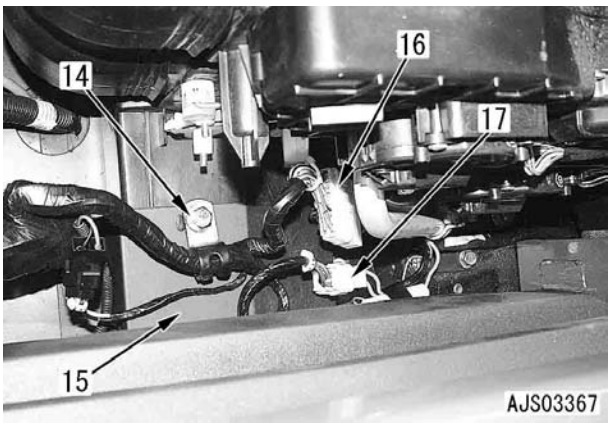
7. Remove cover (8) and internal air filter.
8. Remove plate (9).
9. Remove 3 mounting bolts (11) and remove duct (10).



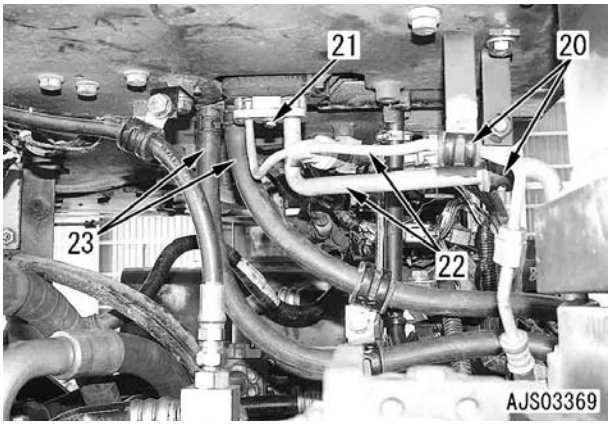
10. Remove duct (12) from the air conditioner unit assembly (13).



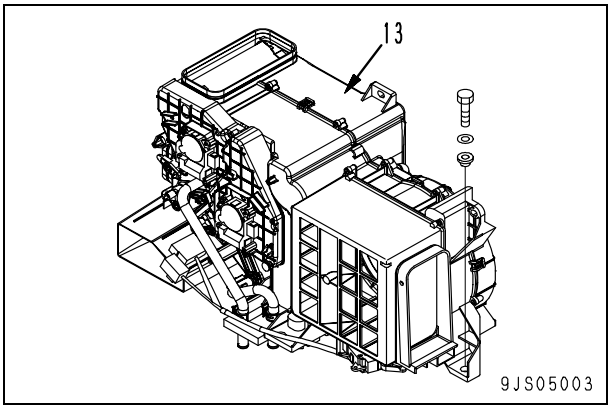
11. Disconnect wiring harness clamp (14).
12. Remove duct (15).
13. Disconnect connectors A10 (16) and A11 (17).



14. Disconnect clamp (18).
15. Disconnect clamp (20).
16. Remove mounting bolt (21), then disconnect air conditioner tube (22). [*1]
17. Disconnect 2 heater hoses (23).
    - ★ Confirming their destination.
    - ★ Arrange for a container.



18. Remove air conditioner unit assembly (13). [*2]



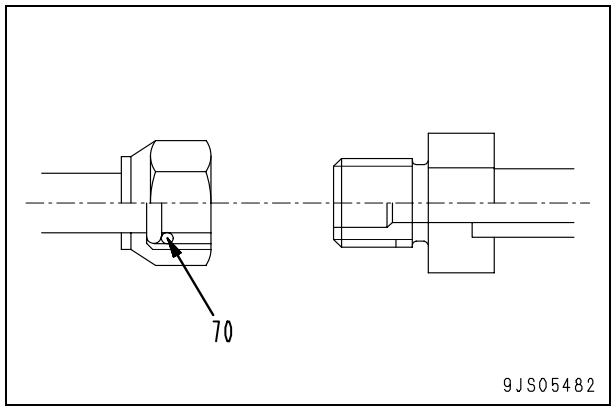
Installation

- Installation is done in the reverse order of removal.

[*1]

- ★ When installing the air conditioner circuit hoses, use care so that dirt, water, may not enter.
- ★ Before tightening, make sure O-ring (70) is provided in the air conditioner hose piping connection.
- ★ Check that there is no defect or deterioration on the O-ring.
- ★ When connecting the refrigerant piping, coat the O-ring with compressor oil **for new refrigerant (R134a) (Denso: ND-OIL8, Zexcel: ZXL100PG (PAG 46 or equivalent))**.

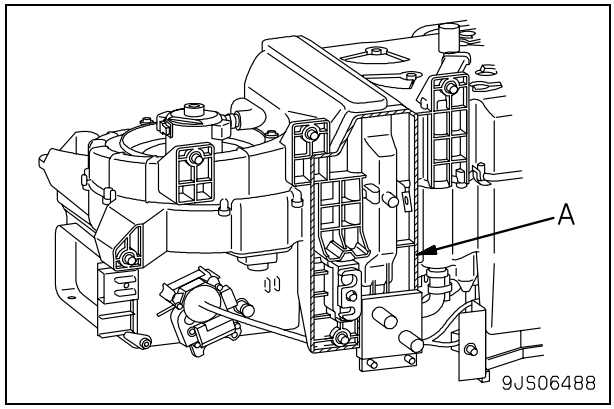
Mounting bolt: **8 – 12 Nm {0.8 – 1.2 kgm}**



[*2]

- ★ Install the air conditioner unit after applying Cemedine 366E or equivalent to the lower hatched area (all around the circumference) of the air conditioner unit.

Lower hatched area (all around the circumference) of the air conditioner unit:
Cemedine 366E or equivalent

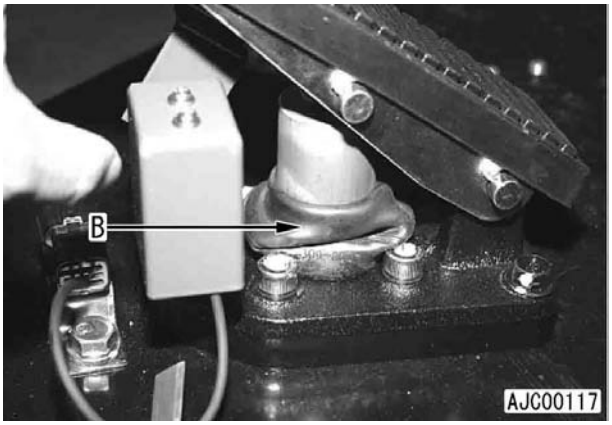


- **Filling of air conditioning gas**
  By using tool **X1**, fill the air conditioner gas **(R134a)** inside the air conditioner circuit.
  - ★ Filling quantity: **850 ± 50 g**

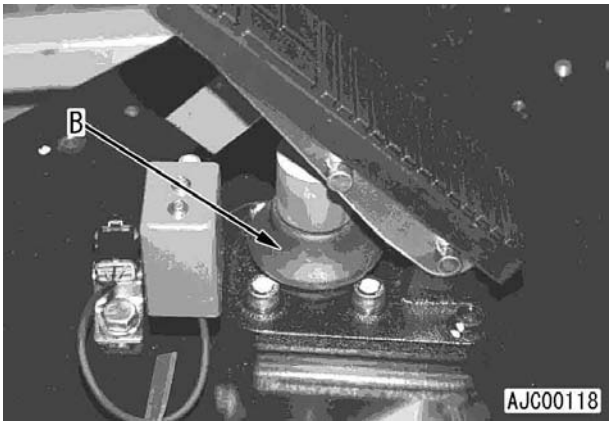
⚠ **After installing the floor mat, check if the brake valve boot (B) is crushed.**

★ Also check if the accelerator pedal boot is crushed.

- **Example of bad boot condition** where the boot (B) is crushed



- **Example of good boot condition** where the boot (B) is not crushed



WA600-6 Wheel loader

Form No. SEN01177-00

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

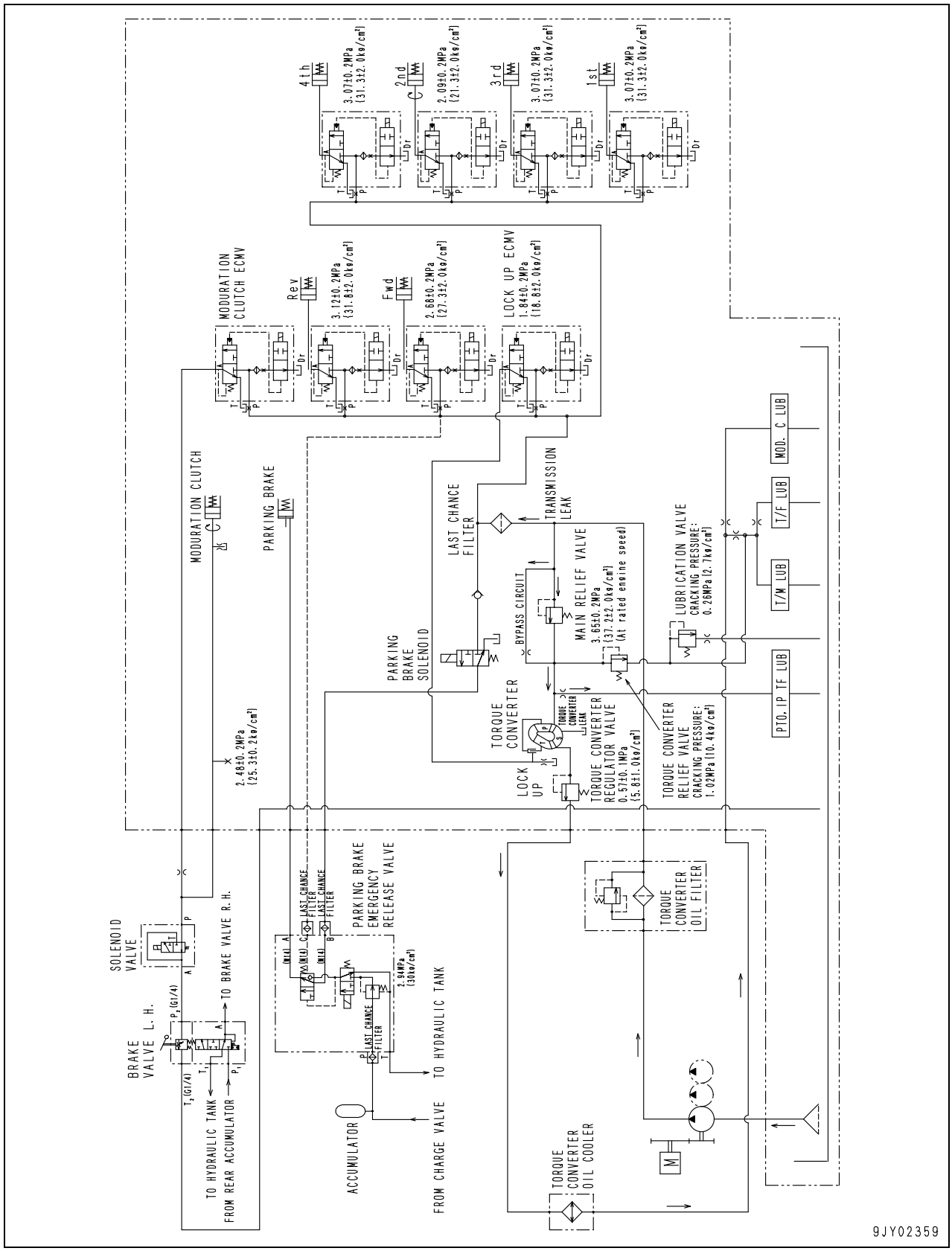
90 Diagrams and drawings

Hydraulic diagrams and drawings

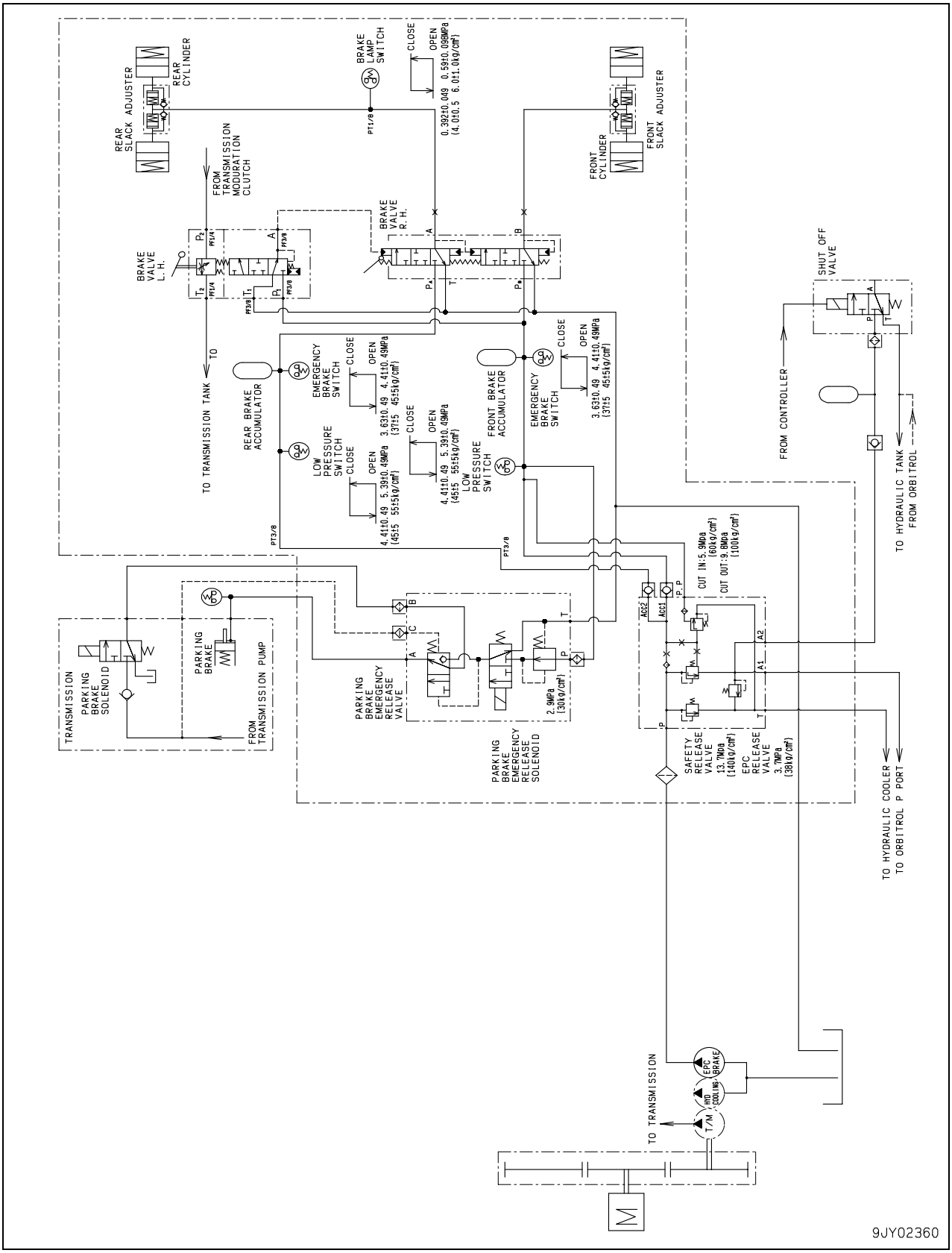
Hydraulic diagrams and drawings 2
Power train hydraulic circuit diagram 2
Brake hydraulic circuit diagram 3
Work equipment hydraulic circuit diagram 5

