VEBM440101

SHOP MANUAL

WA380-6

MACHINE MODEL	SERIAL NUMBER
WA380-6	**H60051 and up**

- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require. Materials and specifications are subject to change without notice.
- WA380-6 mounts the SAA6D107E-1 engine.

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WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 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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WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 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.

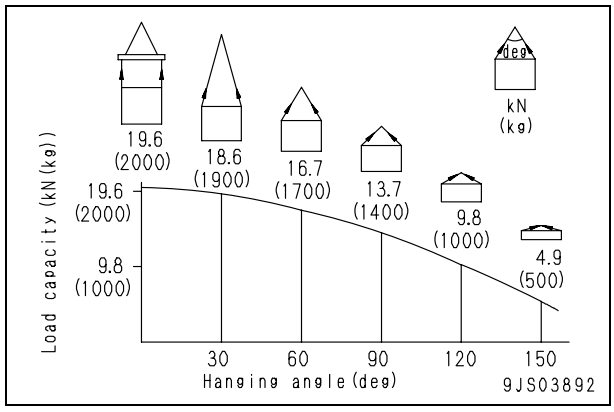
3) When disassembling or assembling, support the machine with blocks, jacks, or stands before starting work.
4) Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off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

3. Precautions during work

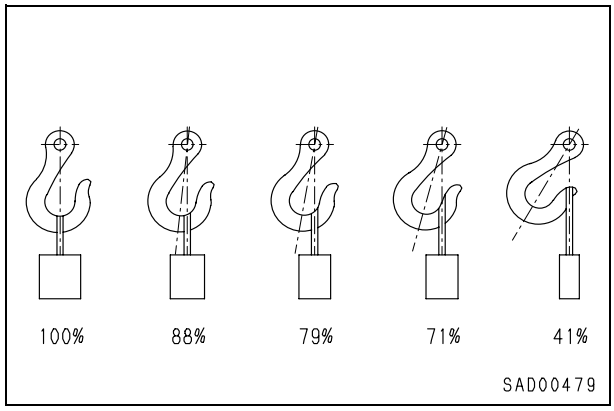
1) Before disconnecting or removing components of the oil, water, or air circuits, first release the pressure completely from the circuit. When removing the oil filler cap, a drain plug, or an oil pressure pickup plug, loosen it slowly to prevent the oil from spurting out.
2) The coolant and oil in the 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

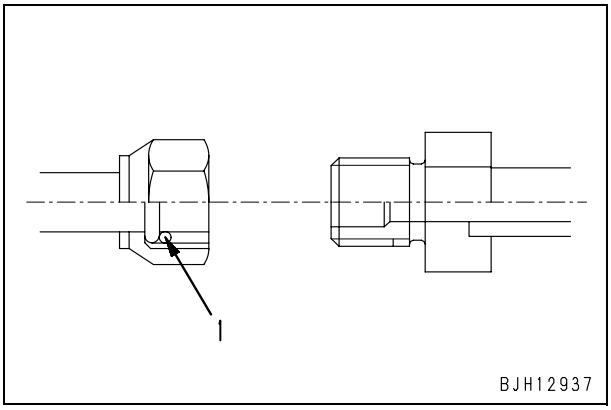
1] When installing the air conditioner circuit hoses and tubes, take care that dirt, dust, water, etc. will not enter them.

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:

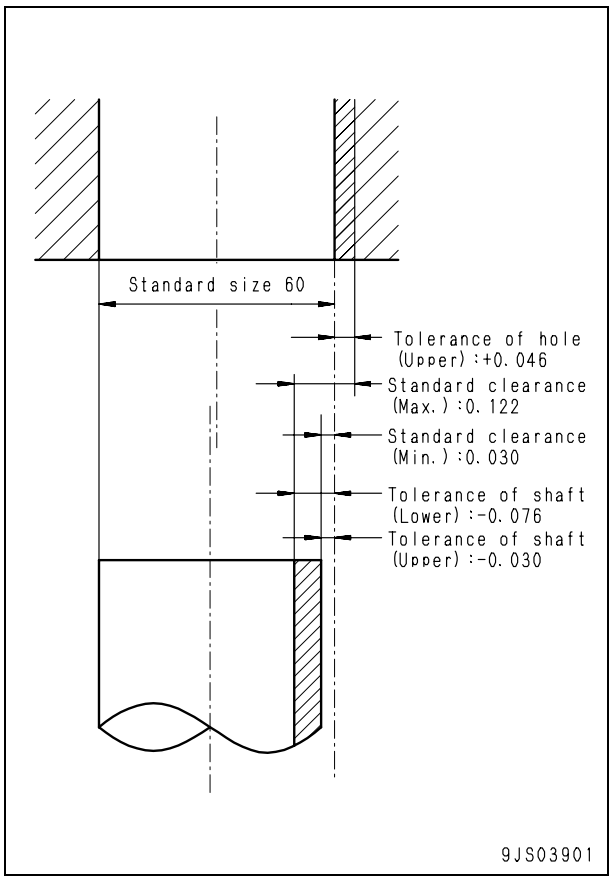
Standard size	Tolerance
120	–0.022 –0.126

★ 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.

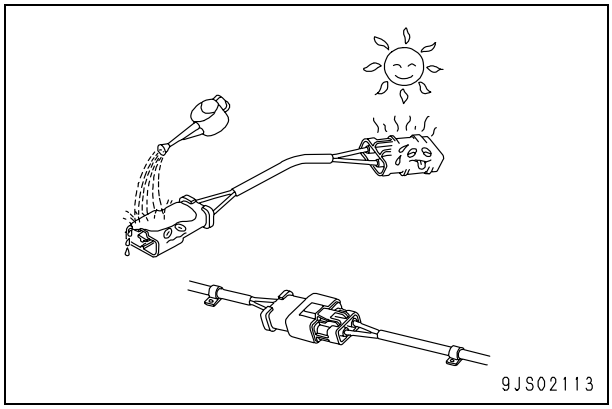
6. Interference limit

- 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

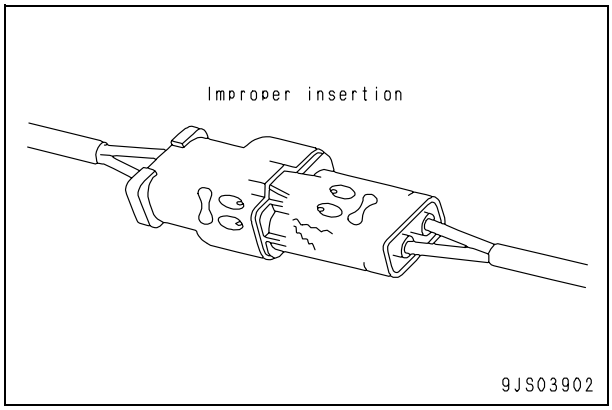
Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protectors or tubes used for protecting the wiring.

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

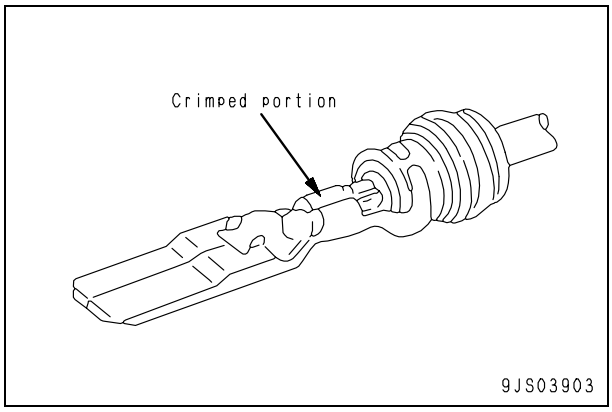
1) Defective contact of connectors (defective contact between male and female)

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.

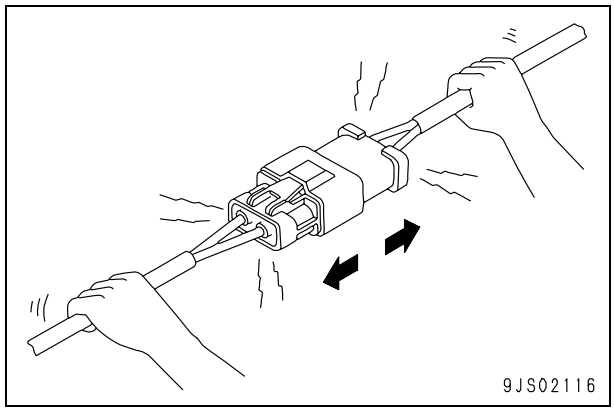


2) Defective crimping or soldering of connectors

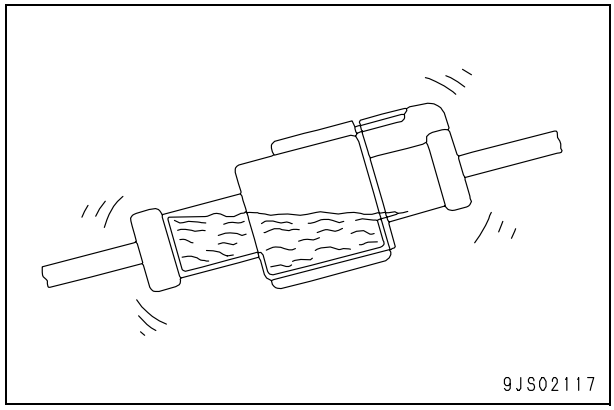
The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.



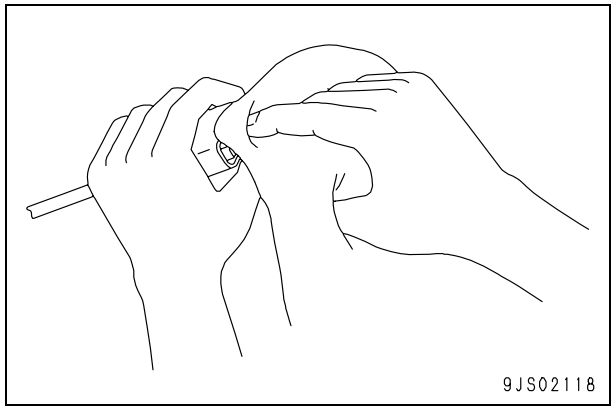
3) Disconnections in wiring
If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.



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.



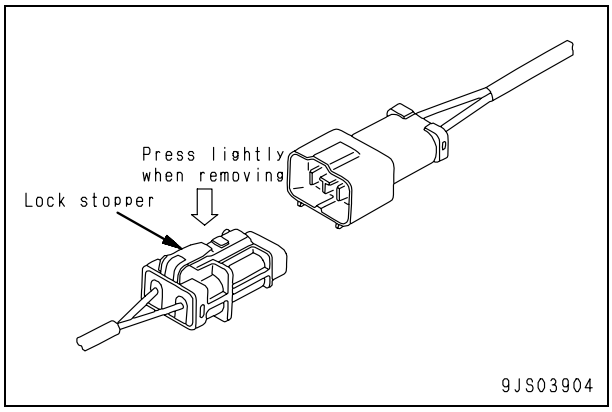
5) Oil or dirt stuck to connector
If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact. If there is oil or grease stuck to the connector, wipe it off 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

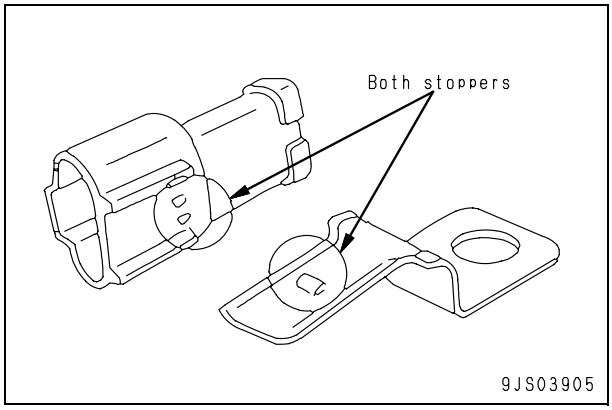
1) Disconnecting connectors

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.

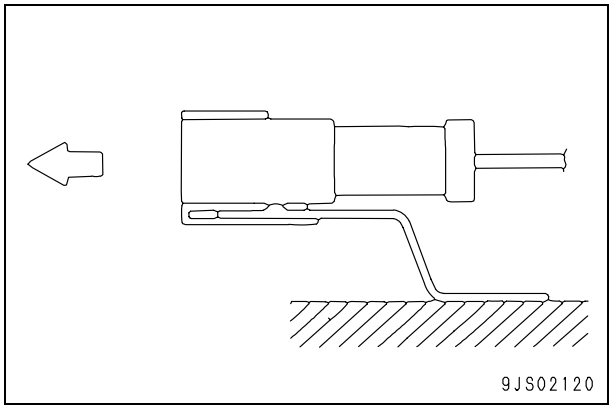


2] When removing from clips

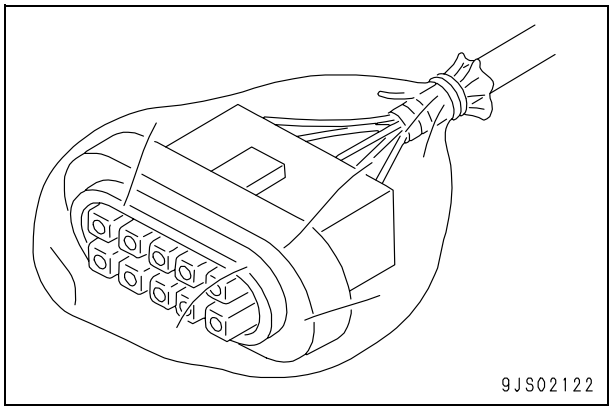
- Both of the connector and clip have stoppers, which are engaged with each other when the connector is installed.



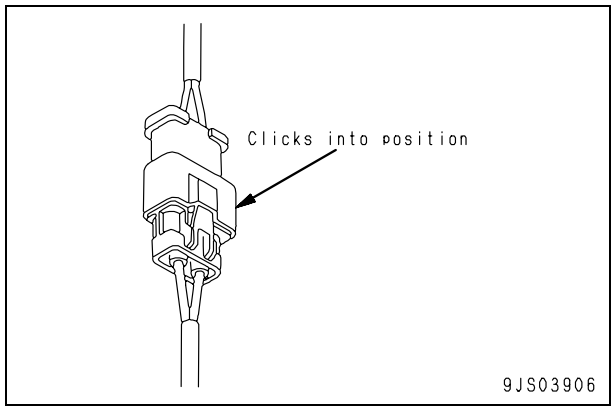
- When removing a connector from a clip, pull the connector in a parallel direction to the clip for removing stoppers.
★ If the connector is twisted up and down or to the left or right, the housing may break.

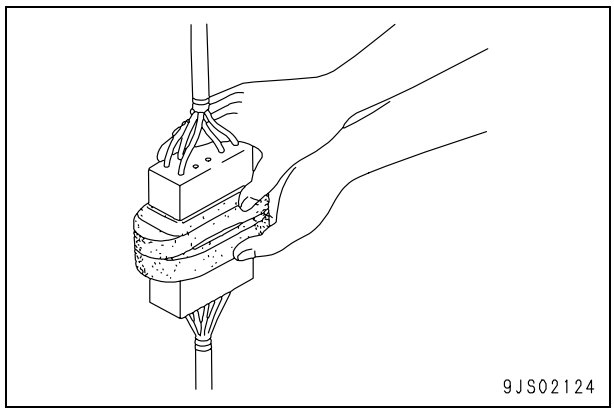


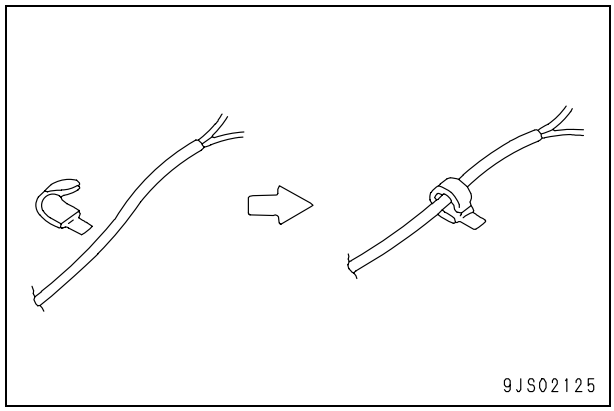
3] Action to take after removing connectors
After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.
★ If the machine is left disassembled for a long time, it is particularly easy for improper contact to occur, so always cover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

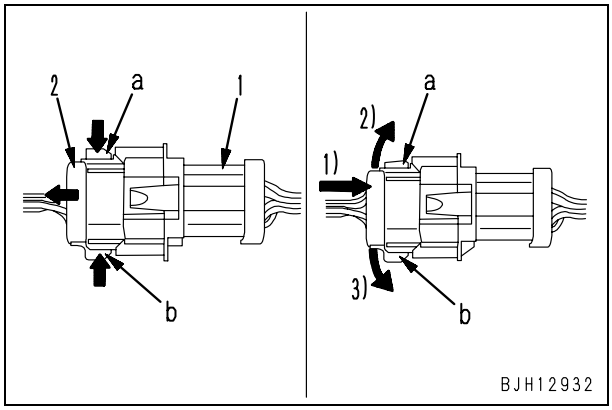




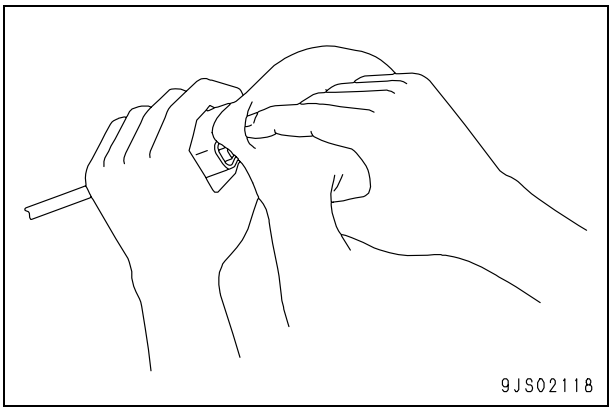


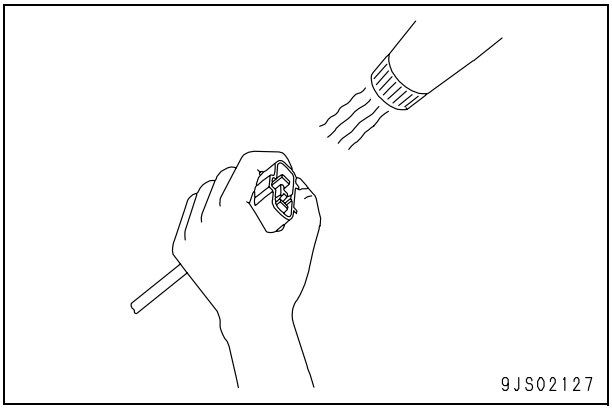
3) Heavy duty wire connector (DT 8-pole, 12-pole)
Disconnection (Left of figure)
While pressing both sides of locks (a) and (b), pull out female connector (2).
Connection (Right of figure)
1] Push in female connector (2) horizontally until the lock clicks.
Arrow: 1)
2] Since locks (a) and (b) may not 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

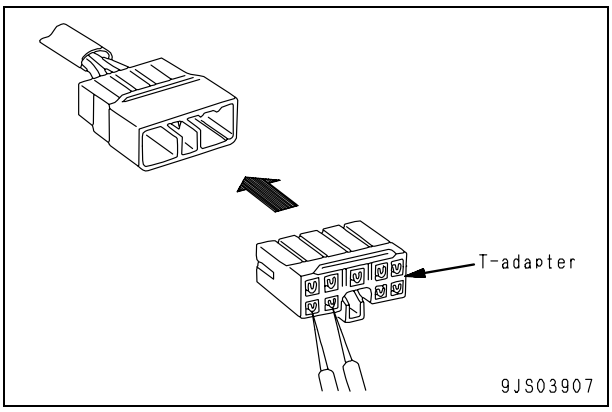
- Disconnection
- Connection (Example of incomplete setting of (a))



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.

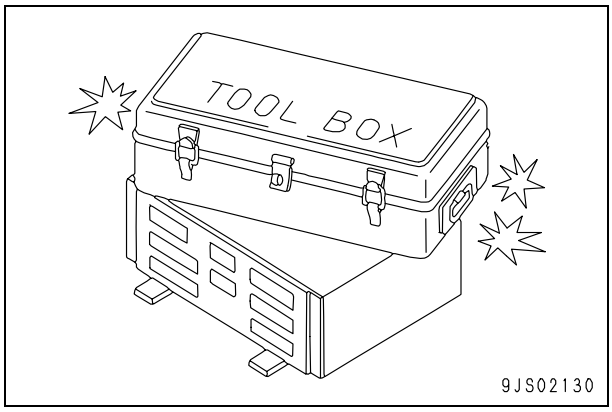


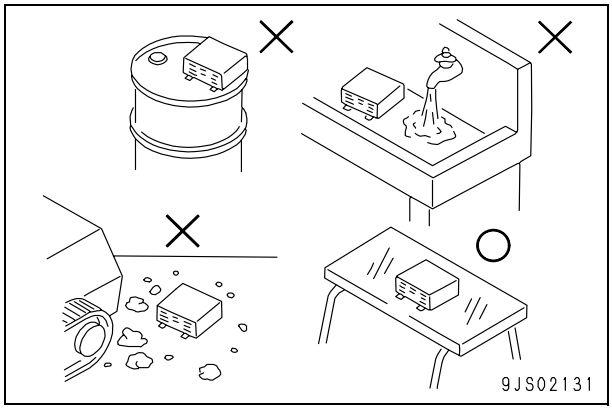




4. Handling controller

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

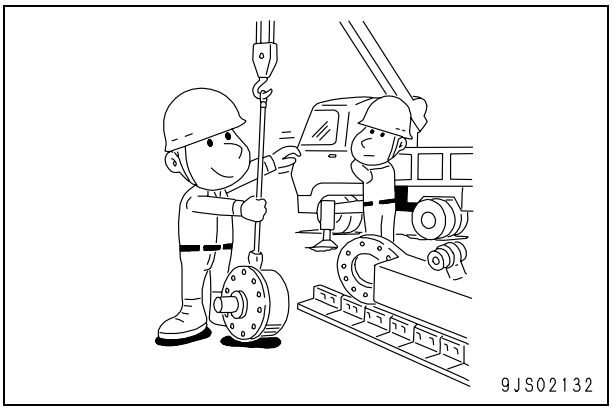
With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

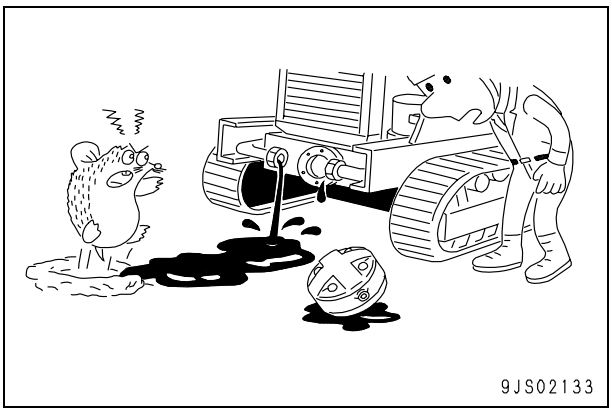
1. **Be careful of the operating environment.**
   Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

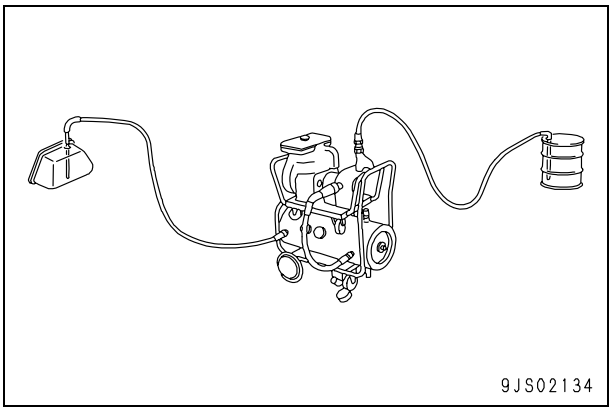
2. **Disassembly and maintenance work in the field**
   If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to check the performance after repairs, so it is desirable to use unit exchange. Disassembly 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.





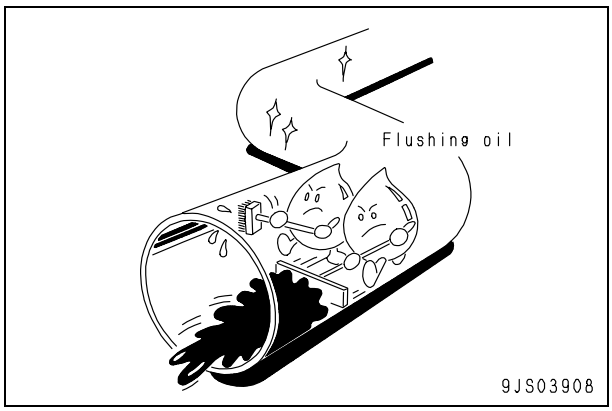


5. Change hydraulic oil when the temperature is high

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.

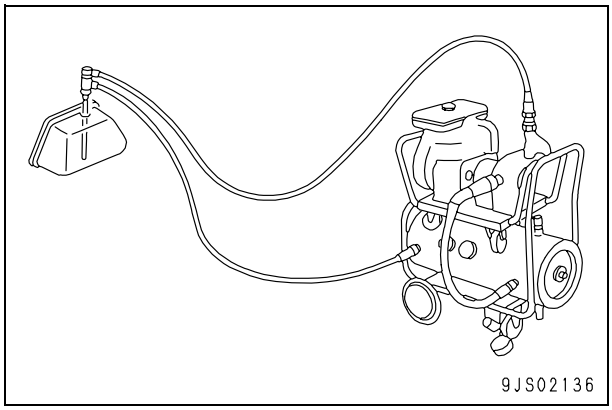
6. Flushing operations

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 ✕) 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)

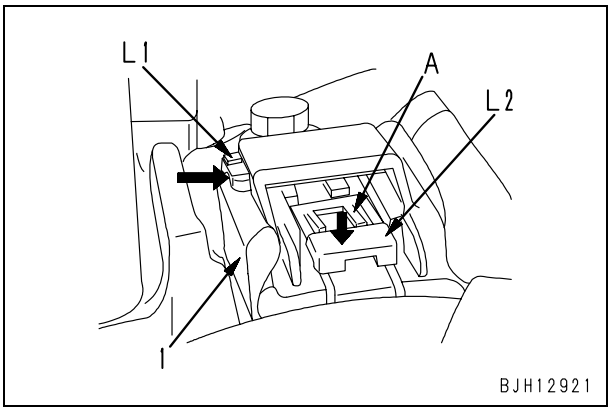
- 107 – 170, 12V140 engines
  - Various pressure sensors and NE speed sensor

  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.



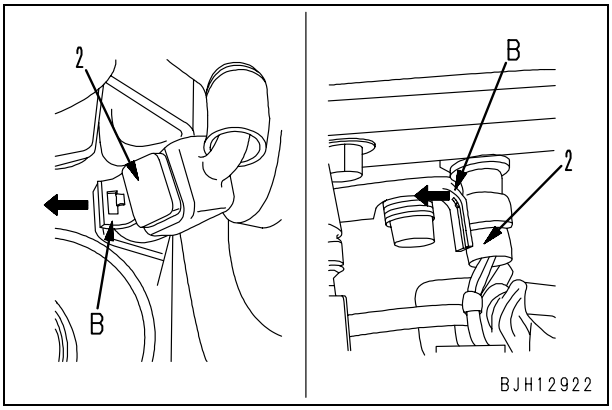
2. Pull lock type (PACKARD-2)

- 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.



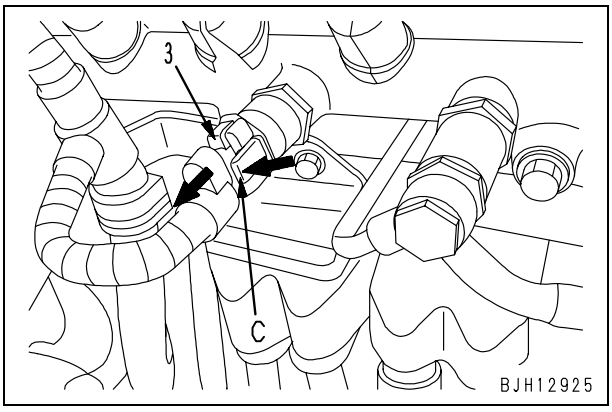
3. Push lock type

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

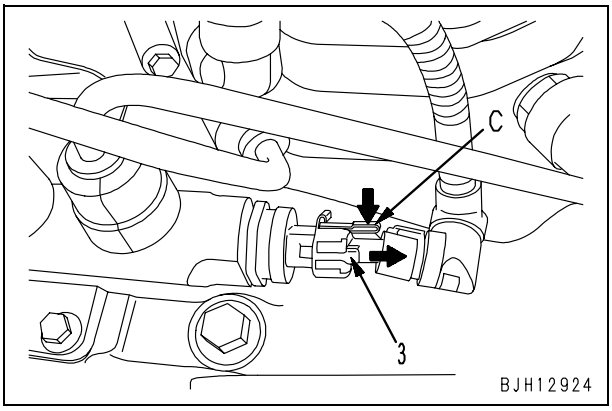
Disconnect connector (3) according to the following procedure.

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

- 114 engine

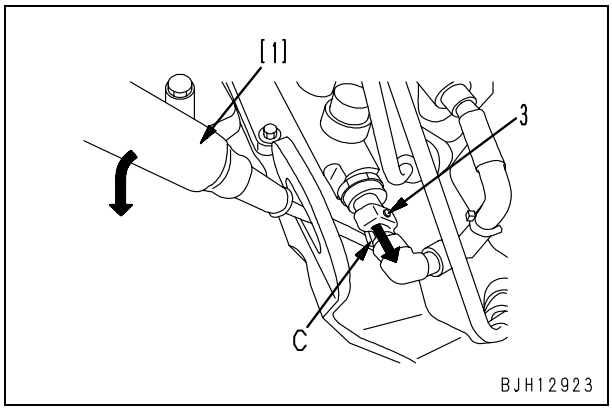


- 107 engine



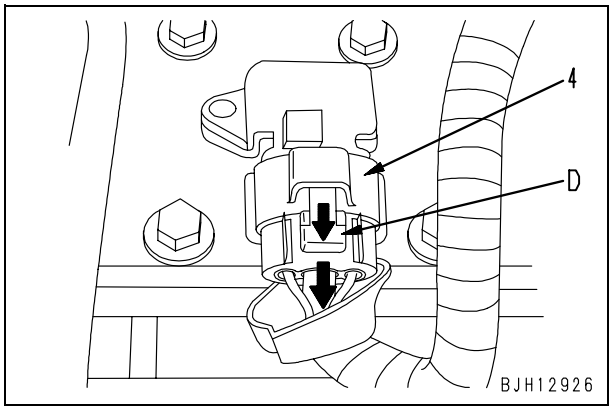
★ If the lock is on the underside, use flat-head screwdriver [1] since you cannot insert your fingers.

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**)

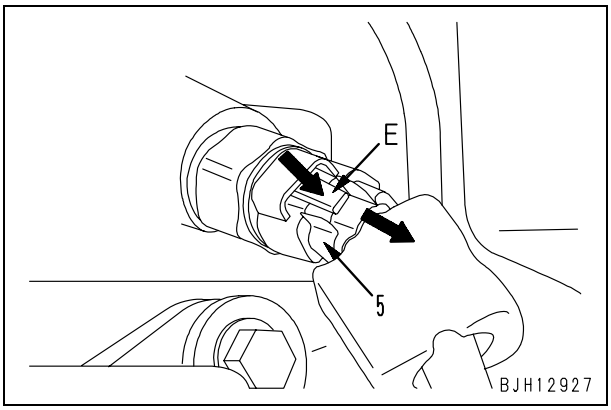
3) While pressing lock (D), pull out connector (4) in the direction of the arrow.



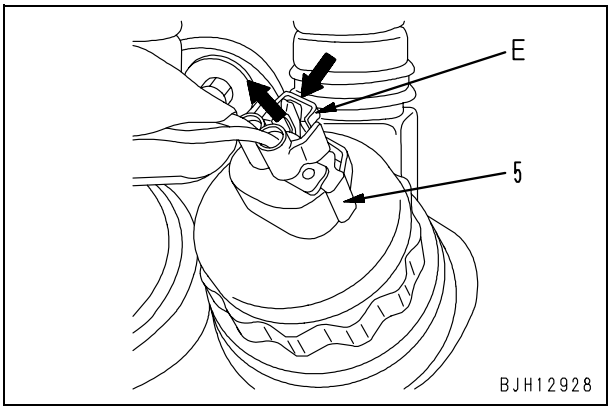
- 125 – 170, 12V140 engine

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**)

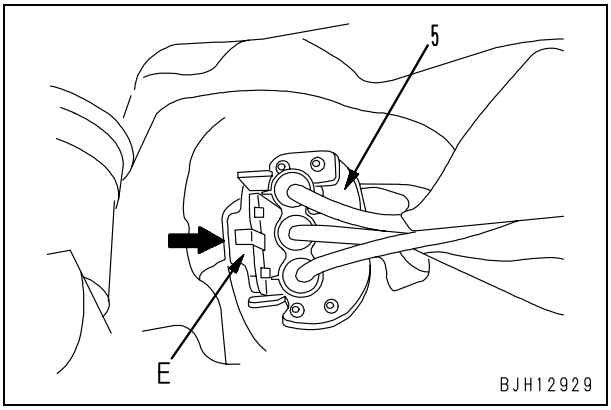


Example)
Injection pressure control valve of fuel supply pump: PCV (**SUMITOMO-2**)



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

★ Pull the connector straight up.



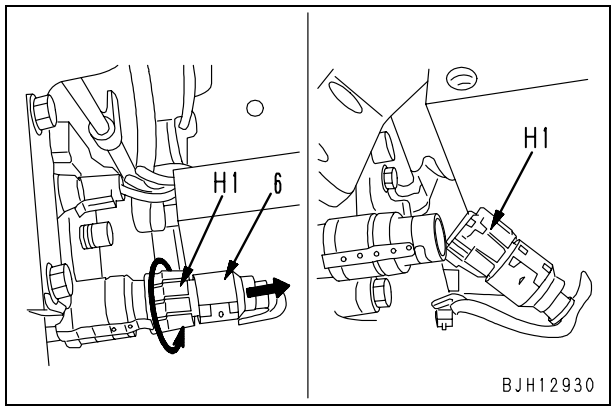
4. Turn-housing type (Round green connector)

- 140 engine

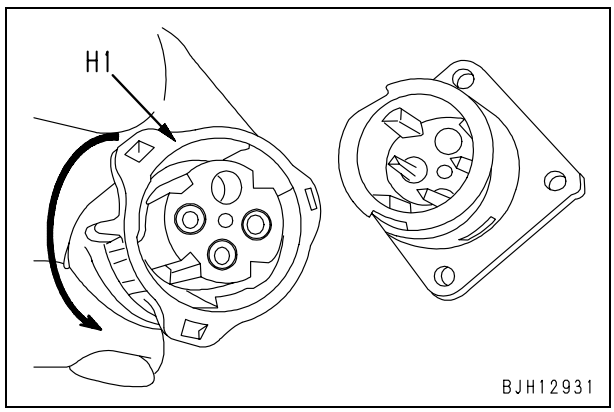
Example)
Intake air pressure sensor in intake manifold (CANNON-04): PIM etc.

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.



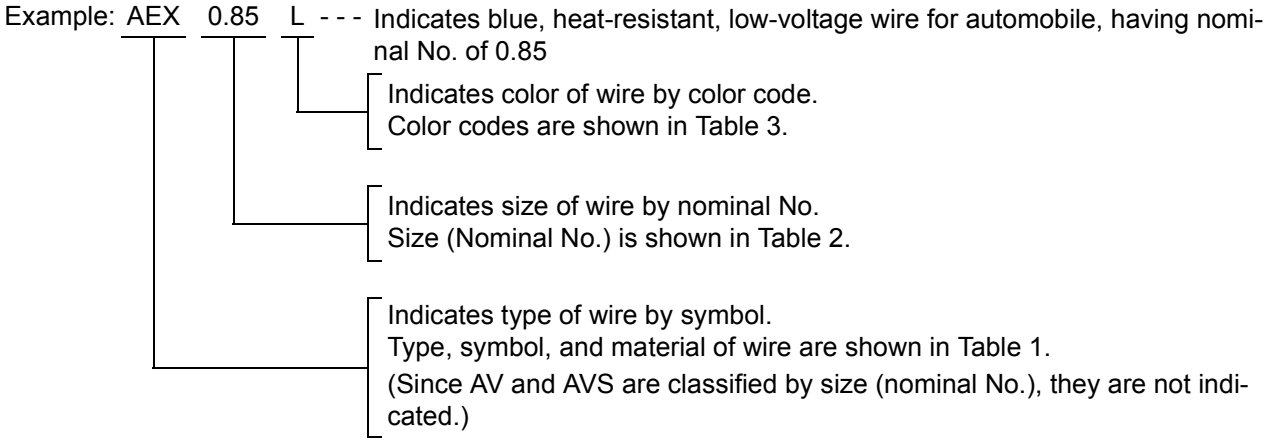
2) Connect the connector according to the following procedure.
   1] Insert the connector to the end, while setting its groove.
   2] Turn housing (H1) in the direction of the arrow until it “clicks”.