Hydraulic diagrams and drawings

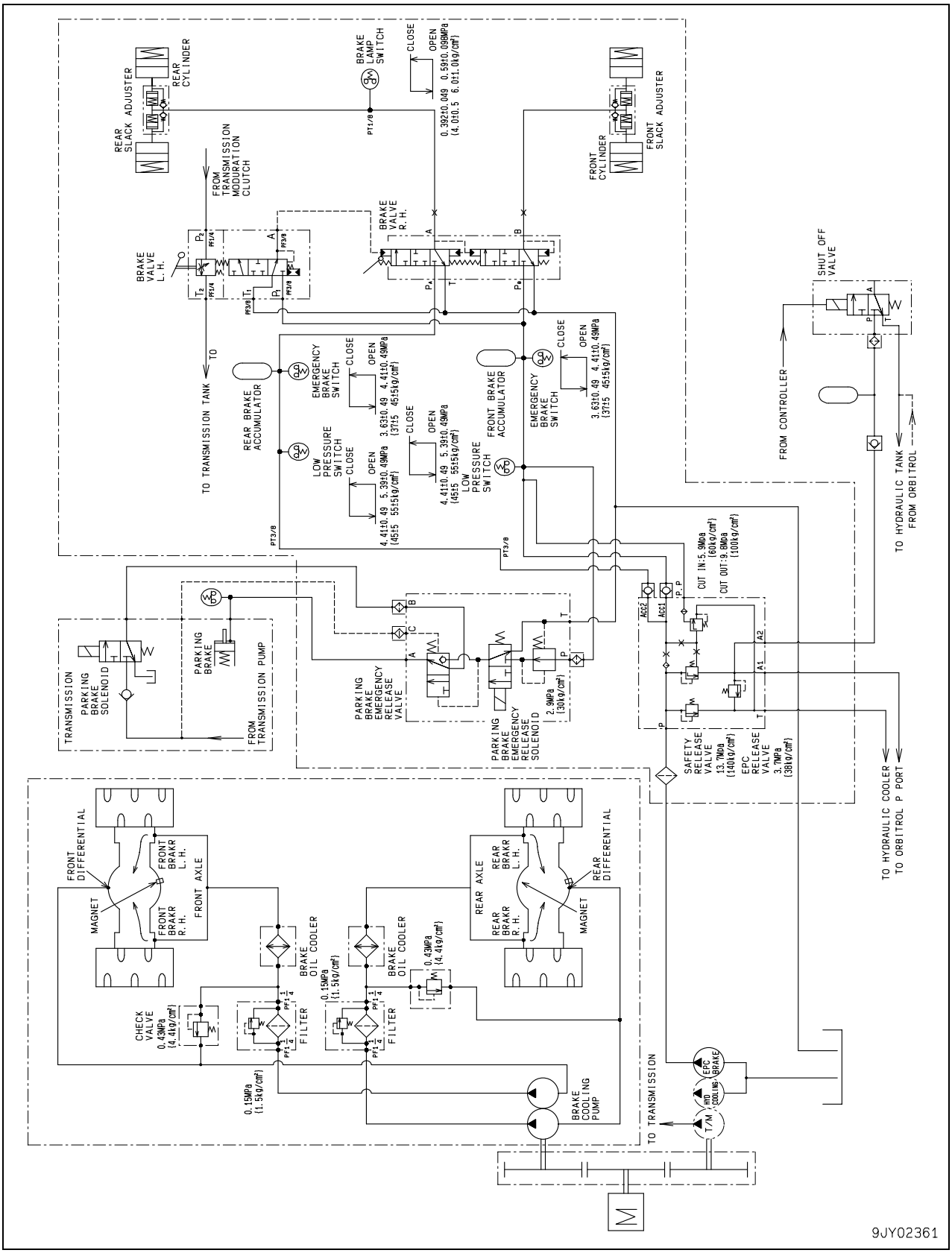
Power train hydraulic circuit diagram



Brake hydraulic circuit diagram

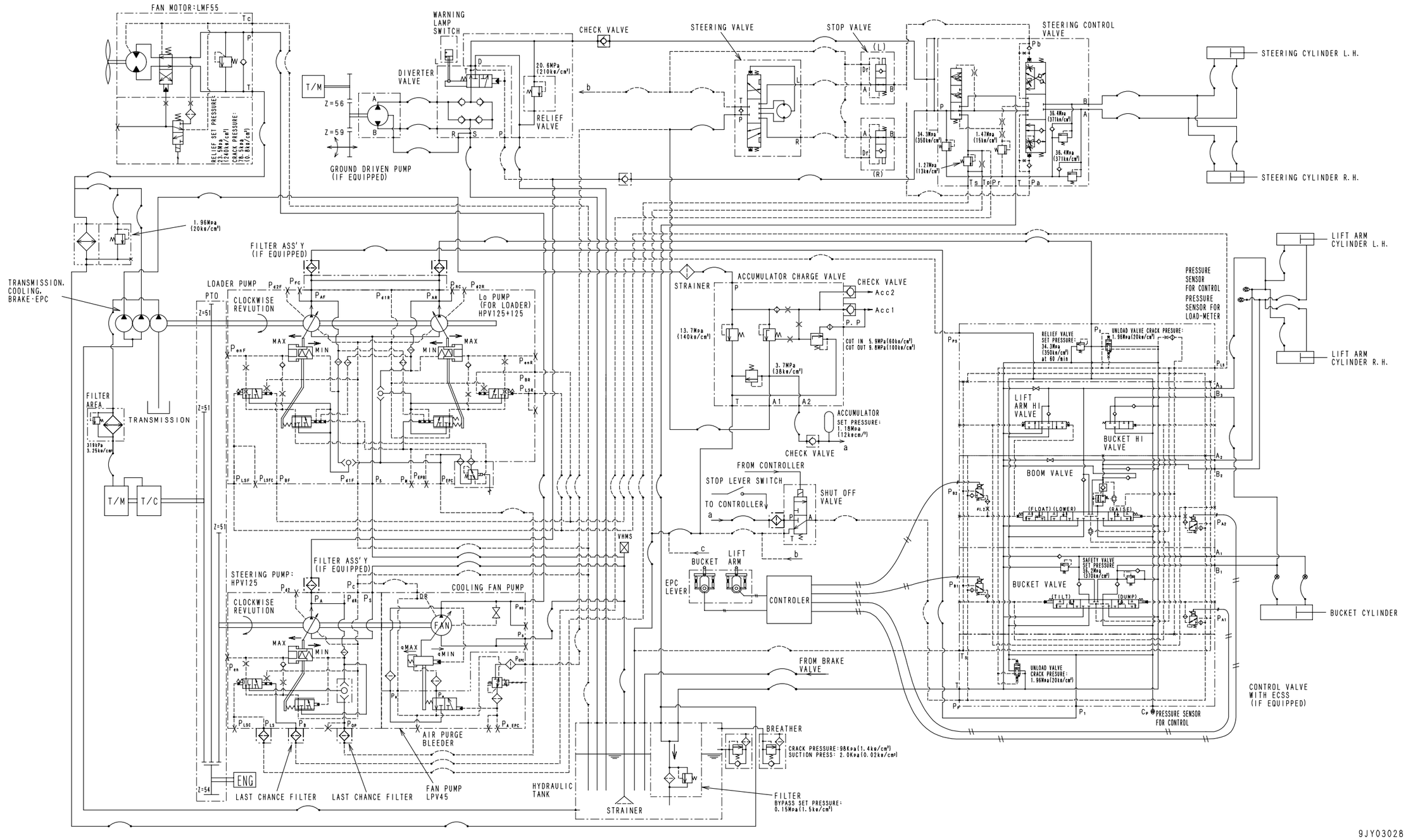


(Forced brake cooling system attached)

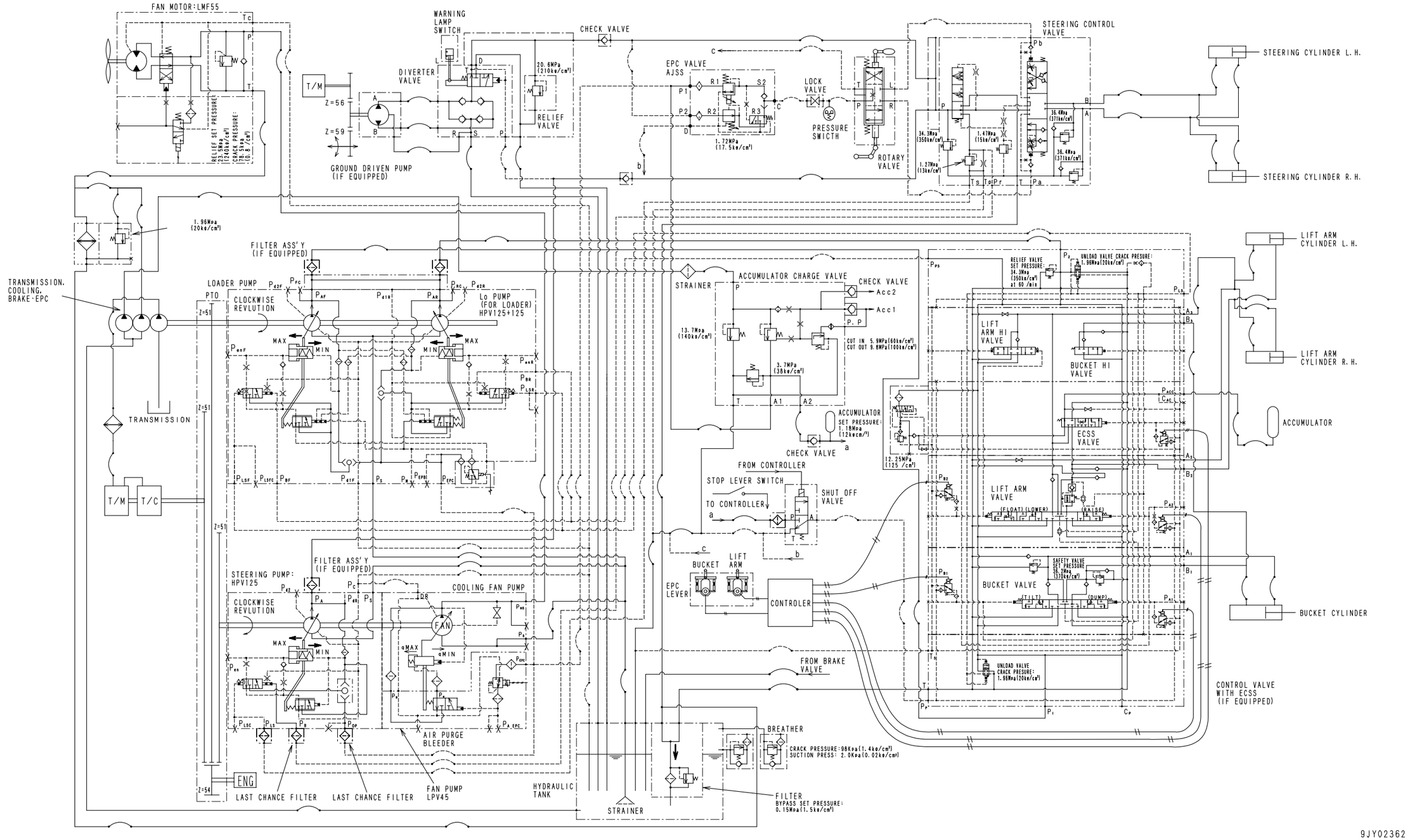


Work equipment hydraulic circuit diagram

Steering wheel specification



AJSS (Advanced Joystick Steering System) specification



WA600-6 Wheel loader

Form No. SEN00412-02

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WHEEL LOADER

WA600-6

Machine model	Serial number
WA600-6	60001 and up

90 Diagrams and drawings

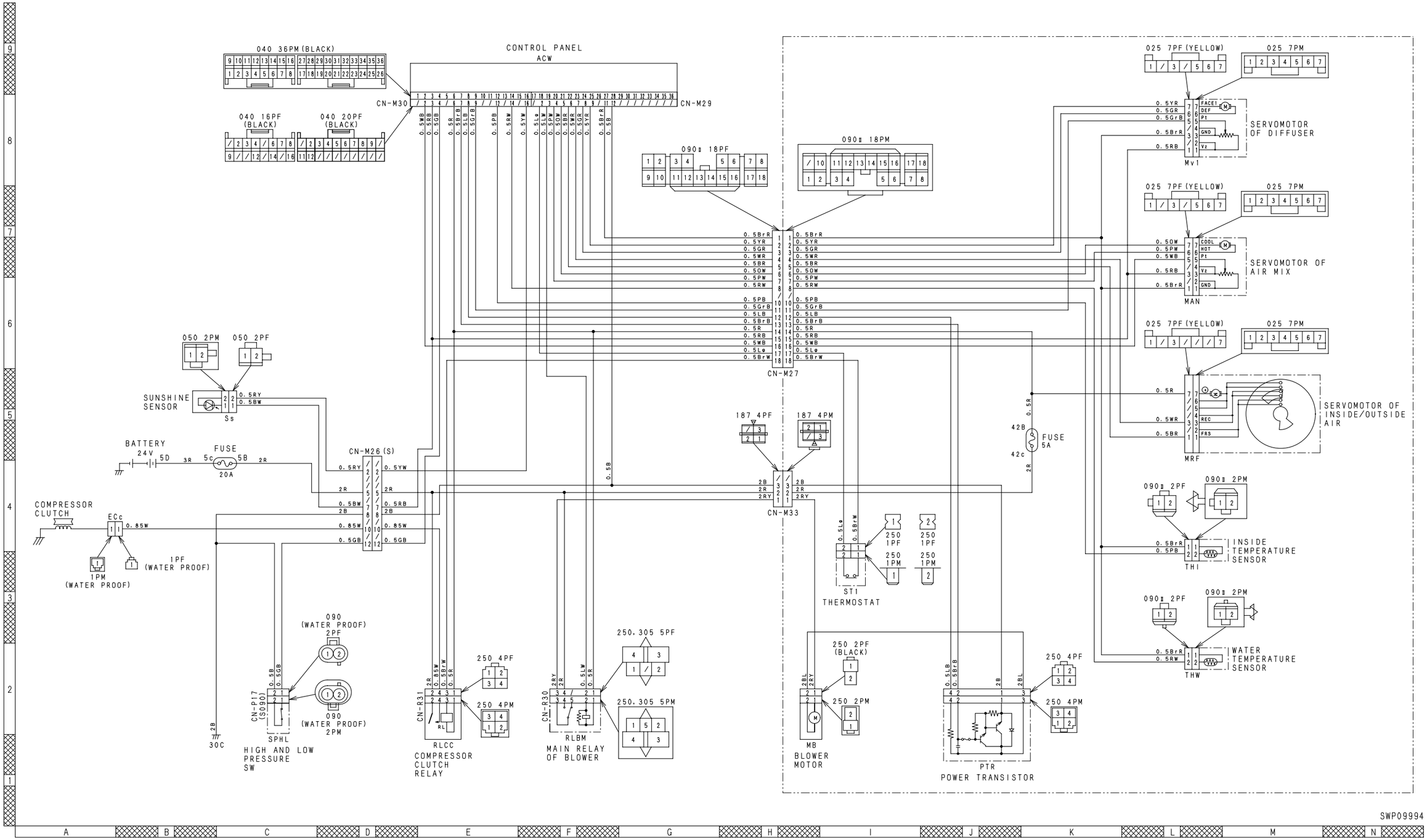
Electrical diagrams and drawings

Electrical diagrams and drawings 3
Air conditioner electrical circuit diagram 3
Steering wheel specification
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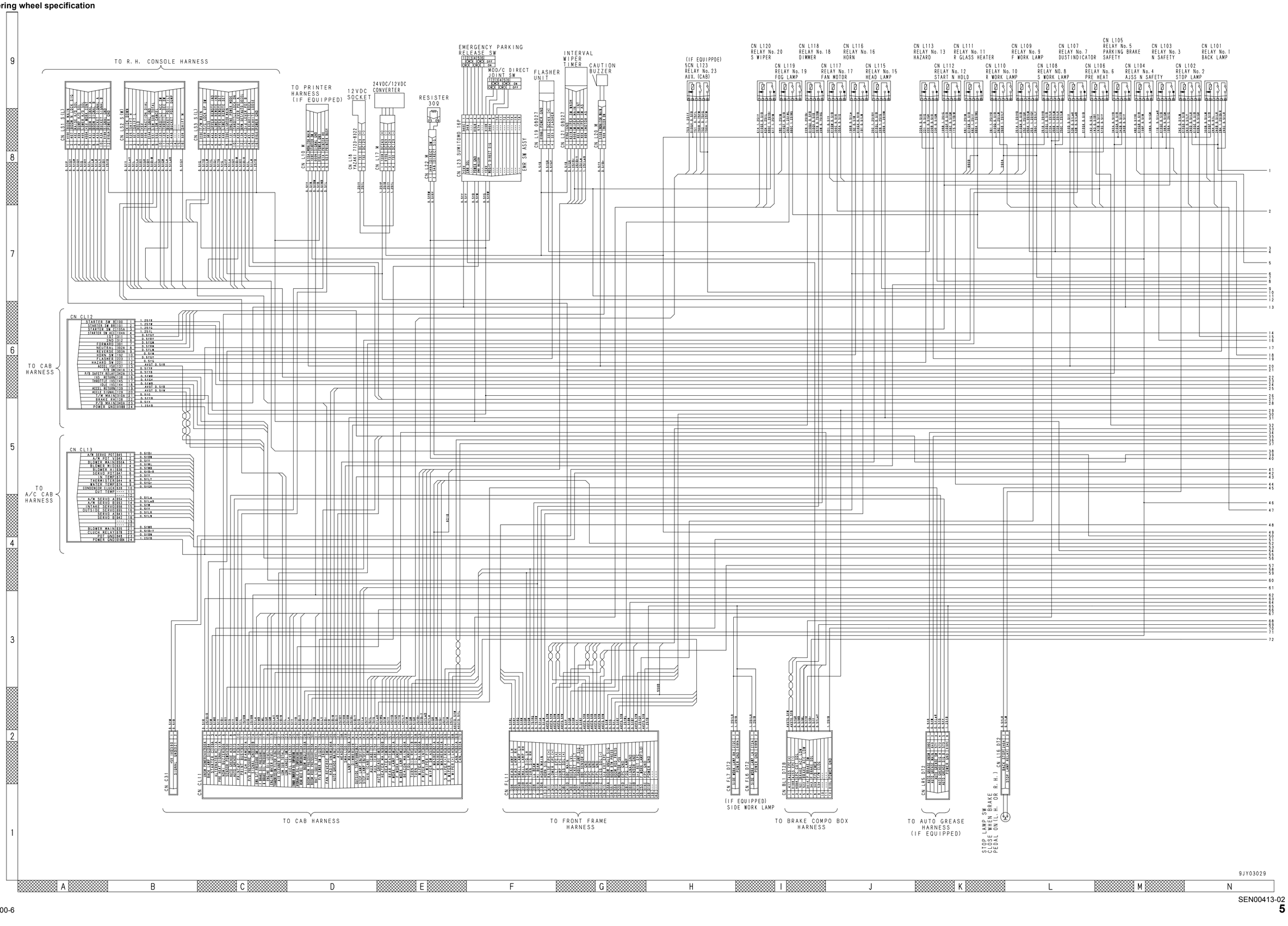
Electrical diagrams and drawings

Air conditioner electrical circuit diagram



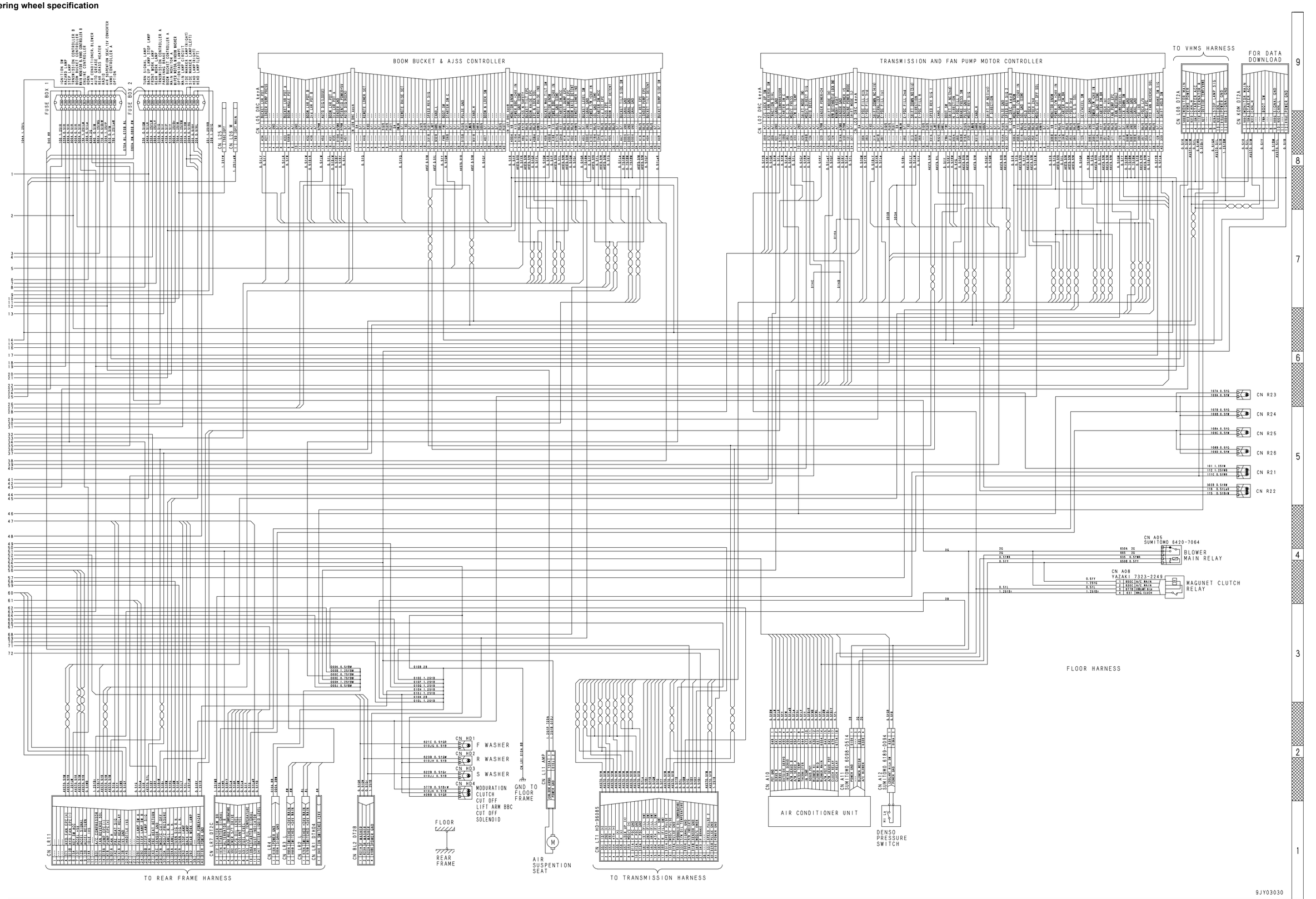
Electrical circuit diagram (1/10)