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		

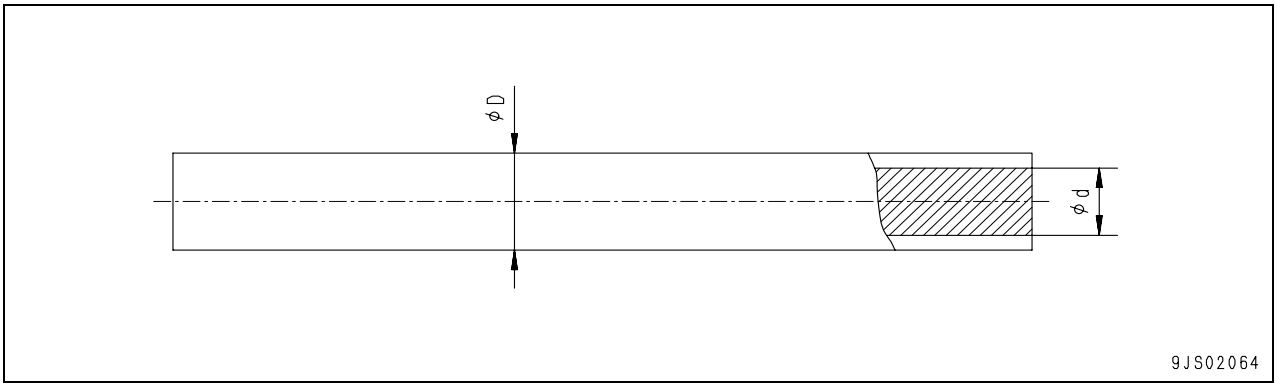
2. Dimensions

(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	Color Code	Color of wire
B	Black	LgW	Light green & White
Br	Brown	LgY	Light green & Yellow
BrB	Brown & Black	LR	Blue & Red
BrR	Brown & Red	LW	Blue & White
BrW	Brown & White	LY	Blue & Yellow
BrY	Brown & Yellow	O	Orange
Ch	Charcoal	P	Pink
Dg	Dark green	R	Red
G	Green	RB	Red & Black
GB	Green & Black	RG	Red & Green
GL	Green & Blue	RL	Red & Blue
Gr	Gray	RW	Red & White
GR	Green & Red	RY	Red & Yellow
GW	Green & White	Sb	Sky Blue
GY	Green & Yellow	Y	Yellow
L	Blue	YB	Yellow & Black
LB	Blue & Black	YG	Yellow &Green
Lg	Light green	YL	Yellow & Blue
LgB	Light green & Black	YR	Yellow & Red
LgR	Light green & 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

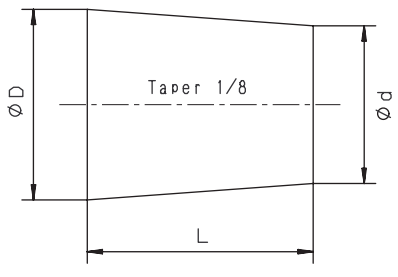
Nominal number	Plug (nut end)	Sleeve nut (elbow end)
02	07376-70210	02789-20210
03	07376-70315	02789-20315
04	07376-70422	02789-20422
05	07376-70522	02789-20522
06	07376-70628	02789-20628
10	07376-71034	07221-21034
12	07376-71234	07221-21234

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

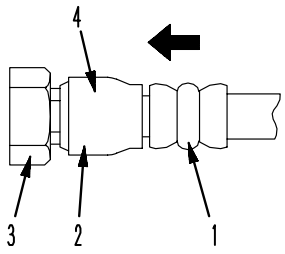


Fig. 2

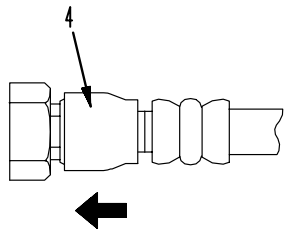
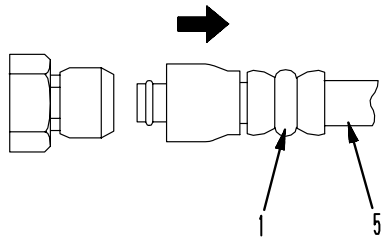


Fig. 3



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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

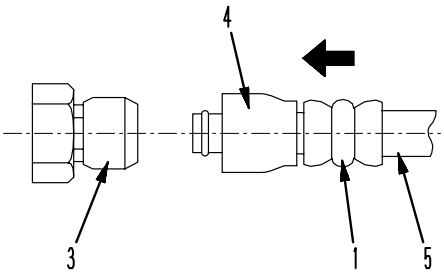
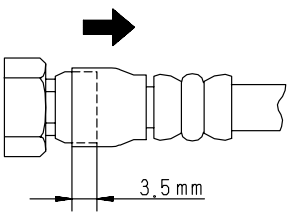


Fig. 5

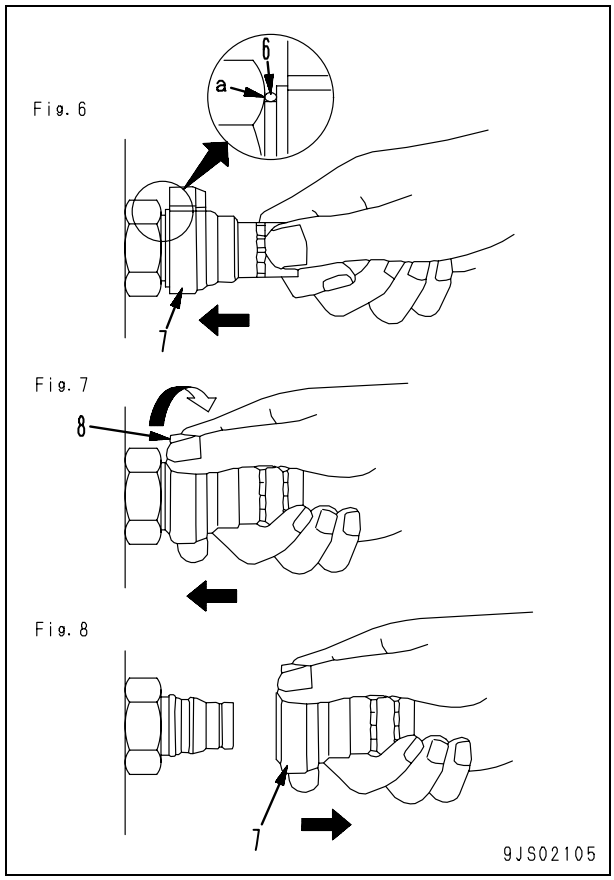


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Type 2

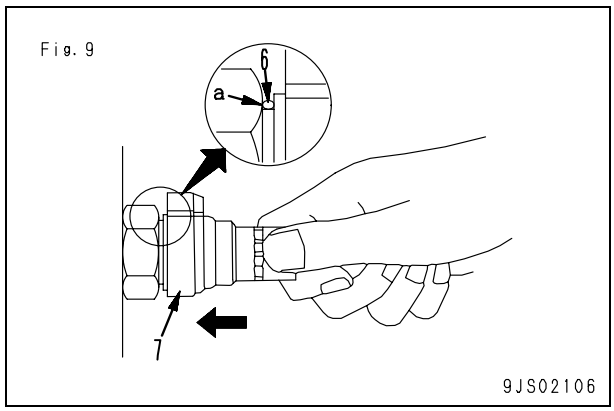
1. Disconnection

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

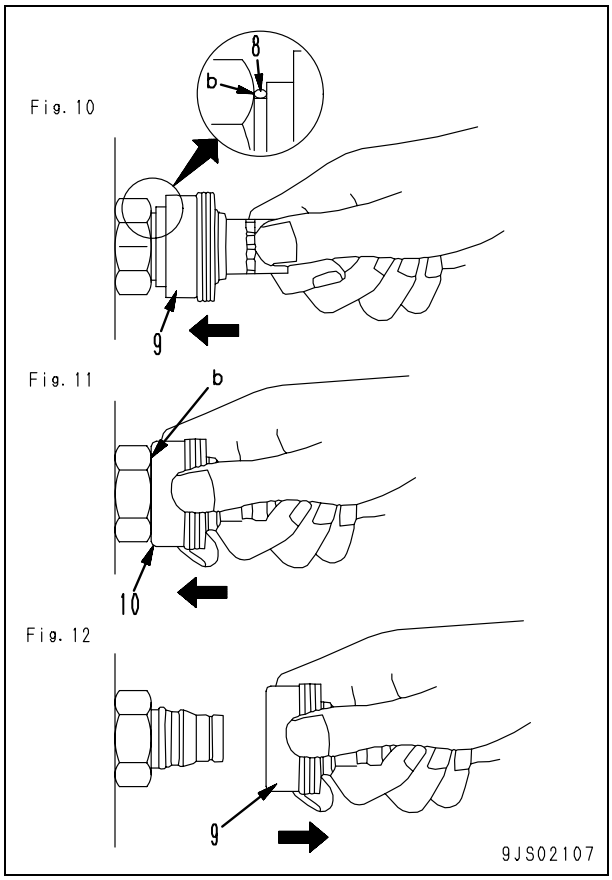
- Hold the tightening portion and push body (7) straight until sliding prevention ring (6) contacts contact surface (a) of the hexagonal portion at the male end. (Fig. 9)



Type 3

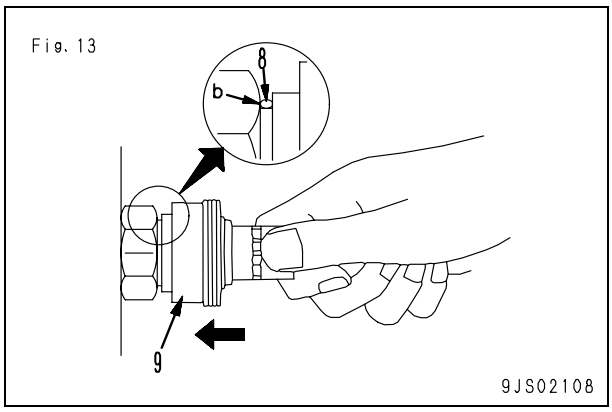
1. Disconnection

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)

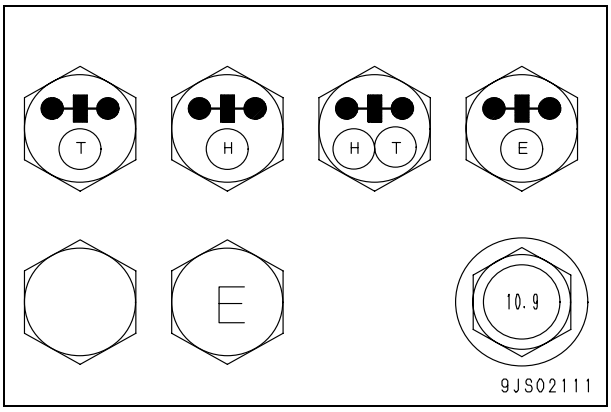
   ★ The following table corresponds to the bolts in Fig. A.

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

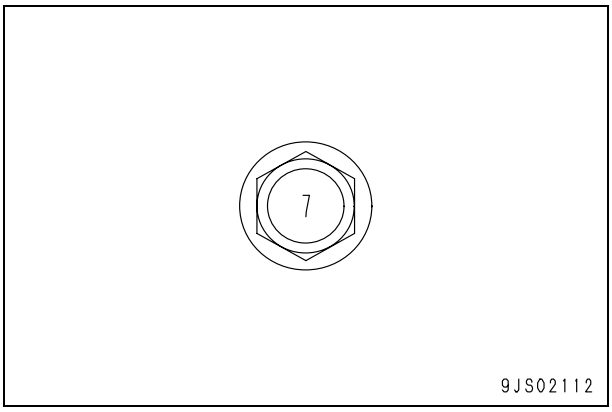
   ★ The following table corresponds to the bolts in Fig. B.

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

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

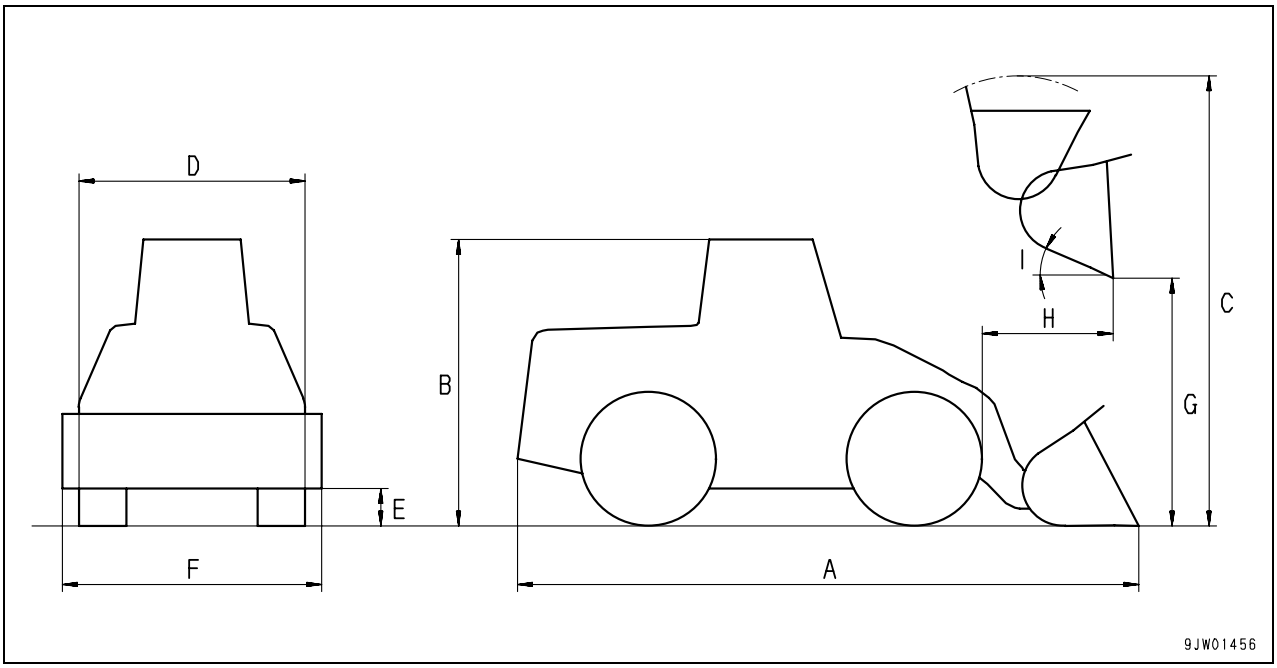
01 Specification

Specification and technical data

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Specification and technical data

Specification dimension drawing



	Check item		Unit	WA380-6 (In P-mode)
	Machine weight (With BOC)		kg	17,570
	Normal load		kg	5,580
	Bucket capacity (Heaped, with BOC)		m^3	3.1
	Engine model name		—	Komatsu SAA6D107E-1 Diesel engine
	Engine rated output • Net [ISO 9249/SAE J1349] (*1) • Gross [SAE J1955] (*2)		kW {HP} /rpm	 142 {191} /2,100 143 {192} /2,100
A	Overall length (with BOC)		mm	8,111
B	Overall height		mm	3,361
C	Overall height with bucket lifted up		mm	5,456
D	Overall width		mm	2,762
E	Minimum ground clearance		mm	436
F	Bucket width		mm	2,916
G	Dumping clearance	Bucket tip/BOC tip	mm	2,976/
H	Dumping reach	Bucket tip/BOC tip	mm	1,076/
I	Dumping angle		deg.	45
	Min. turning radius	Bucket tip/BOC tip	mm	7,215/7,190
		Center of outside tire	mm	6,660
	Tolerable drawbar pull load		kN {kg}	115 {11,700}
	Travel speed	1st (Forward/reverse)	km/h	6.6/7.1
		2nd (Forward/reverse)		11.5/12.3
		3rd (Forward/reverse)		20.2/21.5
		4th (Forward/reverse)		34.0/35.5

*1: Indicates the value at the minimum speed of cooling fan.
*2: Indicates the value of the engine alone (without cooling fan).
★ The engine rated output is indicated in the net value and gross value. Gross denotes the rated output measured of an independent engine. While, net denotes the value measured of an engine under the conditions that are essentially the same as that it will be exposed on a machine.
★ Following shows the rated output (net) at the minimum cooling fan speed.
133 kW {179 HP} /2,100 rpm
★ BOC: Abbreviation for Bolt-On Cutting edge

Specifications

Machine model name			WA380-6	
Serial number			65001 and up	
Weight	Machine weight	kg	17,570	
	Machine weight (Front wheel) in SAE travel posture	kg	7,665	
	Machine weight (Rear wheel) in SAE travel posture	kg	9,905	
Performance	Bucket capacity (Heaped)	m^3	3.1	
	Normal load	kg	5,580	
			E-mode	P mode
	Travel speed (Forward 1st)	km/h	5.5	6.6
	(Forward 2nd)		9.6	11.5
	(Forward 3rd)		16.5	20.2
	(Forward 4th)		26.6	34.0
	(Reverse 1st)	km/h	5.9	7.1
	(Reverse 2nd)		10.2	12.3
	(Reverse 3rd)		17.5	21.5
	(Reverse 4th)		27.8	35.5
	Maximum drawbar pull (Forward)	kN {kg}	119 {12,100}	165 {16,800}
	(Reverse)		109 {11,100}	151 {15,420}
	Gradeability	deg.	25	
	Min. turning radius (Center of outside tire)	mm	6,660	
	Turning radius (Teeth edge/BOC tip) SAE travel posture	mm	7,215/7,190	
Dimension	Overall length (With BOC)	mm	8,111	
	Overall width (Machine body)	mm	2,762	
	Bucket width (With BOC)	mm	2,916	
	Overall height (Cab top)	mm	3,361	
	Overall height with bucket lifted up	mm	5,456	
	Wheelbase	mm	3,300	
	Tread	mm	2,160	
	Minimum ground clearance	mm	436	
	Max. hinge pin height	mm	4,095	
	Dumping clearance (Bucket edge/BOC tip)	mm	2,990/2,915	
	Dumping reach (Bucket edge/BOC tip)	mm	1,130/1,165	
	Steering angle	deg.	35	
	Bucket tilt-back angle (Operating posture)	deg.	44	
	(Max. height)		66	
	Bucket tilt-forward angle (Max. height)	deg.	49	
	Digging depth, 0°	mm	80	

★ BOC: Abbreviation for Bolt-On Cutting edge

Machine model name				WA380-6
Serial number				H65001 and up
Engine	Model name			SAA6D107E-1
	Model			4-cycle, water-cooled, in-line 6-cylinder, direct injection type with turbocharger and air-cooled aftercooler
	Cylinder bore x Cylinder stroke		mm	107 x 124
	Total piston displacement		ℓ {cc}	6.69 {6,690}
	Performance (In P-mode)	Flywheel horsepower • Net [ISO 9249/SAE J1349] (*1) • Gross [SAE J1995] (*2)	kW {HP} /rpm	142 {191} /2,100 143 {192} /2,100
		Max. torque (*1)	Nm {kgm} /rpm	941 {96} /1,450
		Min. fuel consumption	g/kWh {g/HPh}	224 {167}
		High idle speed	rpm	2,230 ± 50
		Low idle speed	rpm	850 ± 25
	Starting motor			24 V, 5.5 kW
	Alternator			24 V, 60 A
	Battery (*3)			24 V, 136 Ah x 2 pcs
Power train	Torque converter			3-element, 1-stage, 1-phase
	Transmission			Counter-shaft, helical and spur gear constant-mesh type, multi-disc type, hydraulic type, modulating
	Reduction gear unit			Spiral bevel gear type and oil bath lubrication type
	Differential system			Straight bevel gear type
	Final drive			Planetary gear single reduction type and oil bath lubrication type
Wheel and axle	Drive wheel			Front and rear wheel drive
	Front axle			Fixed frame, semi-float type
	Rear axle			Center pin supporting, semi-float type
Tires	Size			23.5R25XHA☆
	Rim size			19.50-25WTB
	Tire inflation pressure	(Front wheel)	kPa {kg/cm^2}	350 {3.5}
		(Rear wheel)		320 {3.2}
Brake	Main	Braking method		4-wheel brake, independent front and rear wheel brakes
		Type of brake		Enclosed wet disc type
		Drive method		Hydraulic drive
		Operating method		With hydraulic booster
	Parking	Braking method		Transmission output shaft brake
		Type of brake		Wet disc type
		Drive method		Driven with spring, hydraulically released type
Steering	Steering method			Articulated chassis type
	Drive method			Hydraulic drive

*1: Indicates the value at the minimum speed of cooling fan.
*2: Indicates the value of the engine alone (without cooling fan).
*3: The battery capacity (Ah) indicates the 5-hour rate value.
★ The engine rated output is indicated in the net value and gross value. Gross denotes the rated output measured of an independent engine. While, net denotes the value measured of an engine under the condition essentially the same as that when it is installed on machine.
★ Following shows the rated output (net) at the minimum cooling fan speed.
133 kW {179 HP} /2,100 rpm

Machine model name					WA380-6
Serial number					H60051 and up
Hydraulic system	Hydraulic pump	Power train pump			
		• Type			Gear type
		• Delivery		cm^3/rev	80.2
		Steering pump			
		• Type			Variable displacement, swash plate, piston type
		• Delivery		cm^3/rev	63
		Work equipment pump			
		• Type			Variable displacement, swash plate, piston type
		• Delivery		cm^3/rev	90
		Cooling fan pump			
		• Type			Variable displacement, swash plate, piston type
		• Delivery		cm^3/rev	30
		Emergency steering pump			
		• Type			Gear type
		• Delivery		cm^3/rev	21
	Cylinder	Steering cylinder	Type		Double-acting piston type
			Cylinder bore	mm	75
			Piston rod outside diameter	mm	45
			Stroke	mm	442
			Max. distance between centers of pins	mm	1,209
			Min. distance between centers of pins	mm	767
		Lift cylinder	Type		Double-acting piston type
			Cylinder bore	mm	130
			Piston rod outside diameter	mm	90
			Stroke	mm	713
			Max. distance between centers of pins	mm	2,050
			Min. distance between centers of pins	mm	1,337
		Bucket cylinder	Type		Double-acting piston type
			Cylinder bore	mm	150
			Piston rod outside diameter	mm	90
			Stroke	mm	535
			Max. distance between centers of pins	mm	1,690
			Min. distance between centers of pins	mm	1,155

Machine model name				WA380-6
Serial number				H60051 and up
Hydraulic system	Control valve	Work equipment control valve		
		• Type		2-spool type
		• Set pressure	MPa {kg/cm^2}	31.4 {320}
		Steering valve		
		• Type		Spool type
		• Set pressure	MPa {kg/cm^2}	24.5 {250}
	Motor	Cooling fan motor		
		• Type		Fixed displacement, swash plate, piston type
		• Motor capacity	cm^3/rev	28
Work equipment	Type of link			Single link
	Shape of bucket cutting edge			Straight cutting edge with BOC

★ BOC: Abbreviation for Bolt-On Cutting edge

Weight table

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

Unit: kg

Machine model name	WA380-6
Serial number	H60051 and up
Engine (excluding coolant and oil)	585
Cooling assembly (excluding coolant and oil)	116
• Radiator	20
• Aftercooler	14
• Oil cooler	9
Torque converter oil cooler	21
Cooling fan pump	25
Cooling fan motor	14
Transmission (including torque converter)	
• Without lockup clutch	790
• With lockup clutch	835
Center drive shaft	26
Front drive shaft	22
Rear drive shaft	13
Front axle	
• With conventional differential	880
• With limited slip differential	890
Rear axle	
• With conventional differential	820
• With limited slip differential	830
Axle pivot (Rear axle)	103
Wheel [19.50-25WTB] (1 piece)	226
Tire [23.5R25XHA☆] (1 piece)	307
Power train pump	23
Work equipment pump	39
Steering pump	38
Work equipment control valve	64
Work equipment PPC valve	4
Brake valve	7
Steering valve	24
Emergency steering motor	13
Emergency steering pump	3
Steering cylinder assembly (1 piece)	23
Lift cylinder assembly (1 piece)	158
Bucket cylinder assembly	168
Front frame	1,356
Rear frame	1,380
Counterweight	1,640
Engine hood assembly	369
• Hood body	191
• • Side door (1 piece)	32
• Hydraulic tank (excluding hydraulic oil)	178
Fuel tank (excluding fuel)	178

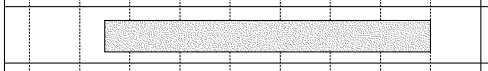
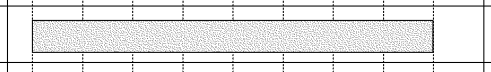
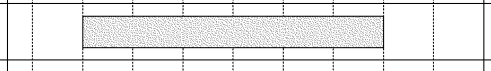
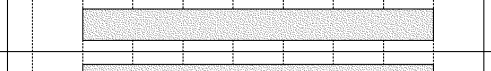
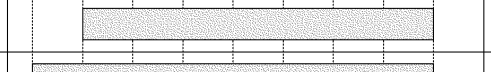
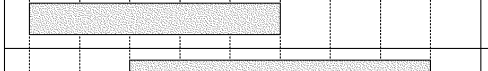
Unit: kg

Machine model name	WA380-6
Serial number	H60051 and up
Lift arm (including bushing)	1,074
Bucket link	55
Bell crank	316
Bucket (2,905 mm wide, including BOC)	1,606
Operator's cab (including floor assembly)	981
Operator seat	35
Air conditioner unit	5
Battery (1 piece)	45

★ BOC: Abbreviation for Bolt-On Cutting edge

Table of fuel, coolant and lubricants

★ For details of the notes (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		Komatsu EO10W30-DH
			Komatsu EO15W40-DH
			Komatsu EO30-DH
Transmission case	Powertrain oil (Note.1)		TO10
Hydraulic system	Powertrain oil		TO10
	Hydraulic oil		HO46-HM
	Engine oil		Komatsu EO10W30-DH
			Komatsu EO15W40-DH
Axle	Axle oil (Note.2)		AXO80
	Engine oil	 (Note.3)	EO50-CD
Pin / Bushing Grease fitting (Note.4)	Hyper grease (Note.5)		G2-T,G2-TE
	Lithium EP grease		G2-LI
Cooling system	Supercoolant AF-NAC (Note.6)		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

Unit: ℓ

Refill point	WA380-6	
	Specified capacity	Refill capacity
Engine oil pan	25.5	23
Transmission case	47	38
Hydraulic oil system	210	139
Axle (Front/Rear)	40/40	40/40
Fuel tank	300	—
Coolant system	30.5	—

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

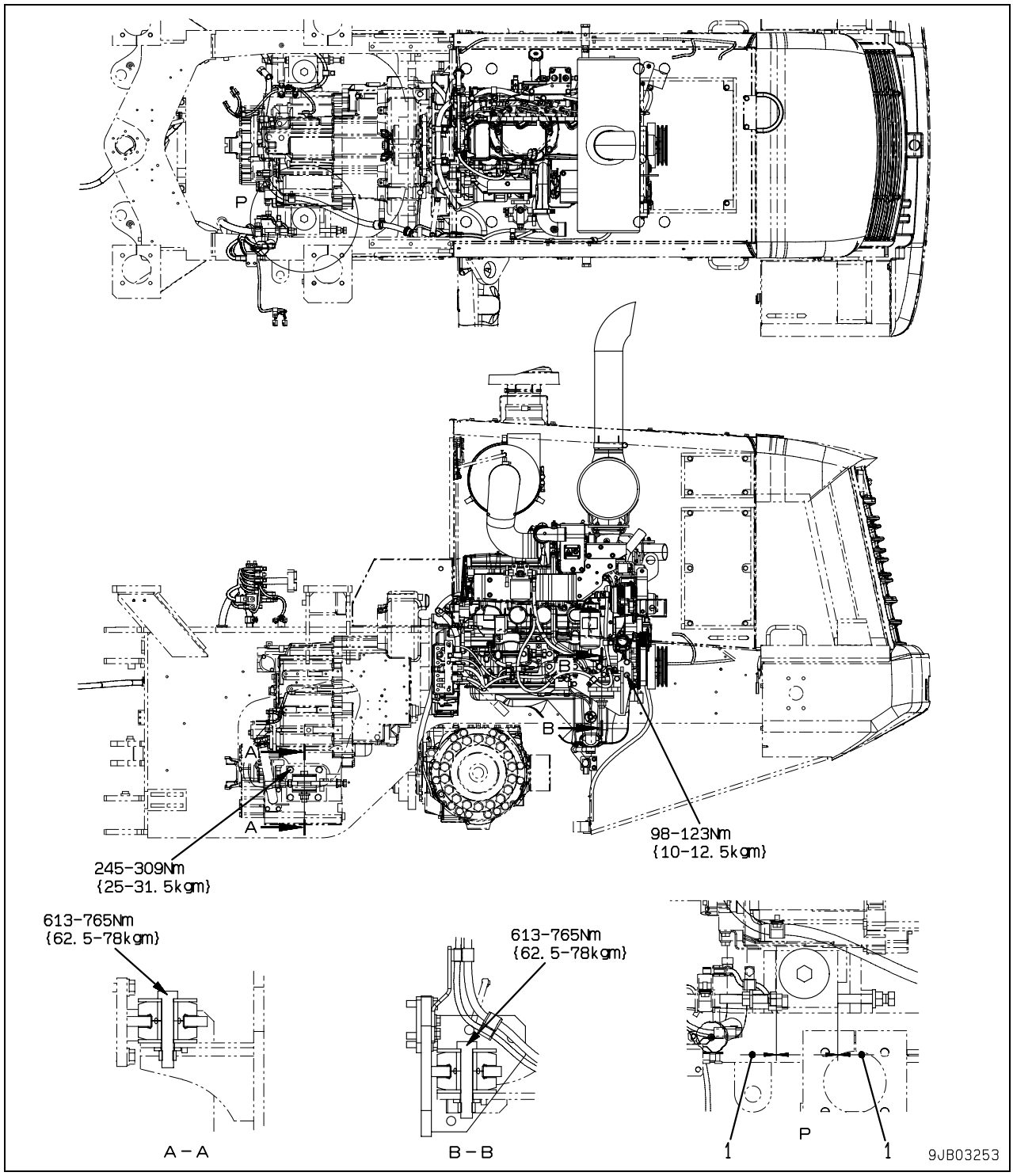
10 Structure, function and maintenance standard

Engine and cooling system

Engine and cooling system 2
Engine mount and transmission mount 2
Cooling system 3
Cooling fan pump 4
Cooling fan motor 12

Engine and cooling system

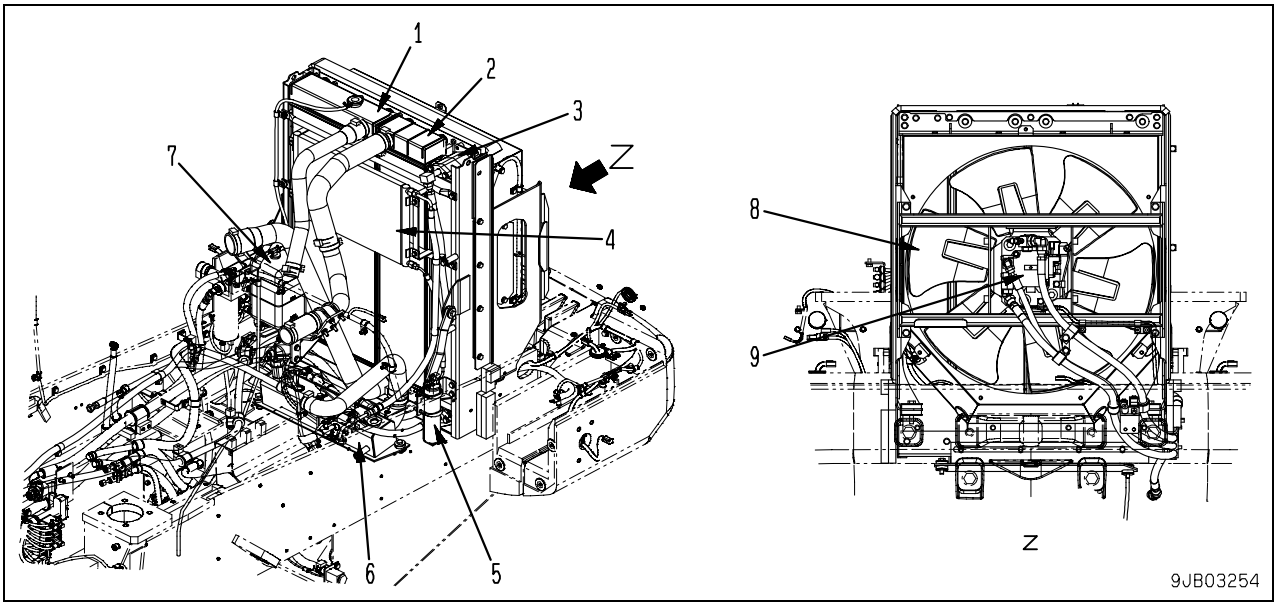
Engine mount and transmission mount



Unit: mm

No.	Check item	Criteria	Remedy
1	Clearance between transmission mount bracket and adjustment bolt	1 – 1.5	Adjust

Cooling system



1. Radiator
2. Aftercooler
3. Oil cooler
4. Condenser
5. Receiver
6. Power train oil cooler
7. Reservoir tank
8. Cooling fan
9. Cooling fan motor

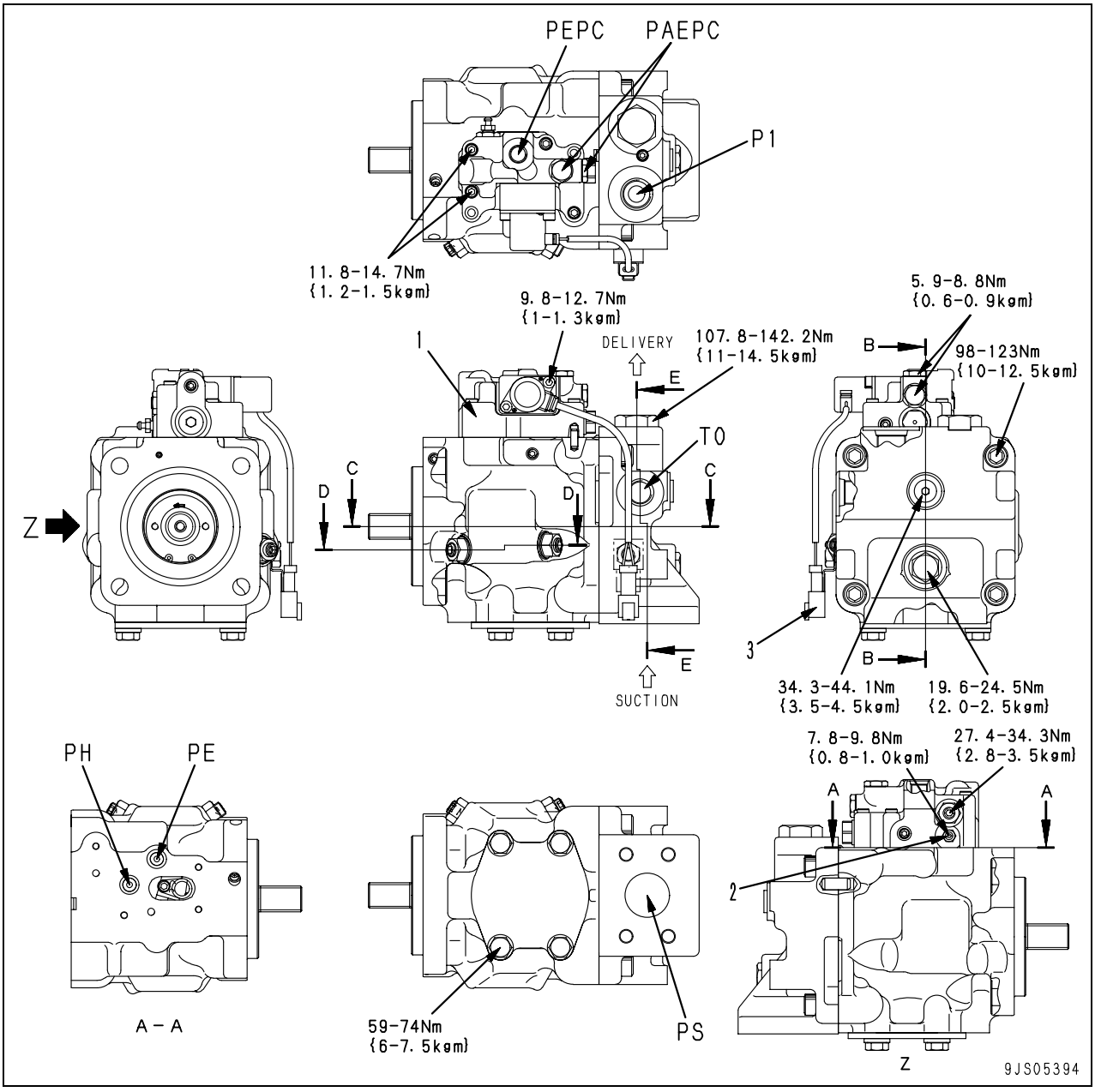
Specifications

	Radiator	Oil cooler	Aftercooler	Power train oil cooler
Model name of core	AL WAVE-4	CF40-1	AL WAVE	PTO-OL
Fin pitch (mm)	3.5/2	3.5/2	4.0/2	*1 100 x 558 x 12-stage
Total heat dissipation surface (m^2)	52.40	4.28 x 2	17.69	1.291
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