Steering wheel specification



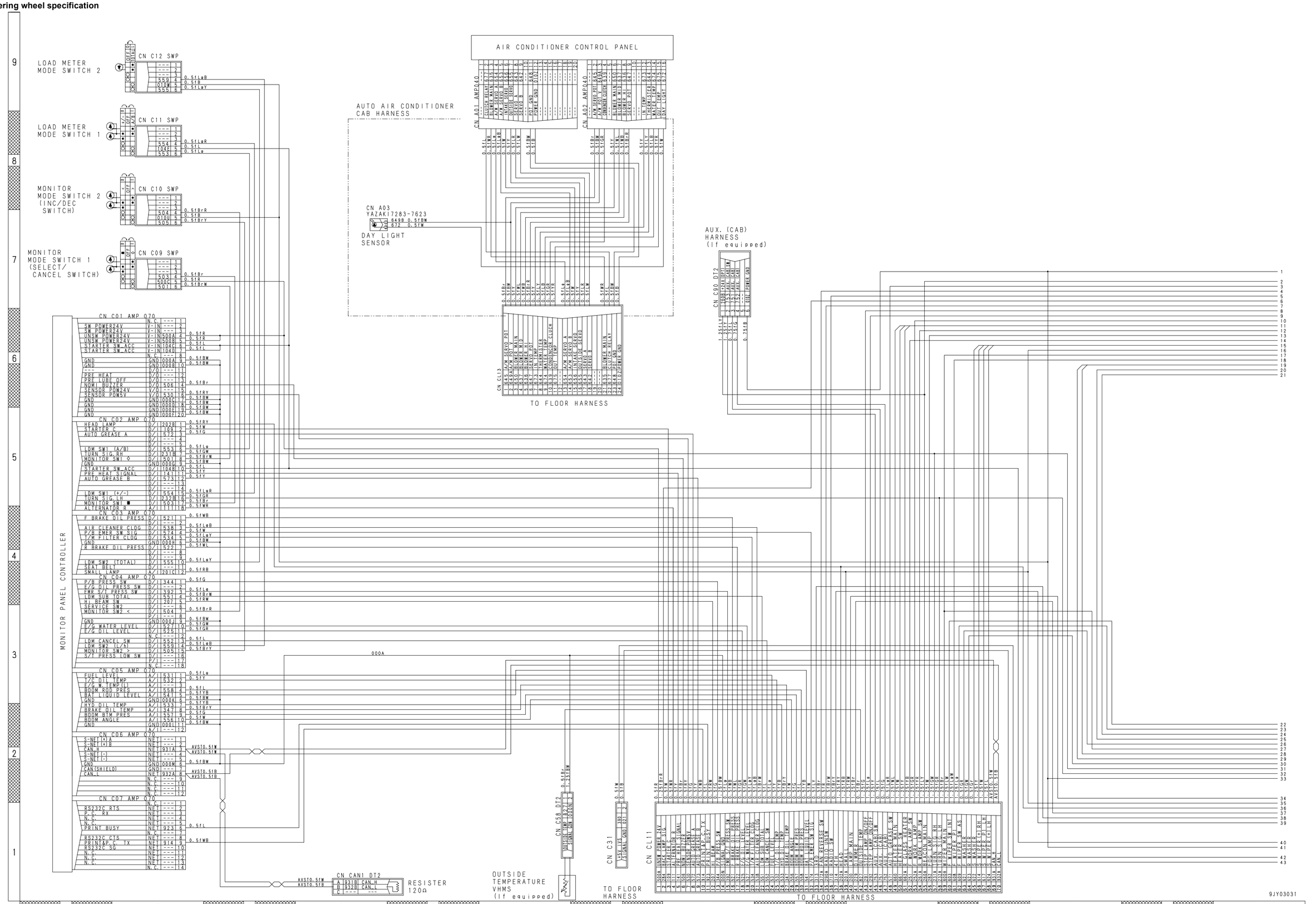
Electrical circuit diagram (2/10)

Steering wheel specification



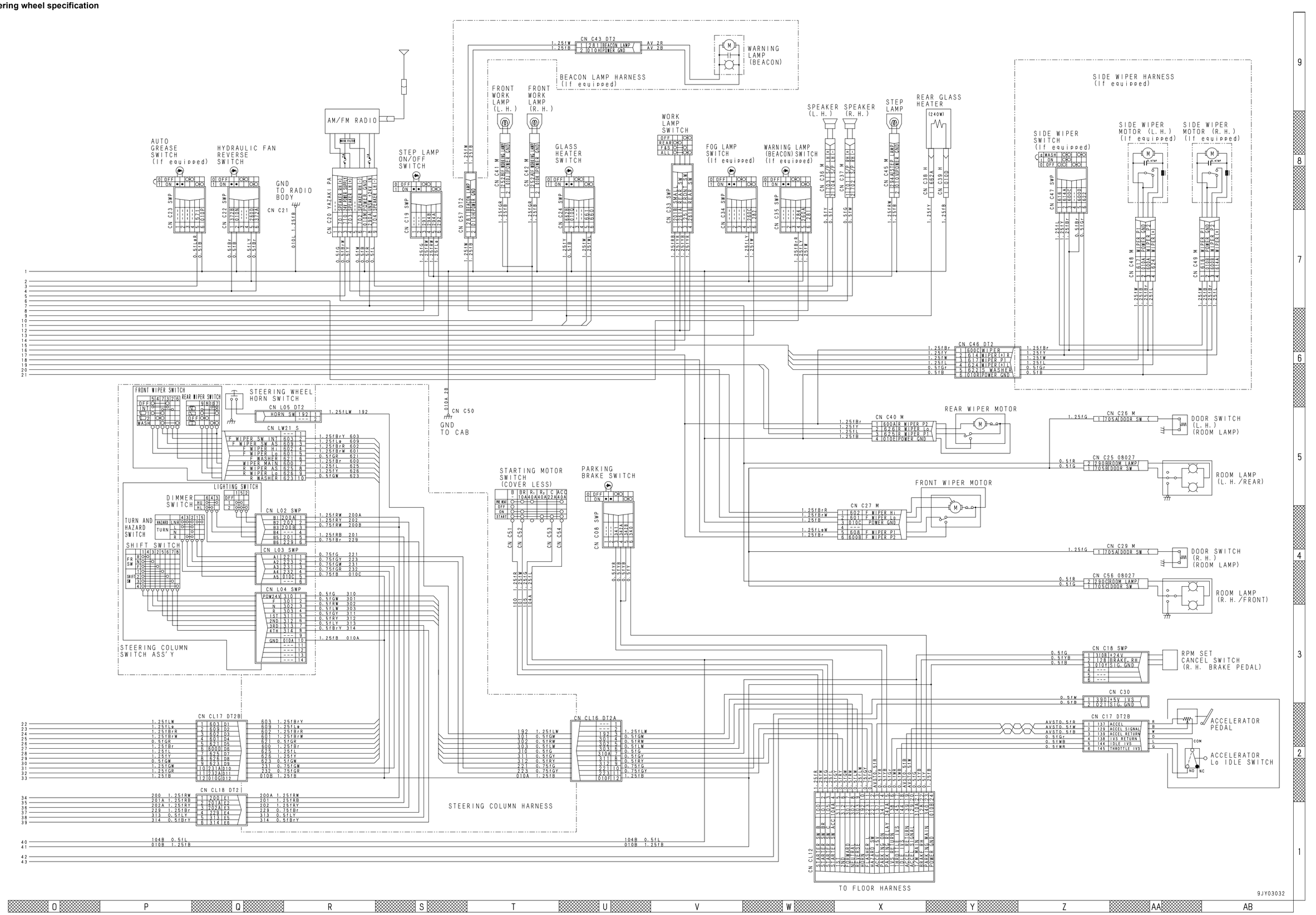
Electrical circuit diagram (3/10)

Steering wheel specification



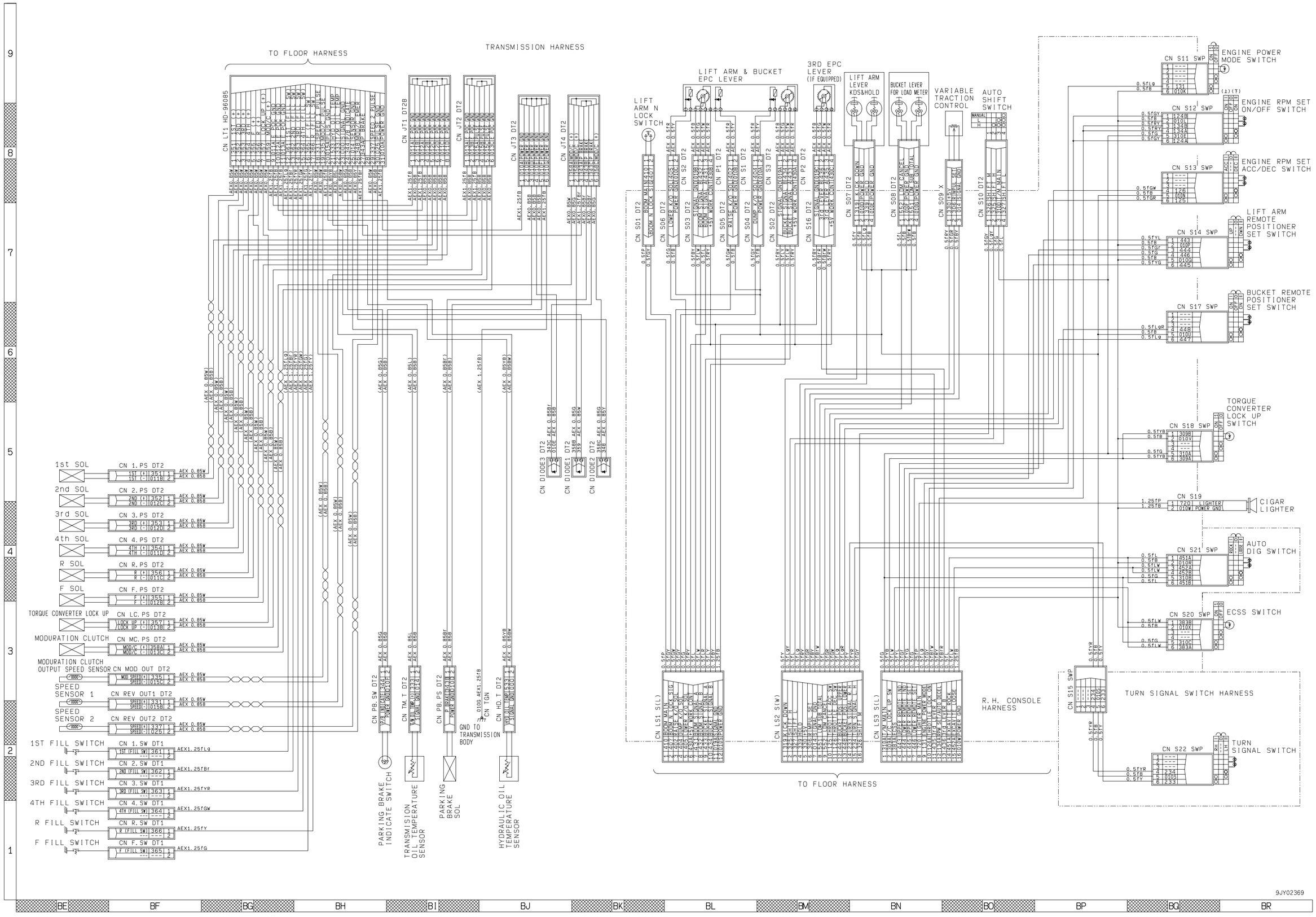
Electrical circuit diagram (4/10)

Steering wheel specification



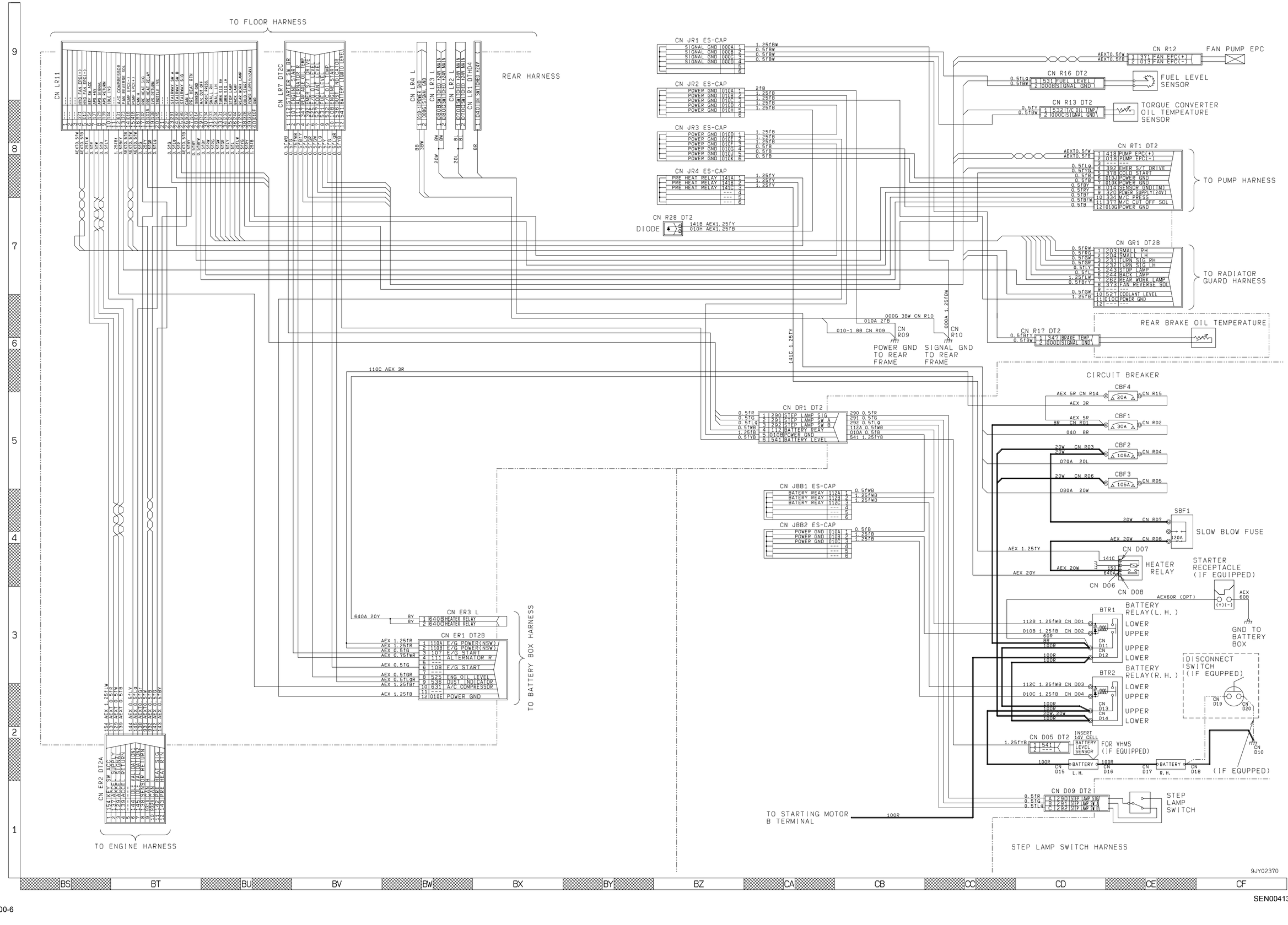
Electrical circuit diagram (5/10)

Steering wheel specification



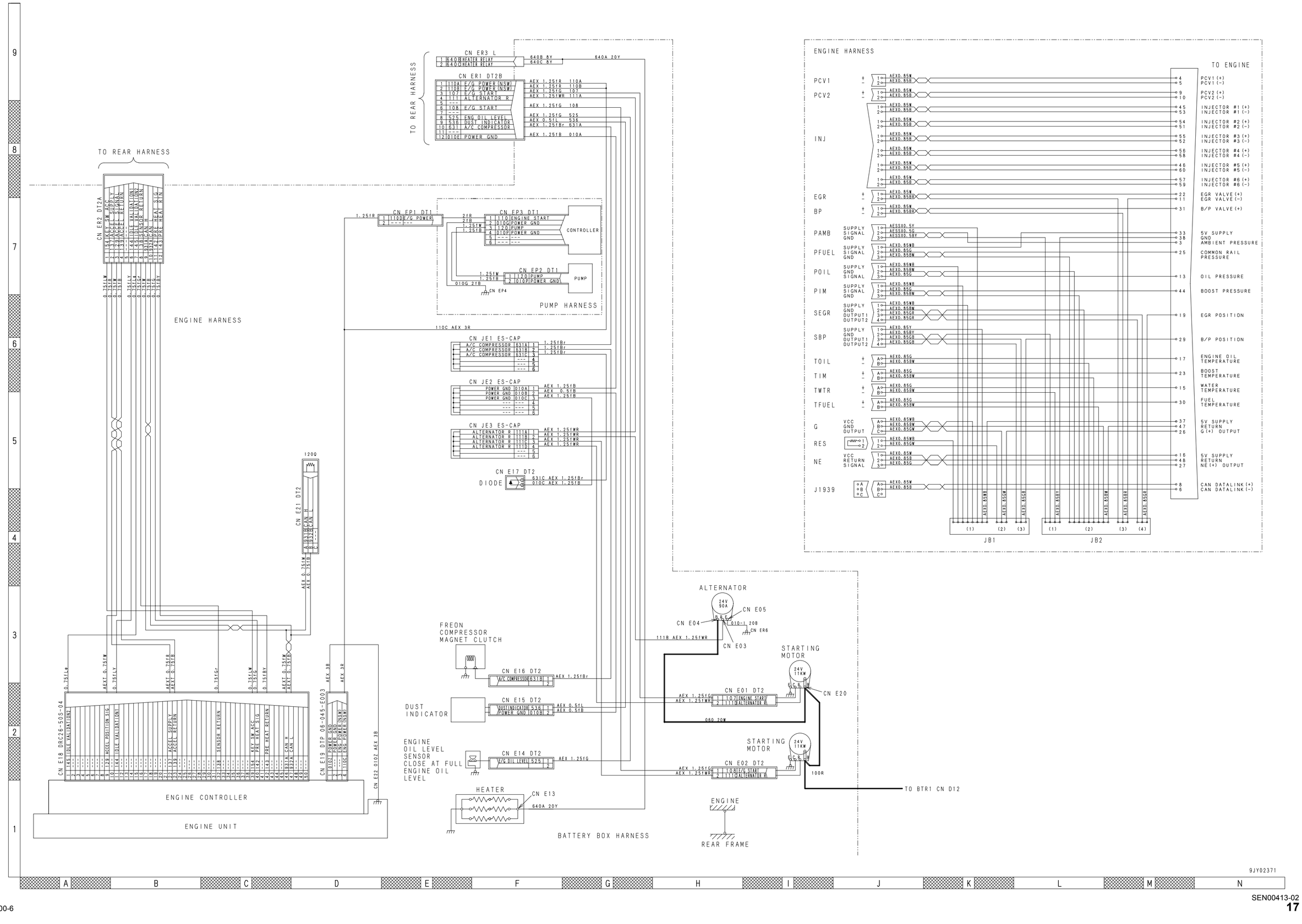
Electrical circuit diagram (6/10)