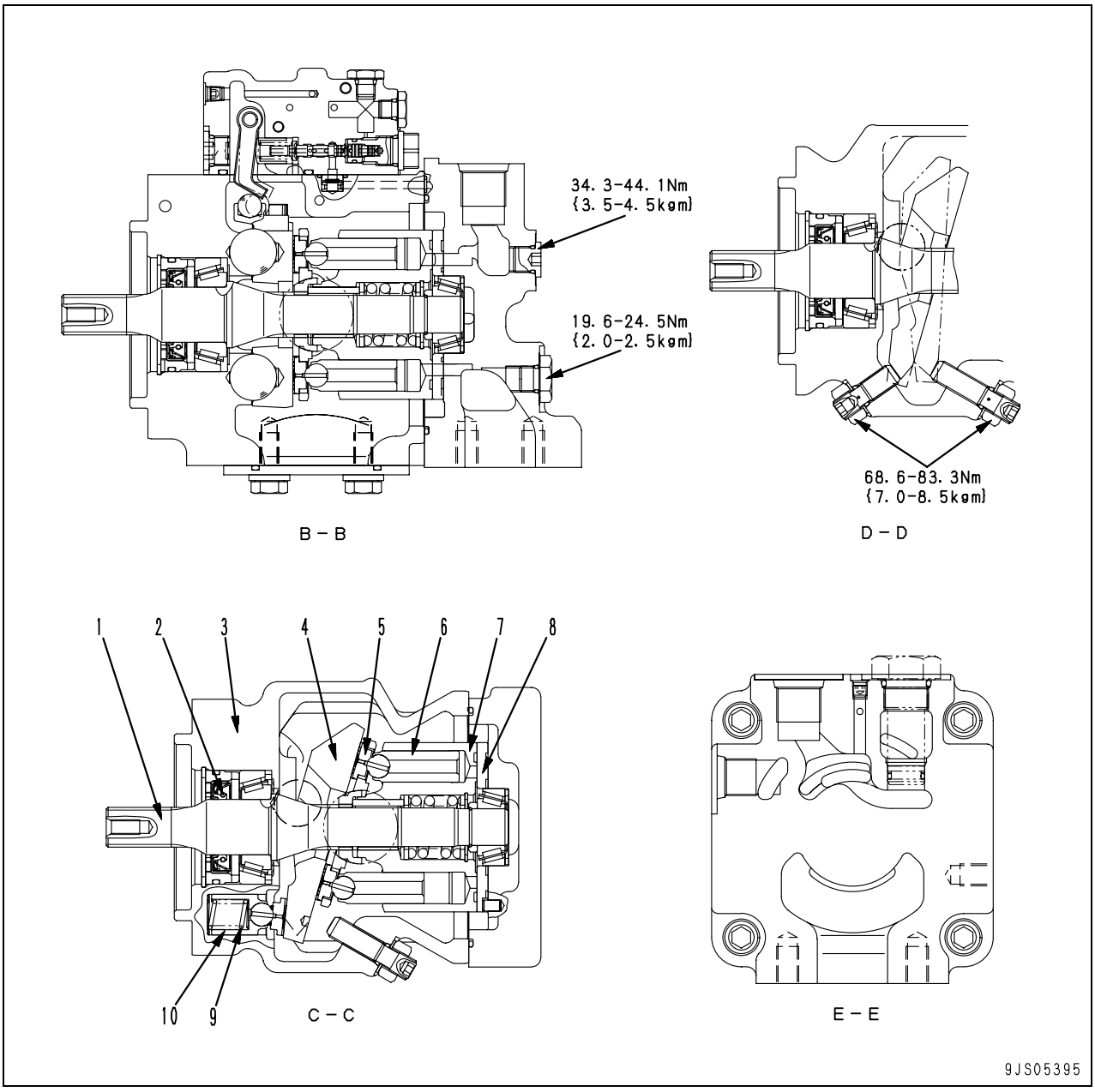
Cooling fan pump

Type:LPV30

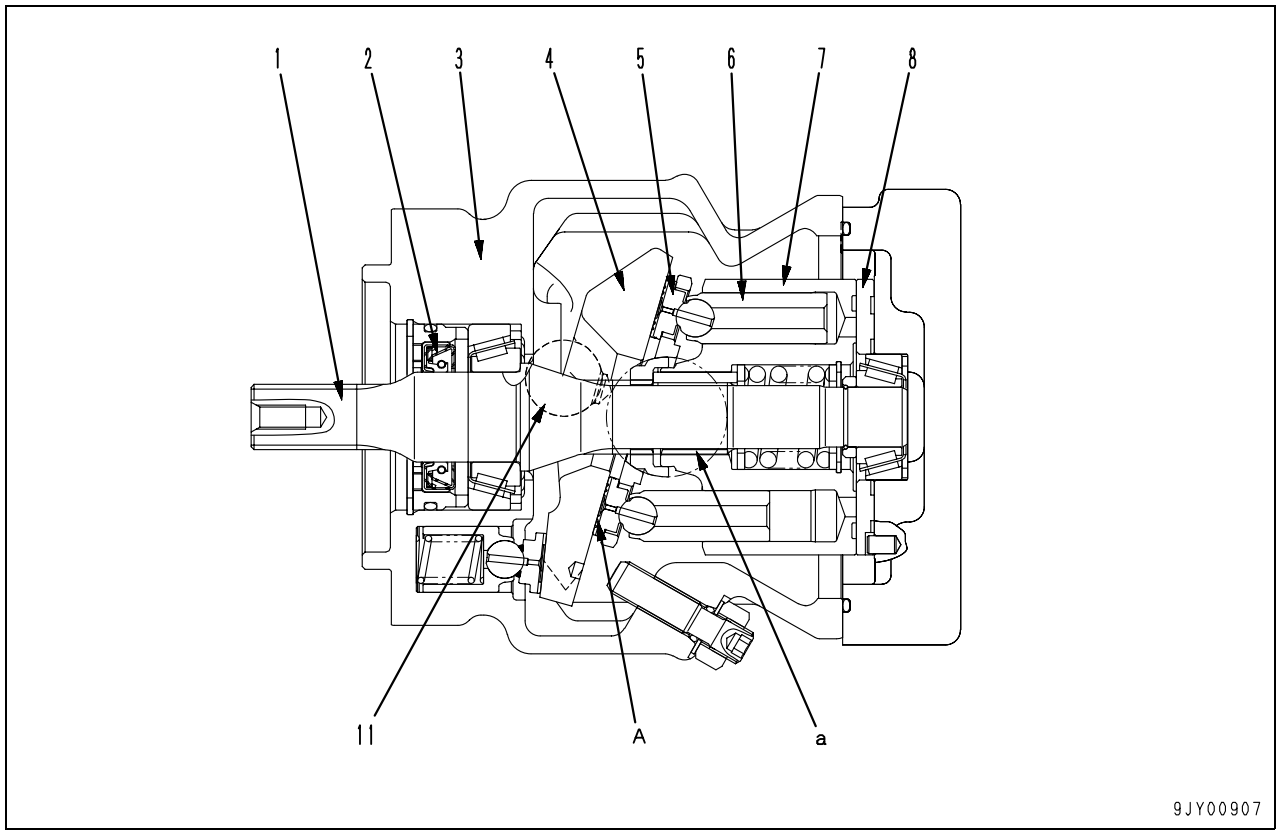


P1: Pump discharge port
PE: Control piston pressure input port
PH: Pump discharge pressure output port
PS: Pump suction port
TO: Drain port
PEPC: EPC valve basic pressure input port
PAEPC: EPC output pressure pickup plug

1. Servo valve
2. Air bleeder
3. Command current input connector



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 rotation and torque of the engine are transmitted to the shaft of this pump. Then, this pump converts the rotation and torque into hydraulic energy and discharges hydraulic oil according to the load.
- It is possible to change the delivery by changing the swash plate angle.

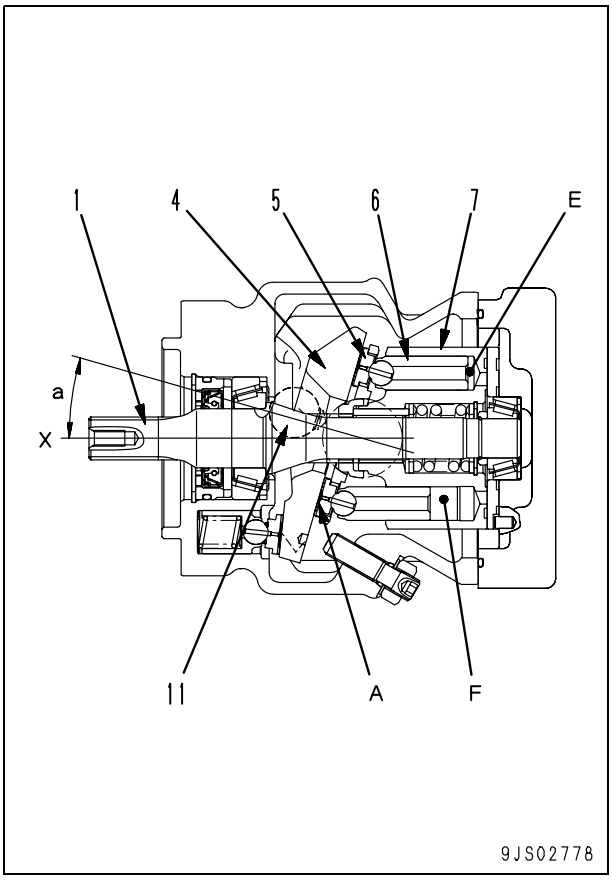
Structure

- Cylinder block (7) is supported to shaft (1) by spline (a), and shaft (1) is supported by the front and rear bearings.
- The tip of piston (6) is 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 as it slides in a circle. Rocker cam (4) also slides around ball (11) using it as fulcrum.
- Piston (6) carries out relative movement in the axial direction inside each cylinder chamber of cylinder block (7).
- Cylinder block (7) carries out rotation relative to valve plate (8) while sealing the pressurized oil, and this surface ensures that the hydraulic balance is maintained correctly.
- And oil in each cylinder chamber of cylinder block (7) is available for suction or discharge through valve plate (8).

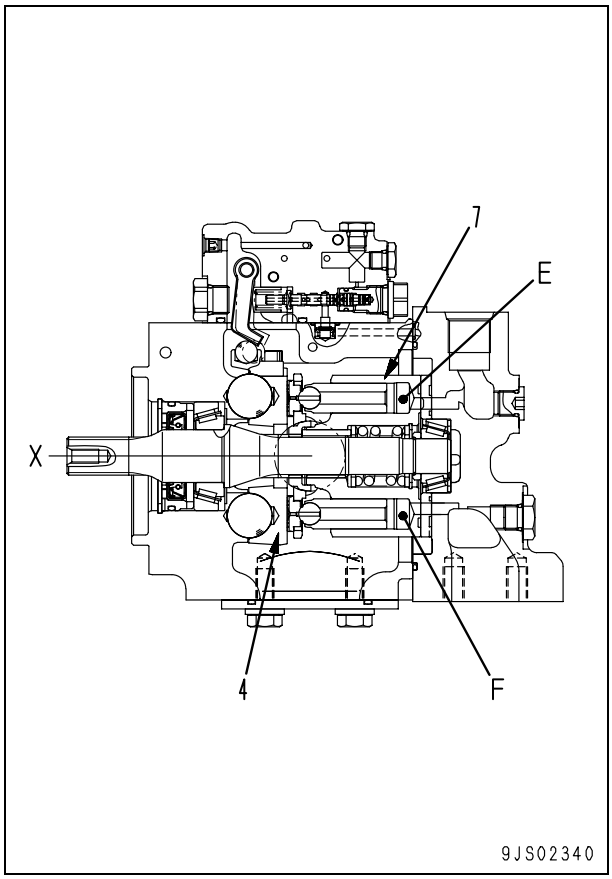
Operation

1. Operation of pump

- Cylinder block (7) rotates together with shaft (1) and shoe (5) slides on plane (A). At this time, rocker cam (4) slants around ball (11), changing the angle of inclination (a) of the center line (X) of rocker cam (4) in the axial direction of cylinder block (7). Angle (a) is called the swash plate angle.
- If angle (a) is made between center line (X) of rocker cam (4) and the axis of cylinder block (7), plane (A) works as a cam for shoe (5).
- Accordingly, piston (6) slides inside cylinder block (7) and a difference is made between volumes (E) and (F) in cylinder block (7). As a result, each piston (6) sucks and discharges oil by (F) – (E).
- In other words, cylinder block (7) rotates, and the volume of chamber (E) becomes smaller, so pressurized oil is discharged during this process. At the same time, the volume of chamber (F) becomes larger and the oil is sucked in this process. [In the figure, chamber (F) is at the end of the suction stroke and chamber (E) is at the end of the discharge stroke.]

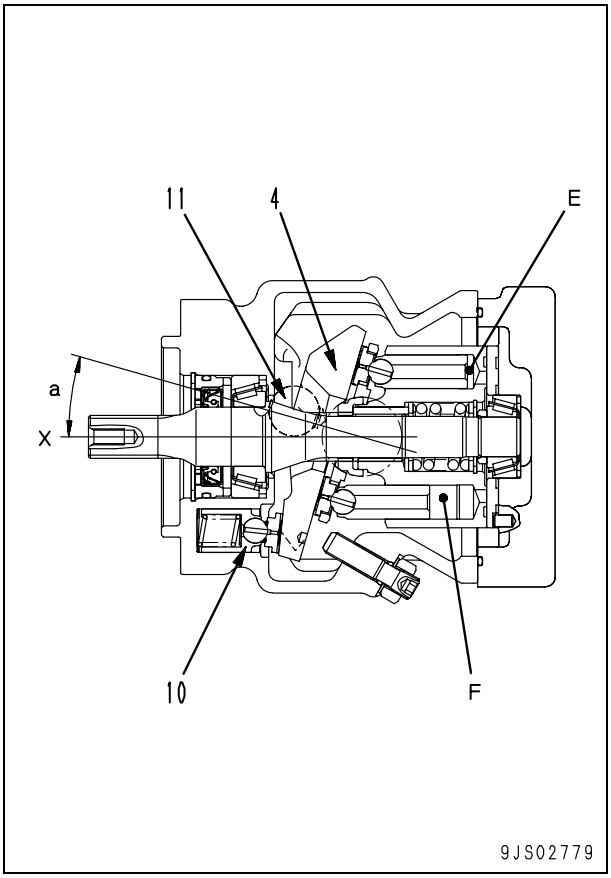


- When center line (X) of rocker cam (4) is the same as the axial direction of cylinder block (7) [swash plate angle = 0], the difference between volumes (E) and (F) inside cylinder block (7) is 0, so pump does not suck and discharge, and no pumping is carried out. [The swash plate angle is not set to 0 actually, however.]
- In short, swash plate angle (a) is in proportion to the pump delivery.

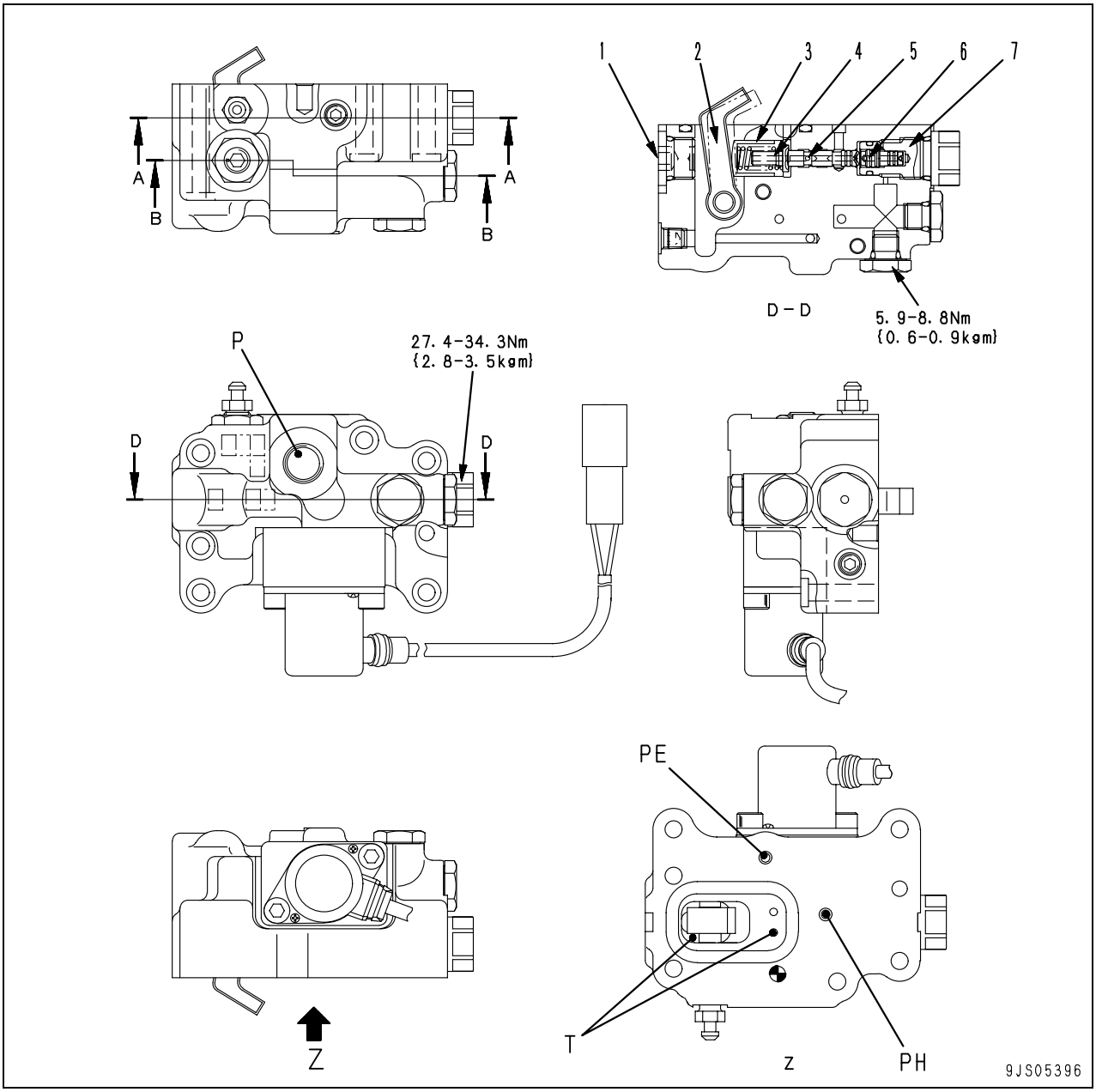


2. Control of delivery

- If swash plate angle (a) is increased, the difference between volumes (E) and (F) is increased, or delivery (Q) is increased. 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 line motion is transmitted to rocker cam (4). Then, rocker cam (4) supported on ball (11) sways around ball (11).

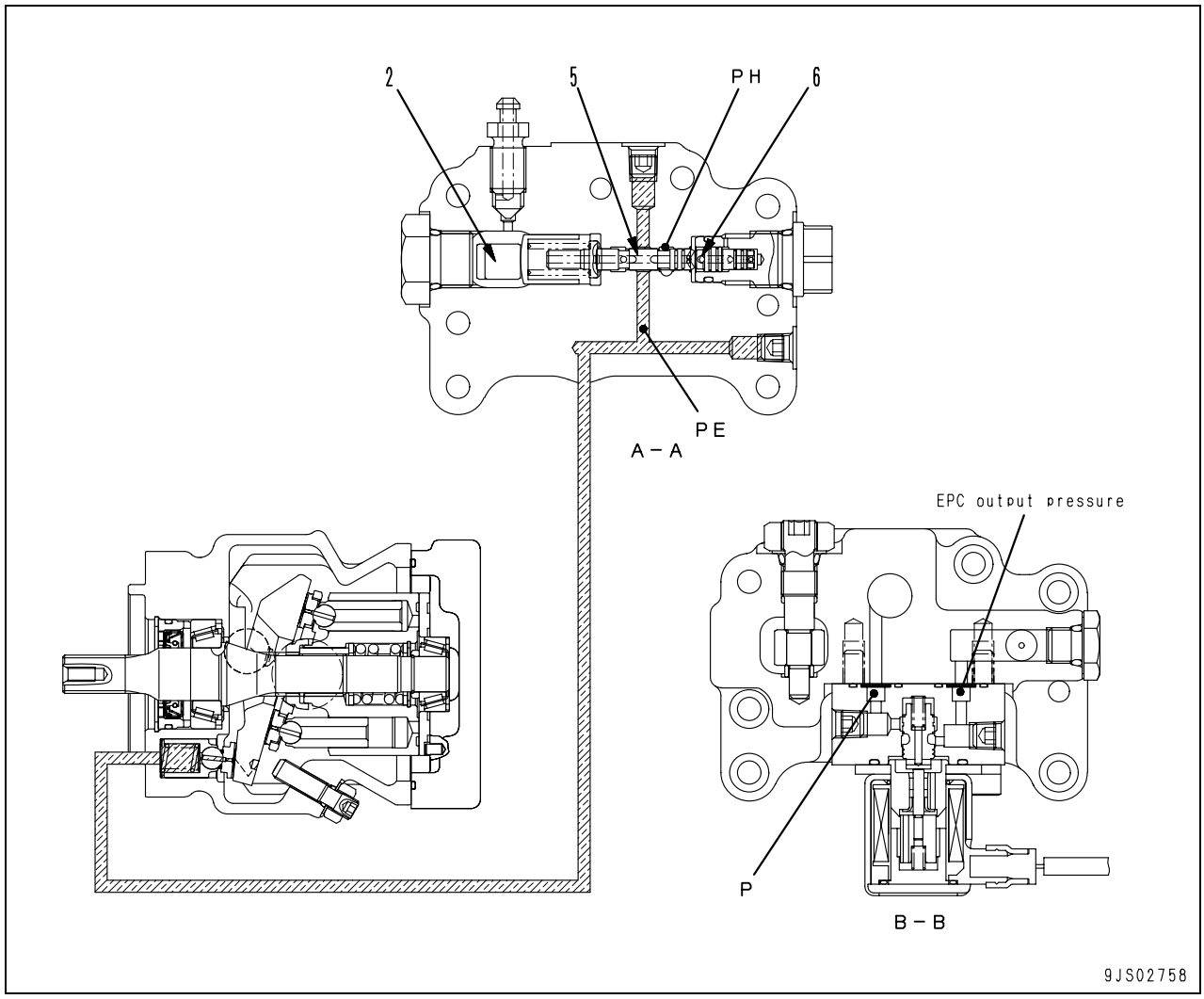


Servo valve



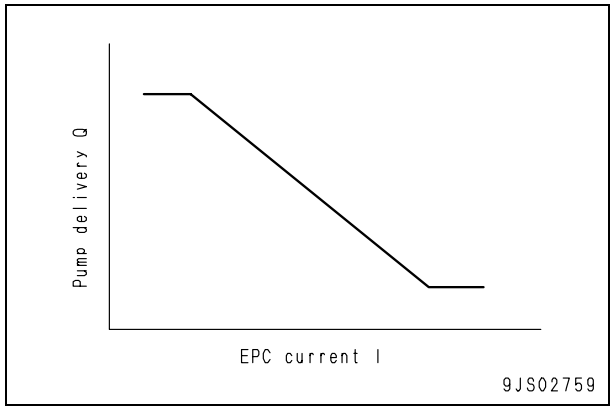
P: EPC valve basic pressure
T: Drain
PE: Control piston pressure
PH: Pump discharge pressure

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



Function

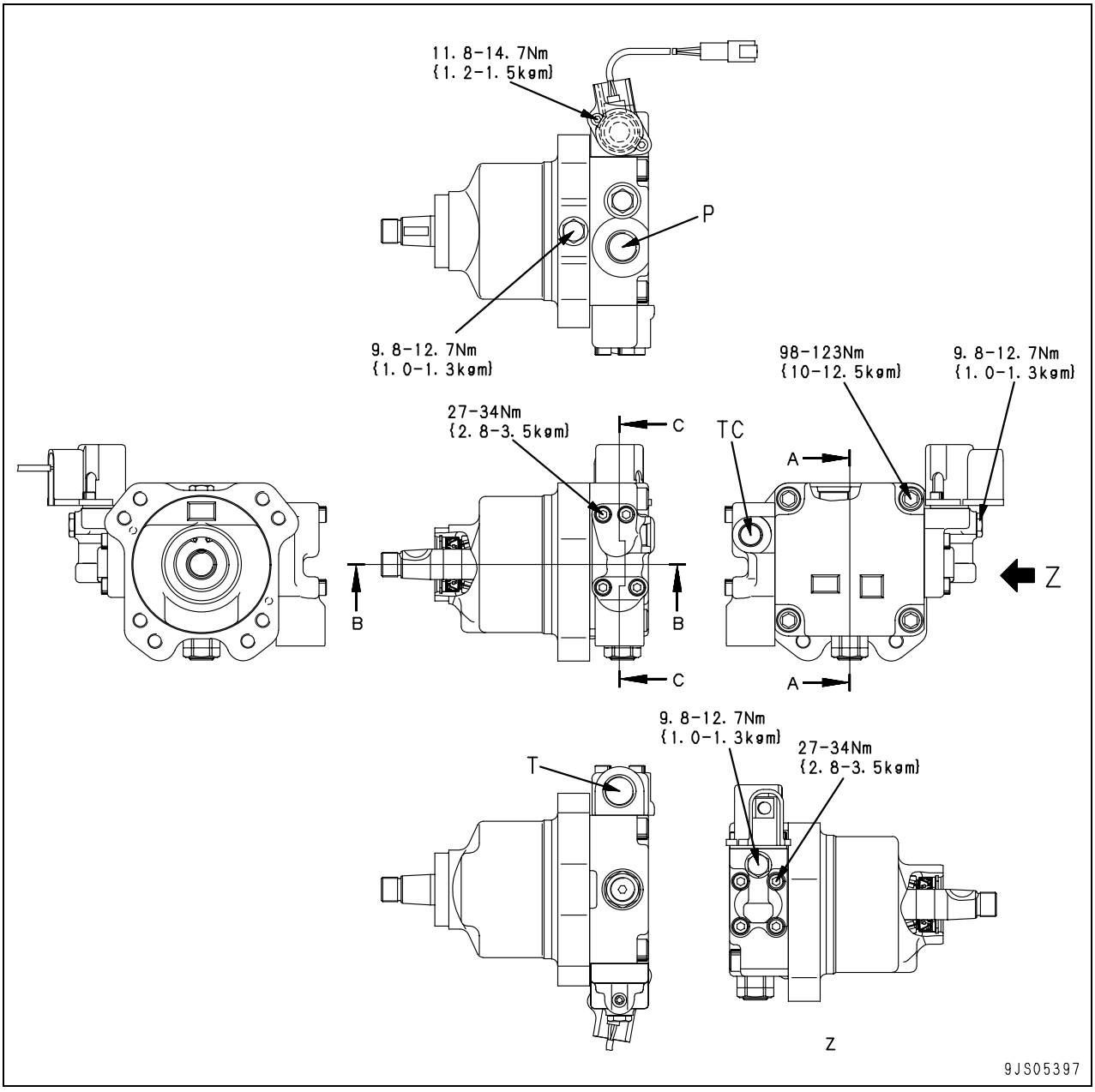
- The servo valve controls the current input to the EPC valve and the pump delivery (Q) so that they will be related as shown in the diagram.



- The output pressure of EPC valve is applied to the piston chamber to push piston (6). Piston (6) pushes spool (5) until it is balanced with the spring.
- Then, land (PE) of the servo piston pressure passage is connected to the pump discharge passages by the notch of spool (5) and the discharge pressure is led to the servo piston.
- The servo piston is raised by the rocker cam. Then, the position feedback is applied and the lever moves to compress the spring.
- If spool (5) is pushed back, the pump discharge circuit and the servo piston circuit are shut off. The pressure in the servo piston chamber lowers and the rocker cam returns toward the maximum swash plate angle.
- These processes are repeated until the swash plate is fixed to a position where the EPC output is balanced with the spring force.
- Accordingly, as the EPC output pressure is heightened, the swash plate angle is decreased. As the EPC output pressure is lowered, the swash plate angle is increased.

Cooling fan motor

Type: LMF28

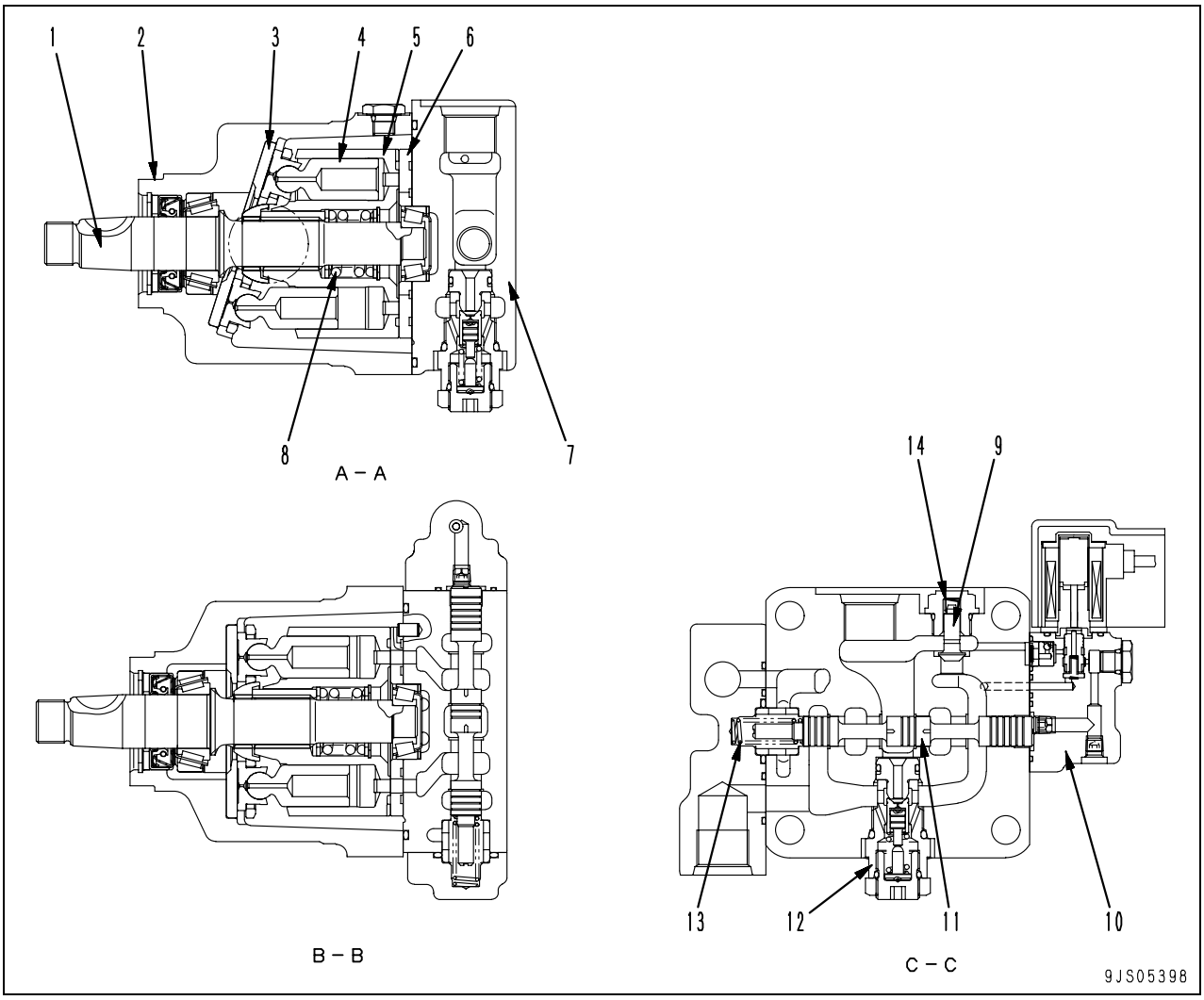


P: From fan pump
T: From cooler to tank
TC: To tank

Specifications

Type:	LMF28
Capacity:	28.0 cc/rev
Rated speed:	1,500 rpm
Rated flow rate:	42 ℓ/min

Check valve cracking pressure: 44.1 kPa {0.45 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
10. Pilot valve
11. Spool for reversible valve
12. Safety valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
13	Spool return spring	44.84 x 12	33	58.8 N {6 kg}	—	47.1 N {4.8 kg}	If damaged or deformed, replace spring
14	Check valve spring	13.0 x 6.5	9.5	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	

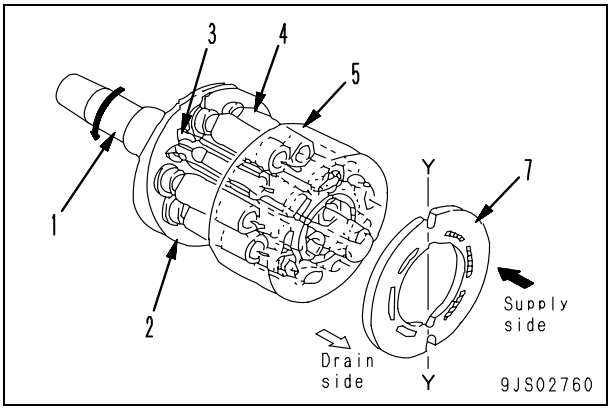
1. Hydraulic motor

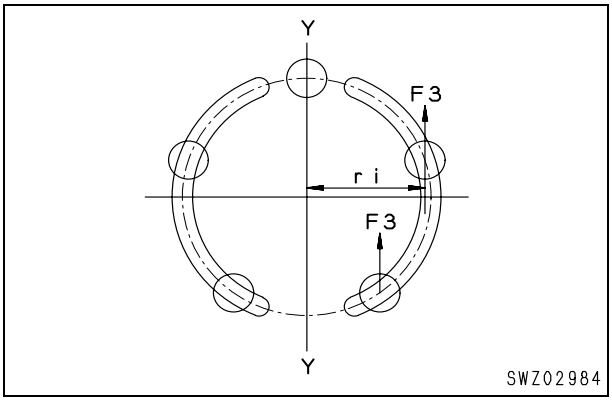
Function

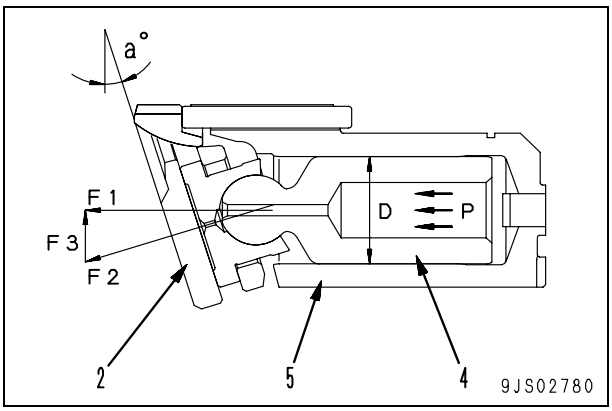
- This hydraulic motor is called a swash plate-type axial piston motor. It converts the energy of the pressurized oil sent from the hydraulic pump into rotary motion.

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 piston (4) [2 or 3 pieces], and generates force (F1) [F1 = P x $\pi D^2/4$].
- This force is applied to thrust plate (2). Since thrust plate (2) is fixed to the angle of (a°) degrees to output shaft (1), the force is divided into components (F2) and (F3).
- The 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 = Σ(F3 x ri)] rotates cylinder block (5) through the piston.
- Since this cylinder block (5) is splined to the output shaft, the output shaft revolves to transmit the torque.







2. Suction valve

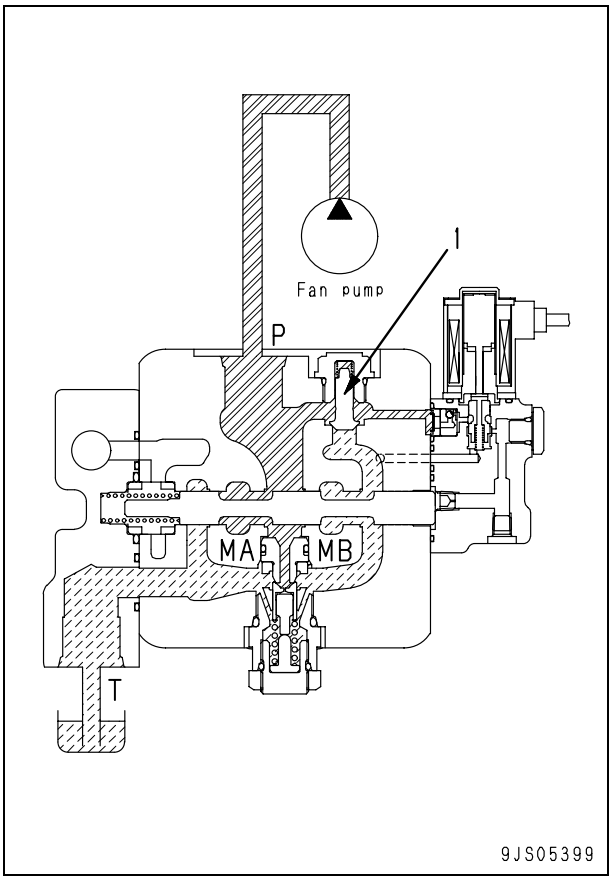
Function

- If the fan pump stops, the pressurized oil does not flow into the motor. Since the motor continues revolution because of the force of inertia, however, the pressure on the outlet side of the motor rises.
- 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 to prevent cavitation.

Operation

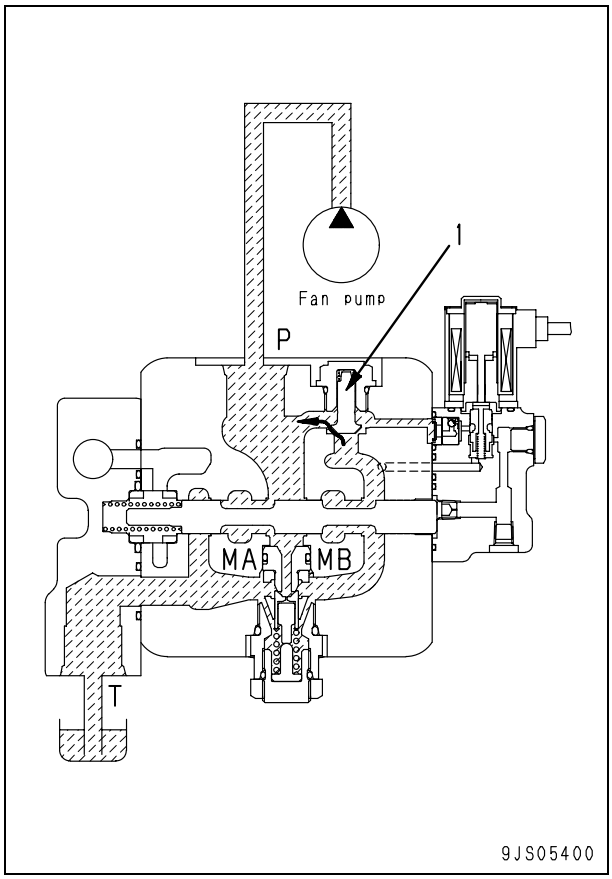
1) When pump is started

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



2) When the pump is stopped

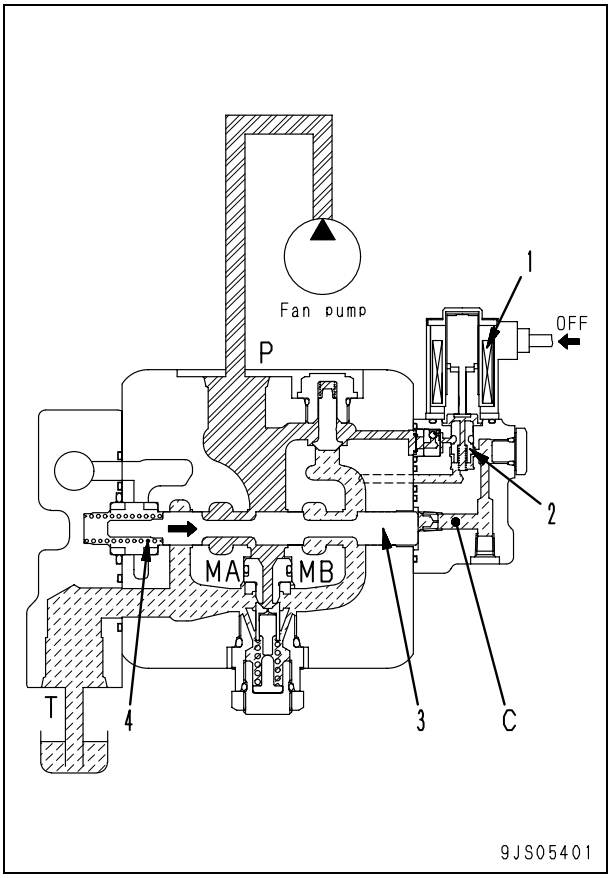
- If the engine is stopped and the input revolution of the fan pump lowers to 0 rpm, the pressurized oil from the pump is not supplied to port (P) any more. As the pressurized oil is not supplied to (MA) side of the motor, the motor speed lowers gradually to stop.
- If the motor shaft is revolved by the force of inertia while the oil flow in (P) is reducing, the oil in port (T) on the outlet side is sent by suction valve (1) to (MA) side to prevent cavitation.



3. Operation of reversible valve

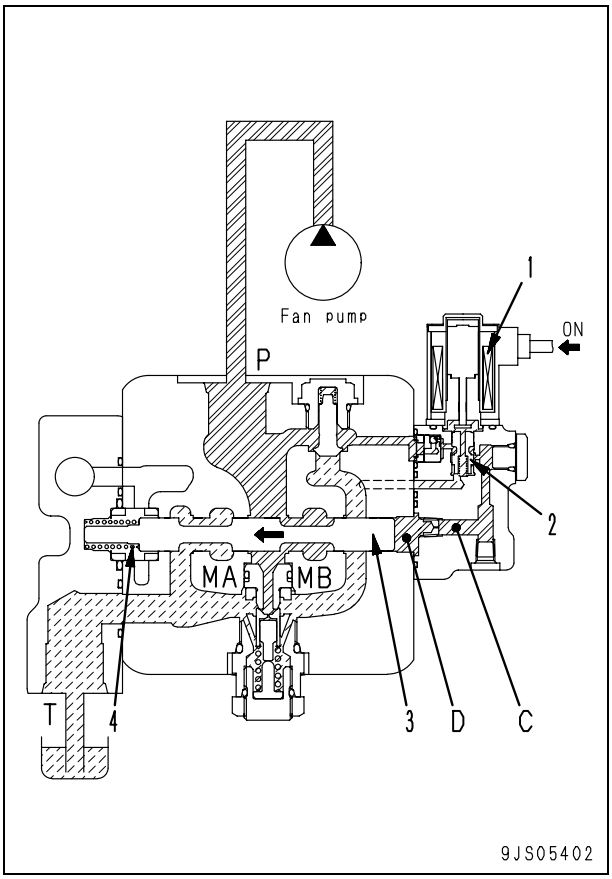
1) When the ON/OFF solenoid is de-energized.

- If ON/OFF solenoid (1) is “de-energized”, the pressurized oil from the pump is blocked by ON/OFF selector valve (2), and port (C) opens for the tank circuit.
- Spool (3) is pushed to the right by spring (4).
- Motor port (MA) opens and pressurized oil flows in to revolve the motor in forward (clockwise).

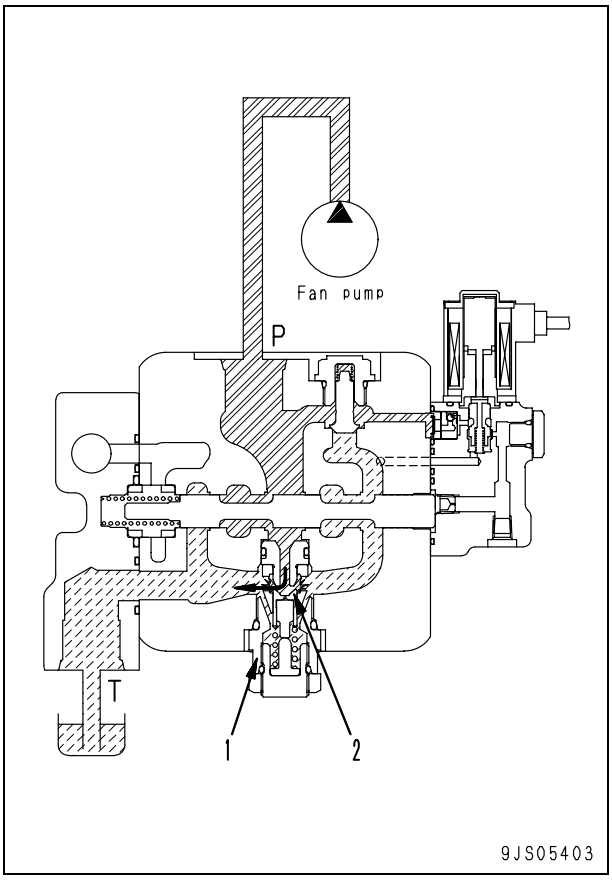


2) When the ON/OFF solenoid is energized.

- If ON/OFF solenoid (1) is “energized”, ON/OFF selector valve (2) changes to let the pressurized oil from the pump flow through port (C) into spool chamber (D).
- The pressurized oil in chamber (D) pushes valve spool (3) to the left against spring (4).
- Motor port (MB) opens and pressurized oil flows in to revolve the motor 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).
- By this operation, generation of abnormal pressure in port (P) is prevented.

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

10 Structure, function and maintenance standard

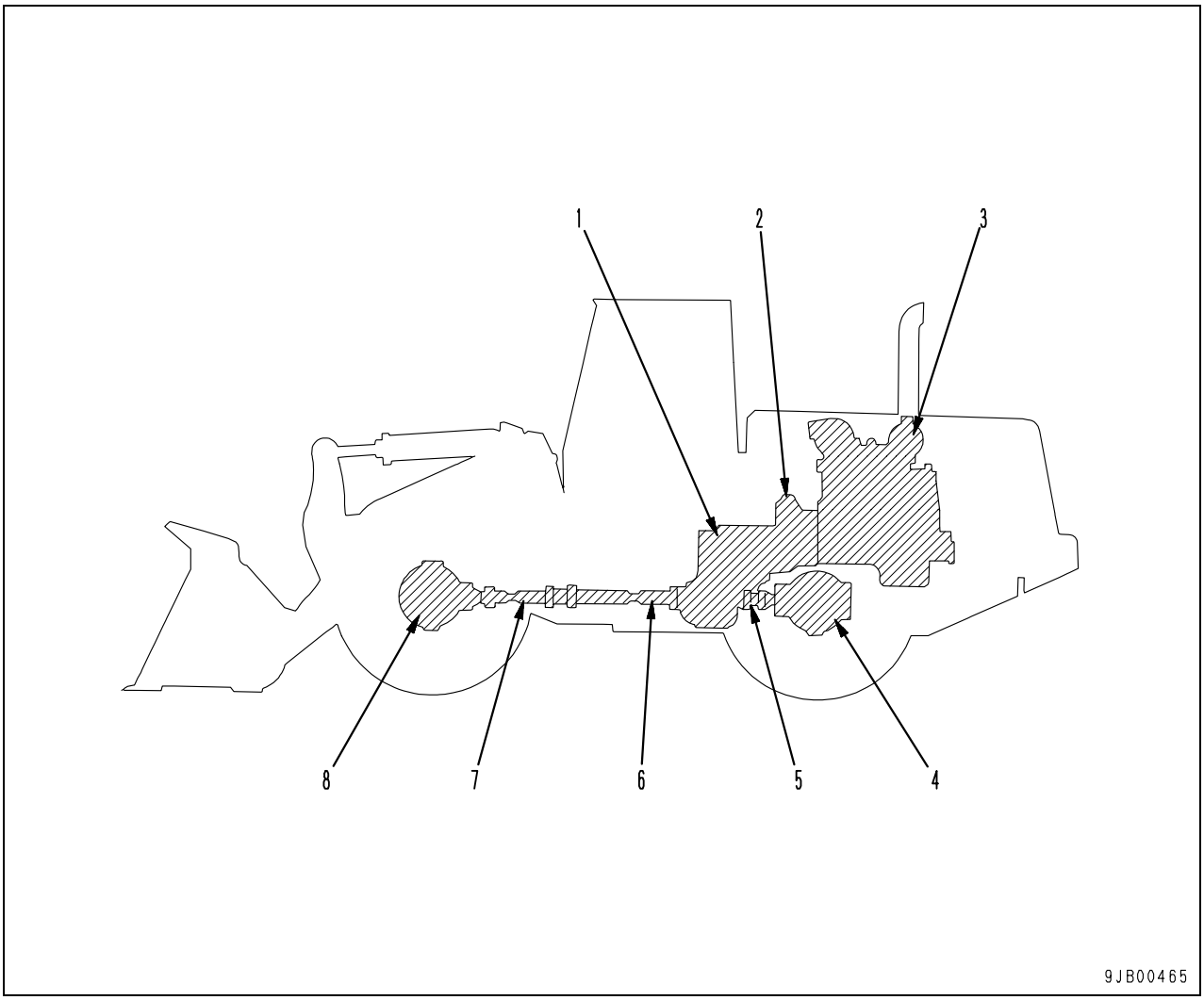
Power train

Power train 3
Power train 3
Power train system diagram 4
Drive shaft 6
Power train piping diagram 7
Torque converter 8
Transmission 16
Flow control valve 33
Valve assembly 34
ECMV 35
Main relief valve and torque converter relief valve 42
Axle 44
Differential 46

Limited slip differential 51
Final drive 58

Power train

Power train

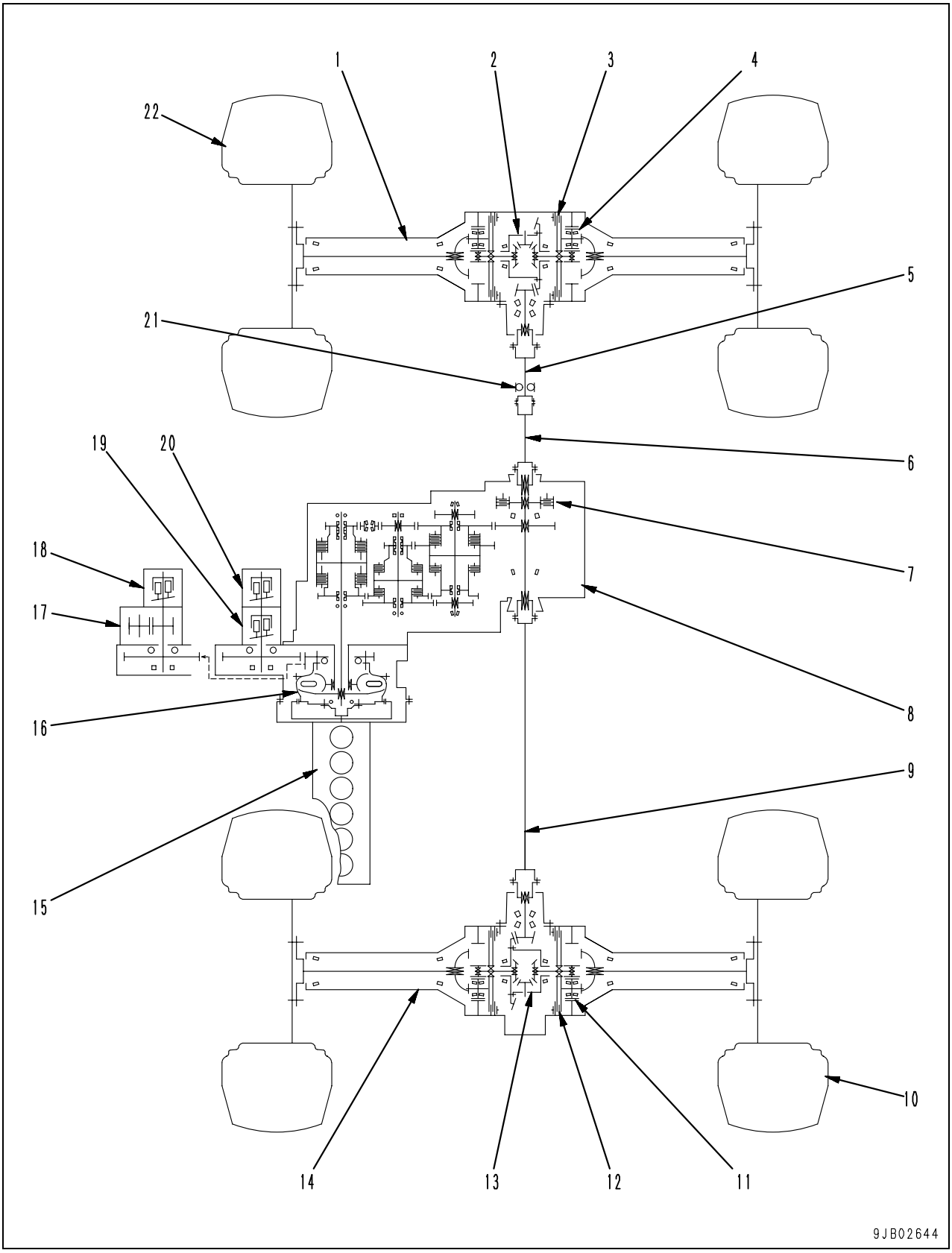


1. Transmission
2. Torque converter
3. Engine
4. Rear axle
5. Rear drive shaft
6. Center drive shaft
7. Front drive shaft
8. Front axle

Outline

- The power from engine (3) is transmitted through the flywheel of the engine to torque converter (2). The turbine of the torque converter is connected to the input shaft of transmission (1).
- The transmission has 6 hydraulic clutches to set itself to 4 forward gear speeds and 4 reverse gear speeds.
- The power from the transmission output shaft is transmitted through center drive shaft (6), front drive shaft (7), and rear drive shaft (5) to front axle (8) and rear axle (4), and then transmitted through the wheels to the tires.

Power train system diagram

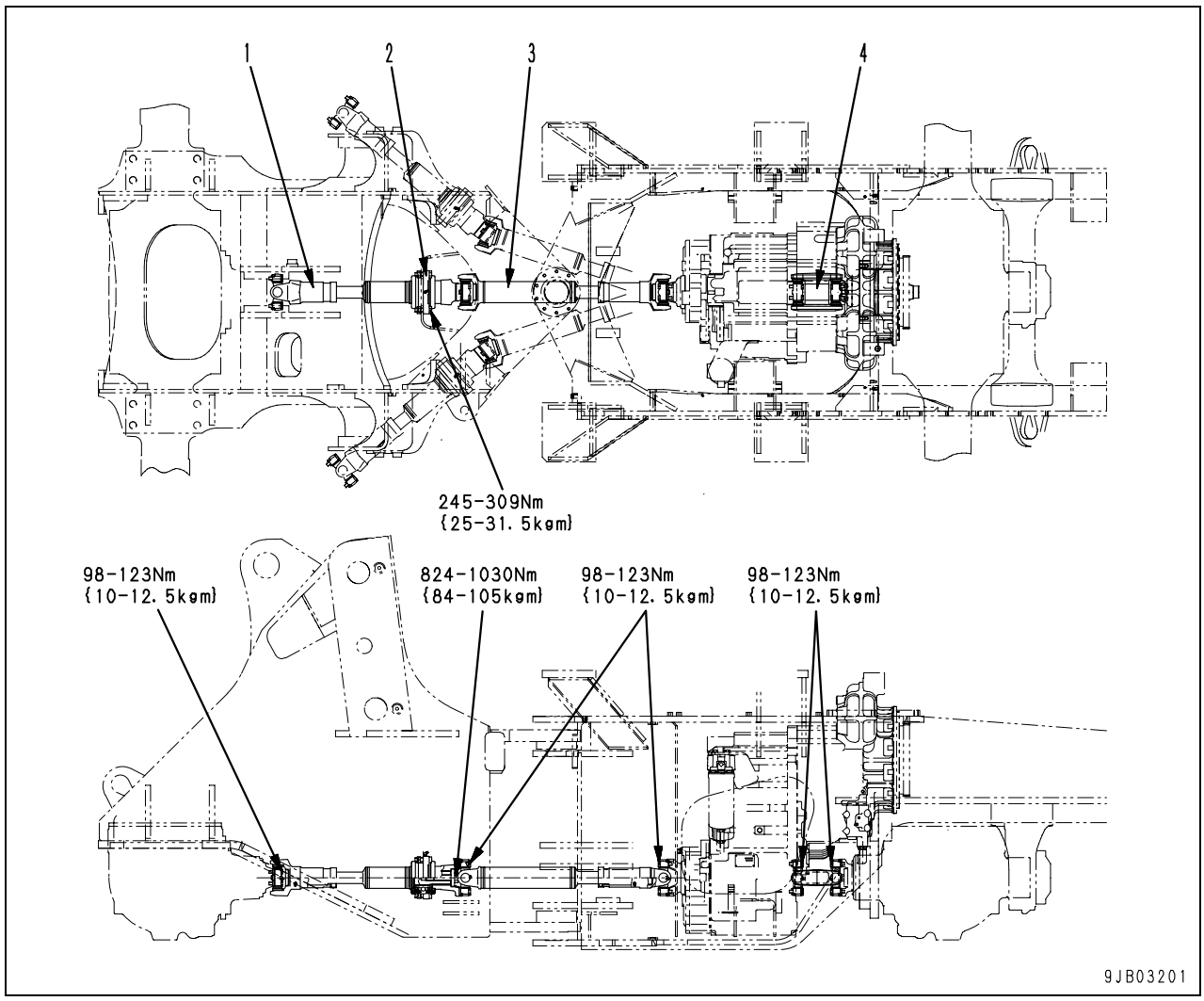


1. Front axle
2. Differential
3. Wet-type multi-disc brake
4. Final drive
5. Front drive shaft
6. Center drive shaft
7. Parking brake (wet-type multi-disc)
8. Transmission (counter-shaft type)
9. Rear drive shaft
10. Rear tire
11. Final drive
12. Wet-type multi-disc brake
13. Differential
14. Rear axle
15. Engine
16. Torque converter
17. Power train pump
18. Work equipment pump
19. Steering pump
20. Cooling fan pump
21. Flange bearing
22. Front tire

Outline

- The power from engine (15) is transmitted through the flywheel of the engine to torque converter (16).
  The torque converter converts the transmitted torque according to the fluctuation of the load by using oil as a medium and transmits the power to the input shaft of transmission (8).
  The engine power is also transmitted through the pump drive gear of the torque converter to steering pump (19), cooling fan pump (20), power train pump (17) and work equipment pump (18) to drive respective pumps.
- The 6 hydraulic clutches of transmission (8) are operated with the directional valve and gearshift valve of the transmission valve to set the transmission to one of 4 gear speeds in the forward or reverse travel direction.
- Parking brake (7) is a wet-type multiple disc brake, which is installed to the front side of the output shaft and used to stop the machine. It is operated by the solenoid valve which is actuated with the parking brake switch.
- The power of transmission (8) is transmitted to the front and rear axles.
  On the front side, the power is transmitted through center drive shaft (6), flange bearing (21), and front drive shaft (5) to front axle (1).
  On the rear side, the power is transmitted through rear drive shaft (9) to rear axle (14).
- The power transmitted to front axle (1) and rear axle (14) is reduced in speed by the pinion gears of differentials (2) and (13), and then transmitted through the differential mechanism to the sun gear shafts.
- The power of the sun gears is further reduced in speed by final drives (4) and (11) of the planetary mechanism, and then transmitted through the axle shafts to the wheels.

Drive shaft

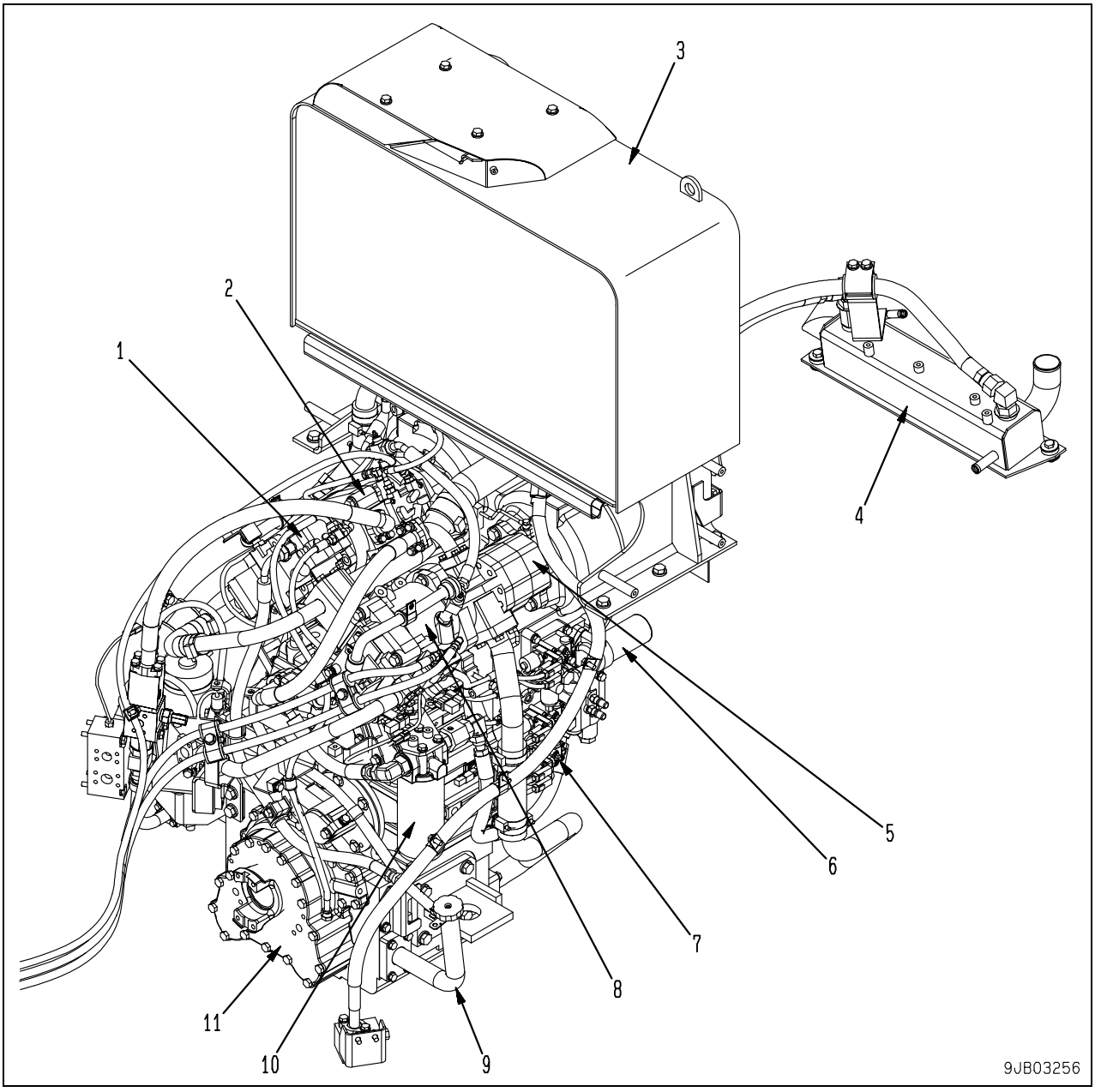


1. Front drive shaft
2. Flange bearing
3. Center drive shaft
4. Rear drive shaft

Outline

- The power from the transmission output shaft is transmitted through center drive shaft (3), front drive shaft (1), and rear drive shaft (4) to the front axle and rear axle.
- When the machine is articulated or when it receives traveling impacts or working impacts, the distances between the transmission and the front and rear axles change. The drive shafts absorb fluctuations in the angle and length with the universal joints and flange bearing (2) so that the power will be transmitted without damaging the parts even when the machine is exposed to above impacts or changes in the component positions.

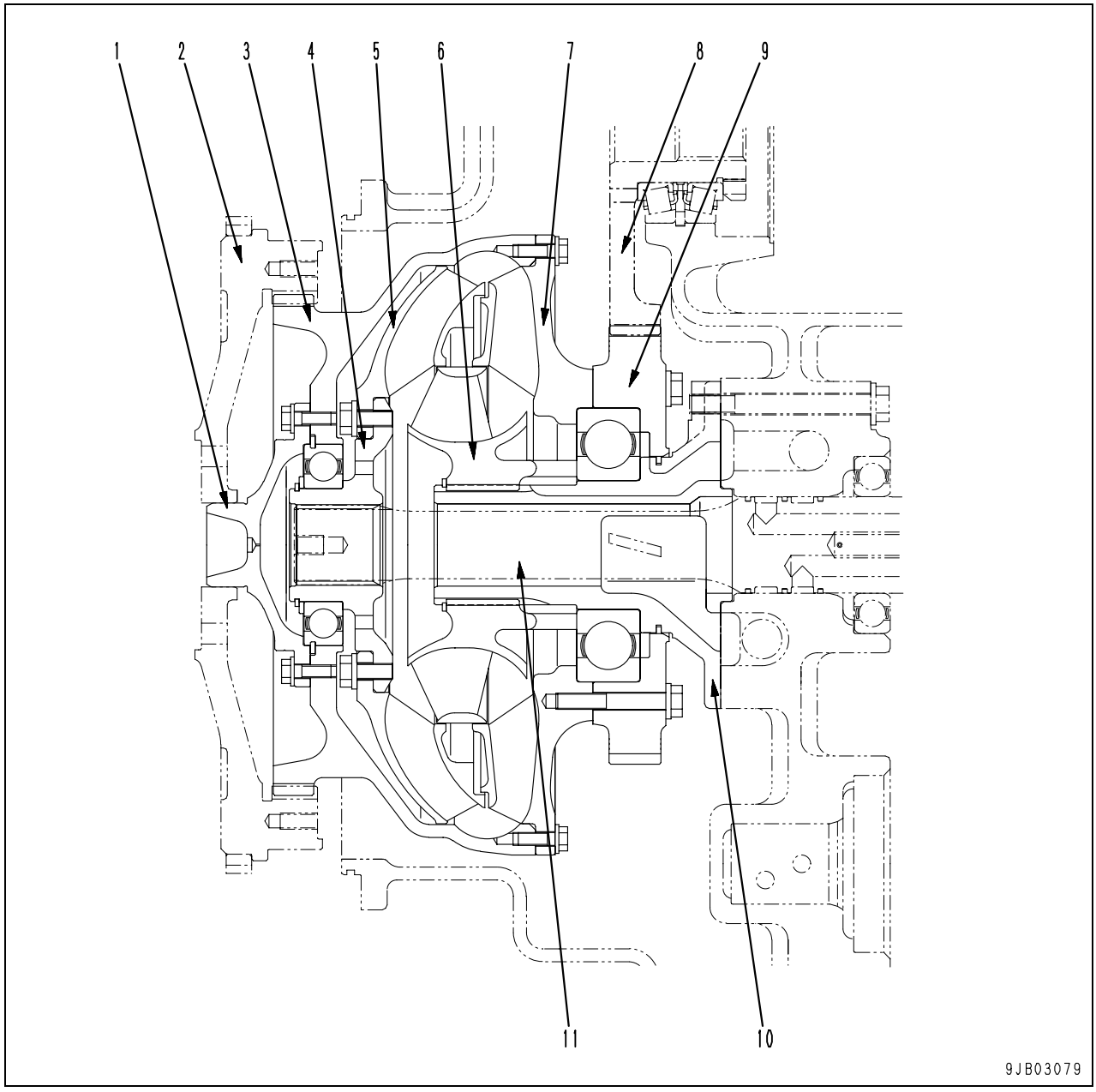
Power train piping diagram



1. Cooling fan pump
2. Steering pump
3. Hydraulic tank
4. Power train oil cooler
5. Power train pump
6. Last chance filter
7. Transmission ECMV
8. Work equipment pump
9. Oil filler pipe
10. Oil filter
11. Transmission assembly

Torque converter

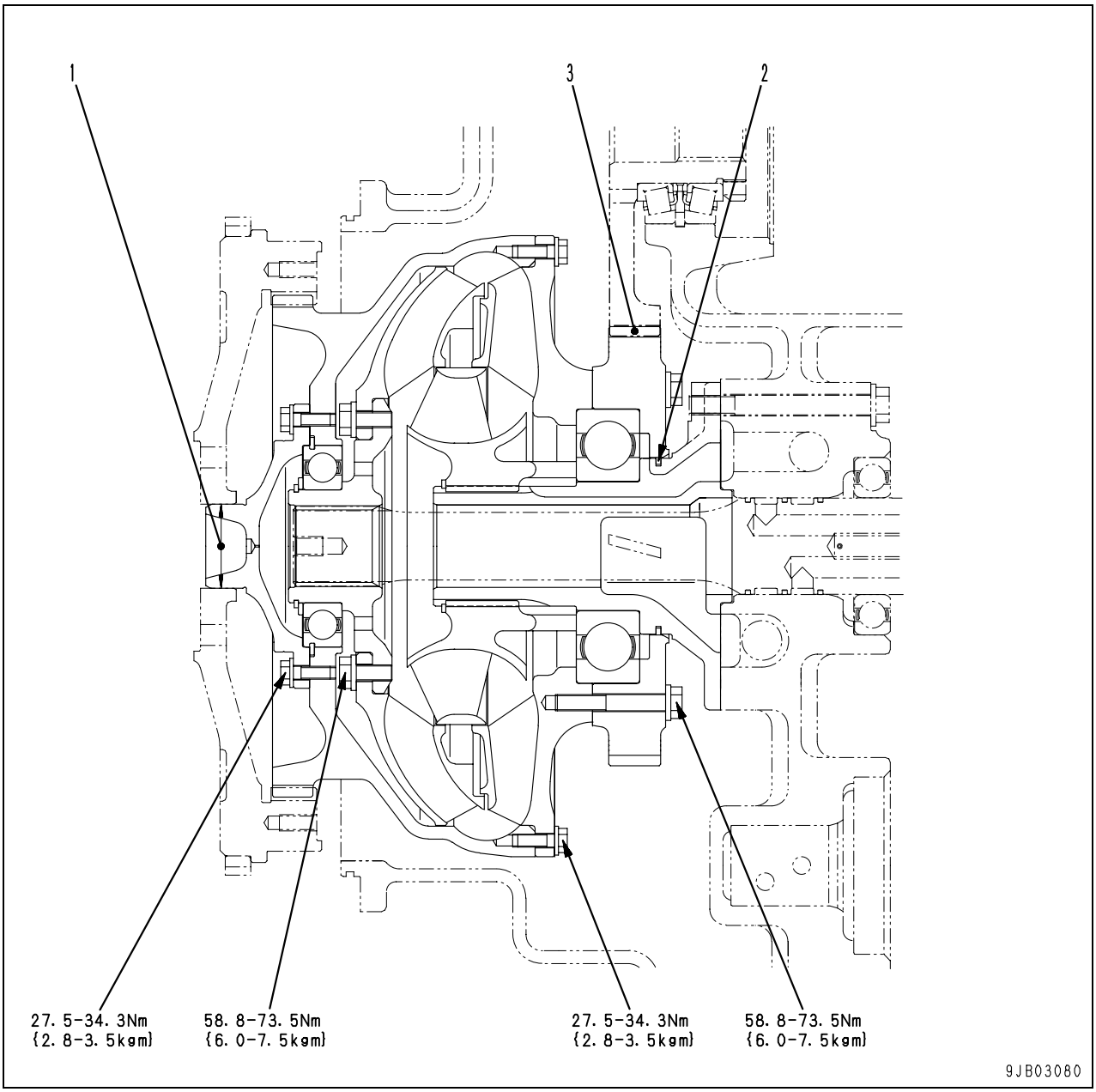
Without lockup clutch



1. Pilot
2. Flywheel
3. Drive case
4. Boss
5. Turbine
6. Stator
7. Pump
8. PTO gear
9. PTO drive gear (Number of teeth: 103)
10. Stator shaft
11. Input shaft