Steering wheel specification



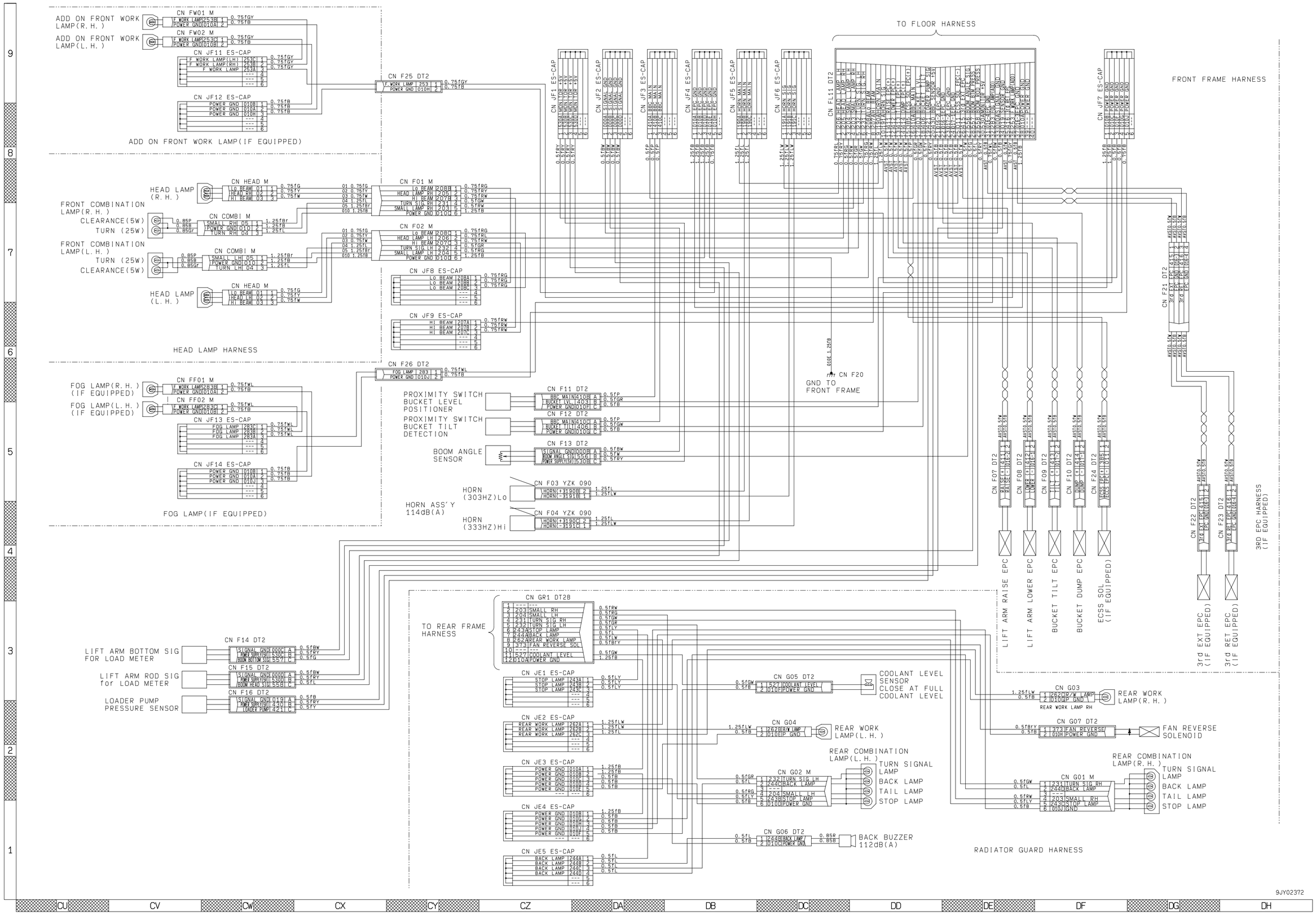
Electrical circuit diagram (7/10)

Steering wheel specification



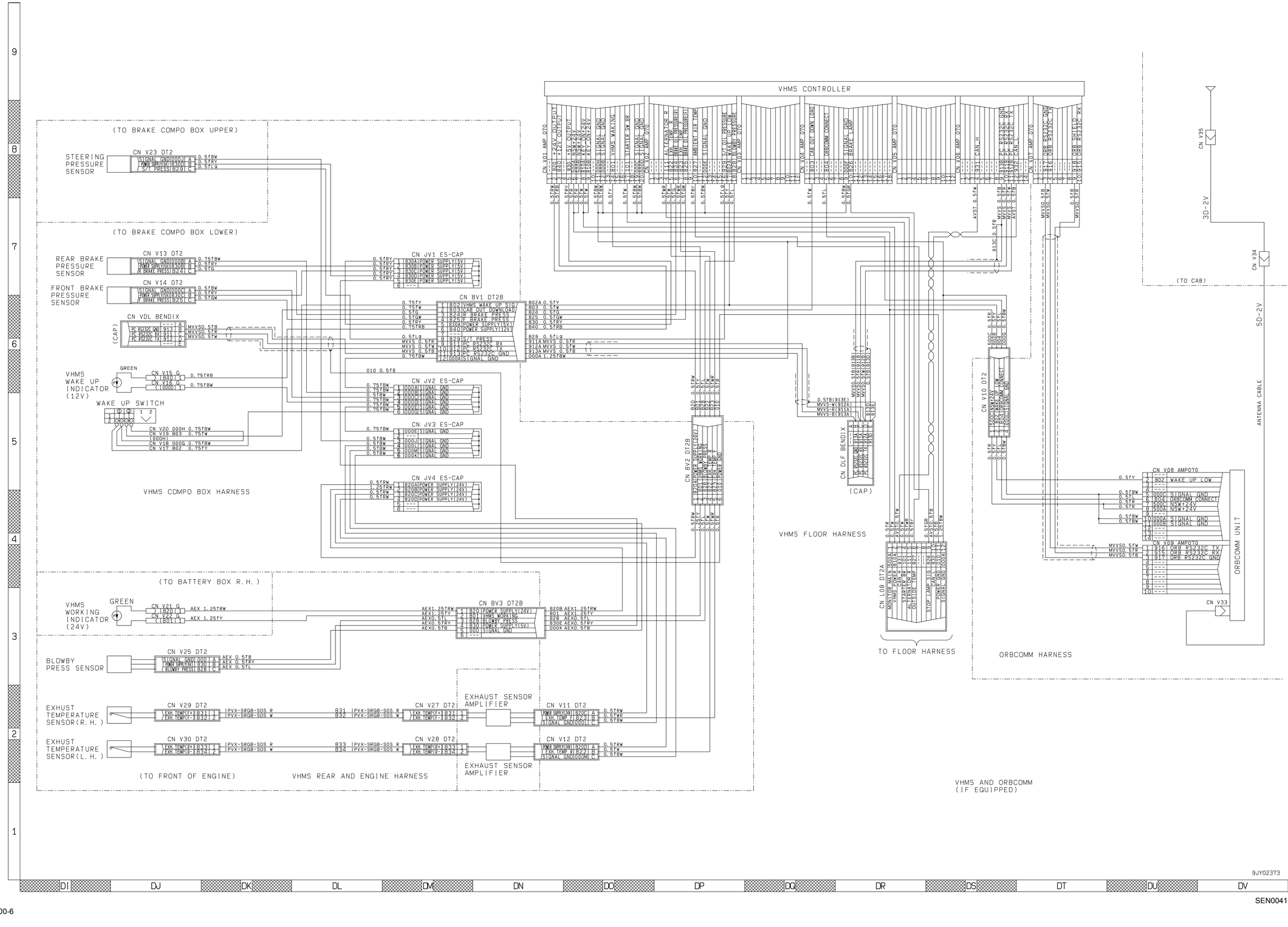
Electrical circuit diagram (8/10)

Steering wheel specification



Electrical circuit diagram (9/10)

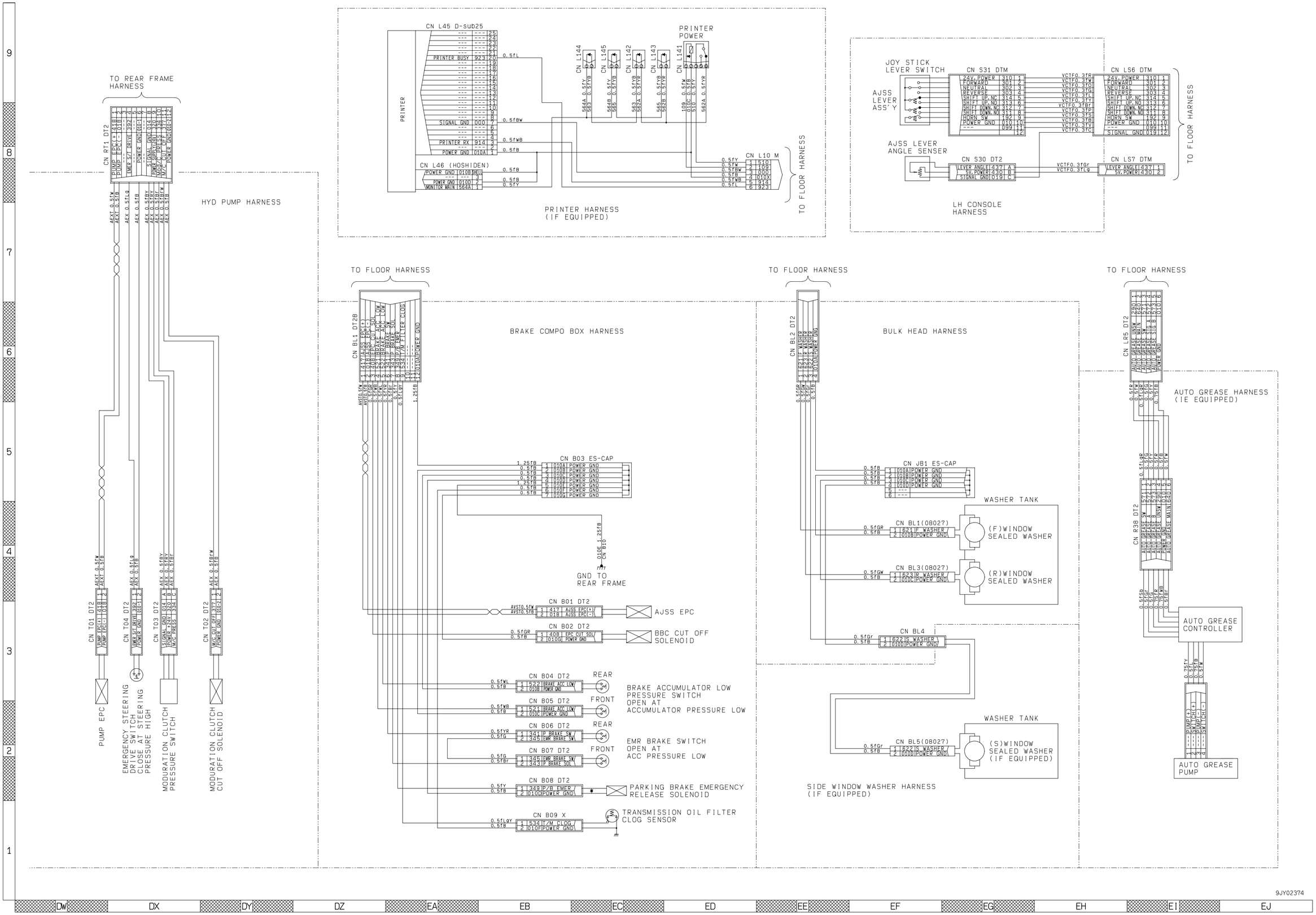
Steering wheel specification



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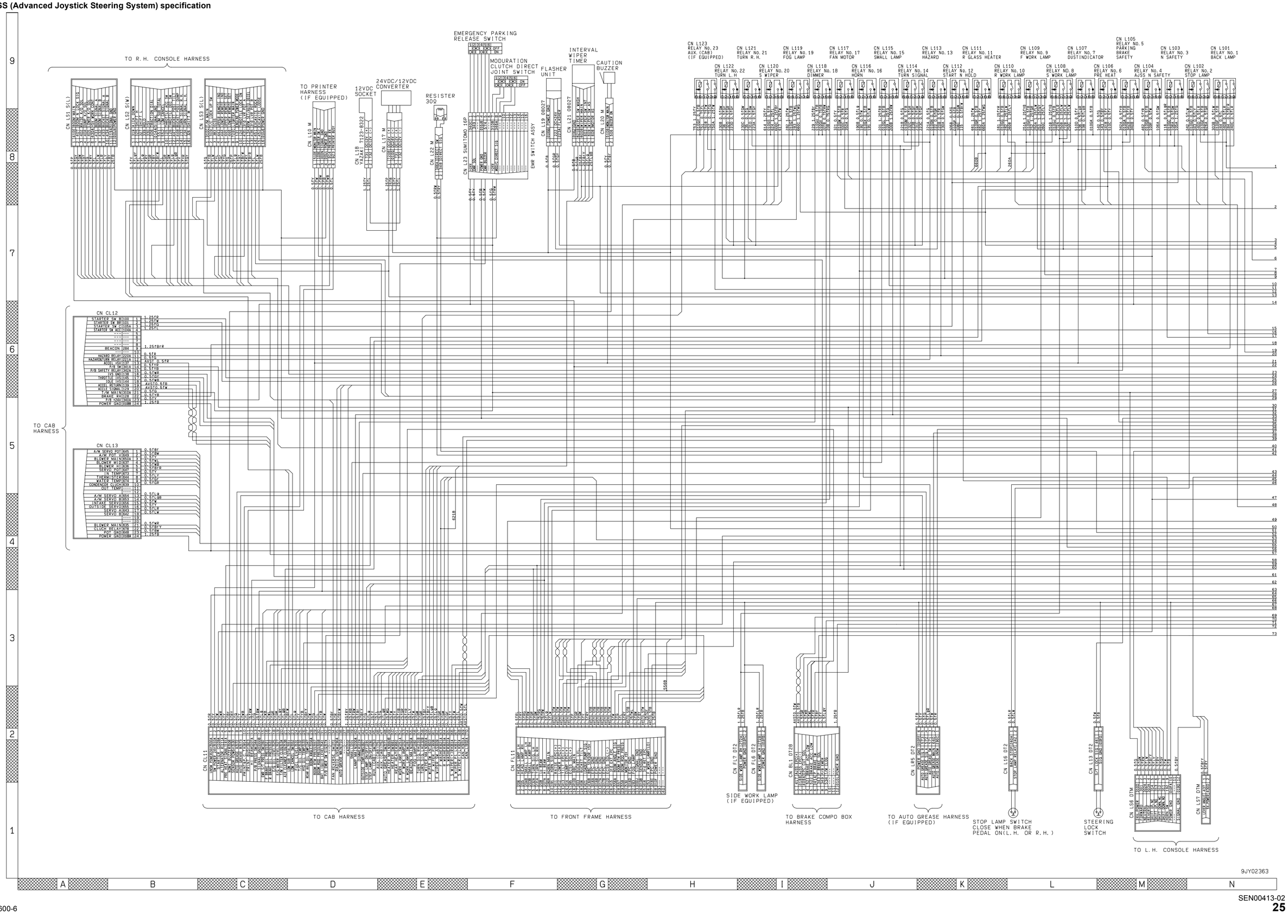
Electrical circuit diagram (10/10)

Steering wheel specification



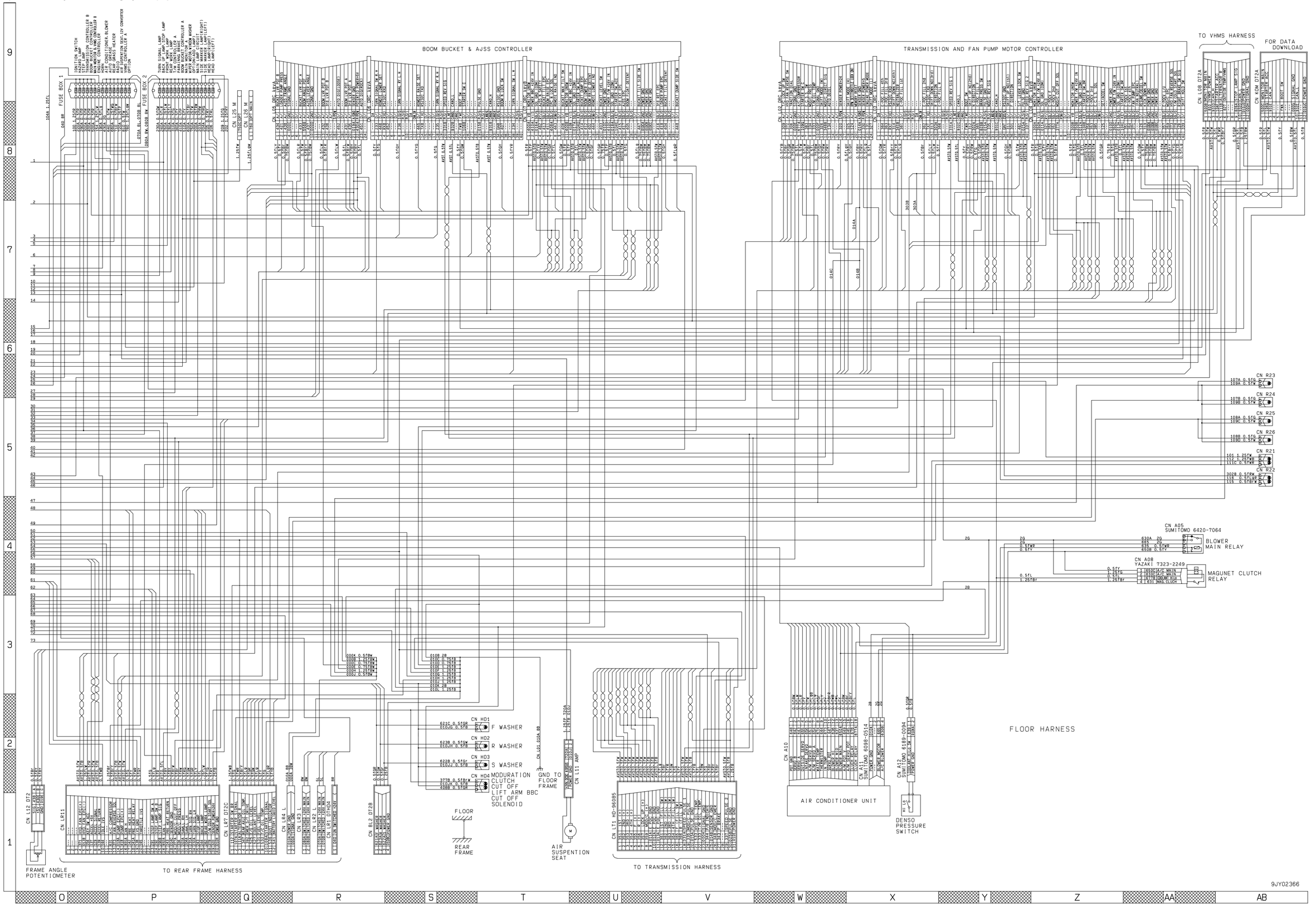
Electrical circuit diagram (1/10)

AJSS (Advanced Joystick Steering System) specification



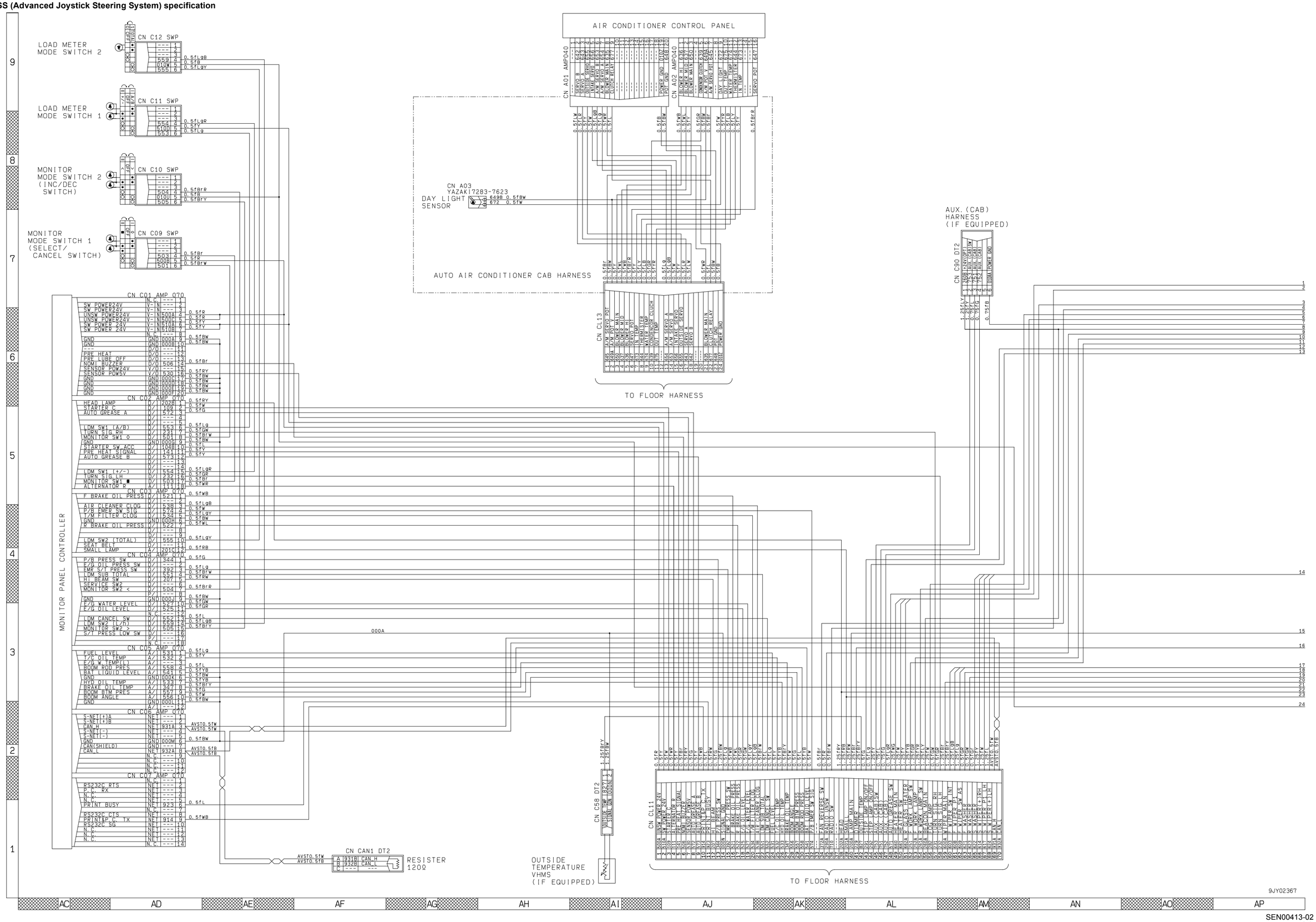
Electrical circuit diagram (2/10)

AJSS (Advanced Joystick Steering System) specification



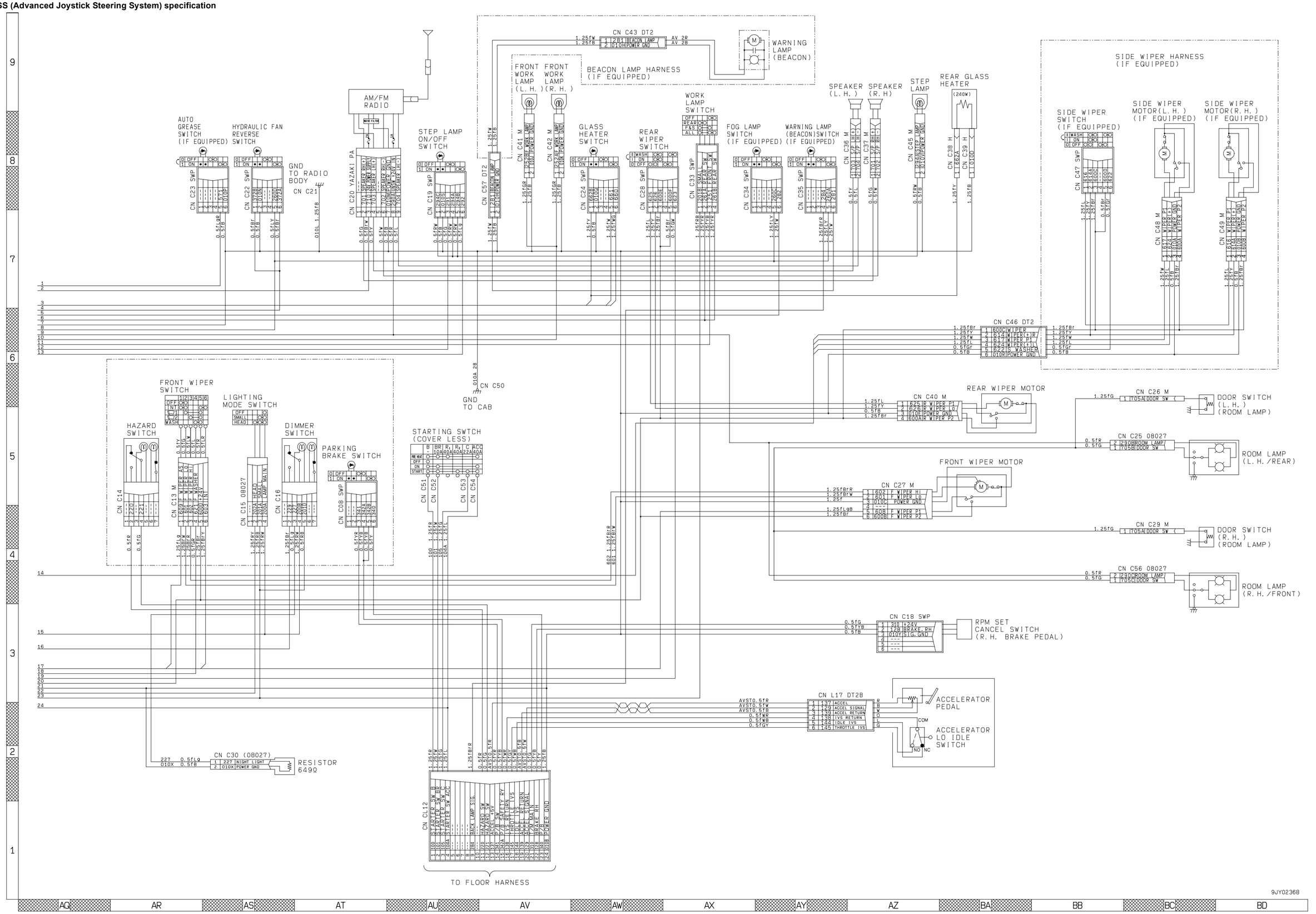
Electrical circuit diagram (3/10)

AJSS (Advanced Joystick Steering System) specification



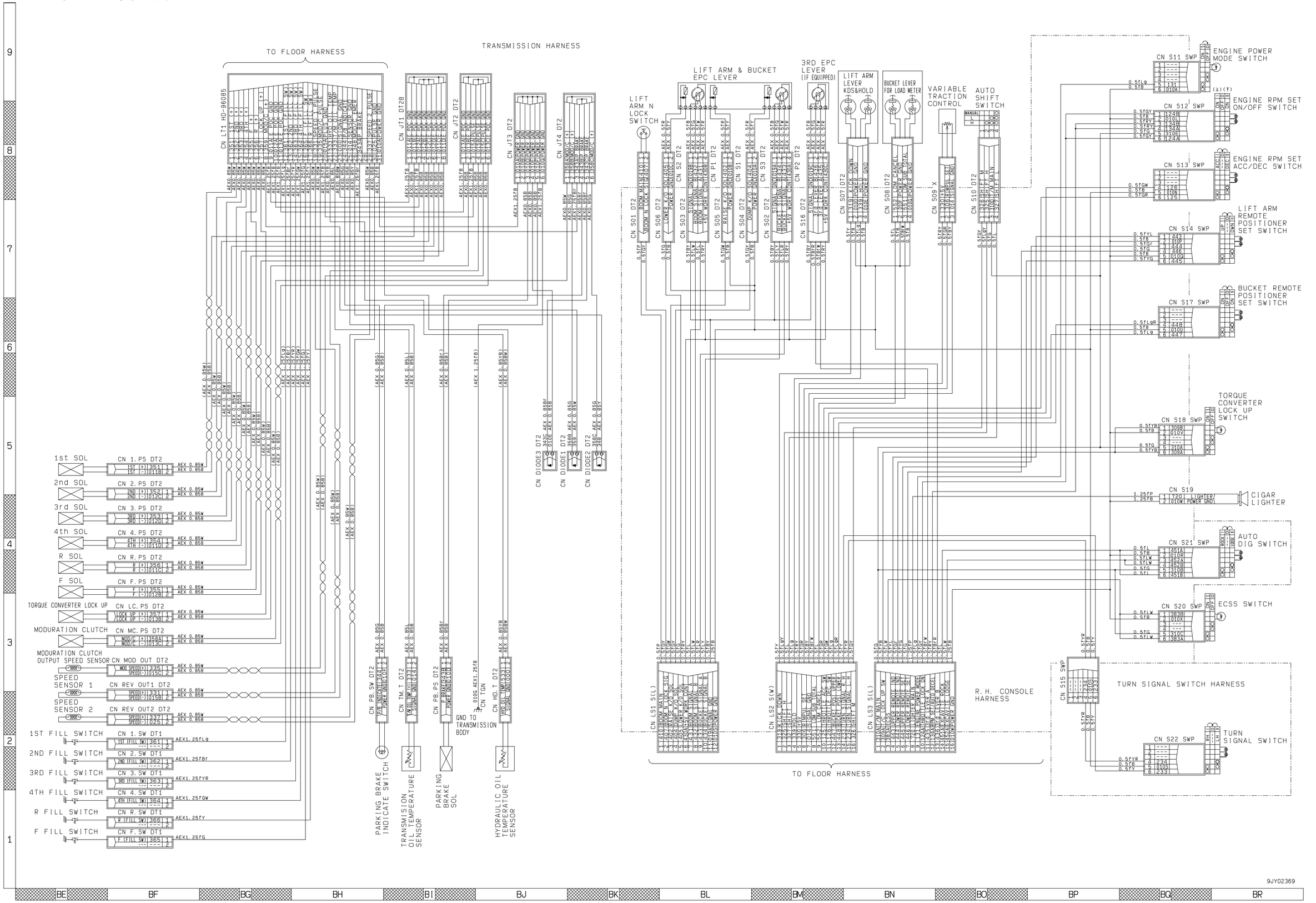
Electrical circuit diagram (4/10)

AJSS (Advanced Joystick Steering System) specification



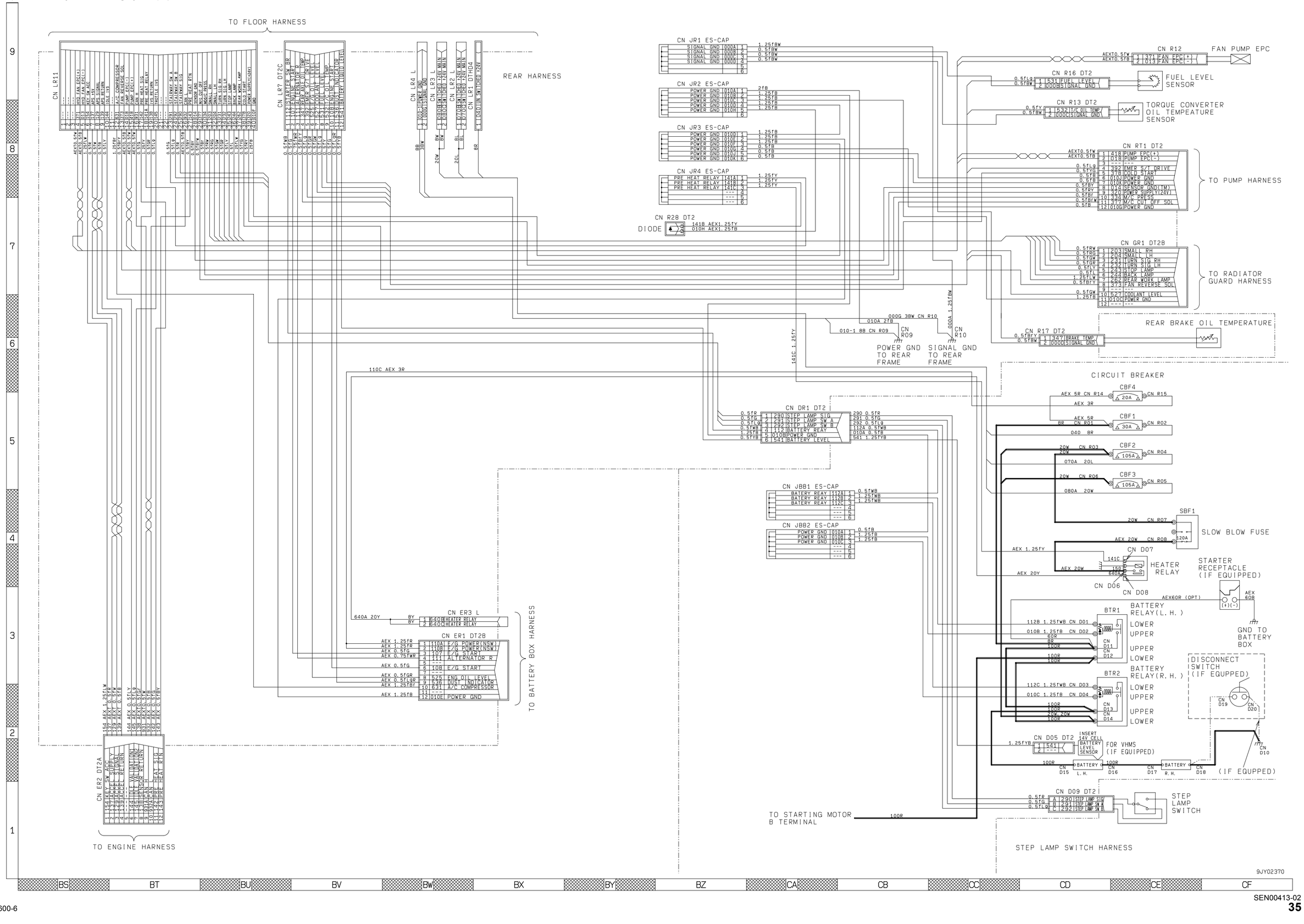
Electrical circuit diagram (5/10)

AJSS (Advanced Joystick Steering System) specification



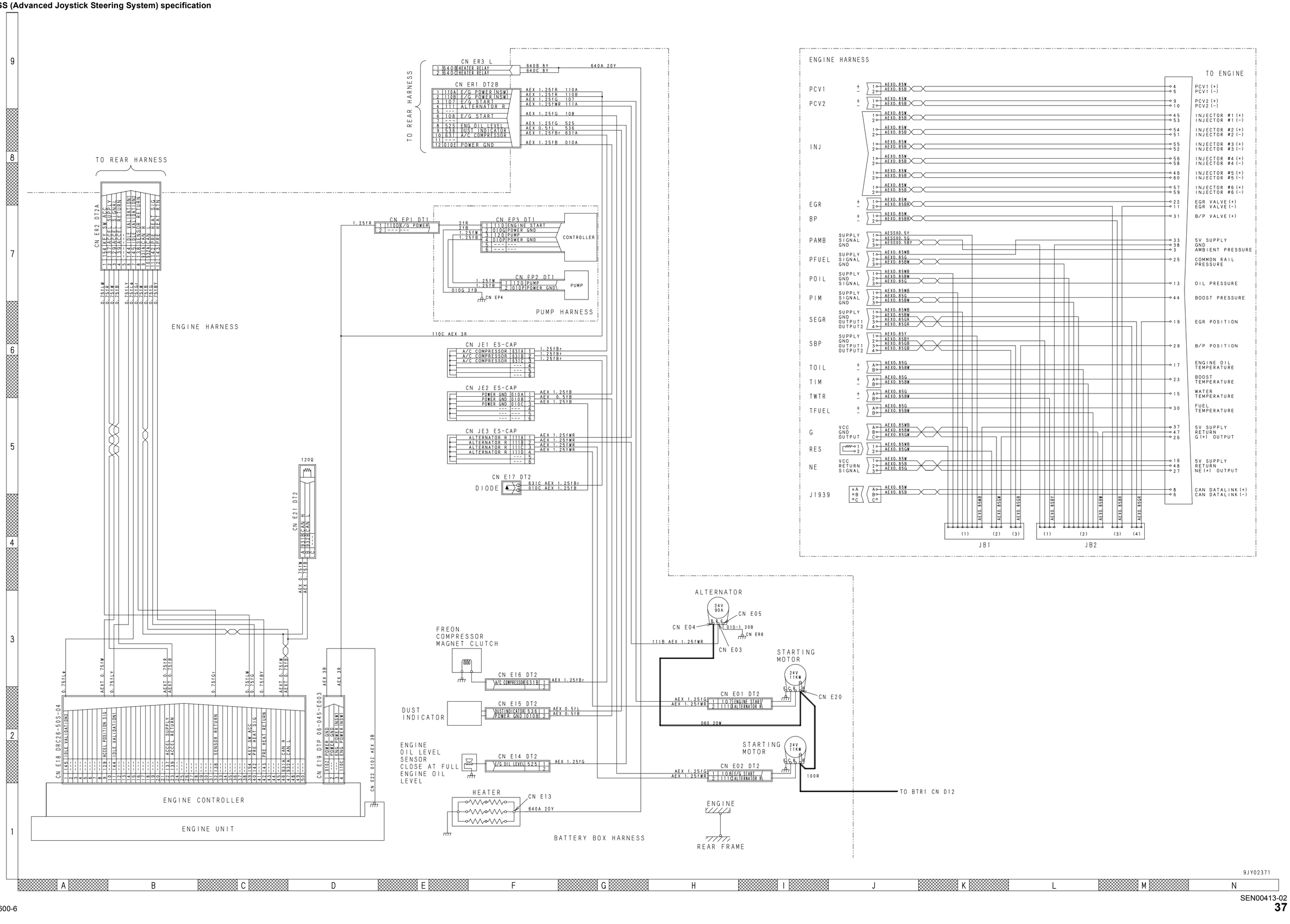
Electrical circuit diagram (6/10)