Specifications

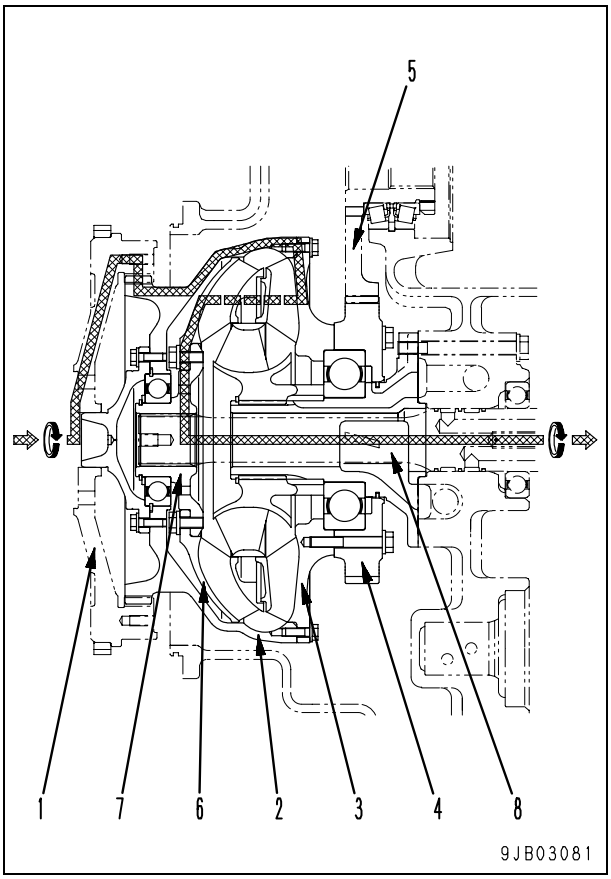
Type	3-element, 1-stage, 1-phase
Stall torque ratio	3.27



Unit: mm

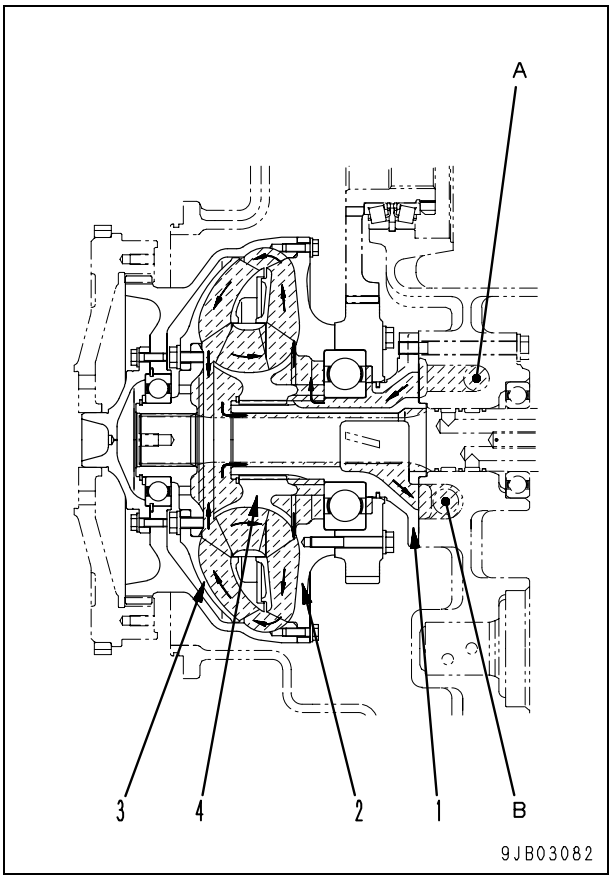
No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Outside diameter of pilot	52	–0.010 –0.040	51.95	Repair by hard chromium-plating or replace
2	Inside diameter of PTO gear seal ring contact surface	110	+0.035 0	110.5	
3	Backlash of PTO drive gear and PTO gear	0.17 – 0.45			Replace

Power transmitting route



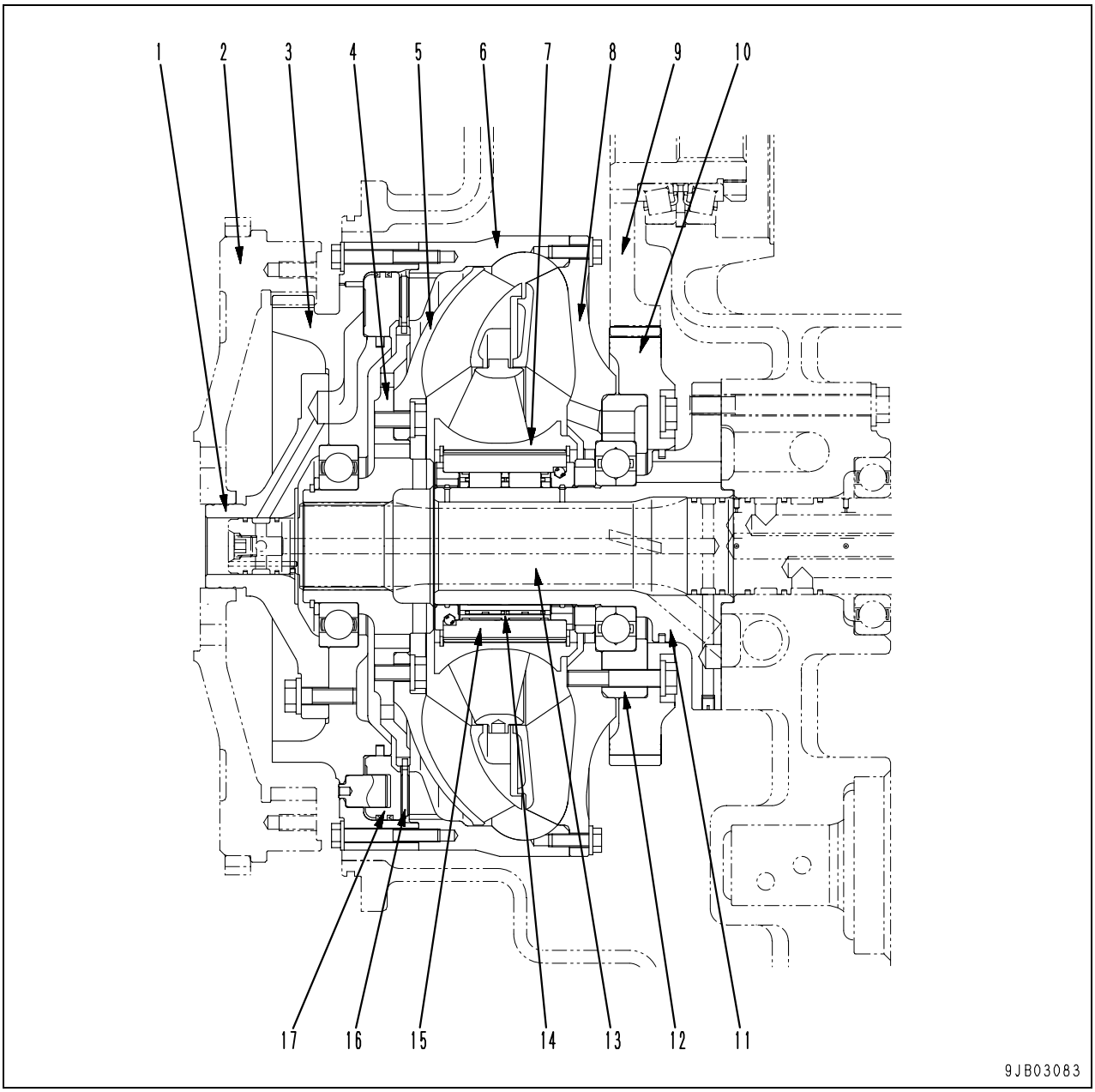
- The power from engine is transmitted to drive case (2) through flywheel (1).
- The power being transmitted to drive case (2) rotates pump (3) and PTO drive gear (4).
- The power transmitted to pump (3) rotates turbine (6) and boss (7) using oil as the medium, and is then transmitted to transmission input shaft (8).
- The power transmitted to PTO drive gear (4) is also used as power for driving the pump after being transmitted through PTO gear (5).

Oil flow



- The oil flows through the main relief valve and its pressure is reduced to below the set pressure by the torque converter relief valve, and then it flows through inlet port (A) and oil passage of stator shaft (1) to pump (2).
- The oil is given centrifugal force by pump (2) and flows into turbine (3) to transmit its energy to turbine (3).
- The oil from turbine (3) is sent to stator (4) and flows into pump (2) again. However, part of the oil passes between turbine (3) and stator (4) and is sent from outlet port (B) to the oil cooler to be cooled. It is then used to lubricate the transmission.

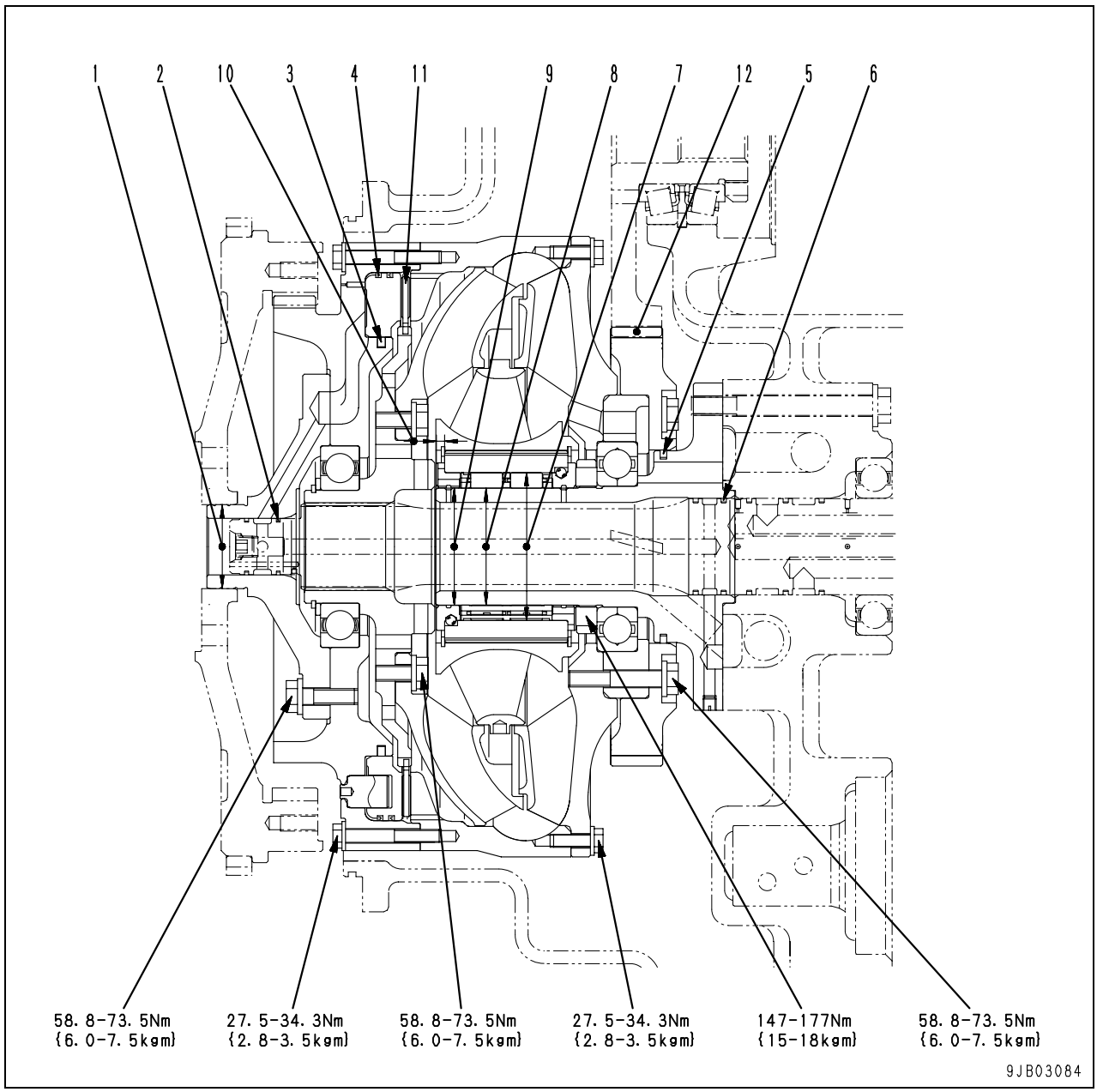
With lockup clutch



1. Pilot
2. Flywheel
3. Lockup clutch housing
4. Boss
5. Turbine
6. Drive case
7. Stator
8. Pump
9. PTO gear
10. PTO drive gear (Number of teeth: 103)
11. Stator shaft
12. Guide
13. Input shaft
14. Free wheel
15. Race
16. Lockup clutch disc
17. Lockup clutch piston

Specifications

Type	3-element, 1-stage, 2-phase
Stall torque ratio	2.98

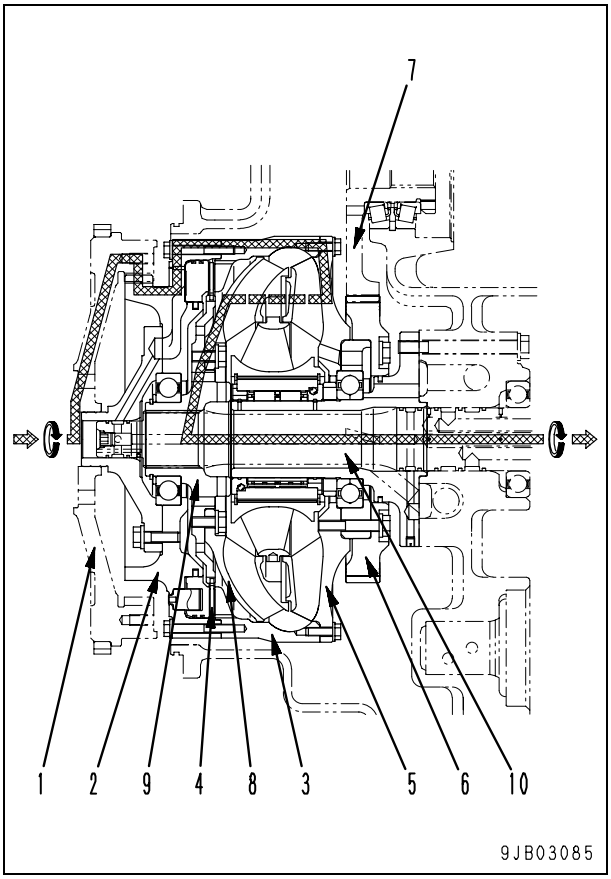

1
2
10
3
4
11
9
8
7
12
5
6
58. 8-73. 5Nm
{6. 0-7. 5kgm}
27. 5-34. 3Nm
{2. 8-3. 5kgm}
58. 8-73. 5Nm
{6. 0-7. 5kgm}
27. 5-34. 3Nm
{2. 8-3. 5kgm}
147-177Nm
{15-18kgm}
58. 8-73. 5Nm
{6. 0-7. 5kgm}
9JB03084

Unit: mm

No.	Check item		Criteria			Remedy
			Standard size	Tolerance	Repair limit	
1	Outside diameter of pilot		52	–0.010 –0.040	51.95	Repair by hard chromium-plating or replace
2	Inside diameter of pilot seal ring contact surface		35	+0.025 0	35.5	
3	Inside diameter of clutch piston seal ring contact surface		260	+0.081 0	260.1	
	Wear of clutch housing seal ring	Width	5	–0.01 –0.04	4.5	Replace
		Thick-ness	6	±0.15	5.85	
4	Inside diameter of clutch housing seal ring contact surface		340	+0.089 0	340.5	Repair by hard chromium-plating or replace
5	Inside diameter of PTO drive gear seal ring contact surface		120	+0.040 0	120.5	
6	Inside diameter of stator shaft seal ring contact surface		60	+0.030 0	60.5	
7	Inside diameter of free wheel transfer surface of race		91.661	±0.008	91.691	Replace
8	Inside diameter of free wheel transfer surface of stator shaft		72.661	+0.008 –0.005	72.631	
9	Inside diameter of bushing sliding part		72.775	+0.015 0	72.855	
10	Thickness of bushing sliding part		5	0 –0.1	4.5	
11	Thickness of clutch disc		5	±0.1	4.5	
12	Backlash of PTO drive gear and PTO gear		0.17 – 0.45			

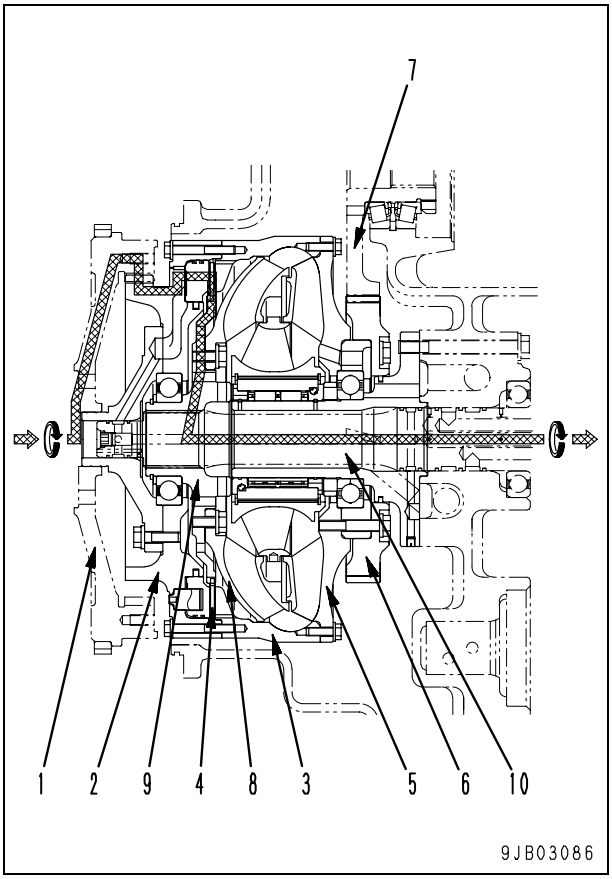
Power transmitting route

When lockup clutch is “disengaged”



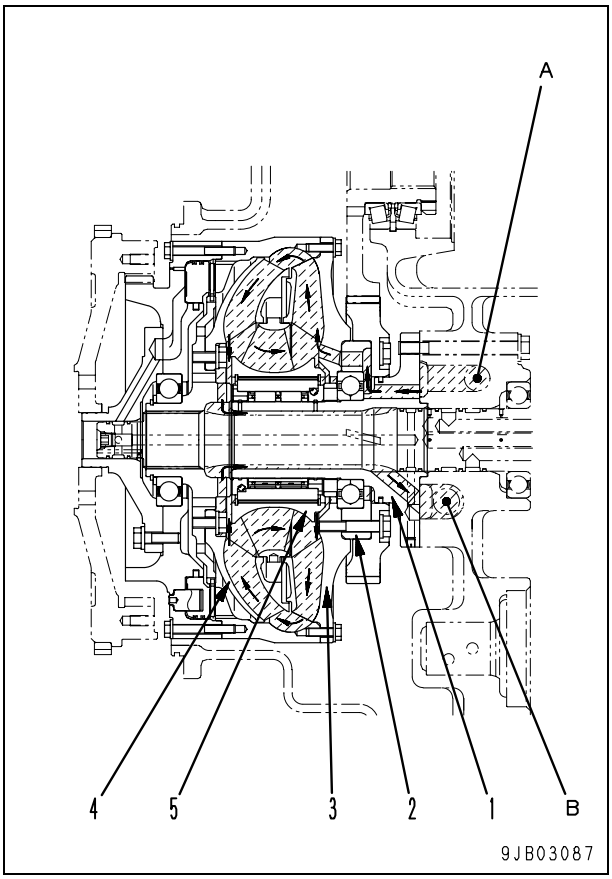
- When lockup clutch (4) is “disengaged”, drive case (3), boss (9) and turbine (8) are separated from each other.
  Above state enables the torque converter to carry out the normal functions.
- The power from engine is transmitted to clutch housing (2) through flywheel (1).
- The power being transmitted to clutch housing (2) rotates drive case (3), pump (5) and PTO drive gear (6).
- The power transmitted to pump (5) rotates turbine (8) and boss (9) using oil as the medium, and is then transmitted to transmission input shaft (10).
- The power transmitted to PTO drive gear (6) is also used as power for driving the pump after being transmitted through PTO gear (7).

When lockup clutch is “engaged”



- When lockup clutch (4) is “engaged”, drive case (3), boss (9) and turbine (8) are connected.
  Above state enables the torque converter to carry out the lockup function.
- The power from engine is transmitted to clutch housing (2) through flywheel (1).
- The power being transmitted to clutch housing (2) rotates drive case (3), pump (5) and PTO drive gear (6).
- Since lockup clutch (4) is fixed, the power transmitted to drive case (3) rotates boss (9) directly and is then transmitted to transmission input shaft (10).
- The power transmitted to PTO drive gear (6) is also used as power for driving the pump after being transmitted through PTO gear (7).

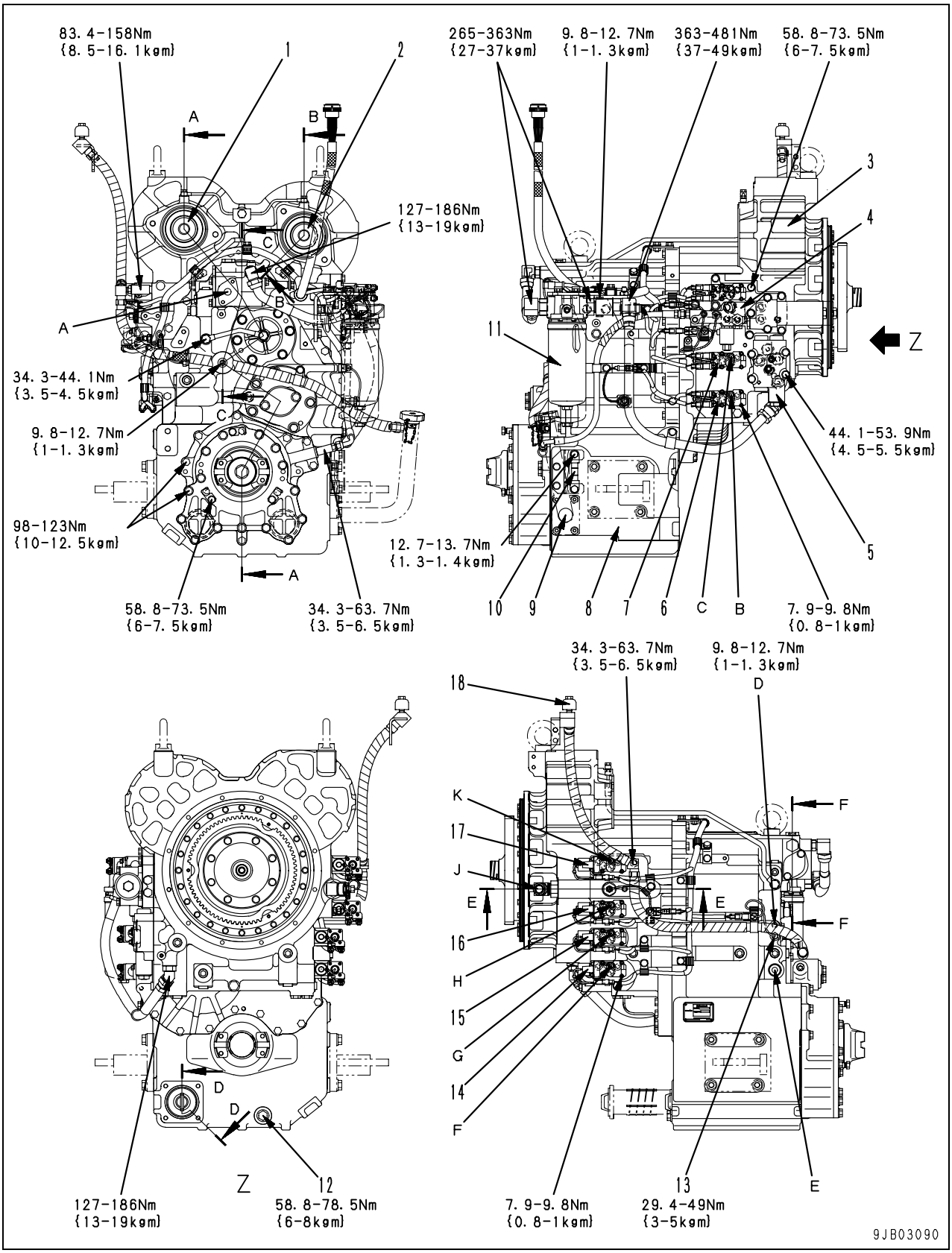
Oil flow



- The oil flow passes through the main relief valve and its pressure is reduced to below the set pressure by the torque converter relief valve. The oil then flows through inlet port (A) and the oil passage of stator shaft (1) and guide (2) to pump (3).
- The oil is provided with centrifugal force from pump (3) and then it enters turbine (4) to transmit its energy to turbine (4).
- The oil from turbine (4) is sent to stator (5) and then returned to pump (3) again. Part of this oil flows between turbine (4) and stator (5) to outlet port (B). It is then cooled in the oil cooler and then used for lubrication of the transmission.

Transmission

★ Transmission with lockup clutch



A: From power train pump
B: 2nd clutch oil pressure pickup port
C: 1st clutch oil pressure pickup port
D: Transmission lubricant pressure pickup port
E: From oil cooler
F: 3rd clutch oil pressure pickup port
G: 4th clutch oil pressure pickup port
H: Lockup clutch oil pressure pickup port (if equipped)
J: To oil cooler
K: F clutch oil pressure pickup port

1. Steering pump and cooling fan pump mounting port
2. Power train pump and work equipment pump mounting port
3. Transmission case (rear)
4. Valve assembly
5. Main relief valve and torque converter relief valve
6. 2nd clutch ECMV
7. 1st clutch ECMV
8. Transmission case (front)
9. Oil filler pipe mounting port
10. Oil level gauge
11. Transmission oil filter
12. Drain plug
13. Transmission oil temperature sensor
14. 3rd clutch ECMV
15. 4th clutch ECMV
16. Lockup clutch ECM (if equipped)
17. F clutch ECMV
18. Breather

Outline

- The transmission employed consists of the counter-shaft constant gear mesh mechanism and disc clutch that provides “4 forward gear speeds and 4 reverse gear speeds”.
- The transmission selects one rotation direction and gear speed by fixing the counter-shaft type, constant mesh gear mechanisms and 2 out of 6 sets disc clutch with the oil pressure by ECMV operation.
- 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	11	10
F clutch	11	10
1st clutch	7	6
4th clutch	7	6
2nd clutch	9	8
3rd clutch	6	5

Combinations of clutches at respective gear speeds and reduction ratio

Gear speed	Clutch used	Reduction ratio
Forward 1st	F x 1st	4.112
Forward 2nd	F x 2nd	2.311
Forward 3rd	F x 3rd	1.265
Forward 4th	F x 4th	0.711
Neutral	—	—
Reverse 1st	R x 1st	3.826
Reverse 2nd	R x 2nd	2.151
Reverse 3rd	R x 3rd	1.178
Reverse 4th	R x 4th	0.661

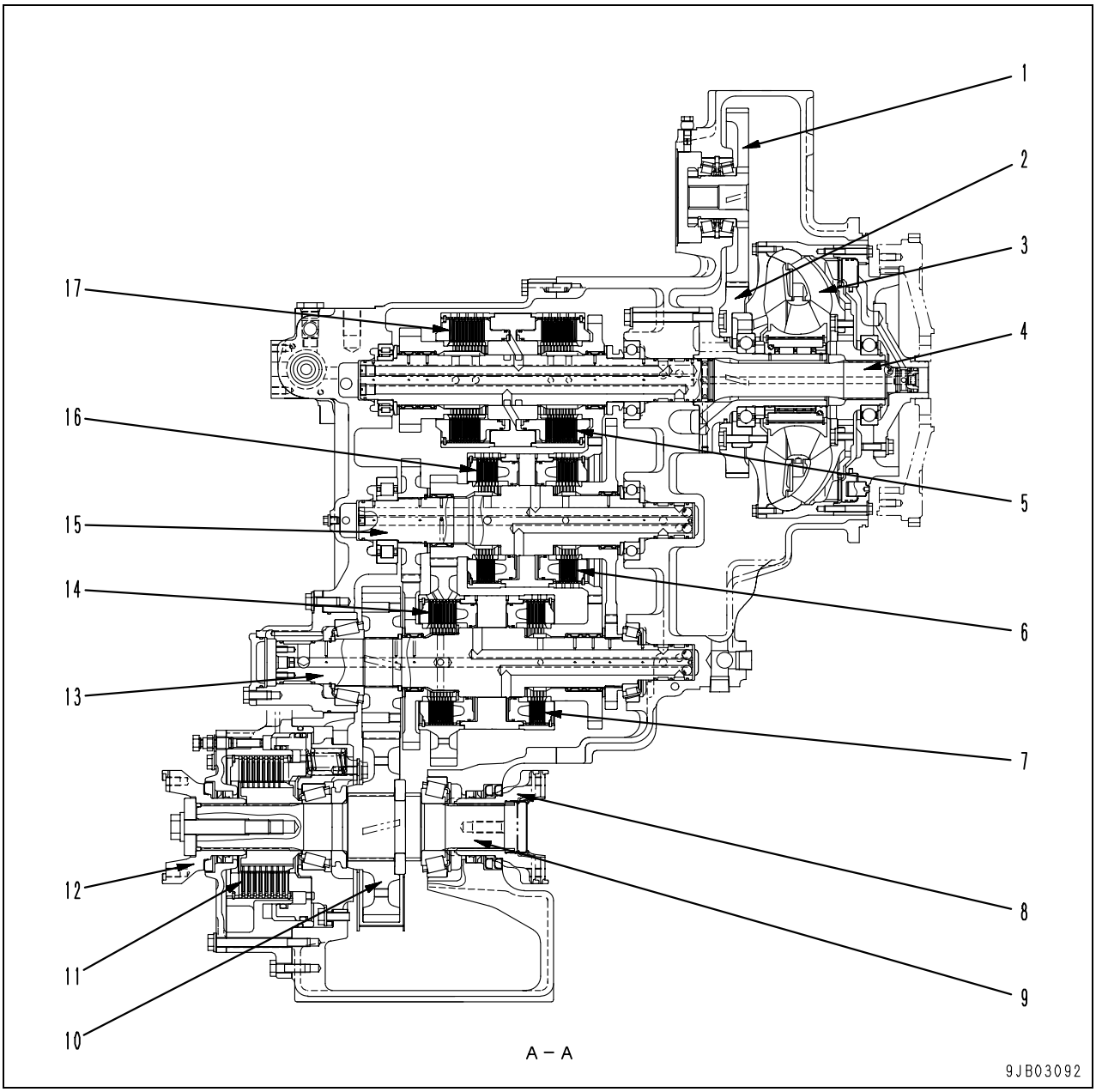
Operation table of ECMV

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

L/U: Indicates the lockup clutch ECMV (if equipped).

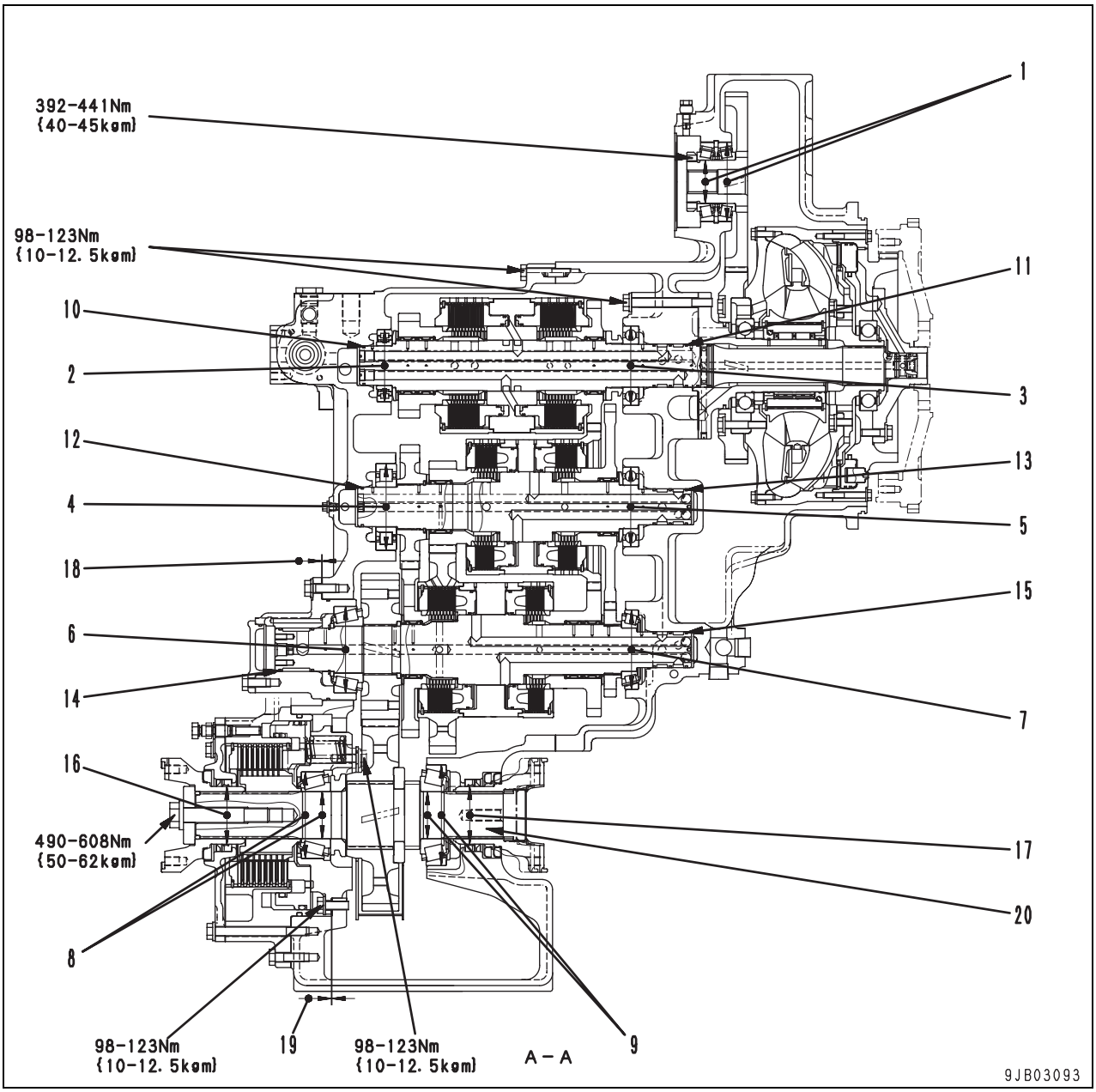
- The oil from the pump flows through the flow control valve and oil filter to the transmission front case. The oil is then diverged to the main relief circuit and clutch actuation circuit.
- The pressure of the oil sent to the clutch actuation circuit is regulated by the main relief valve, and then 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 – 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 3rd and 4th speed travel, the lockup clutch ECMV (if equipped) operates at a speed above that being specified from the transmission controller.

★ Transmission with lockup clutch



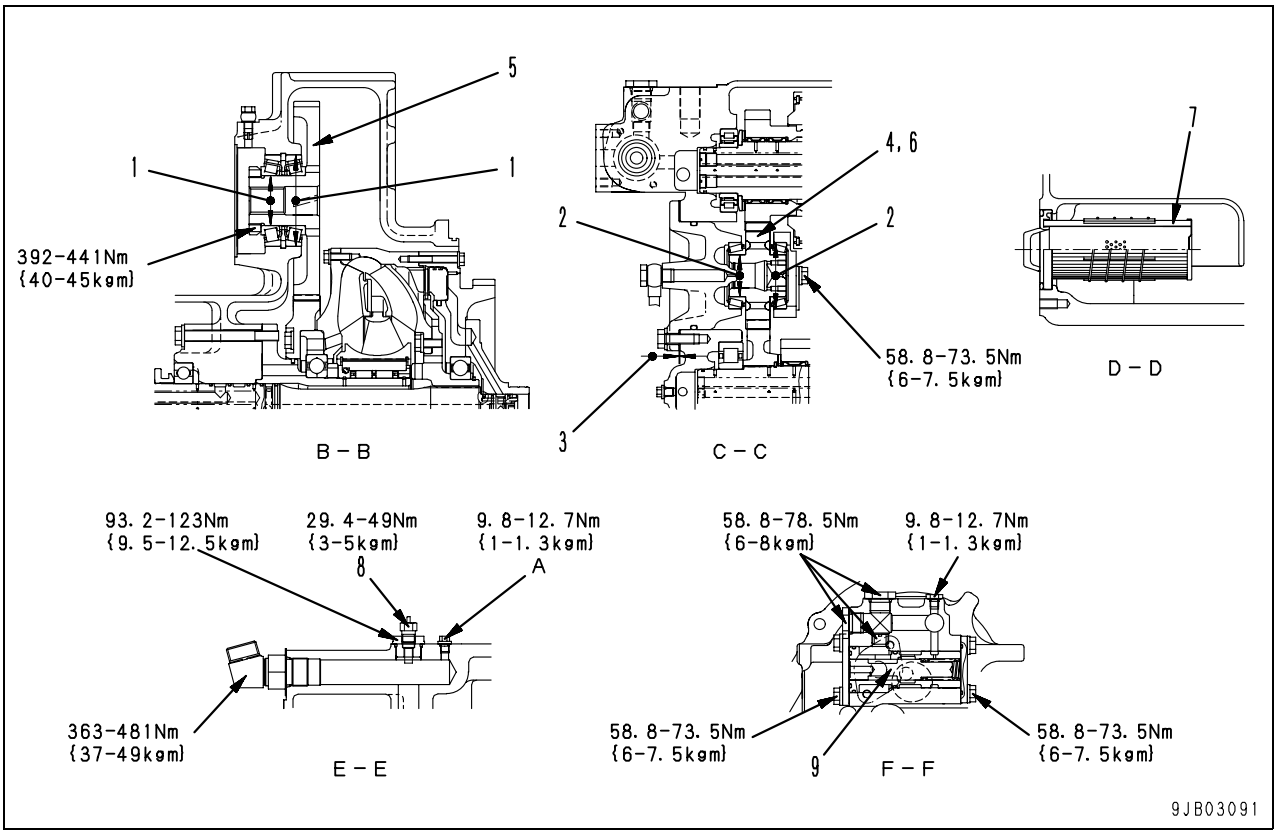
1. PTO gear A (Number of teeth: 94)
2. PTO drive gear (Number of teeth: 103)
3. Torque converter
4. Input shaft
5. F clutch
6. 4th clutch
7. 3rd clutch
8. Rear coupling
9. Output shaft
10. Output gear (Number of teeth: 62)
11. Parking brake
12. Front coupling
13. Lower shaft
14. 2nd clutch
15. Upper shaft
16. 1st clutch
17. R clutch

★ Transmission with lockup clutch



Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between PTO gear A bearing and rear case	110	0 –0.015	–0.006 –0.028	–0.028 – 0.009	—	
	Clearance between PTO gear A bearing and PTO gear A	60	+0.021 +0.002	0 –0.015	–0.036 – –0.002	—	
2	Clearance between input shaft bearing and front case	100	0 –0.015	+0.030 0	0 – 0.045	—	
3	Clearance between input shaft bearing and rear case	110	0 –0.015	+0.030 0	0 – 0.045	—	
4	Clearance between upper shaft bearing and front case	120	0 –0.015	+0.030 0	0 – 0.045	—	
5	Clearance between upper shaft bearing and rear case	110	0 –0.015	+0.030 0	0 – 0.045	—	
6	Clearance between lower shaft bearing and cage	120	0 –0.018	+0.035 0	0 – 0.053	—	
7	Clearance between lower shaft bearing and rear case	110	0 –0.018	+0.035 0	0 – 0.053	—	
8	Clearance between output shaft bearing and retainer	120	0 –0.018	–0.015 –0.040	–0.040 – 0.003	—	
	Clearance between output shaft bearing and output shaft	65	+0.030 +0.011	0 –0.015	–0.045 – –0.011	—	
9	Clearance between output shaft bearing and front case	140	0 –0.020	–0.018 –0.058	–0.058 – 0.002	—	
	Clearance between output shaft bearing and output shaft	65	+0.030 +0.011	0 –0.015	–0.045 – –0.011	—	
10	Inside diameter of input shaft seal ring contact surface (front)	Standard size		Tolerance	Repair limit		Replace
		55		+0.05 0	55.1		
	Width of input shaft seal ring groove (front)	3.2		+0.076 0	3.5		
11	Inside diameter of input shaft seal ring contact surface (rear)	60		+0.05 0	60.1		
	Width of input shaft seal ring groove (rear)	3.2		+0.076 0	3.5		
12	Inside diameter of upper shaft seal ring contact surface (front)	55		+0.05 0	55.1		
	Width of upper shaft seal ring groove (front)	3.2		+0.076 0	3.5		
13	Inside diameter of upper shaft seal ring contact surface (rear)	50		+0.05 0	50.1		
	Width of upper shaft seal ring groove (rear)	3.2		+0.076 0	3.5		
14	Inside diameter of lower shaft seal ring contact surface (front)	60		+0.03 0	60.1		
	Width of lower shaft seal ring groove (front)	3.2		+0.076 0	3.5		
15	Inside diameter of lower shaft seal ring contact surface (rear)	50		+0.05 0	50.1		
	Width of lower shaft seal ring groove (rear)	3.2		+0.076 0	3.5		
16	Outside diameter of front coupling oil seal contact surface	80		0 –0.074	79.8		
17	Outside diameter of rear coupling oil seal contact surface	80		0 –0.074	79.8		
18	Clearance between cage and case	Standard clearance			Clearance limit		
		1.19 – 1.95 (Standard shim thickness 1.4)			—		
19	Clearance between retainer and case	0.85 – 1.42 (Standard shim thickness 1.0)			—		
20	Free rotational torque of output shaft	0.74 – 1.46 Nm {0.076 – 0.149 kgm}					



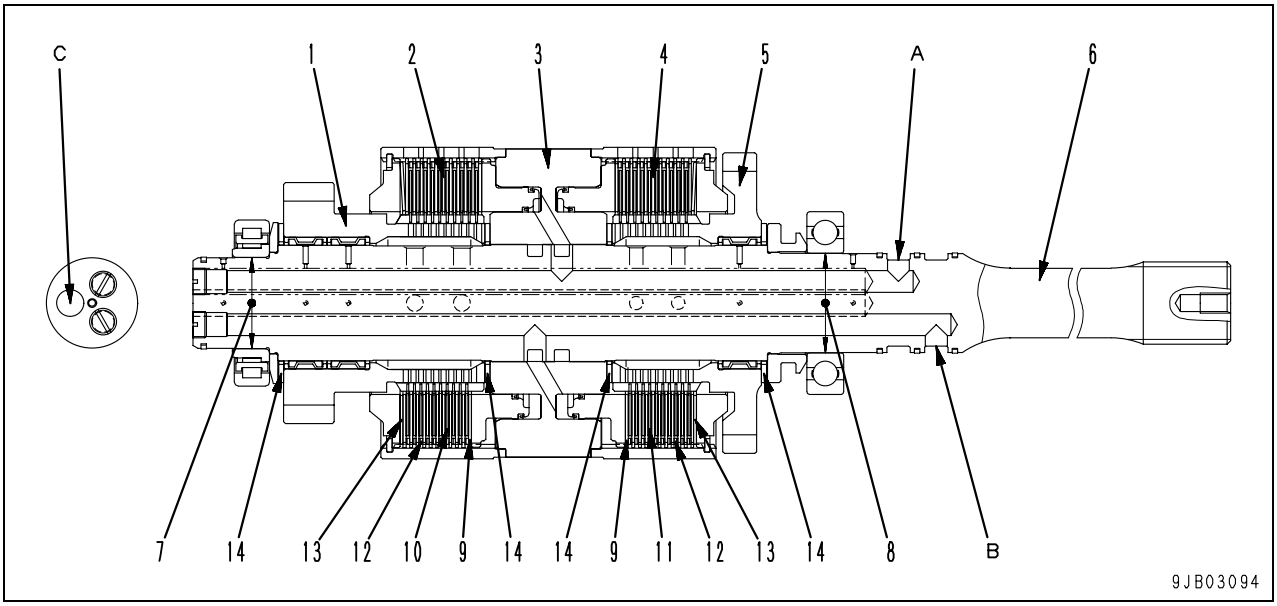
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between PTO gear B bearing and rear case	110	0 –0.015	–0.006 –0.028	–0.028 – 0.009	—	Replace
	Clearance between PTO gear B bearing and PTO gear B	60	+0.021 +0.002	0 –0.015	–0.036 – –0.002	—	
2	Clearance between R idler gear bearing and front case	80	0 –0.016	–0.013 –0.040	–0.040 – 0.003	—	
	Clearance between R idler gear bearing and R idler gear	50	+0.050 +0.040	0 –0.012	–0.062 – –0.040	—	
3	Clearance between cage and case	Standard clearance			Clearance limit		
		1.15 – 1.91 (Standard shim thickness 1.35)			—		
4	Free rotational torque of R idler gear	0.49 – 0.98 Nm {0.05 – 0.1 kgm}					

5. PTO gear B (Number of teeth: 90)
6. R idler gear (Number of teeth: 26)
7. Strainer
8. Torque converter oil temperature sensor
9. Flow control valve

A: Torque converter outlet port oil pressure pickup port

F and R clutches
Without lockup clutch



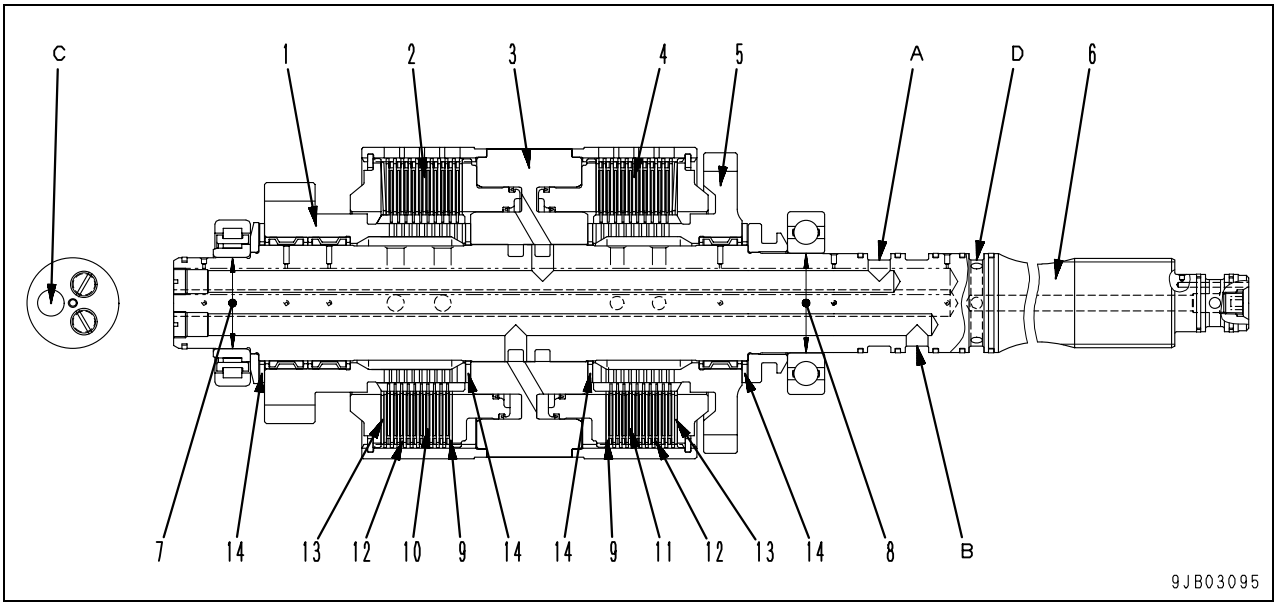
A: R clutch oil port
B: F clutch oil port
C: Lubricating oil port

1. R clutch gear (Number of teeth: 30)
2. R clutch
3. F and R cylinders
4. F clutch
5. F clutch gear (Number of teeth: 38)
6. Input shaft

Unit: mm

No.	Check item		Criteria					Remedy
			Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
7	Clearance between input shaft bearing and input shaft (front)		55	+0.034 +0.024	0 –0.015	–0.049 – –0.024	—	Replace
8	Clearance between input shaft bearing and input shaft (rear)		60	+0.030 +0.011	0 –0.015	–0.045 – –0.011	—	
			Standard size	Tolerance		Repair limit		
9	Clutch plate	Thickness	1.7	±0.05		1.53		
		Strain	—	0.05		0.15		
10	Clutch disc (R clutch)	Thickness	2.2	±0.08		1.82		
		Strain	—	0.1		0.25		
11	Clutch disc (F clutch)	Thickness	2.2	±0.08		1.82		
		Strain	—	0.1		0.25		
12	Load of wave spring [Testing height: 2.2 mm]		1,010 N {103 kg}	±101 N {±10.3 kg}		859 N {87.6 kg}		
13	Warp of spring plate		1.4	±0.2		1.2		
14	Thrust washer thickness		3	±0.1		2.7		

F and R clutches
With lockup clutch



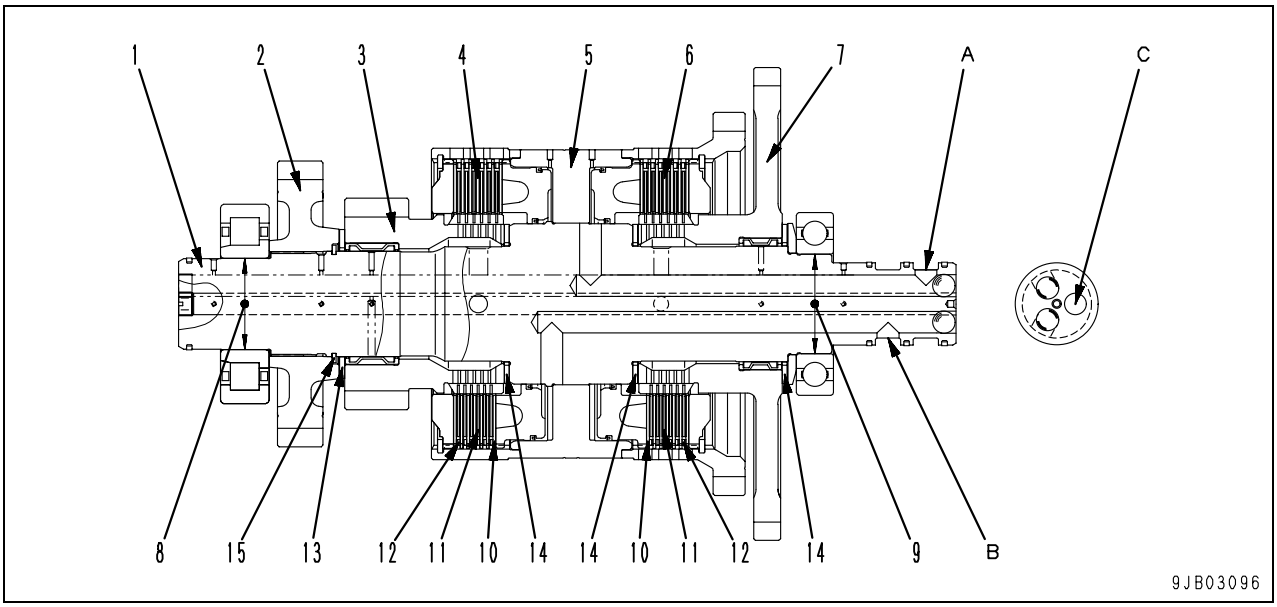
A: R clutch oil port
B: F clutch oil port
C: Lubricating oil port
D: Lockup clutch oil port

1. R clutch gear (Number of teeth: 30)
2. R clutch
3. F and R cylinders
4. F clutch
5. F clutch gear (Number of teeth: 38)
6. Input shaft

Unit: mm

No.	Check item		Criteria					Remedy
7	Clearance between input shaft bearing and input shaft (front)		Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
			55	+0.034 +0.024	0 –0.015	–0.049 – –0.024	—	
8	Clearance between input shaft bearing and input shaft (rear)		60	+0.030 +0.011	0 –0.015	–0.045 – –0.011	—	
9	Clutch plate		Standard size	Tolerance		Repair limit		
		Thickness	1.7	±0.05		1.53		
		Strain	—	0.05		0.15		
10	Clutch disc (R clutch)	Thickness	2.2	±0.08		1.82		
		Strain	—	0.1		0.25		
11	Clutch disc (F clutch)	Thickness	2.2	±0.08		1.82		
		Strain	—	0.1		0.25		
12	Load of wave spring [Testing height: 2.2 mm]		1,010 N {103 kg}	±101 N {±10.3 kg}		859 N {87.6 kg}		
13	Warp of spring plate		1.4	±0.2		1.2		
14	Thrust washer thickness		3	±0.1		2.7		

1st and 4th clutches



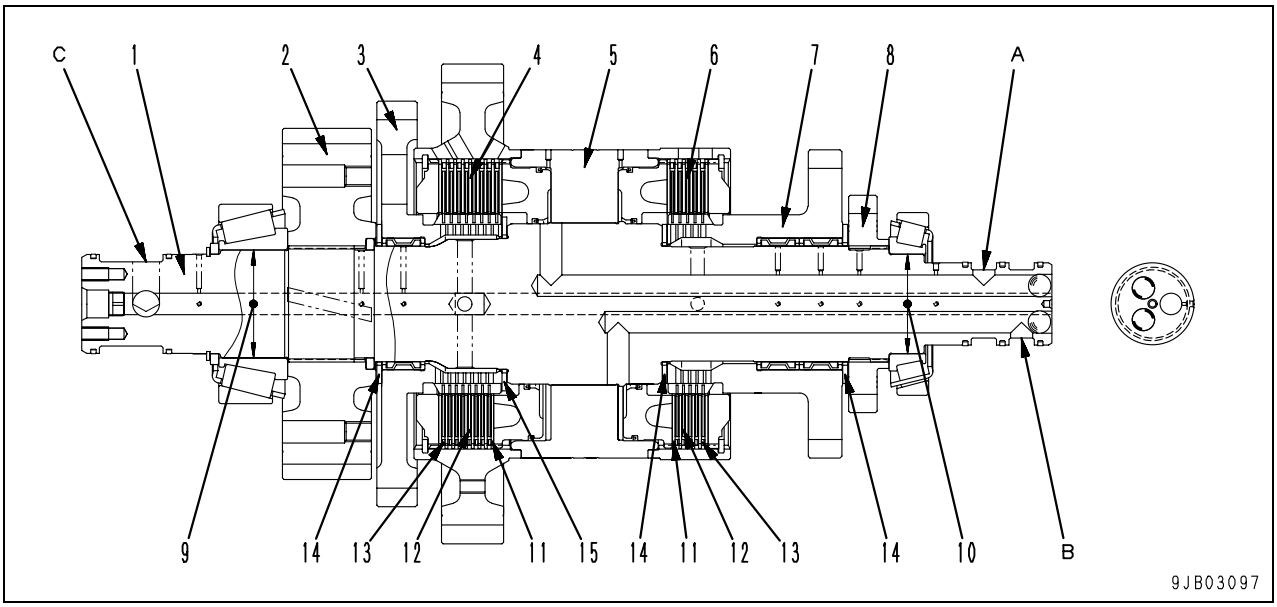
A: 4th clutch oil port
B: 1st clutch oil port
C: Lubricating oil port

1. Upper shaft
2. Upper gear (Number of teeth: 36)
3. 1st clutch gear (Number of teeth: 25)
4. 1st clutch
5. 1st and 4th cylinders (Number of teeth: 49)
6. 4th clutch
7. 4th clutch gear (Number of teeth: 62)

Unit: mm

No.	Check item		Criteria					Remedy
8	Clearance between upper shaft bearing and upper shaft (front)		Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
			55	+0.035 +0.025	0 –0.015	–0.050 – –0.025	—	
9	Clearance between upper shaft bearing and upper shaft (rear)		60	+0.039 +0.020	0 –0.015	–0.054 – –0.020	—	
10	Clutch plate		Standard size		Tolerance		Repair limit	
		Thickness	1.7		±0.05		1.53	
		Strain	—		0.05		0.15	
11	Clutch disc	Thickness	2.2		±0.08		1.75	
		Strain	—		0.10		0.25	
12	Load of wave spring [Testing height: 2.2 mm]		1,010 N {103 kg}		±101 N {±10.3 kg}		859 N {87.6 kg}	
13	Thrust washer thickness (1st clutch)		3		±0.1		2.7	
14	Thrust washer thickness (1st and 4th clutches)		3		±0.1		2.7	
15	Snap ring		Reuse after disassembly not allowed					

2nd and 3rd clutches



A: 2nd clutch oil port
B: 3rd clutch oil port
C: Lubricating oil port

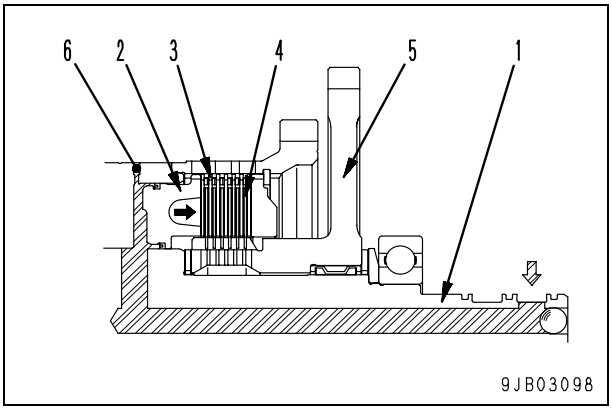
1. Lower shaft
2. Lower gear A (Number of teeth: 49)
3. 2nd clutch gear (Number of teeth: 51)
4. 2nd clutch
5. 2nd and 3rd cylinders (Number of teeth: 63)
6. 3rd clutch
7. 3rd clutch gear (Number of teeth: 38)
8. Lower gear B (Number of teeth: 27)

Unit: mm

No.	Check item		Criteria					Remedy
9	Clearance between lower shaft bearing and lower shaft (front)		Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
			65	+0.055 +0.045	0 –0.015	–0.070 – –0.045	—	
10	Clearance between lower shaft bearing and lower shaft (rear)		60	+0.039 +0.020	0 –0.015	–0.054 – –0.020	—	
11	Clutch plate		Standard size		Tolerance		Repair limit	
		Thickness	1.7		±0.05		1.53	
		Strain	—		0.05		0.15	
12	Clutch disc	Thickness	2.2		±0.08		1.75	
		Strain	—		0.10		0.25	
13	Load of wave spring [Testing height: 2.2 mm]		1,010 N {103 kg}		±101 N {±10.3 kg}		859 N {87.6 kg}	
14	Thrust washer thickness (2nd and 3rd clutches)		3		±0.1		2.7	
15	Thrust washer thickness (2nd clutch)		3		±0.1		2.7	

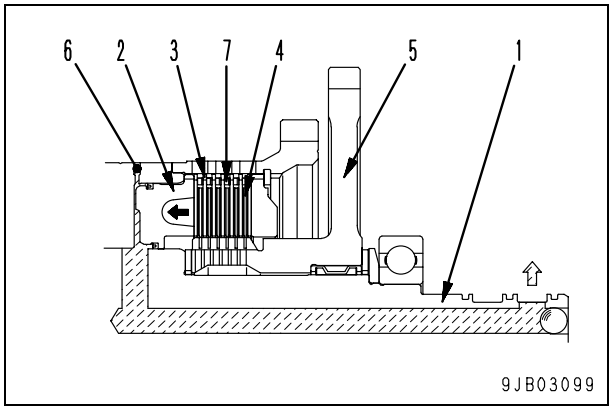
Operation of the disc clutch

When clutch is "engaged" (fixed)



- The oil sent from the ECMV flows through the oil passage of shaft (1), is pressure-fed to the back side of piston (2), and pushes piston (2) to the right.
- Piston (2) compresses plates (3) and discs (4) and the rotation of discs (4) is stopped by the frictional force.
- As the internal teeth of disc (4) are meshed with clutch gear (5), shaft (1) and clutch gear (5) transfer the power as a unit.
- The oil is drained from oil drain hole (6), but the drain amount is less than the amount of oil supplied, so there is no influence on the actuation of the clutch.

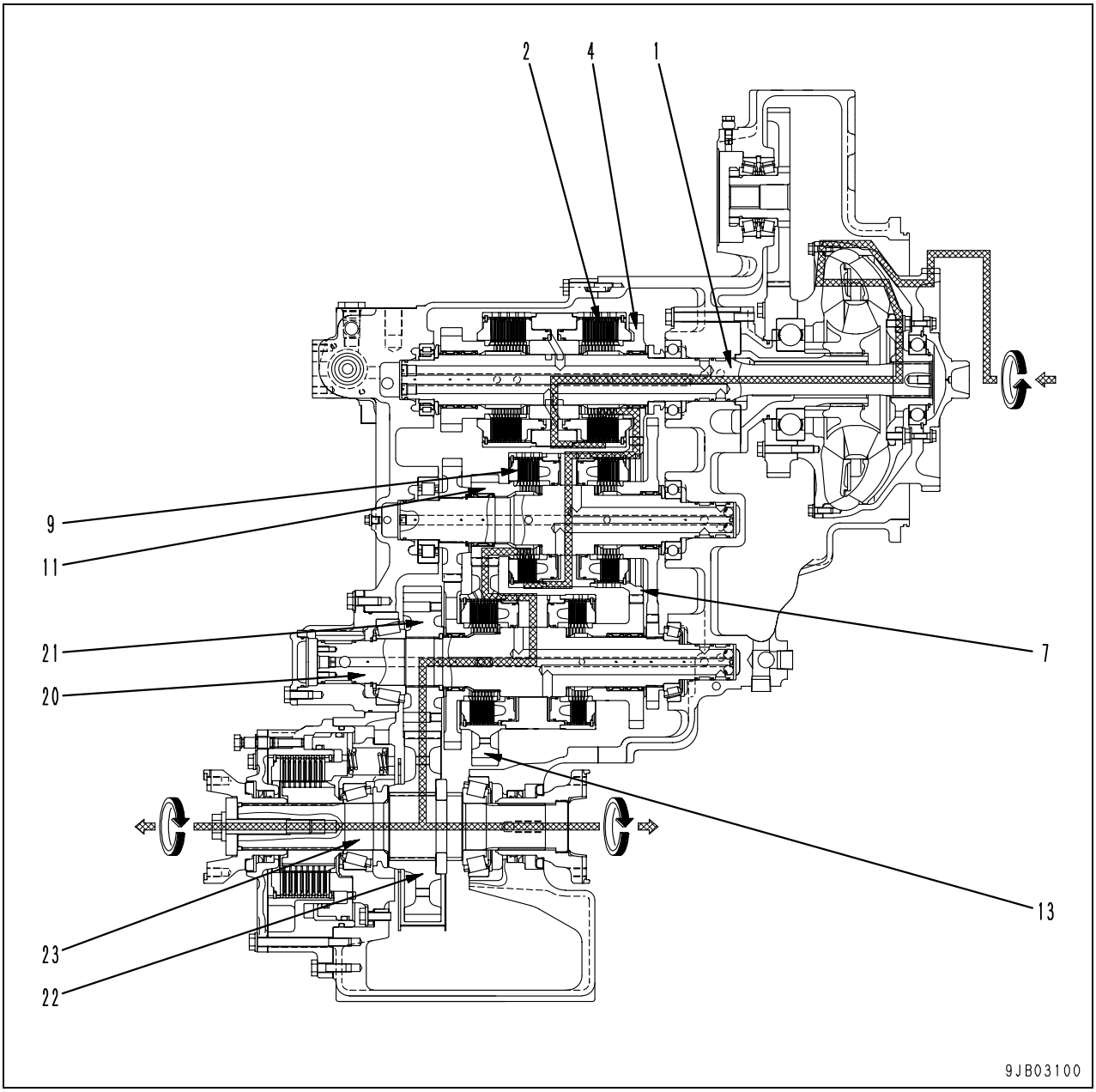
When clutch is "disengaged" (released)



- When the oil sent from the ECMV is shut off, pressure of the oil acting on the back face of piston (2) goes down.
- Piston (2) is pushed back to the left by repulsive force of wave spring (7).
- The friction force between plates (3) and discs (4) is eliminated and shaft (1) and clutch gear (5) are released.
- When the clutch is released, the oil in the back side of piston is drained by the centrifugal force through oil drain hole (6) to prevent the clutch from being partially applied.

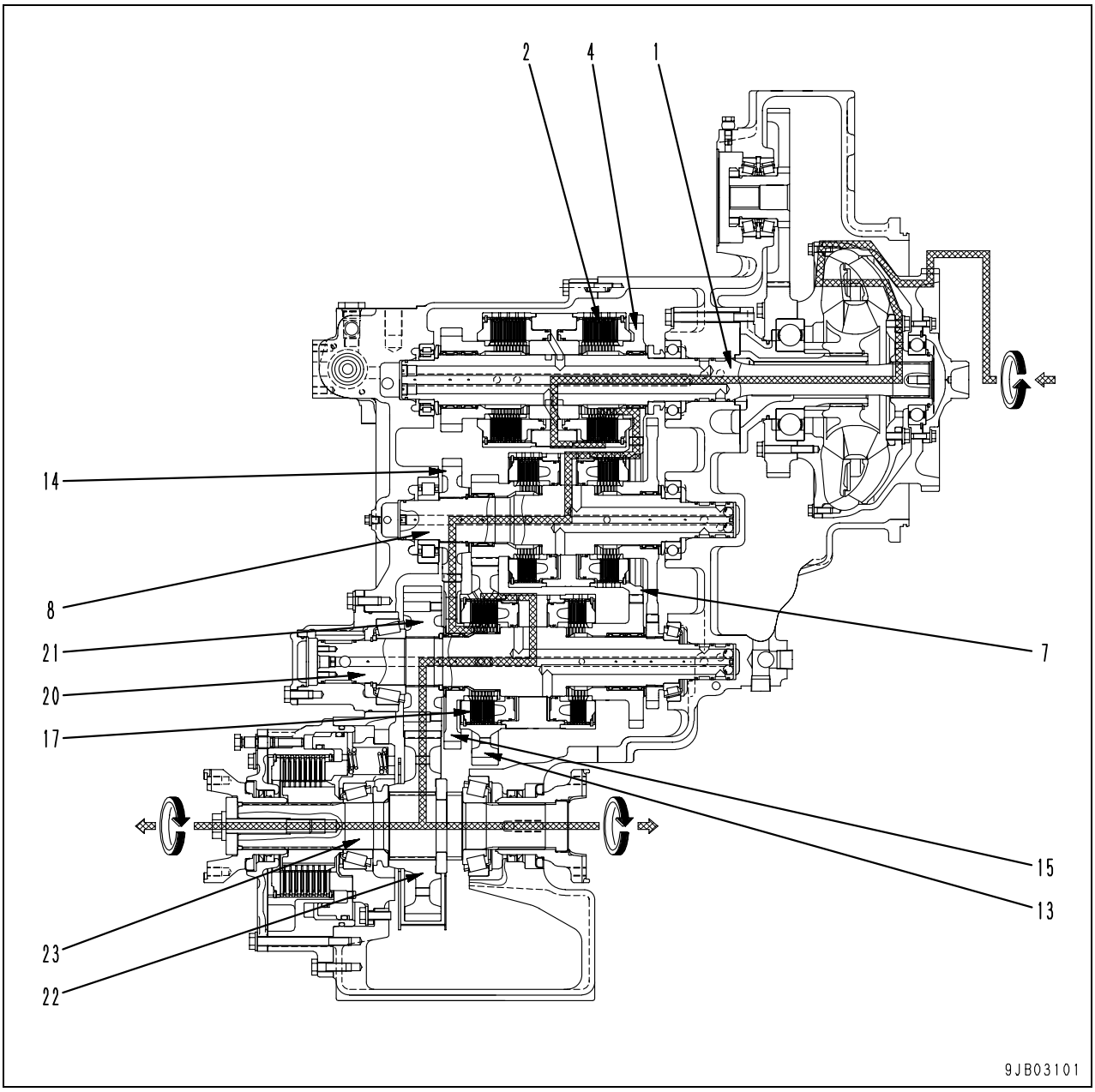
★ Oil drain hole (6) is made of only with the 1st, 2nd, 3rd, and 4th clutches.

Power transmitting route
Forward 1st gear speed



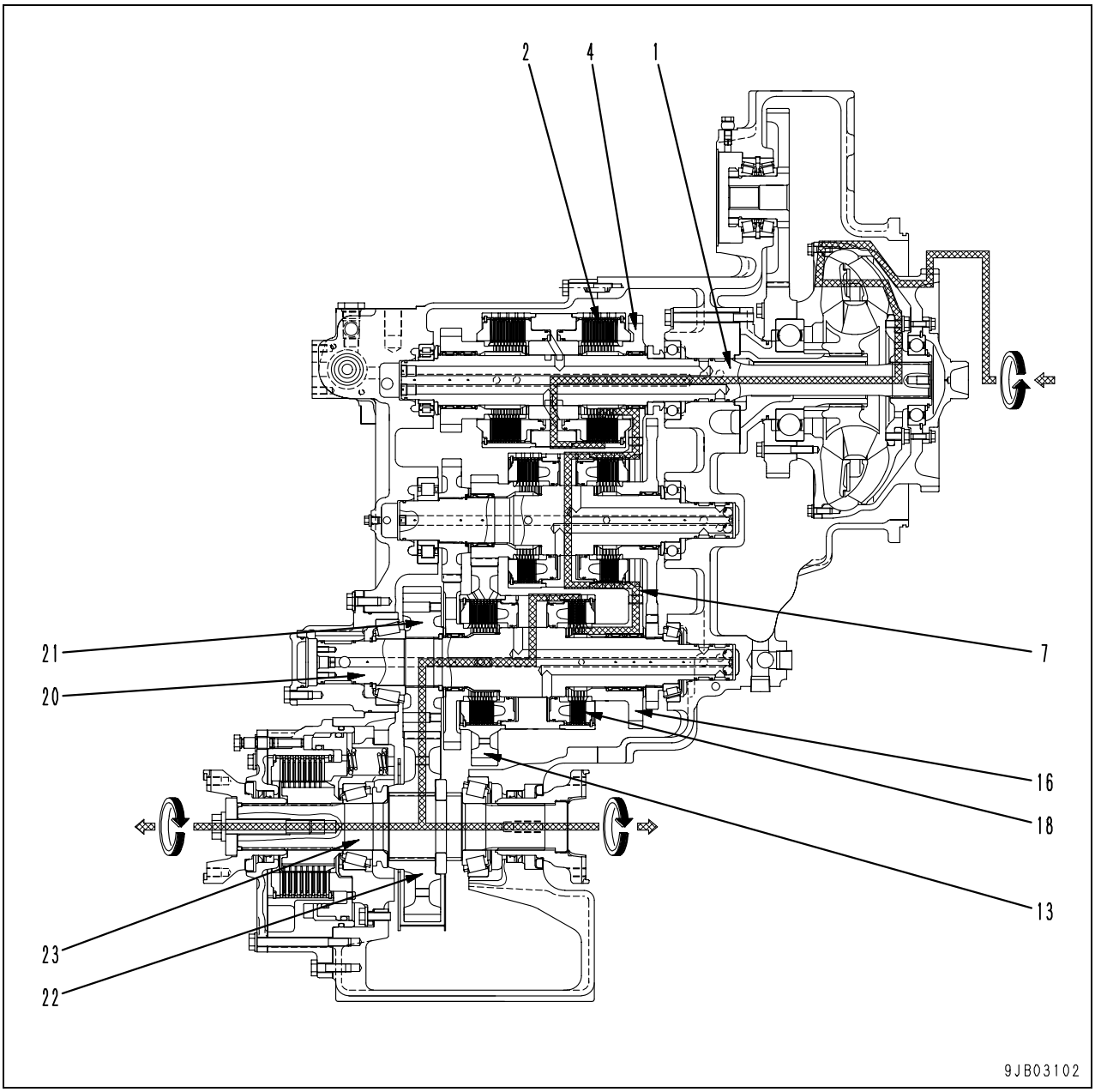
- When the transmission is set in the forward 1st gear speed, F clutch (2) and 1st clutch (9) are engaged. The power from the torque converter to transmission input shaft (1) is then transmitted to output shaft (23).
- F clutch (2) and 1st clutch (9) fix respective clutch discs with the oil pressure applied to the clutch piston.
- F clutch (2) is engaged at this point. Thus, the power transmitted from the torque converter to input shaft (1) is transmitted through F clutch (2) and F gear (4) to the 1st and 4th cylinders (7).
- Since 1st clutch (9) is engaged, the power transmitted to 1st and 4th cylinders (7) is further transmitted through 1st clutch (9) and 1st gear (11) to 2nd and 3rd cylinders (13) and lower shaft (20).
- The power transmitted to lower shaft (20) is then transmitted to output shaft (23) through lower gear A (21) and output gear (22).