AJSS (Advanced Joystick Steering System) specification



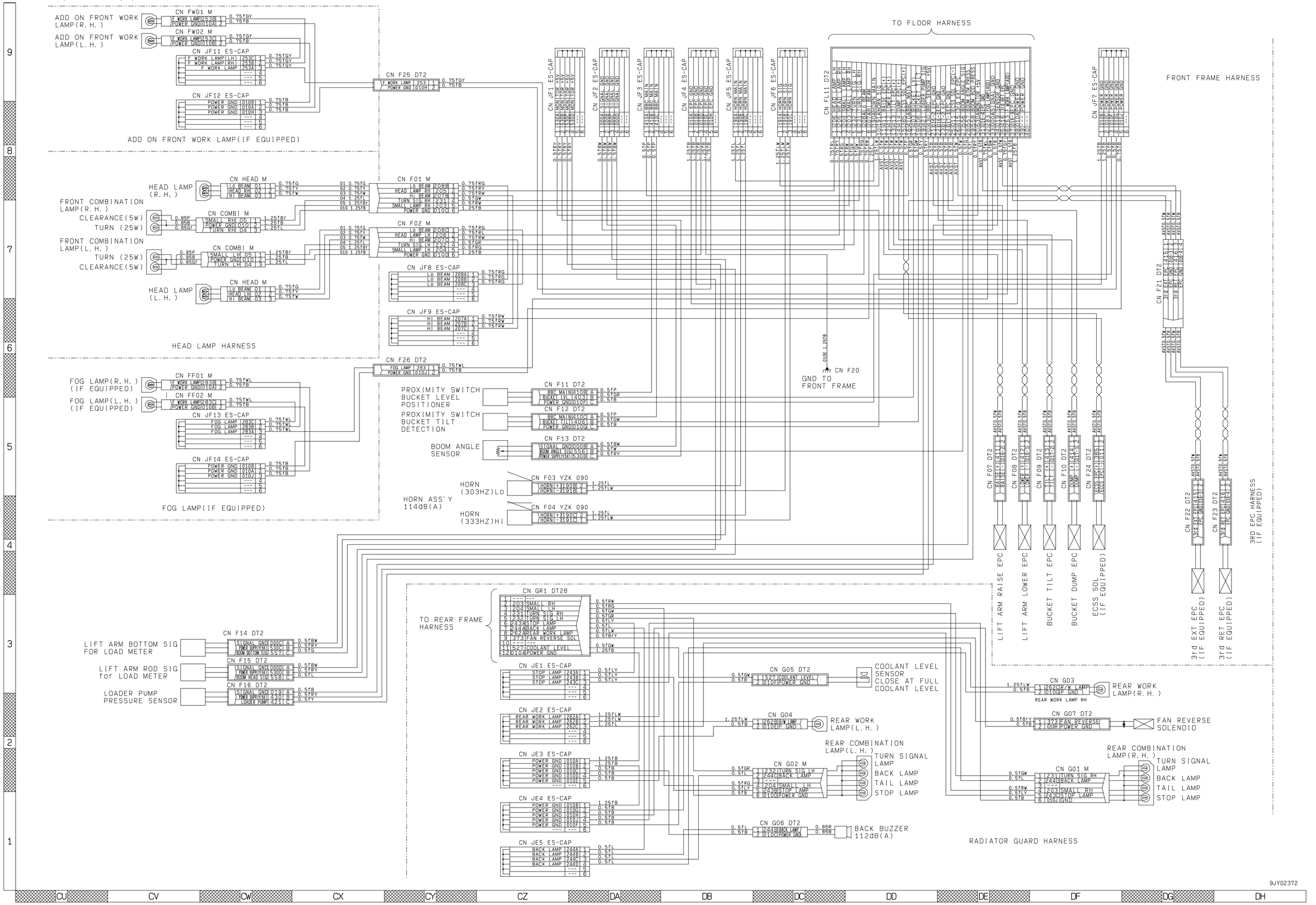
Electrical circuit diagram (7/10)

AJSS (Advanced Joystick Steering System) specification



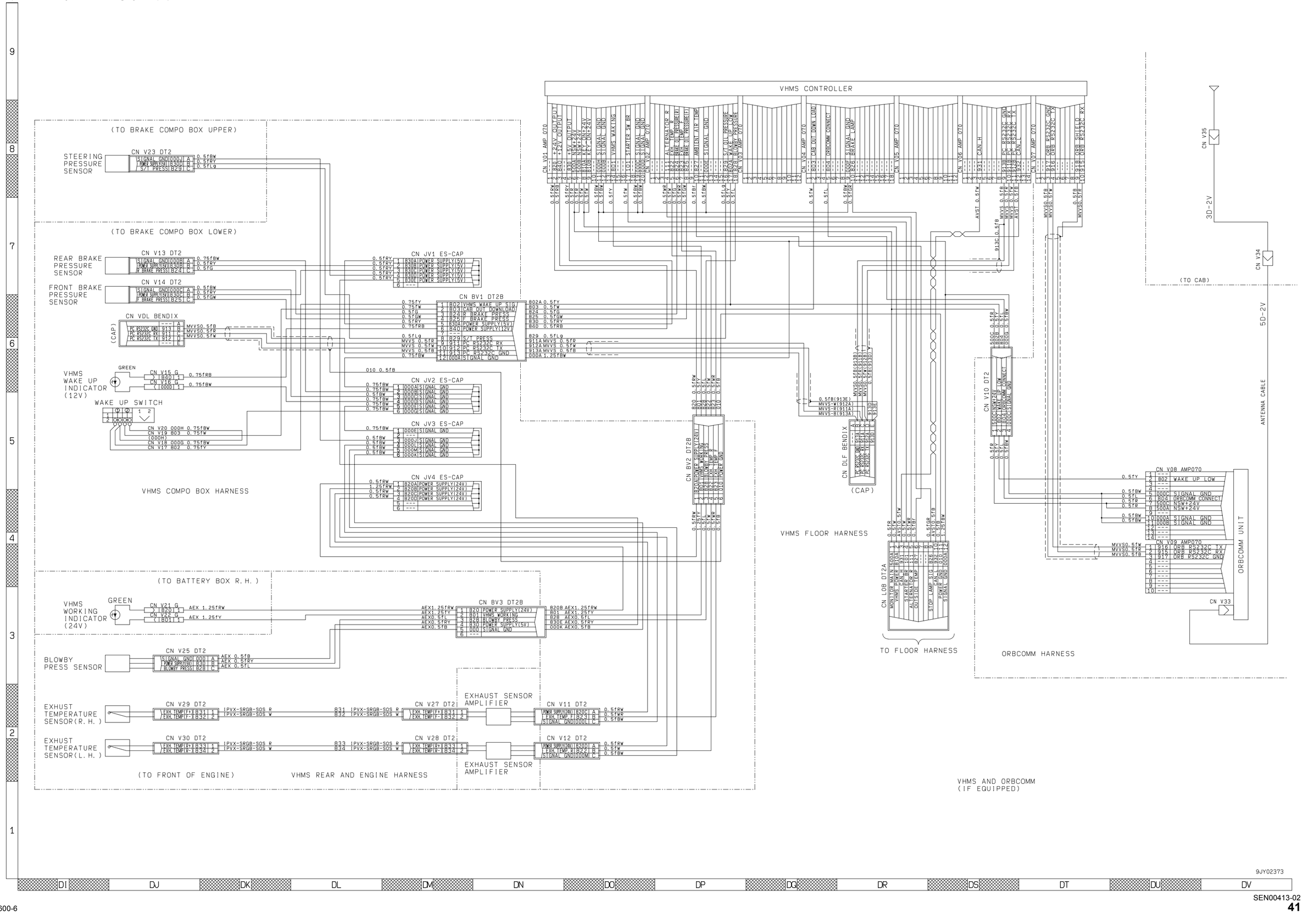
Electrical circuit diagram (8/10)

AJSS (Advanced Joystick Steering System) specification



Electrical circuit diagram (9/10)

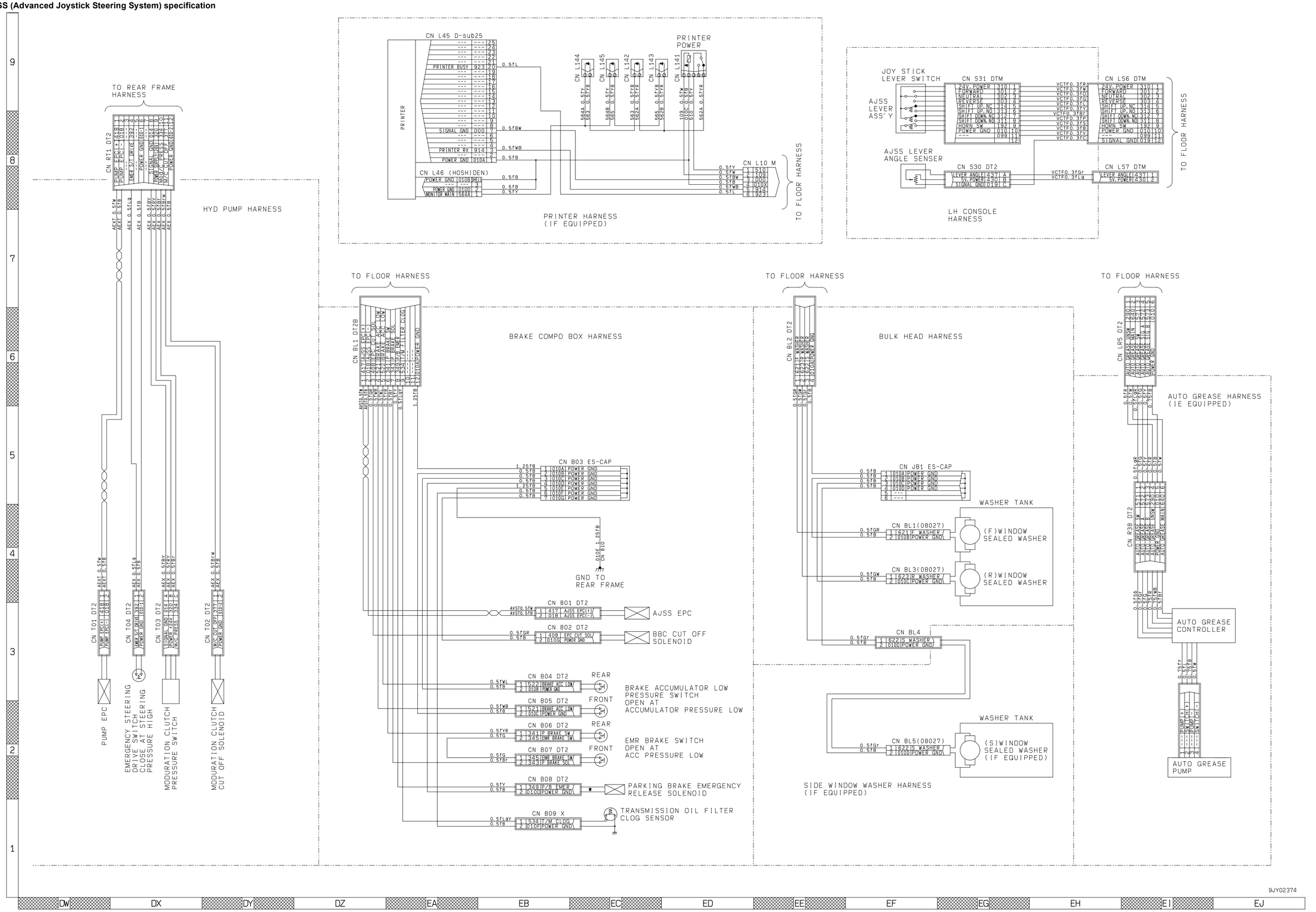
AJSS (Advanced Joystick Steering System) specification



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Electrical circuit diagram (10/10)