Forward 2nd gear speed



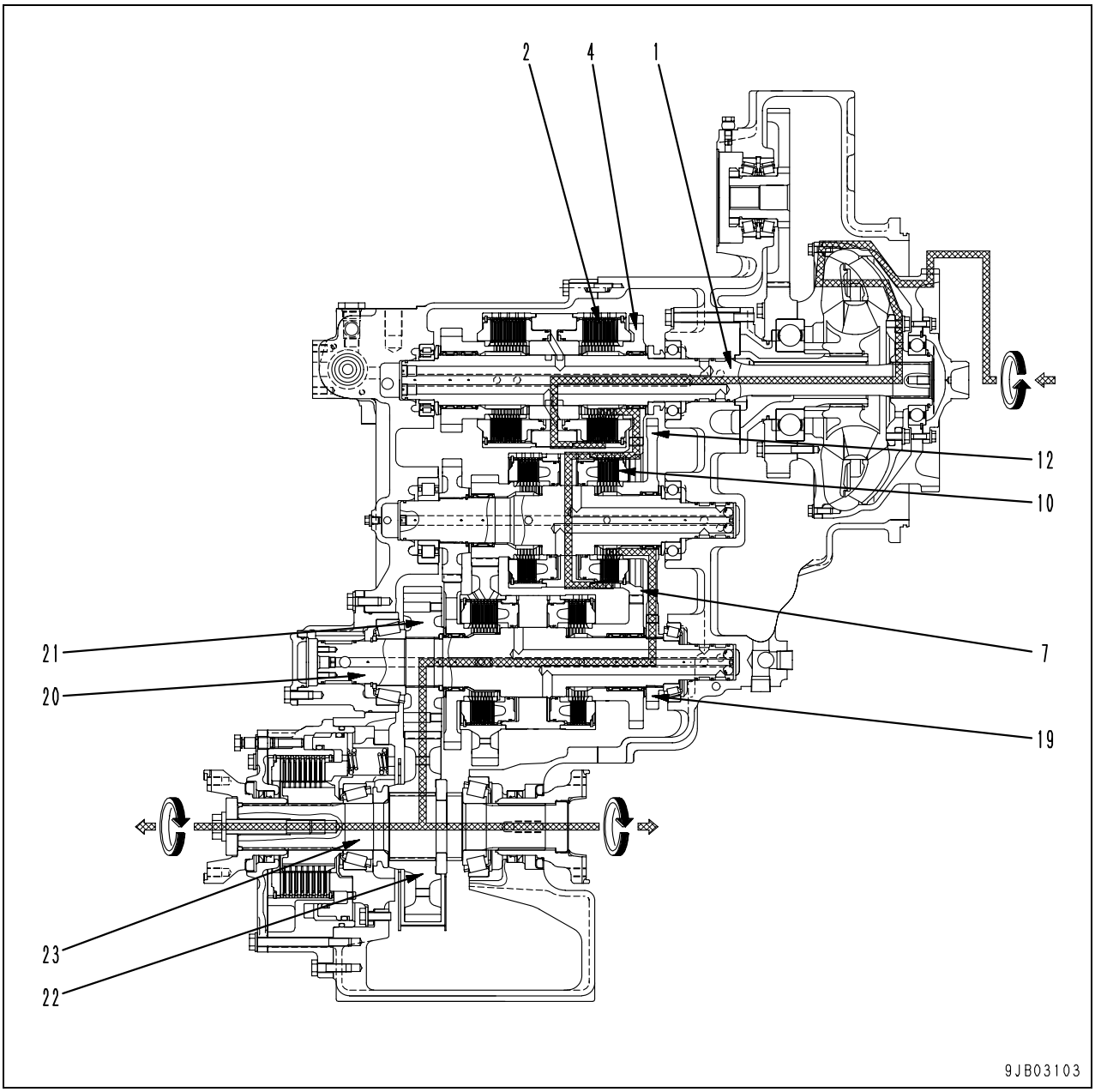
- When the transmission is set in the forward 2nd gear speed, F clutch (2) and 2nd clutch (17) are engaged. The power from the torque converter to transmission input shaft (1) is then transmitted to output shaft (23).
- F clutch (2) and 2nd clutch (17) fix respective clutch discs using the oil pressure applied to the clutch piston.
- F clutch (2) is engaged at this point. Thus, the power transmitted from the torque converter to input shaft (1) is transmitted through F clutch (2) and F gear (4) to the 1st and 4th cylinders (7).
- The power transmitted to 1st and 4th cylinders (7) is then transmitted to 2nd gear (15) through upper shaft (8) and upper gear (14).
- 2nd clutch (17) is engaged at this point. Thus, the power transmitted to 2nd gear (15) is transmitted through 2nd clutch (17) to 2nd and 3rd cylinders (13) and lower shaft (20).
- The power transmitted to lower shaft (20) is then transmitted to output shaft (23) through lower gear A (21) and output gear (22).

Forward 3rd gear speed



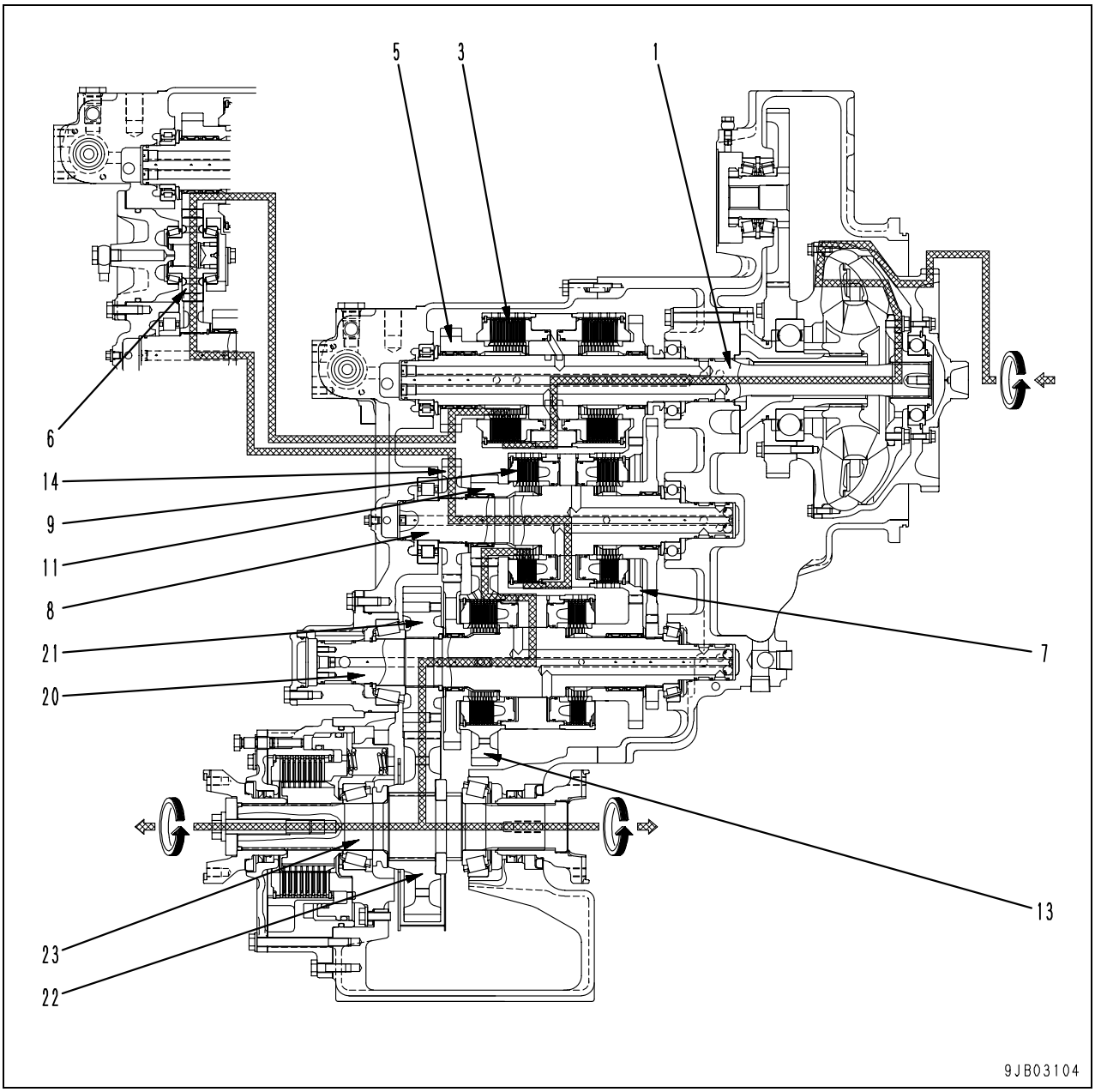
- When the transmission is set to the forward 3rd gear speed, F clutch (2) and 3rd clutch (18) are engaged. The power from the torque converter to transmission input shaft (1) is then transmitted to output shaft (23).
- F clutch (2) and 3rd clutch (18) fix respective clutch discs using the oil pressure applied to the clutch piston.
- F clutch (2) is engaged at this point. Thus, the power transmitted from the torque converter to input shaft (1) is transmitted through F clutch (2) and F gear (4) to the 1st and 4th cylinders (7).
- 3rd clutch (18) is engaged at this point. Thus, the power transmitted to 1st and 4th cylinders (7) is further transmitted through 3rd gear (16) and 3rd clutch (18) to 2nd and 3rd cylinders (13) and lower shaft (20).
- The power transmitted to lower shaft (20) is then transmitted to output shaft (23) through lower gear A (21) and output gear (22).

Forward 4th gear speed



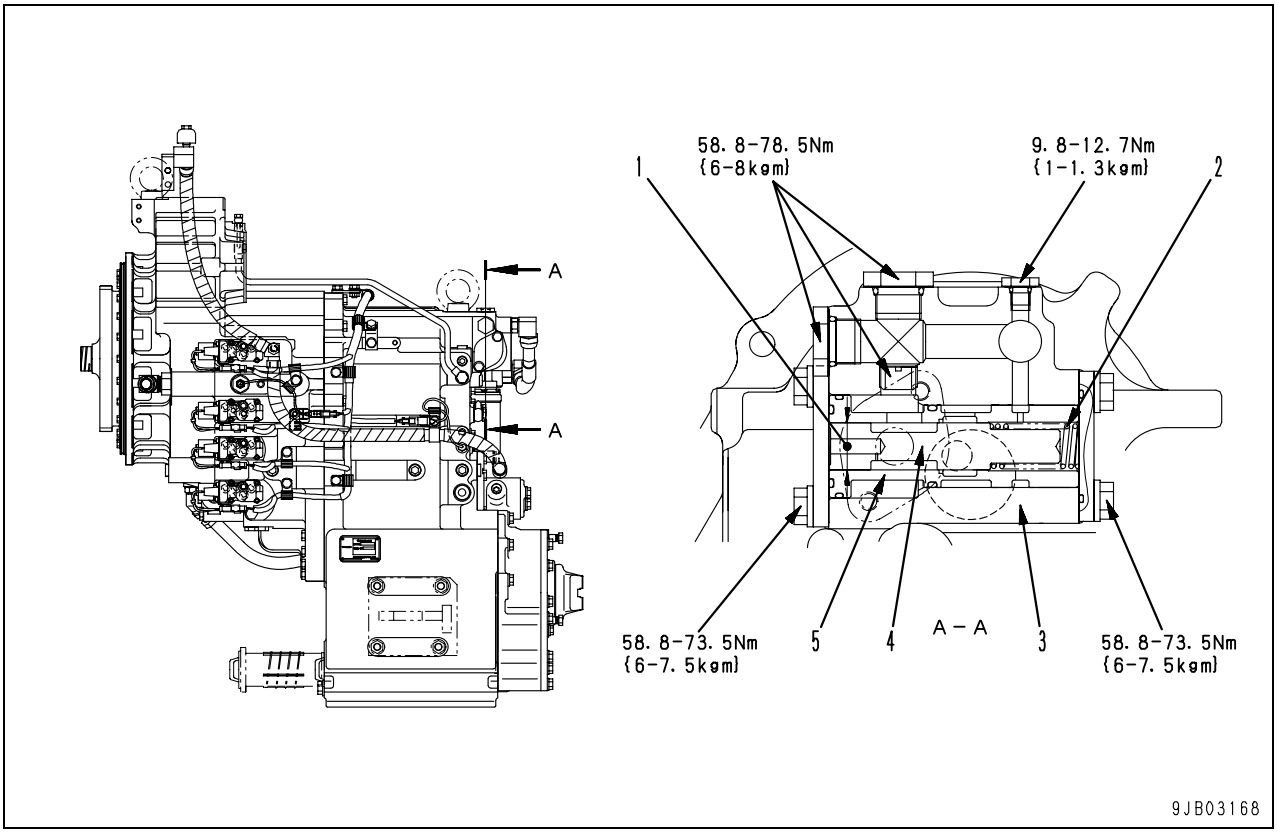
- When the transmission is set to the forward 4th gear speed, F clutch (2) and 4th clutch (10) are engaged. The power from the torque converter to transmission input shaft (1) is then transmitted to output shaft (23).
- F clutch (2) and 4th clutch (10) fix respective clutch discs using the oil pressure applied to the clutch piston.
- F clutch (2) is engaged at this point. Thus, the power transmitted from the torque converter to input shaft (1) is transmitted through F clutch (2) and F gear (4) to the 1st and 4th cylinders (7).
- 4th clutch (10) is engaged at this point. Thus, the power transmitted to 1st and 4th cylinders (7) is further transmitted through 4th clutch (10) and 4th gear (12) to lower gear B (19) and lower shaft (20).
- The power transmitted to lower shaft (20) is then transmitted to output shaft (23) through lower gear A (21) and output gear (22).

Reverse 1st gear speed



- When the transmission is set to the reverse 1st gear speed, R clutch (3) and 1st clutch (9) are engaged. The power from the torque converter to transmission input shaft (1) is then transmitted to output shaft (23).
- R clutch (3) and 1st clutch (9) fix respective clutch discs using the oil pressure applied to the clutch piston.
- R clutch (3) is engaged at this point. Thus, the power transmitted from the torque converter to input shaft (1) is transmitted through R clutch (3) and R gear (5) to R idler gear (6).
- The power being reversed on R idler gear (6) is transmitted through upper gear (14) and upper shaft (8) to 1st and 4th cylinders (7).
- Since 1st clutch (9) is engaged, the power transmitted to 1st and 4th cylinders (7) is further transmitted through 1st clutch (9) and 1st gear (11) to 2nd and 3rd cylinders (13) and lower shaft (20).
- The power transmitted to lower shaft (20) is then transmitted to output shaft (23) through lower gear A (21) and output gear (22).

Flow control valve



Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between flow control valve and sleeve	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		25	–0.020 –0.030	+0.013 0	0.020 – 0.043	0.063	
2	Flow control valve spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		63.8	47	79.5 N {8.11 kg}	61.9	75.5 N {7.7 kg}	

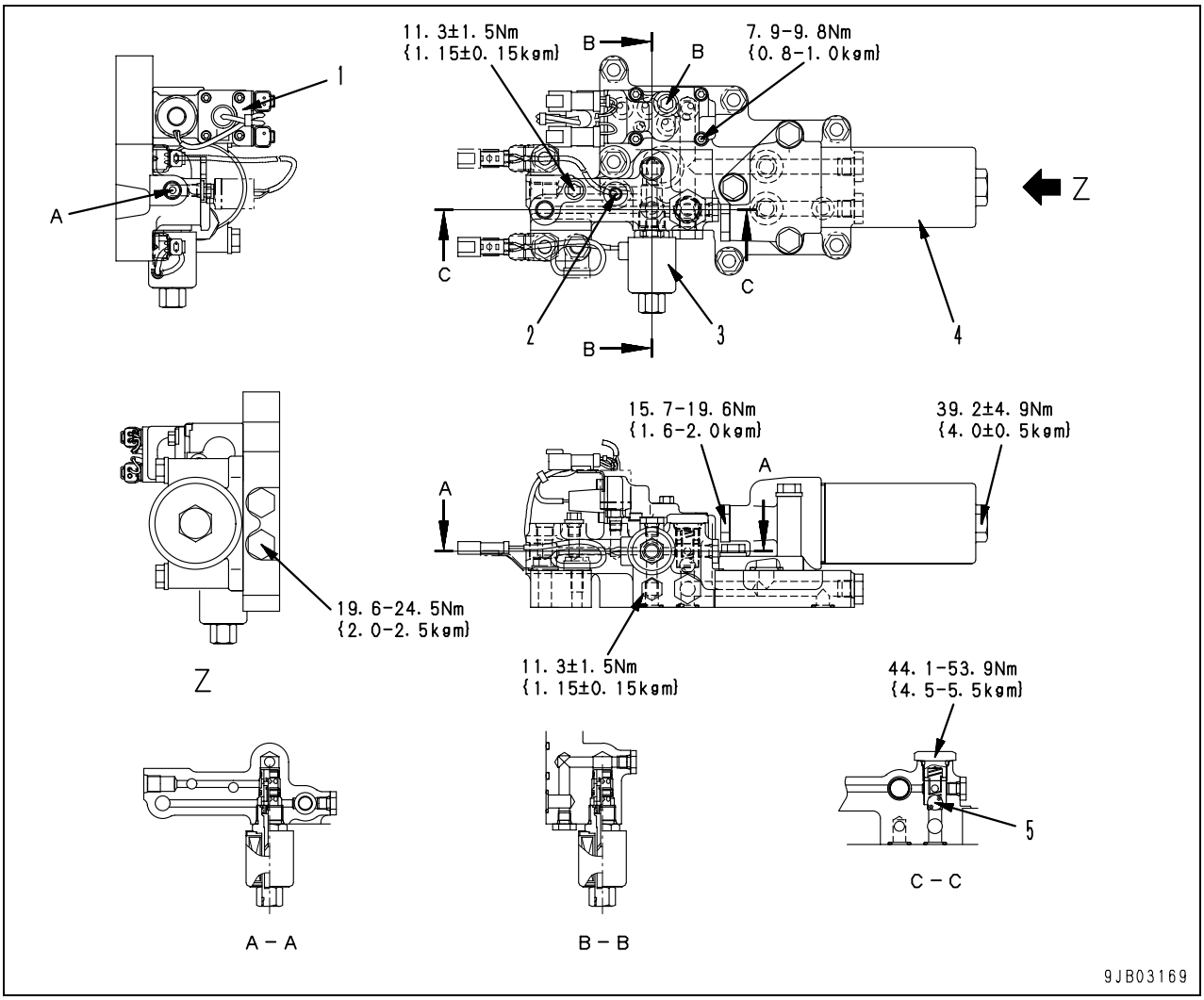
3. Transmission case (front)
4. Flow control valve
5. Sleeve

Operation

- As the oil flow from the pump to the transmission valve circuit exceeds the set level, flow control valve (4) moves to diverge part of the oil from the pump to the transmission lubricating circuit.

Valve assembly

(R clutch ECMV, last chance filter and parking brake solenoid valve)



A: To parking brake
B: R clutch oil pressure pickup port

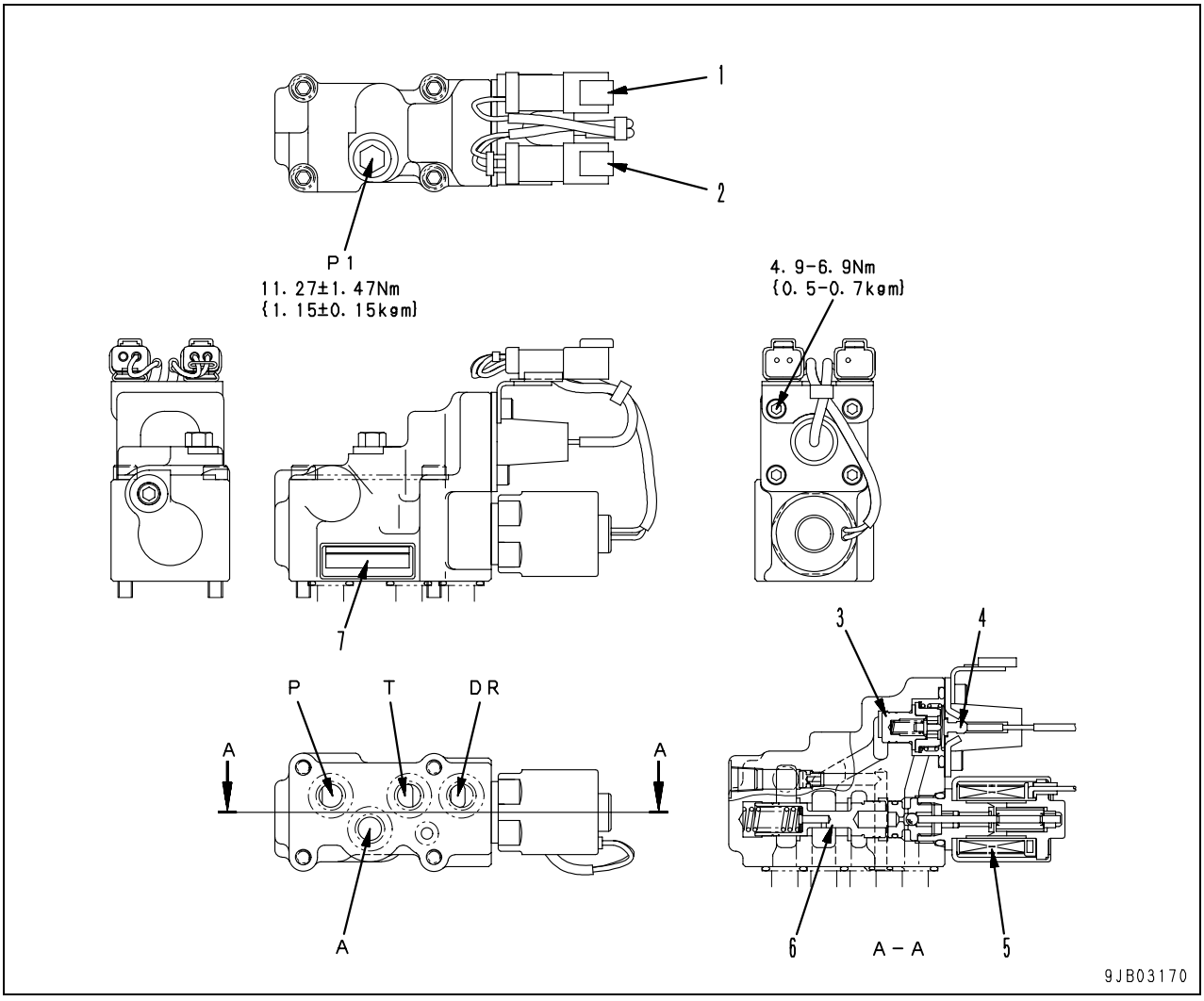
1. R clutch ECMV
2. Parking brake oil pressure switch mounting port
3. Parking brake solenoid valve
4. Last chance filter
5. Check valve

ECMV

★ ECMV: Abbreviation for Electronic Control Modulation Valve

For R, 1st and 2nd clutches

★ 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

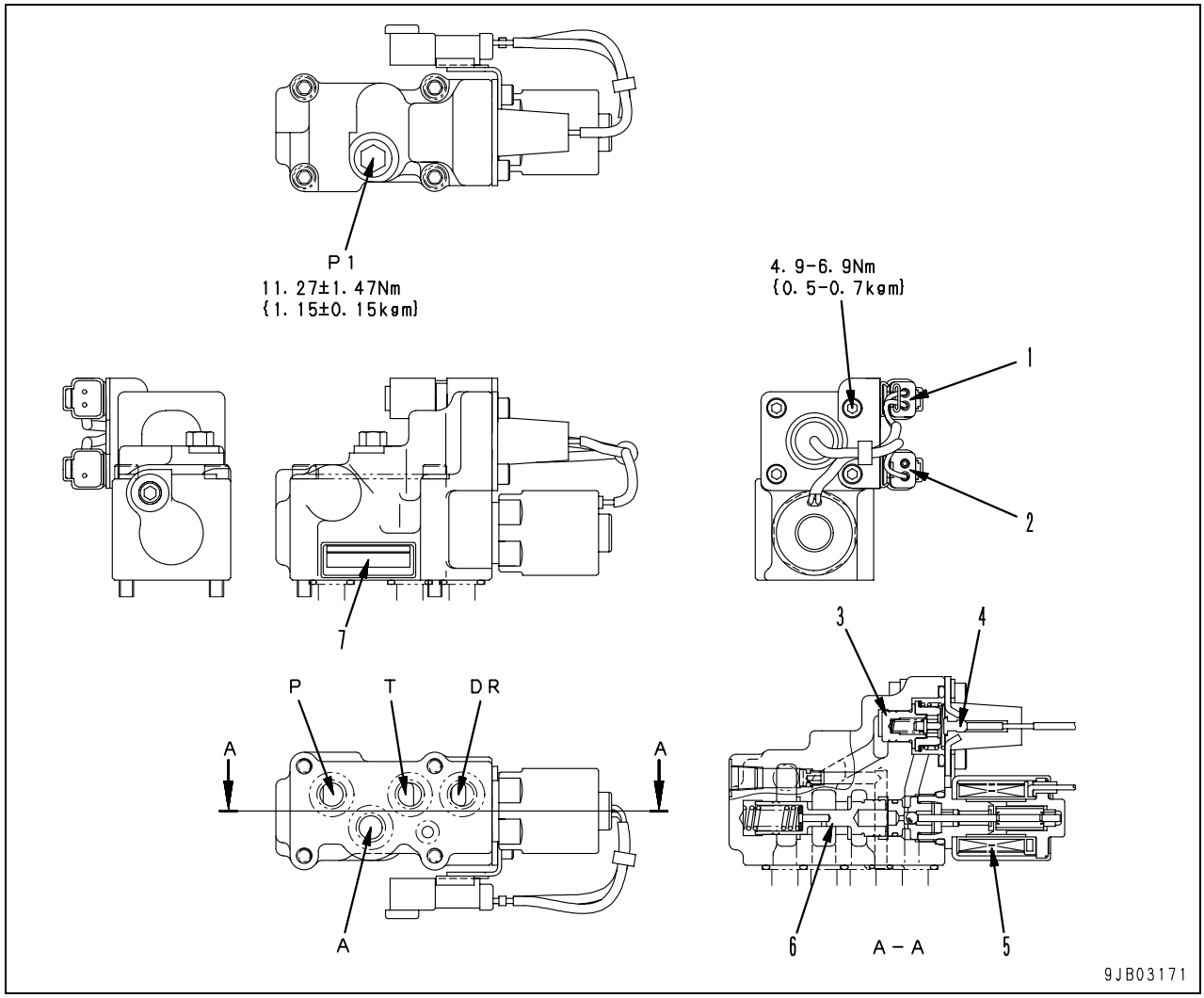
1. Fill switch connector
2. Proportional solenoid connector
3. Pressure detection valve
4. Fill switch
5. Proportional solenoid
6. Pressure control valve
7. Nameplate (*1)

*1:

Clutch used	Printing on name plate
R, 1st, 2nd	L*******

For F, 3rd, 4th and lockup clutches

★ 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. Connector for fill switch
3. Oil pressure pickup valve
4. Fill switch
5. Proportional solenoid
6. Pressure control valve
7. Nameplate (*1)

*1:

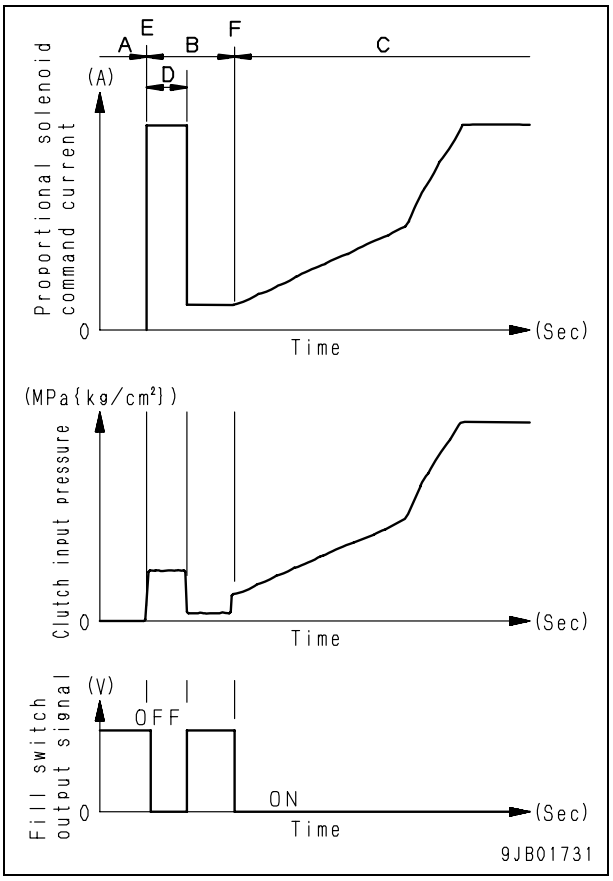
Clutch used	Printing on name plate
F, 3rd, 4th	M*******
Lockup	U*******

ECMV for gear speed clutch

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.



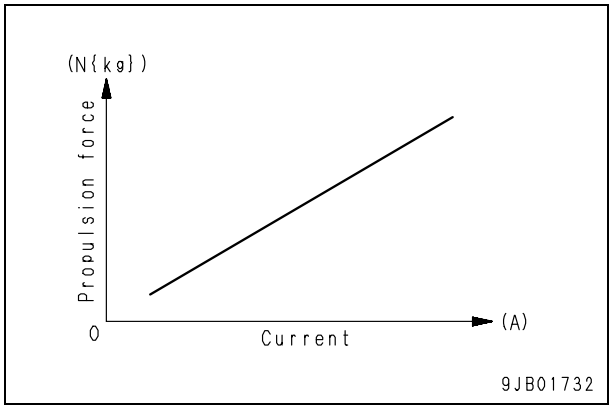
Range A: Before shifting gear (When draining)
Range B: During filling
Range C: Pressure regulation
Range D: During filling (During triggering)
Point E: Start of filling
Point F: Finish of filling

★ 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).

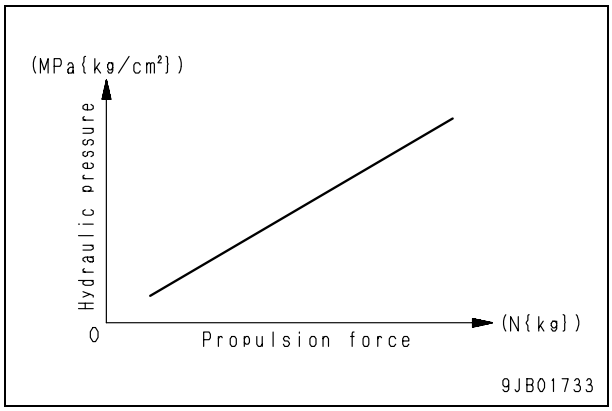
ECMV and proportional solenoid

- 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

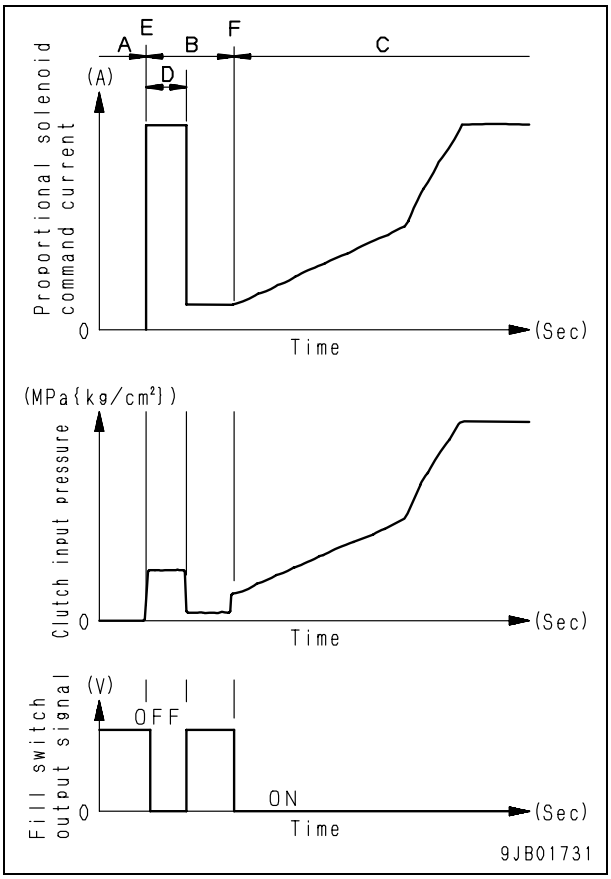


ECMV and fill switch

- 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

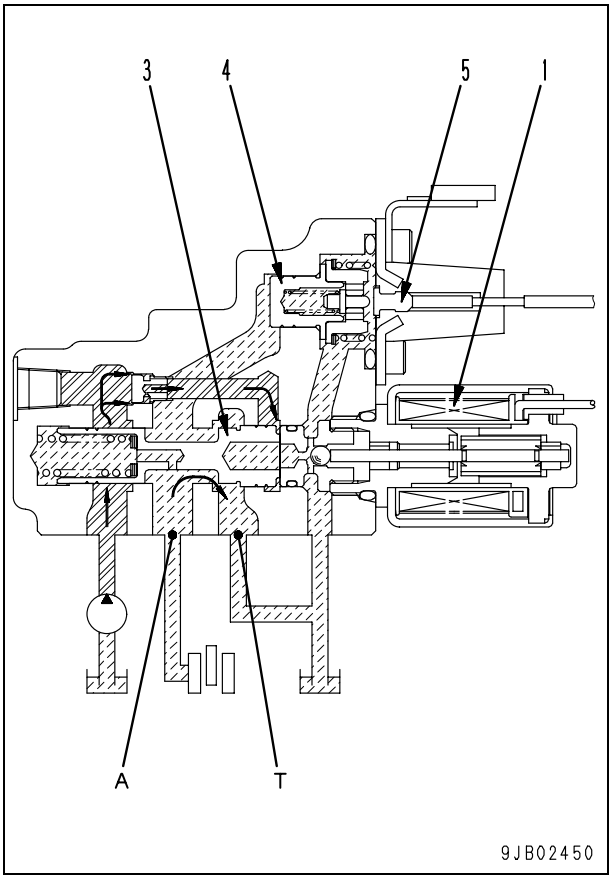
- ECMV is controlled with the command current sent from the controller to the proportional solenoid and the fill switch output signal.
  The relationship between the proportional solenoid command current of ECMV, clutch input pressure, and fill switch output signal is shown below.