AJSS (Advanced Joystick Steering System) specification



9JY02374

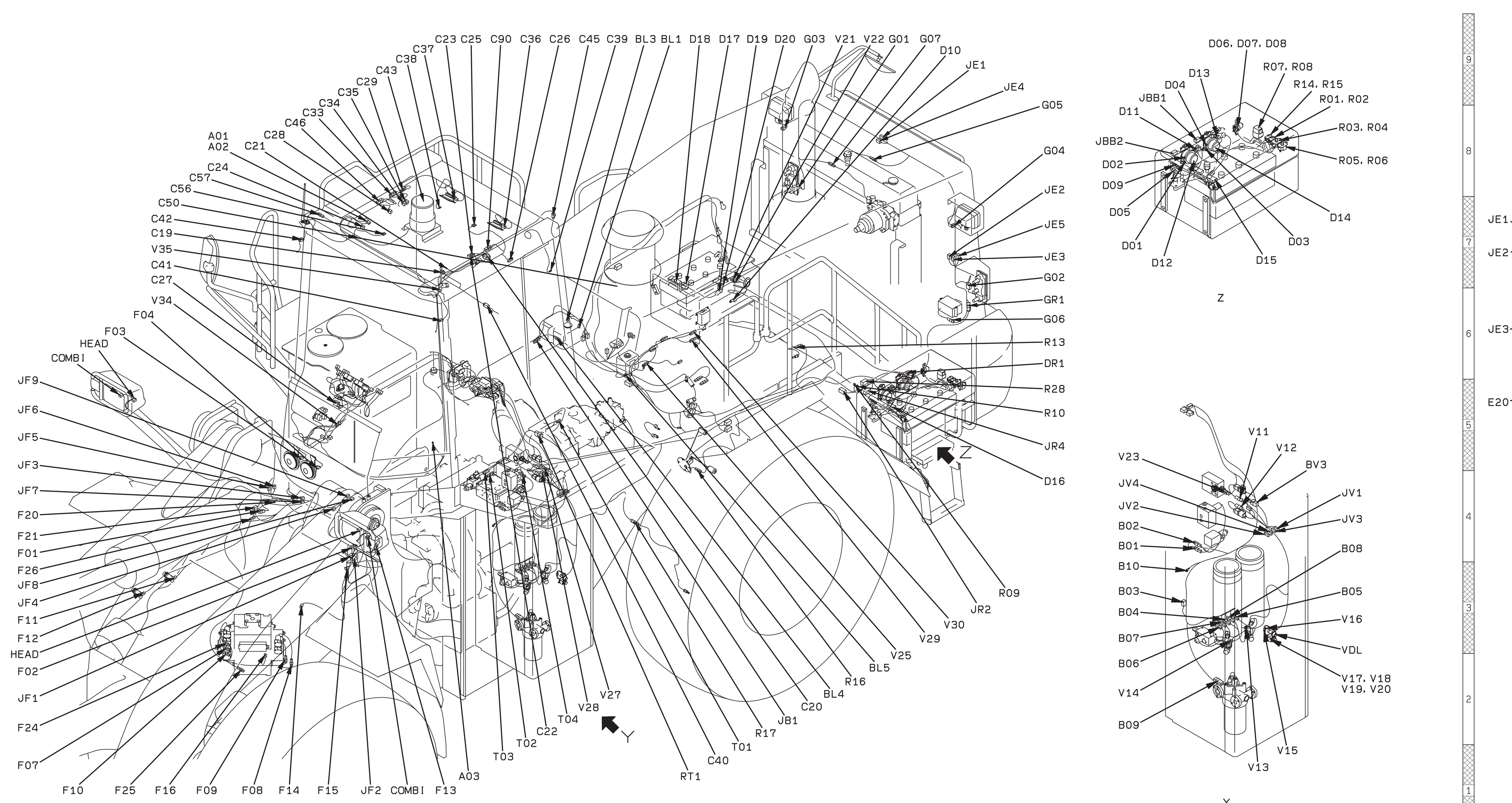
Connector arrangement diagram WA600-6

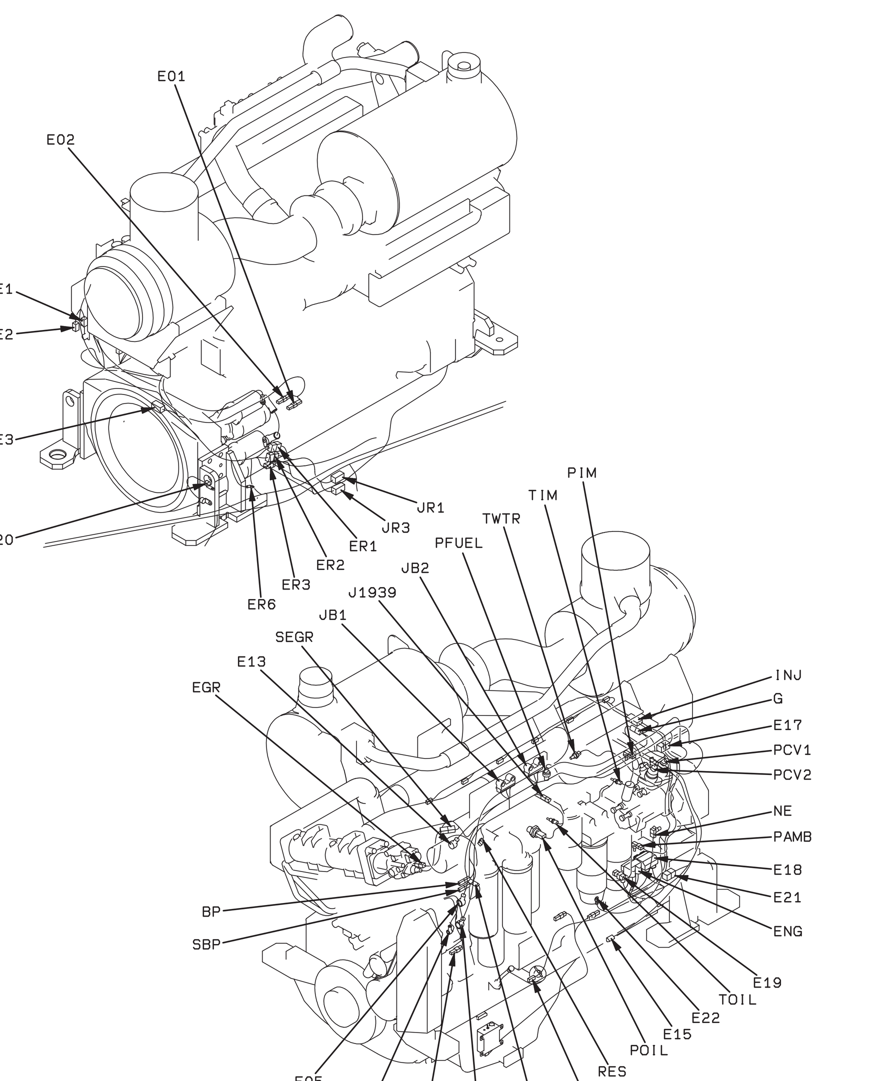
Connector No.	Model	Number of pins	Component name	Address of stereogram
1.PS	DT2	2	1st ECMV solenoid	AN-8
1.SW	DT	2	1st ECMV fill switch	AN-8
2.PS	DT2	2	2nd ECMV solenoid	AM-9
2.SW	DT	2	2nd ECMV fill switch	AN-8
3.PS	DT2	2	3rd ECMV solenoid	AM-9
3.SW	DT	2	3rd ECMV fill switch	AN-9
4.PS	DT2	2	4th ECMV solenoid	AL-9
4.SW	DT	2	4th ECMV fill switch	AK-9
A01	AMP040	20	Air conditioner control panel	C-8
A02	AMP040	16	Air conditioner control panel	C-8
A03	YAZAKI	2	Solar radiation sensor	E-1
A05	SUMITOMO	5	Blower main relay	AB-5
A08	YAZAKI	4	Magnet clutch relay	AB-8
A10	YAZAKI	18	Air conditioner unit	X-5
A11	SUMITOMO	4	Air conditioner unit	V-2
A12	SUMITOMO	2	Coolant Hi/Lo switch	W-3
B01	DT2	2	AJSS EPC solenoid	L-4
B02	DT2	2	EPC cut-off solenoid	L-4
B03	—	7	Junction connector	L-3
B04	DT2	2	Rear brake accumulator low pressure switch	L-3
B05	DT2	2	Front brake accumulator low pressure switch	N-3
B06	DT2	2	Rear emergency brake switch	L-2
B07	DT2	2	Front emergency brake switch	L-3
B08	DT2	2	Parking brake emergency release solenoid	N-4
B09	X	2	Transmission oil filter clogging sensor	L-2
B10	Terminal	1	GND (Rear frame)	L-3
BL1	DT2(B)	12	Intermediate connector (Brake component box)	W-3
BL1	KES0	2	Front windshield washer	G-9
BL2	DT2	4	Intermediate connector (Windshield washer)	X-5
BL3	KES0	2	Rear windshield washer	G-9
BL4	DT2	2	Intermediate connector (Rear windshield washer (if equipped))	I-2
BL5	KES0	2	Rear windshield washer (if equipped)	I-2
BP	DT-T	2	Not used	AR-2
BV1	DT2(B)	12	Intermediate connector (VHMS component box)	W-3
BV2	DT2(B)	6	Intermediate connector (VHMS controller)	X-3
BV3	DT2(B)	6	Intermediate connector (VHMS rear and engine harness)	N-5
C01	AMP070	20	Machine monitor	Q-1
C02	AMP070	18	Machine monitor	Q-1
C03	AMP070	12	Machine monitor	O-3
C04	AMP070	18	Machine monitor	O-4
C05	AMP070	12	Machine monitor	O-4
C06	AMP070	12	Machine monitor	Q-1
C07	AMP070	14	Machine monitor	O-5
C08	SWP	6	Parking brake switch	O-5
C09	SWP	6	Monitor mode switch 1	S-1
C10	SWP	6	Monitor mode switch 2	R-1
C11	SWP	6	Load meter mode switch 1	O-5
C12	SWP	6	Load meter mode switch 2	O-4
C13	M	6	Front wiper switch (AJSS specification)	R-1
C14	YAZAKI	7	Hazard switch (AJSS specification)	R-1
C15	KES1	4	Lighting mode switch (AJSS specification)	O-2
C16	YAZAKI	7	Dimmer switch	O-2
C18	SWP	6	RPM set cancel switch (Right brake pedal)	P-1
C19	SWP	6	Step lamp ON/OFF switch	B-7
C20	YAZAKI	9	AM/FM radio	I-2
C21	Terminal	1	GND (Radio)	C-8
C22	SWP	6	Hydraulic drive fan reverse switch	F-2
C23	SWP	6	Auto grease switch (if equipped)	E-9
C24	SWP	6	Glass heater switch	C-8
C25	KES1	2	Room lamp	E-9
C26	M	1	Left door switch (Room lamp)	F-9
C27	M	6	Front wiper motor	B-7
C28	SWP	6	Rear wiper switch (AJSS specification)	C-8
C29	M	1	Right door switch (Room lamp)	D-9
C30	KES1	2	Resistor (AJSS specification)	P-1
C33	SWP	4	Working lamp switch	D-8
C34	SWP	6	Fog lamp switch (if equipped)	D-9
C35	SWP	6	Warning lamp (Beacon) switch (if equipped)	D-9
C36	M	2	Speaker (Left)	F-9
C37	M	2	Speaker (Right)	E-9
C38	Terminal	1	Rear glass heater	E-9
C39	Terminal	1	Rear glass heater	G-9
C40	M	4	Rear wiper motor	H-1
C41	M	2	Front working lamp (Left)	B-7
C42	M	2	Front working lamp (Right)	B-7
C43	DT2	2	Warning lamp (Beacon) (if equipped)	D-9
C45	M	2	Step lamp	F-9
C46	DT2	6	Intermediate connector (Side wiper harness (if equipped))	C-8
C47	SWP	6	Side wiper switch (if equipped)	
C48	M	4	Side wiper motor (Left) (if equipped)	
C49	M	4	Side wiper motor (Right) (if equipped)	
C50	Terminal	1	GND (Cab)	B-7
C51	Terminal	1	Starting switch terminal B	O-3
C52	Terminal	1	Starting switch terminal BR	O-3
C53	Terminal	1	Starting switch terminal C	O-3
C54	Terminal	1	Starting switch terminal ACC	O-3
C56	KES1	2	Room lamp	B-8
C57	DT2	2	Intermediate connector (Warning lamp (Beacon) (if equipped))	C-8
C58	DT2	2	Outside temperature sensor (if equipped)	P-1
C90	DT2	6	AUX (Cab) harness (if equipped)	E-9
CAN1	DT2	3	Resistor	O-3
CL11	DRC12	70	Intermediate connector (Floor harness – Cab harness)	X-6
CL12	DRC12	24	Intermediate connector (Floor harness – Cab harness)	X-6
CL13	DRC12	24	Intermediate connector (Floor harness – Cab harness)	X-6
CL14	DT2	2	Intermediate connector (Backup lamp) (Steering wheel specification)	X-7
CL16	DT2(Gr)	12	Intermediate connector (Steering column switch) (Steering wheel specification)	O-2
CL17	DT2(B)	12	Intermediate connector (Steering column switch) (Steering wheel specification)	O-2
CL18	DT2	6	Intermediate connector (Steering column switch) (Steering wheel specification)	O-3
COMBI	M	3	Front combination lamp (Right)	A-6
COMBI	M	3	Front combination lamp (Left)	E-1
D01	Terminal	1	Battery relay (Right)	L-7
D02	Terminal	1	Battery relay (Right)	L-8
D03	Terminal	1	Battery relay (Left)	M-7

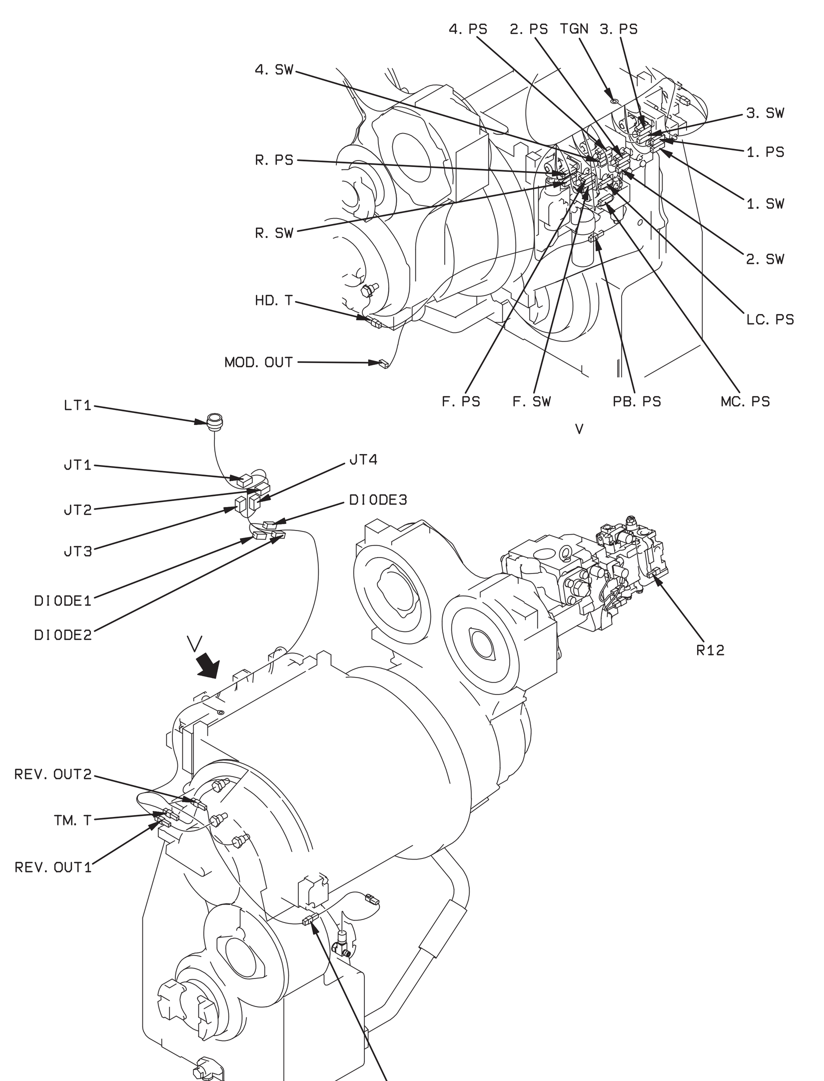
Connector No.	Model	Number of pins	Component name	Address of stereogram
D04	Terminal	1	Battery relay (Left)	L-9
D05	DT2	2	Battery electrolyte level sensor (for VHMS, if equipped)	L-7
D06	Terminal	1	Heater relay	M-9
D07	Terminal	1	Heater relay	M-9
D08	Terminal	1	Heater relay	M-9
D09	DT2	3	Step lamp switch	L-8
D10	Terminal	1	GND	J-9
D11	Terminal	1	Battery relay (Right)	L-8
D12	Terminal	1	Battery relay (Right)	L-7
D13	Terminal	1	Battery relay (Left)	L-9
D14	Terminal	1	Battery relay (Left)	N-7
D15	Terminal	1	Battery	M-7
D16	Terminal	1	Battery	K-4
D17	Terminal	1	Battery	H-9
D18	Terminal	1	Battery	G-9
D19	Terminal	1	Disconnection switch (if equipped)	H-9
D20	Terminal	1	Disconnection switch (if equipped)	H-9
DIODE1	DT2	2	Diode	AI-5
DIODE2	DT2	2	Diode	AI-5
DIODE3	DT2	2	Diode	AK-6
DLF	BENDIX	5	Download connector	P-7
DR1	DT2	6	Intermediate connector (Step lamp switch)	K-6
E01	DT2	2	Starting motor	AE-9
E02	DT2	2	Starting motor	AD-8
E03	Terminal	1	Alternator terminal R	AD-2
E04	Terminal	1	Alternator terminal B	AF-1
E05	Terminal	1	Alternator terminal E	AD-3
E13	Terminal	1	Heater	AD-3
E14	DT2	2	Engine oil level sensor	AF-1
E15	DT2	2	Dust indicator	AG-1
E16	DT2	2	Air conditioner compressor	AD-1
E17	DT2	2	Diode	AH-4
E18	DRC26	50	Engine controller	AH-3
E19	DTP	4	Engine controller	AH-2
E20	Terminal	1	Starting motor terminal B	AD-5
E21	DT2	3	Resistor	AH-2
E22	Terminal	1	GND (Engine unit)	AG-2
EGR	DT-T	2	EGR valve solenoid	AR-4
ENG	DRC	60	Engine controller	AV-2
ER1	DT2(B)	12	Intermediate connector (Engine controller)	AH-8
ER2	DT2(Gr)	12	Intermediate connector (Engine controller)	AH-7
ER3	L	2	Intermediate connector (Heater relay)	AF-5
ER6	Terminal	1	GND (Alternator)	AE-5
F.PS	DT2	2	F ECMV solenoid	AL-6
F.SW	DT1	2	F ECMV fill switch	AM-6
F01	M	6	Intermediate connector (Combination lamp (Right), headlamp)	A-4
F02	M	6	Intermediate connector (Combination lamp (Left), headlamp)	A-2
F03	AMP 090	2	Horn Lo	B-6
F04	AMP 090	2	Horn Hi	B-6
F07	DT2	2	Lift arm raise EPC solenoid	A-1
F08	DT2	2	Lift arm lower EPC solenoid	C-1
F09	DT2	2	Bucket tilt EPC solenoid	C-1
F10	DT2	2	Bucket dump EPC solenoid	A-1
F11	DT2	3	Bucket level positioner proximity switch	A-3
F12	DT2	3	Bucket tilt detecting proximity switch	A-3
F13	DT2	3	Lift arm angle sensor	E-1
F14	DT2	3	Lift arm bottom pressure sensor (Load meter specification)	C-1
F15	DT2	3	Lift arm rod pressure sensor (Load meter specification)	D-1
F16	DT2	3	Loader pump pressure sensor	B-1
F20	Terminal	1	GND (Front frame)	A-4
F21	DT2	4	Intermediate connector	A-4
F22	DT2	2	3rd valve (attachment) EXT EPC solenoid (if equipped)	
F23	DT2	2	3rd valve (attachment) RET EPC solenoid (if equipped)	
F24	DT2	2	ECSS solenoid (if equipped)	A-1
F25	DT2	2	Intermediate connector (Front working lamp (if equipped))	B-1
F26	DT2	2	Intermediate connector (Fog lamp (if equipped))	A-3
FF01	M	2	Fog lamp (Right) (if equipped)	
FF02	M	2	Fog lamp (Left) (if equipped)	
FL6	DT2	2	Side working lamp (if equipped)	X-3
FL7	DT2	2	Side working lamp (if equipped)	W-3
FL11	DRC12	40	Intermediate connector (Floor frame – Front frame)	V-2
FW01	M	2	Front working lamp (Right) (if equipped)	
FW02	M	2	Front working lamp (Left) (if equipped)	
G	DENSO	3	Backup speed sensor	AV-4
G01	M	6	Rear combination lamp (Right)	I-9
G02	M	6	Rear combination lamp (Left)	K-7
G03	M	2	Rear working lamp (Right)	I-9
G04	M	2	Rear working lamp (Left)	K-8
G05	DT2	2	Coolant level sensor	K-8
G06	DT2	2	Backup buzzer	K-6
G07	DT2	2	Fan reverse solenoid	J-9
GR1	DT2(B)	12	Intermediate connector (Radiator guard harness)	K-6
HD.T	DT2	2	Hydraulic oil temperature sensor	AK-7
HD1	YAZAKI	2	Diode (F washer)	Y-6
HD2	YAZAKI	2	Diode (R washer)	Y-5
HD3	YAZAKI	2	Diode (S washer)	Z-5
HD4	YAZAKI	3	Diode (M/C cut-off lift arm BBC cut-off solenoid)	Z-4
HEAD	M	3	Headlamp (Right)	B-6
HEAD	M	3	Headlamp (Left)	A-3
INJ	DT-T	12	Fuel injector	AV-4
J1939	DT-T	3	—	AS-5
JB1	—	6	Junction connector	H-2
JB1	—	14	Junction connector	AS-5
JB2	—	19	Junction connector	AT-5
JBB1	—	6	Junction connector	L-9
JBB2	—	6	Junction connector	L-8
JE1	—	6	Junction connector	AD-7
JE1	—	6	Junction connector	J-9
JE2	—	6	Junction connector	AD-7
JE2	—	6	Junction connector	K-8
JE3	—	6	Junction connector	AD-6
JE3	—	6	Junction connector	K-7
JE4	—	6	Junction connector	K-9
JE5	—	6	Junction connector	K-7
JF1	—	6	Junction connector	A-2
JF2	—	6	Junction connector	D-1
JF3	—	6	Junction connector	A-5

Connector No.	Model	Number of pins	Component name	Address of stereogram
JF4	—	6	Junction connector	A-3
JF5	—	6	Junction connector	A-5
JF6	—	6	Junction connector	A-5
JF7	—	6	Junction connector	A-4
JF8	—	6	Junction connector	A-3
JF9	—	6	Junction connector	A-5
JF11	—	6	Junction connector (if equipped)	
JF12	—	6	Junction connector (if equipped)	
JF13	—	6	Junction connector	
JF14	—	6	Junction connector (if equipped)	
JR1	—	6	Junction connector (if equipped)	AF-6
JR2	—	6	Junction connector	J-3
JR3	—	6	Junction connector	AF-5
JR4	—	6	Junction connector	K-5
JT1	DT2(B)	8	Junction connector	AI-6
JT2	DT2	6	Junction connector	AI-5
JT3	DT2	6	Junction connector	AI-5
JT4	DT2	6	Junction connector	AK-6
JV1	—	6	Junction connector	N-4
JV2	—	6	Junction connector	L-4
JV3	—	6	Junction connector	N-4
JV4	—	6	Junction connector	L-4
KOM	DT2(Gr)	12	Data download	U-9
L01	Terminal	1	GND (Floor frame)	W-3
L02	DRC26	24	Transmission controller	U-9
L02	SWP	6	Lighting switch, Dimmer switch (Steering wheel specification)	
L03	DRC26	40	Transmission controller	U-9
L03	SWP	6	Turn and Hazard switch (Steering wheel specification)	
L04	DRC26	40	Transmission controller	V-8
L04	SWP	14	Shift switch (Steering wheel specification)	
L05	DRC26	24	Work equipment controller	V-8
L05	DT2	2	Steering wheel horn switch (Steering wheel specification)	
L06	DRC26	40	Work equipment controller	V-8
L07	DRC26	40	Work equipment controller	V-8
L08	DT2(Gr)	12	Intermediate connector (VHMS harness)	W-8
L10	M	6	Intermediate connector (Printer harness)	U-9
L11	AMP	2	Air suspension seat	V-2
L12	DT2	3	Frame angle potentiometer (AJSS specification)	U-2
L13	DT2	2	Steering lock switch (AJSS specification)	V-2
L16	DT2	2	Stop lamp switch	S-1
L17	DT2(B)	12	Intermediate connector (Steering wheel specification)	
L17	M	4	DC24V/DC12V converter	AA-5
L17	DT2(B)	6	Accelerator pedal	P-1
L18	DT2	6	Intermediate connector (Steering wheel specification)	
L18	YAZAKI	2	DC12V outlet	P-7
L19	KES1	4	Flasher unit	AB-7
L20	M	2	Alarm buzzer	AB-6
L21	S	10	Intermediate connector (Wiper) (Steering wheel specification)	
L21	KES1	6	Interval wiper timer	AB-6
L22	M	2	Resistor	AA-4
L23	SUMITOMO	16	Emergency parking release switch Modulation clutch direct joint switch	U-9
L25	M	1	Option connector	AB-7
L26	M	1	Option connector	AB-6
L45	D-sub	25	Printer (if equipped)	
L46	HOSHIDEN	4	Printer (if equipped)	
L101	SHINAGAWA	6	Relay No.1 Backup lamp	AA-3
L102	SHINAGAWA	6	Relay No.2 Stop lamp	AA-3
L103	SHINAGAWA	5	Relay No.3 Neutral safety	AA-3
L104	SHINAGAWA	5	Relay No.4 AJSS neutral safety	AA-2
L105	SHINAGAWA	5	Relay No.5 Parking brake safety	AA-2
L106	SHINAGAWA	5	Relay No.6 Preheating	Z-3
L107	SHINAGAWA	5	Relay No.7 Dust indicator	Z-3
L108	SHINAGAWA	6	Relay No.8 S working lamp	AA-3
L109	SHINAGAWA	6	Relay No.9 F working lamp	AA-2
L110	SHINAGAWA	6	Relay No.10 R working lamp	AA-2
L111	SHINAGAWA	5	Relay No.11 R glass heater	Z-3
L112	SHINAGAWA	5	Relay No.12 Start neutral hold	Z-3
L113	SHINAGAWA	5	Relay No.13 Hazard	Z-2
L114	SHINAGAWA	6	Relay No. 14 Turn signal (AJSS specification)	AA-1
L115	SHINAGAWA	5	Relay No.15 Small lamp	AA-2
L116	SHINAGAWA	5	Relay No.16 Horn	Z-2
L117	SHINAGAWA	5	Relay No.17 Fan motor	Z-2
L118	SHINAGAWA	5	Relay No.18 Dimmer	Z-2
L119	SHINAGAWA	6	Relay No.19 Fog lamp	Z-2
L120	SHINAGAWA	5	Relay No.20 S wiper	Z-1
L121	SHINAGAWA	5	Relay No. 21 Right turn (AJSS specification)	T-9
L122	SHINAGAWA	5	Relay No. 22 Left turn (AJSS specification)	T-1
L123	SHINAGAWA	6	Relay No.23 AUX (Cab) (if equipped)	T-1
L141	SHINAGAWA	5	Printer power source relay (if equipped)	
L142	YAZAKI	2	Diode (if equipped)	
L143	YAZAKI	2	Diode (if equipped)	
L144	YAZAKI	2	Diode (if equipped)	
L145	YAZAKI	2	Diode (if equipped)	
LC.PS	DT2	2	Torque converter lockup solenoid	AN-7
LR1	DTHD4	1	Intermediate connector	X-5
LR2	L	2	Intermediate connector	X-3
LR3	L	2	Intermediate connector	X-4
LR4	L	2	Intermediate connector	X-5
LR5	DT2	6	Intermediate connector	X-5
LR7	DT2(G)	12	Intermediate connector	X-4
LR11	DRC18	40	Intermediate connector	X-4
LS1	S(L)	12	Intermediate connector	Q-8
LS2	S(W)	16	Intermediate connector	Q-7
LS3	S(L)	16	Intermediate connector	Q-7
LS6	DTM	12	Intermediate connector (AJSS specification)	V-2
LS7	DTM	2	Intermediate connector (AJSS specification)	U-2
LT1	HD30	31	Intermediate connector	AI-6
MC.PS	DT2	2	Modulation clutch solenoid	AN-6
MOD OUT	DT2	2	Modulation clutch output speed sensor	AK-7
NE	FRAMATONE	3	Ne speed sensor	AV-3
P1	DT2	4	Lift arm and Bucket EPC lever	R-9
P2	DT2	4	Lift arm and Bucket EPC lever	S-9
PAMB	FRAMATONE	3	Atmospheric pressure sensor	AV-3
PB.PS	DT2	2	Parking brake solenoid	AM-6
PB.SW	DT2	2	Parking brake indicator switch	AL-1
PCV1	SUMITOMO	2	Supply pump	AV-4

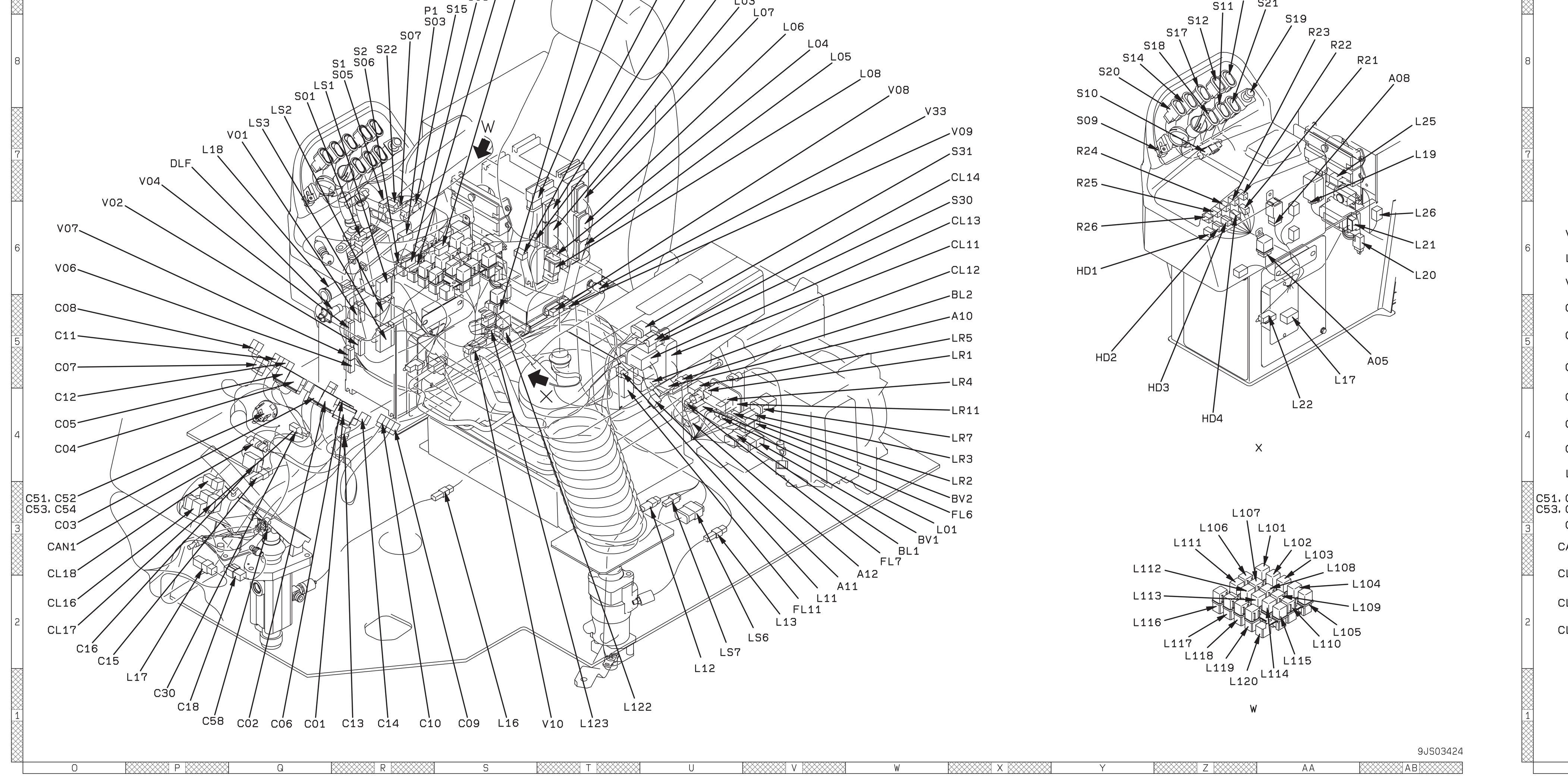
Connector No.	Model	Number of pins	Component name	Address of stereogram
PCV2	SUMITOMO	2	Supply pump	AV-3
PFUEL	AMP	3	Common rail pressure sensor	AT-5
PIM	SUMITOMO	3	Charge pressure (boost pressure) sensor	AU-6
POIL	FRAMATONE	3	Engine oil pressure sensor	AU-1
R.PS	DT2	2	R (Reverse) solenoid	AK-8
R.SW	DT	2	R (Reverse) fill switch	AK-8
R01	Terminal	1	Circuit breaker CBF1	N-9
R02	Terminal	1	Circuit breaker CBF1	N-9
R03	Terminal	1	Circuit breaker CBF2	N-8
R04	Terminal	1	Circuit breaker CBF2	N-8
R05	Terminal	1	Circuit breaker CBF3	N-8
R06	Terminal	1	Circuit breaker CBF3	N-8
R07	Terminal	1	Slow-blow fuse SBF1	M-9
R08	Terminal	1	Slow-blow fuse SBF1	M-9
R09	Terminal	1	GND (Rear frame)	J-3
R10	Terminal	1	GND (Rear frame)	K-5
R12	DT2	2	Fan pump EPC solenoid	AN-4
R13	DT2	2	Torque converter oil temperature sensor	K-6
R14	Terminal	1	Circuit breaker CBF4	N-9
R15	Terminal	1	Circuit breaker CBF4	N-9
R16	DT2	2	Fuel level sensor	I-2
R17	DT2	12	Rear brake oil temperature sensor	H-2
R21	YAZAKI	3	Diode	AB-8
R22	YAZAKI	3	Diode	AA-8
R23	YAZAKI	2	Diode	AA-8
R24	YAZAKI	2	Diode	Y-7
R25	YAZAKI	2	Diode	Y-7
R26	YAZAKI	2	Diode	Y-6
R28	DT2	2	Diode	K-5
R38	DT2	6	Auto grease controller (if equipped)	
RES	DT-T	2	Resistor	AU-1
REV OUT1	DT2	2	Speed sensor 1	AI-3
REV OUT2	DT2	2	Speed sensor 2	AI-3
RT1	DT2	12	Intermediate connector	G-1
S01	DT2	2	Lift arm neutral lock switch	Q-8
S02	DT2	4	Lift arm and Bucket EPC lever	S-9
S03	DT2	4	Lift arm and Bucket EPC lever	R-8
S04	DT2	2	Lift arm and Bucket EPC lever	S-9
S05	DT2	2	Lift arm and Bucket EPC lever	R-8
S06	DT2	2	Lift arm and Bucket EPC lever	R-8
S07	DT2	4	Lift arm lever kickdown and hold switch	R-8
S08	DT2	4	Bucket lever switch (Load meter specification)	S-9
S09	X	3	Variable traction control	Y-7
S1	DT2	2	Lift arm and Bucket EPC lever	R-8
S2	DT2	2	Lift arm and Bucket EPC lever	R-8
S3	DT2	2	Lift arm and Bucket EPC lever	S-9
S10	DT2	4	Auto shift switch	Y-8
S11	SWP	6	Engine power mode switch	Z-9
S12	SWP	6	RPM set ON/OFF switch	Z-8
S13	SWP	6	RPM set ACC/DEC switch	Z-9
S14	SWP	6	Lift arm remote positioner set switch	Y-8
S15	SWP	6	Intermediate connector	S-9
S16	DT2	4	3-spool valve (attachment) EPC lever (if equipped)	
S17	SWP	6	Bucket remote positioner set switch	Z-8
S18	SWP	6	Torque converter lockup switch	Z-8
S19	YAZAKI	2	Cigarette lighter	AA-8
S20	SWP	6	ECSS switch	Y-8
S21	SWP	6	AUTO DIG switch	AA-9
S22	SWP	6	Turn signal switch (AJSS specification)	R-8
S30	DT2	3	AJSS lever angle sensor (AJSS specification)	X-6
S31	DTM	12	Joystick lever switch (AJSS specification)	X-7
SBP	DT-T	4	Not used	AR-2
SEGR	DT-T	4	EGR valve lift sensor	AS-4
T01	DT2	2	Pump EPC solenoid	H-1
T02	DT2	2	Modulation clutch cut-off solenoid	F-2
T03	DT2	3	Modulation clutch pressure switch	F-1
T04	DT2	2	Emergency steering drive switch	F-2
TFUEL	PACKARD	2	Fuel temperature sensor	AT-1
TGN	Terminal	1	GND (Transmission body)	AM-9
TIM	PACKARD	2	Charge temperature (boost temperature) sensor	AU-6
TM.T	DT2	2	Transmission oil temperature sensor	AI-3
TOIL	PACKARD	2	Engine oil temperature sensor	AV-2
TWTR	PACKARD	2	Coolant temperature sensor	AT-5
V01	AMP070	20	VHMS controller	Q-7
V02	AMP070	18	VHMS controller	O-6
V04	AMP070	18	VHMS controller	P-7
V06	AMP070	14	VHMS controller	O-6
V07	AMP070	10	VHMS controller	O-6
V08	AMP070	14	ORBCOM unit	W-8
V09	AMP070	10	ORBCOM unit	X-7
V10	DT2	4	Intermediate connector	T-1
V11	DT2	3	Exhaust gas temperature sensor amplifier	M-5
V12	DT2	3	Exhaust gas temperature sensor amplifier	M-5
V13	DT2	3	Rear brake pressure sensor	M-1
V14	DT2	3	Front brake pressure sensor	L-2
V15	Plug connector	1	VHMS start indicator (12V)	M-1
V16	Plug connector	1	VHMS start indicator (12V)	N-3
V17	Terminal	1	VHMS starting switch	N-2
V18	Terminal	1	VHMS starting switch	N-2
V19	Terminal	1	VHMS starting switch	N-2
V20	Terminal	1	VHMS starting switch	N-2
V21	DT2(B)	6	Intermediate connector	I-9
V22	G	1	VHMS operation indicator (24V)	I-9
V23	DT2	3	Steering pressure sensor	L-5
V25	DT2	3	Blow-by pressure sensor	I-3
V27	DT2	2	Exhaust gas temperature sensor amplifier	G-2
V28	DT2	2	Exhaust gas temperature sensor amplifier	F-2
V29	DT2	2	Exhaust gas temperature sensor (Right)	J-3
V30	DT2	2	Exhaust gas temperature sensor (Left)	J-3
V33	Plug connector	1	ORBCOM unit	W-7
V34	Plug connector	1	Antenna cable	B-6
V35	Plug connector	1	Antenna	B-7
VDL	BENDIX	5	Download connector	N-3



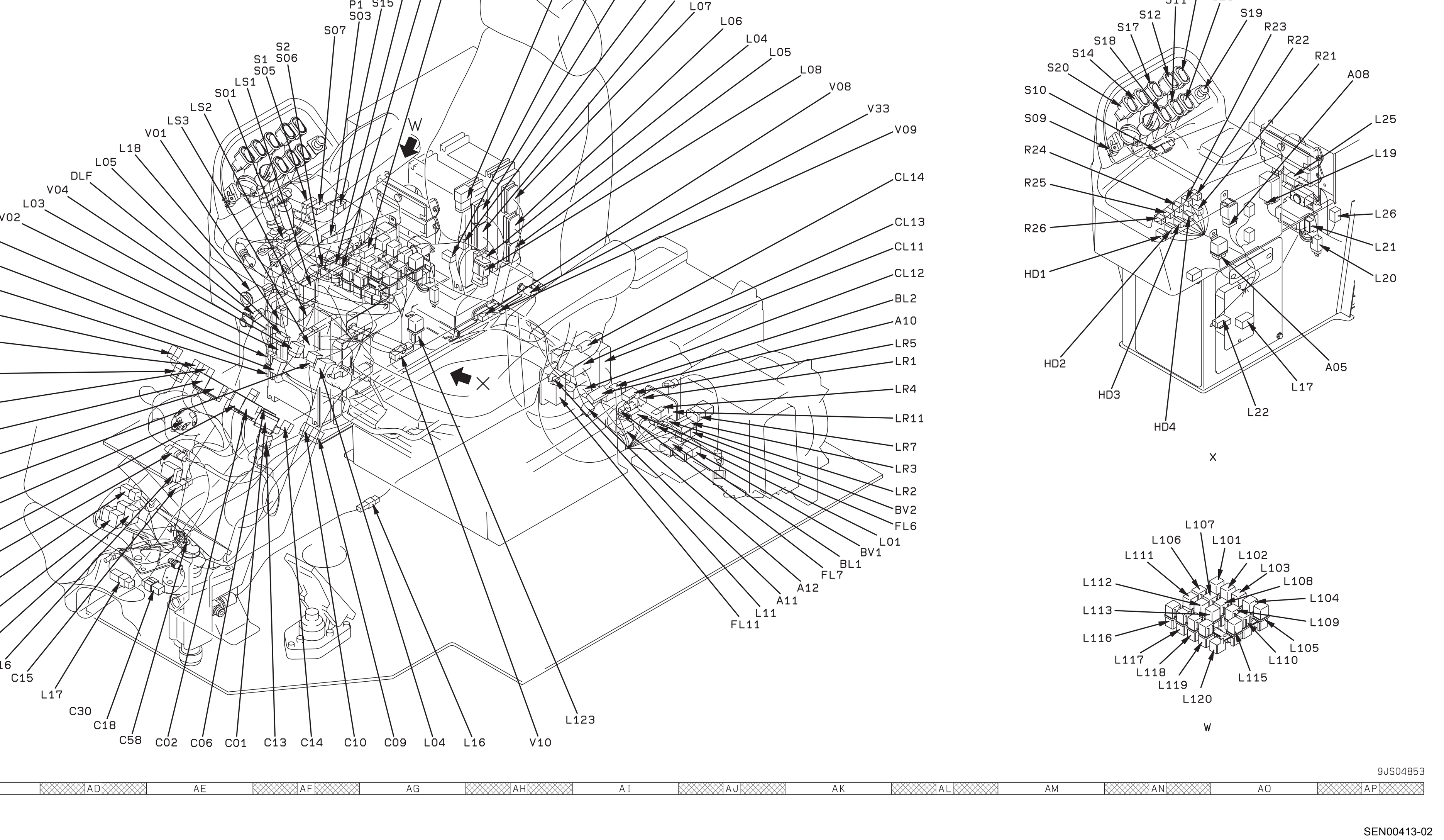




★ AJSS specification



★ Steering wheel specification



WA600-6 Wheel loader

Form No. SEN00413-02

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Printed in Japan 11-06 (01)