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

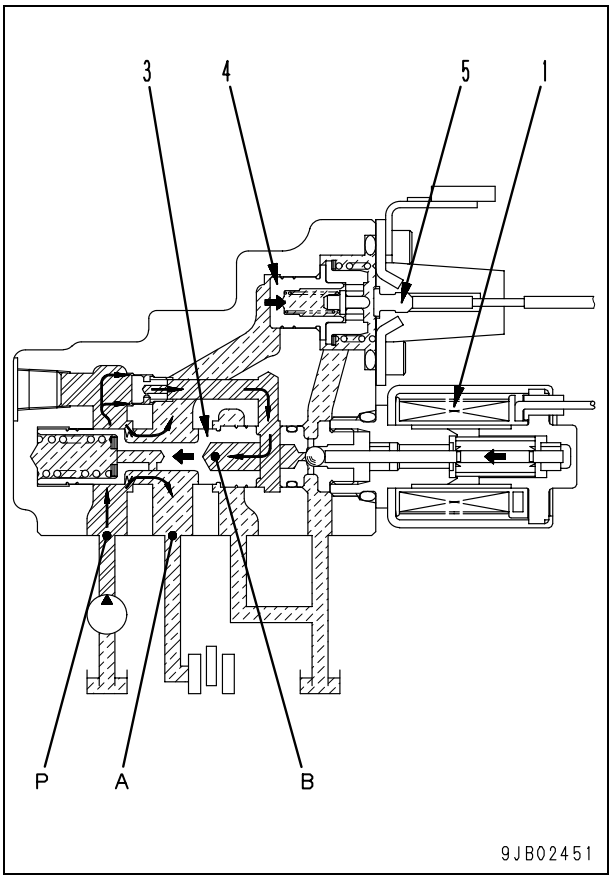
★ The logic is so made that the controller will not recognize completion of filling even if the fill switch is turned “ON” during triggering (Range D).

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



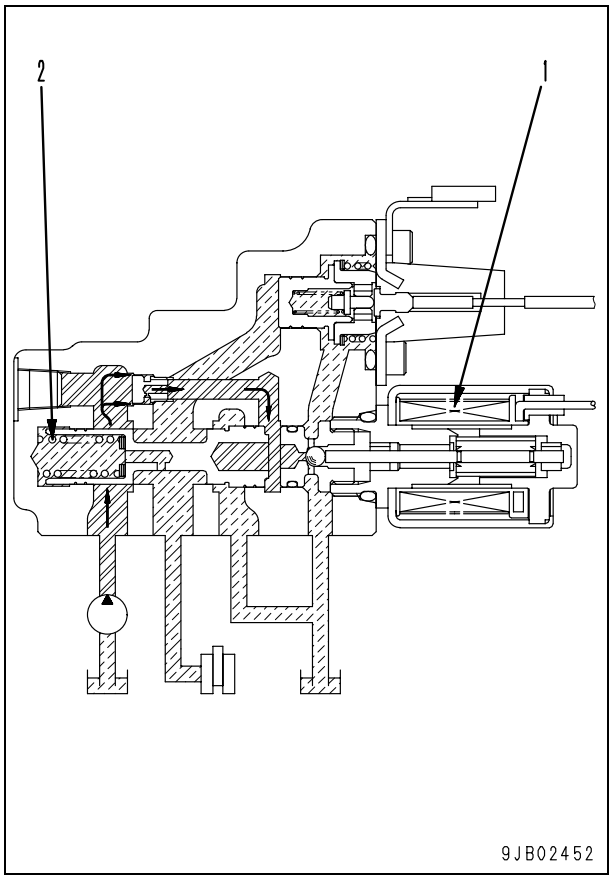
- Under the condition where any current is not sent to the proportional solenoid (1), pressure control valve (3) drains the oil from clutch port (A) through drain port (T).
  Also at this time, fill switch (5) is turned “OFF” because oil pressure is not applied to pressure detection valve (4).

During filling (Range B in chart)



- If current is applied to proportional solenoid (1) with no oil in the clutch, the oil pressure force balanced with the solenoid force is applied to chamber (B) and pushes pressure control valve (3) to the left. This opens pump port (P) and clutch port (A) to feed oil in the clutch. When the clutch is filled with oil, pressure detection valve (4) actuates to turn “ON” fill switch (5).

Pressure regulation (Range C in chart)



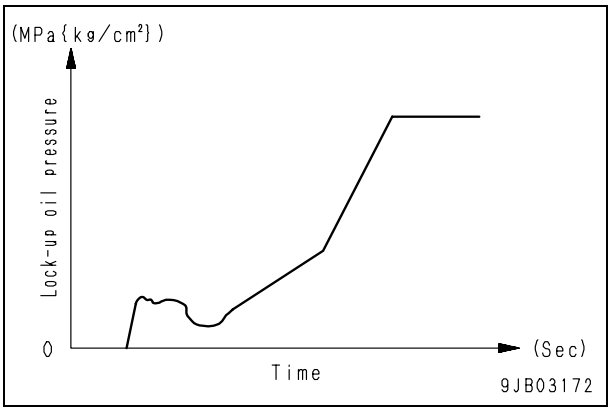
- As current is conducted to proportional solenoid (1), the solenoid generates thrust in proportion to the current. The pressure is settled as the sum of this thrust of the solenoid, thrust generated by the oil pressure in clutch port and the repulsive force of pressure control valve spring (2) is balanced.

ECMV for lockup clutch

Outline

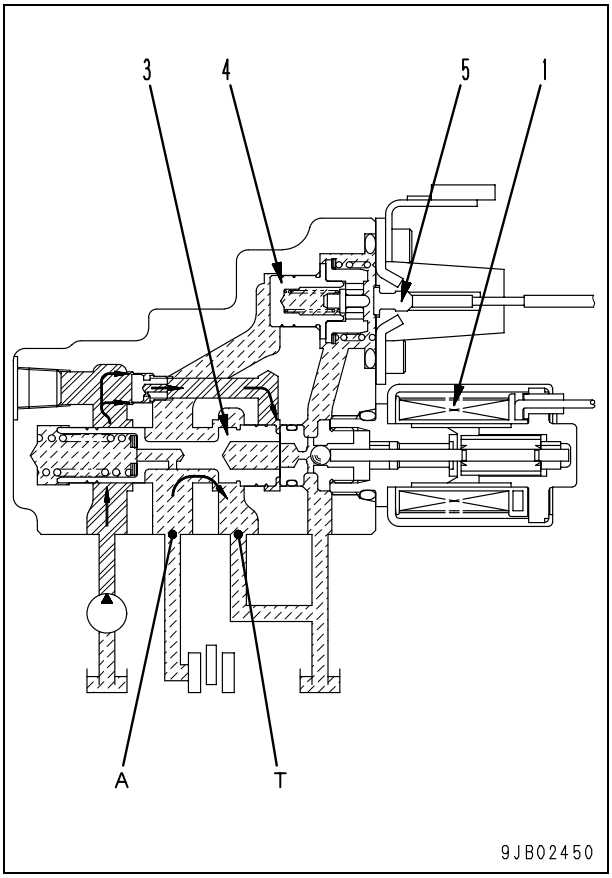
- This valve is used to switch the clutch in order to regulate the clutch oil pressure to the set pressure.
  Since the modulation waveform is used for the pressure application characteristics to the clutch, ECMV is capable of connecting the lockup clutch smoothly, thereby reducing shocks resulting from 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



Operation

When traveling in torque converter range

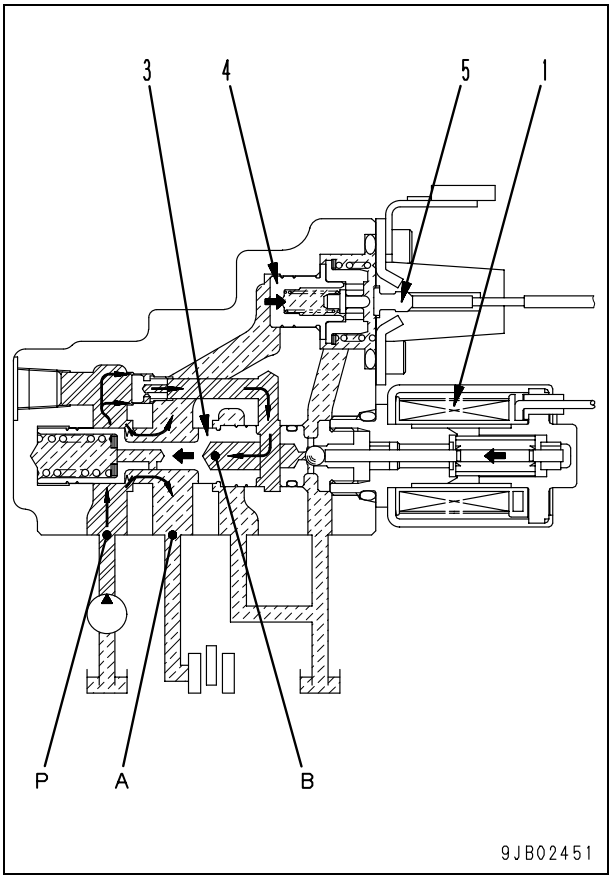


- When traveling in torque converter range, current is not supplied to proportional solenoid (1). Pressure control valve (3) drains the oil from clutch port (A) through drain port (T), and lockup clutch is “released”.
  Also at this time, fill switch (5) is turned “OFF” because oil pressure is not applied to pressure detection valve (4).

When traveling in direct range

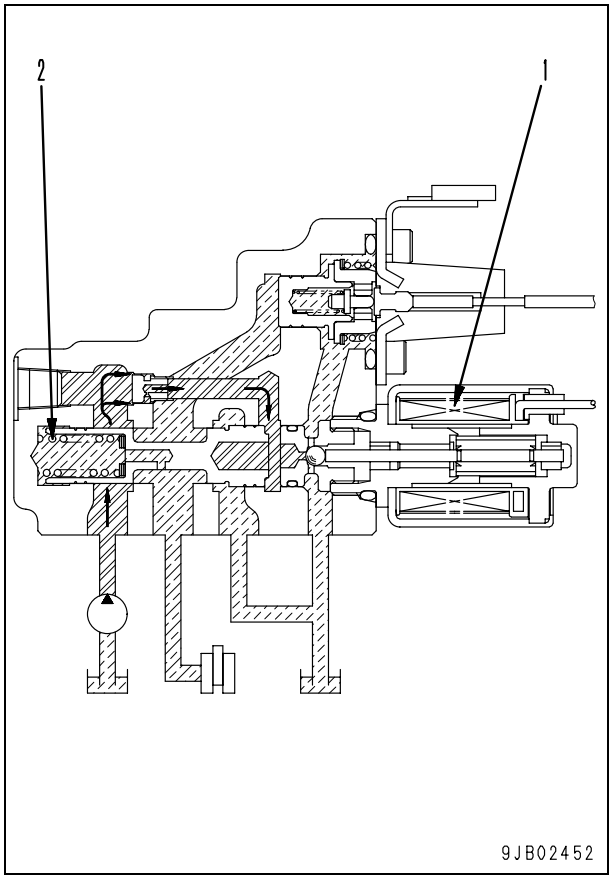
(Torque converter travel → direct travel)

During filling



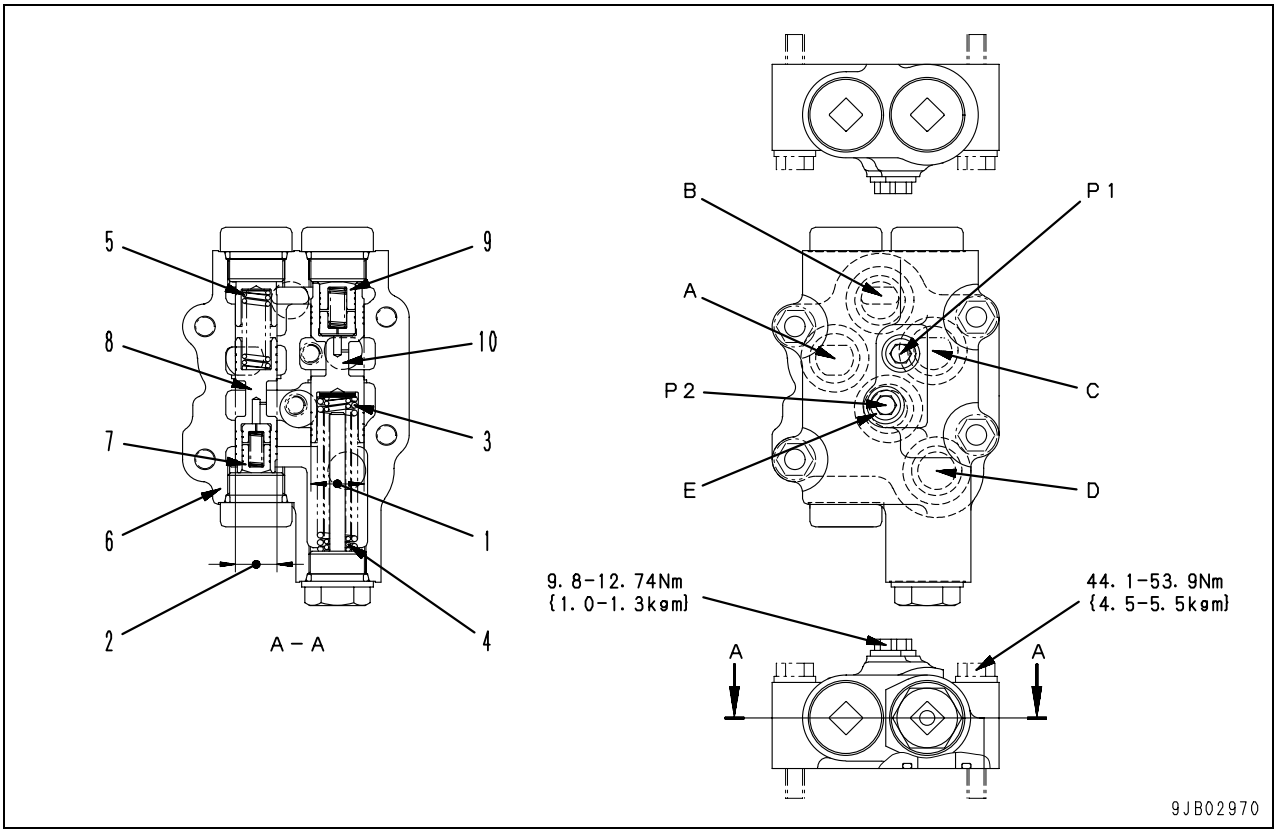
- When traveling in direct (lockup) range, current is supplied to proportional solenoid (1), the oil pressure force balanced with the solenoid force is applied to chamber (B) and pushes pressure control valve (3) to the left. As a result, pump port (P) and clutch port (A) are opened and oil starts filling the clutch. If the clutch is filled with oil, oil pressure detection valve (4) is operated, and fill switch (5) is turned “ON”.

Pressure adjustment



- As current is conducted to proportional solenoid (1), the solenoid generates thrust in proportion to the current. The pressure is settled as the sum of this thrust of the solenoid, thrust generated by the oil pressure in clutch port and the repulsive force of pressure control valve spring (2) is balanced.

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	
		122	82.5	380 N {38.8 kg}	118.3	362 N {36.9 kg}	
4	Main relief valve spring (inside)	108	82.5	314 N {32.0 kg}	104.8	298 N {30.4 kg}	
5	Torque converter relief valve spring	50	42	153 N {15.6 kg}	48.5	145 N {14.8 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

Outline

Torque converter relief valve

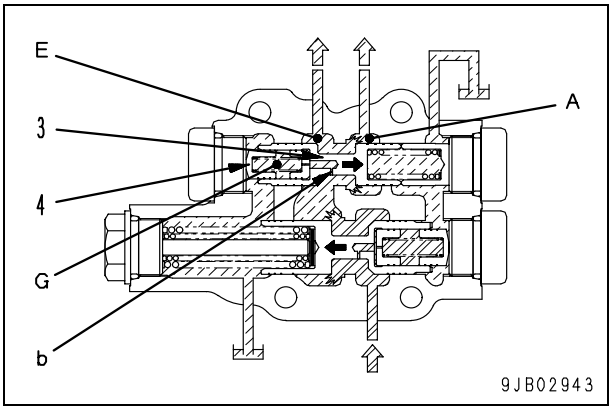
- The torque converter relief valve constantly regulates the torque converter inlet circuit pressure below the set pressure to protect the torque converter from abnormally high pressure.
  Set pressure: 0.91 MPa {9.31 kg/cm^2}
  (Cracking pressure)

Main relief valve

- The main relief valve regulates the pressure in the transmission and parking brake hydraulic circuits to the set pressure.
  Set pressure: 2.87 MPa {29.3 kg/cm^2}
  (At rated engine speed)

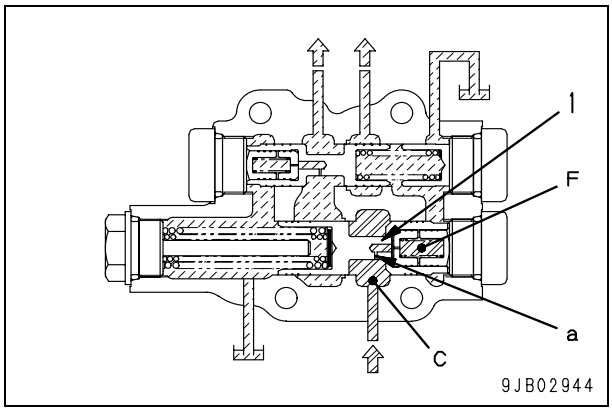
Operation

Operation of torque converter relief valve

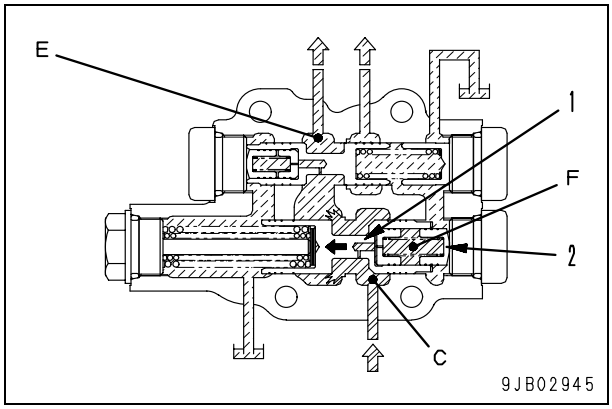


- The oil from the main relief valve is conducted to the torque converter through port (E) and, at the same time, also conducted to chamber (G) through orifice (b) of torque converter relief valve (3).
- As the oil pressure to the torque converter goes beyond the set pressure, the oil conducted to chamber (G) pushes piston (4) and the resulting resisting force pushes torque converter relief valve (3) rightward, opening ports (E) and (A).
  As the result, the oil in port (E) is drained through port (A).

Operation of main relief valve



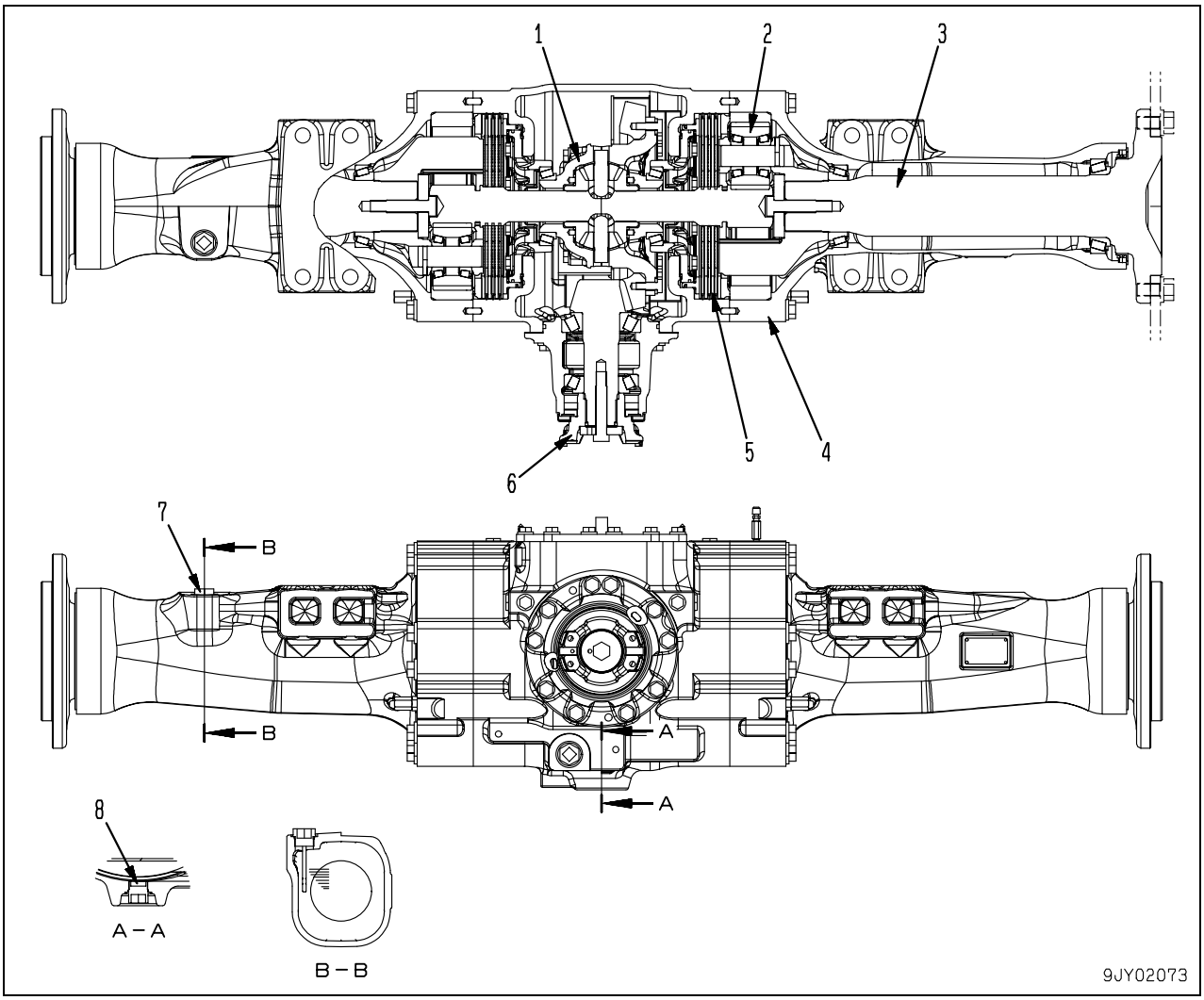
- The oil from the hydraulic pump flows to chamber (F) through the filter, port (C) of the relief valve and orifice (a) of main relief valve (1).



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

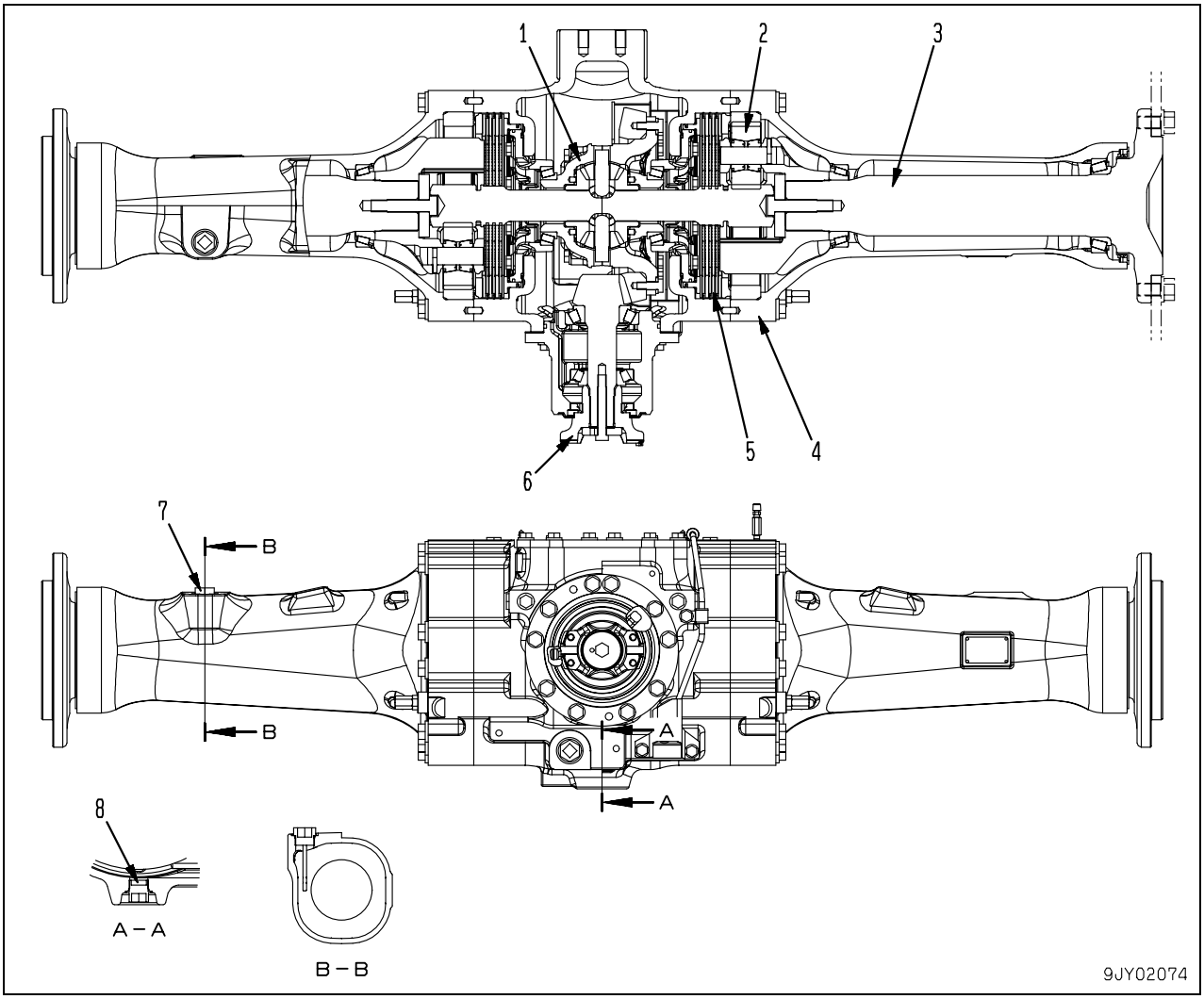
Axle

Front axle



1. Differential
2. Final drive
3. Axle shaft
4. Axle housing
5. Wet-type multi-disc brake
6. Coupling
7. Oil filler and level plug
8. Drain plug

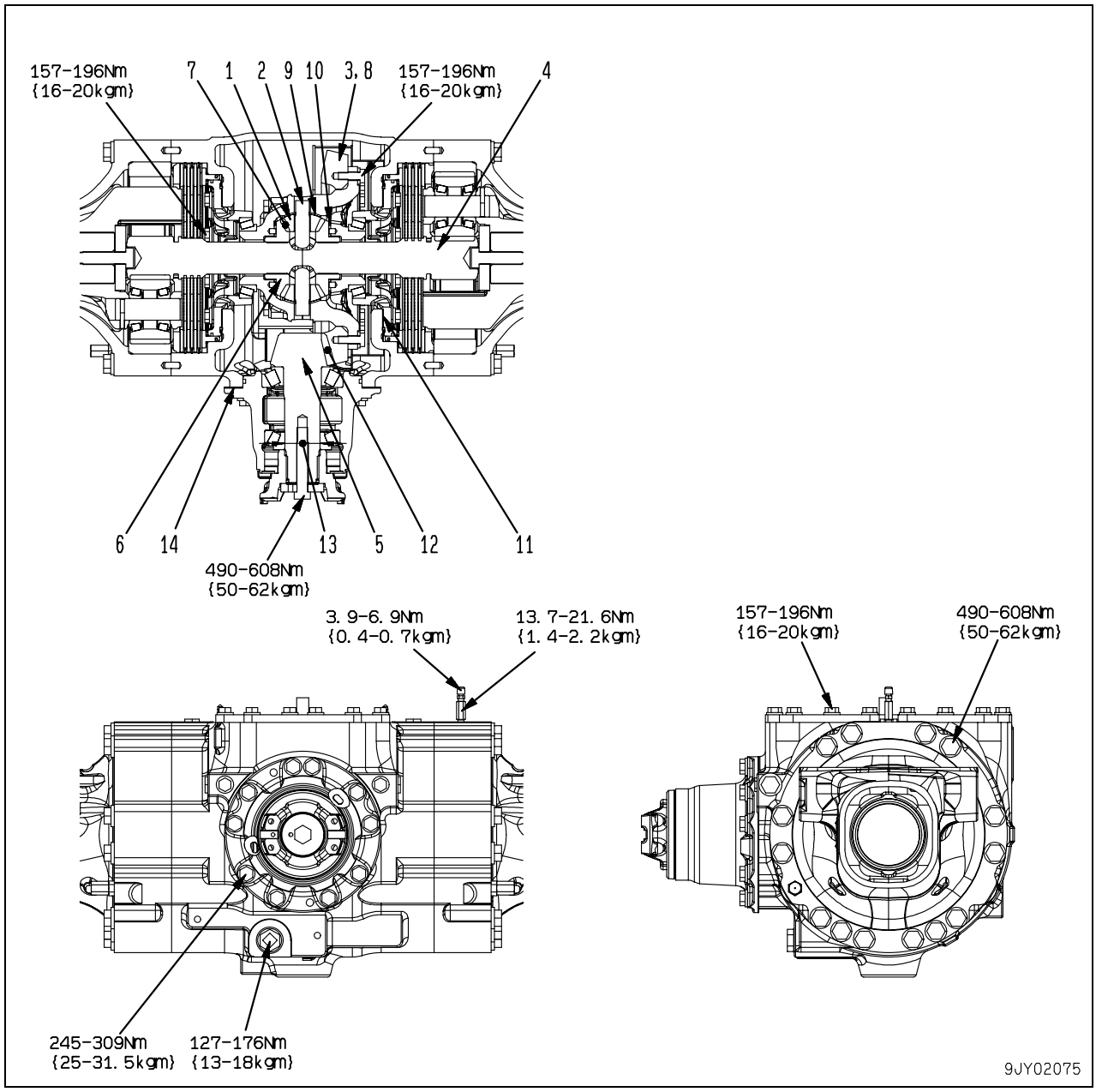
Rear axle



1. Differential
2. Final drive
3. Axle shaft
4. Axle housing
5. Wet-type multi-disc brake
6. Coupling
7. Oil filler and level plug
8. Drain plug

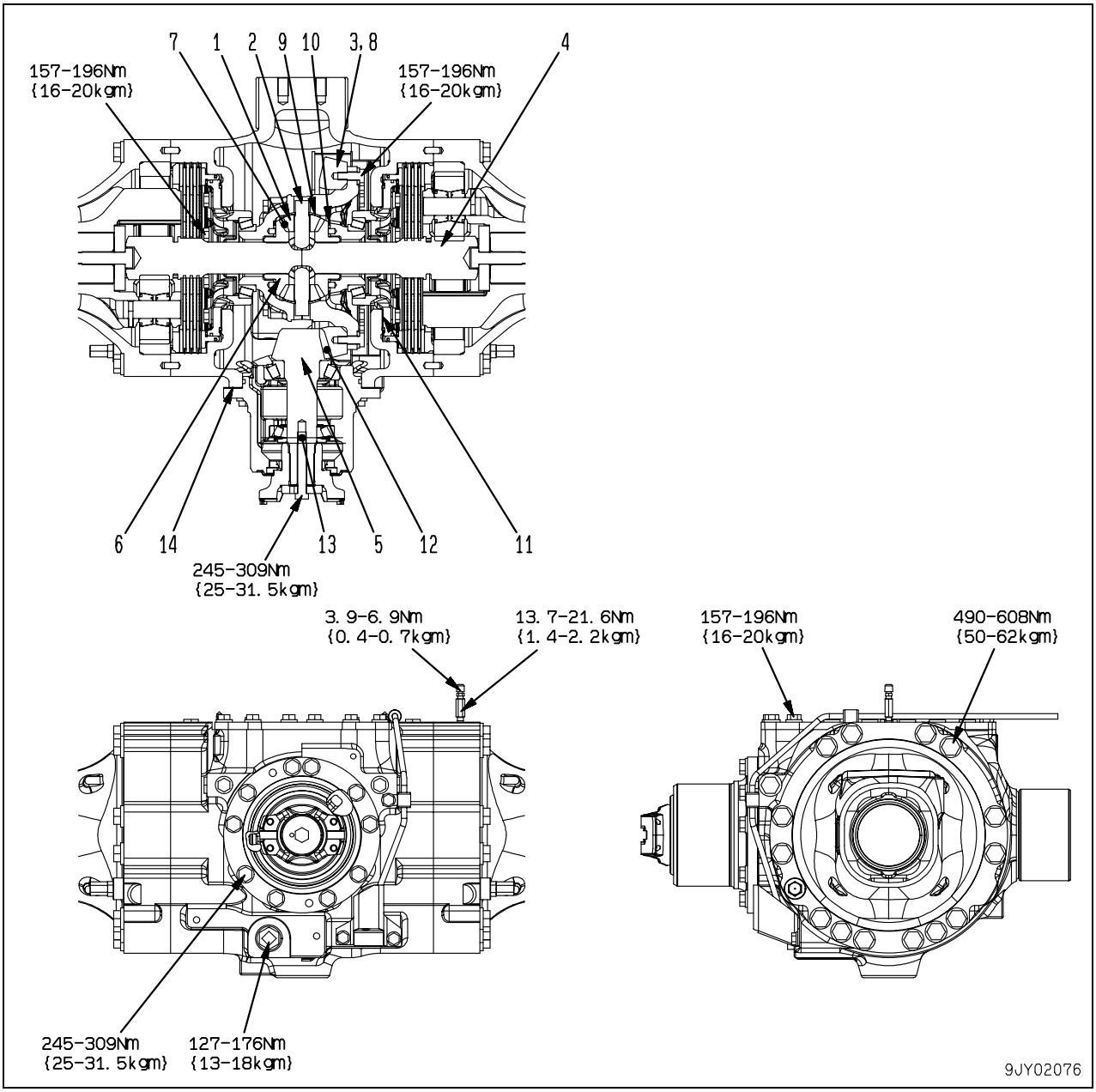
Differential

Front differential



1. Pinion gear (Number of teeth: 12)
2. Shaft
3. Bevel gear (Number of teeth: 41)
4. Sun gear shaft
5. Bevel pinion (Number of teeth: 10)
6. Side gear (Number of teeth: 24)

Rear differential



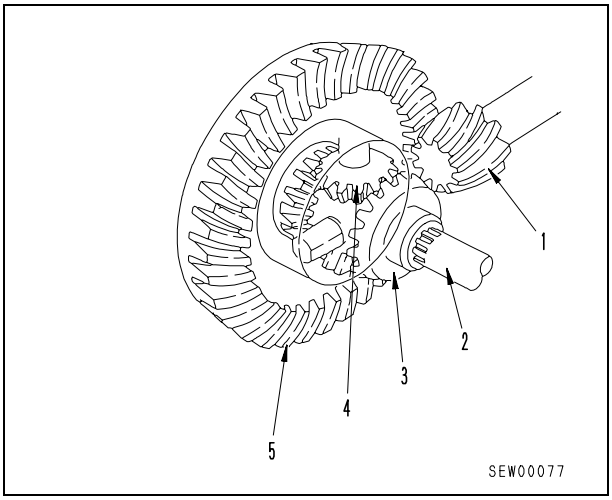
1. Pinion gear (Number of teeth: 12)
2. Shaft
3. Bevel gear (Number of teeth: 41)
4. Sun gear shaft
5. Bevel pinion (Number of teeth: 10)
6. Side gear (Number of teeth: 24)

Unit: mm

No.	Check item	Criteria			Remedy
7	Backlash of differential gear	0.13 – 0.18			Adjust
8	Starting torque of bevel gear	13.7 – 37.2 Nm {1.4 – 3.8 kgm} (Outside of bevel gear)			
9	Thickness of pinion gear washer	Standard size	Tolerance	Repair limit	Replace
		3	±0.08	2.8	
10	Thickness of side gear washer	4	±0.05	3.8	
11	Thickness of shim in differential side bearing carrier (one side)	0.3 – 1.25			Adjust
12	Backlash of bevel gear	0.25 – 0.41			
13	End play of pinion gear	0.08			
14	Thickness of shim in differential housing and gauge assembly	1.05±0.35			

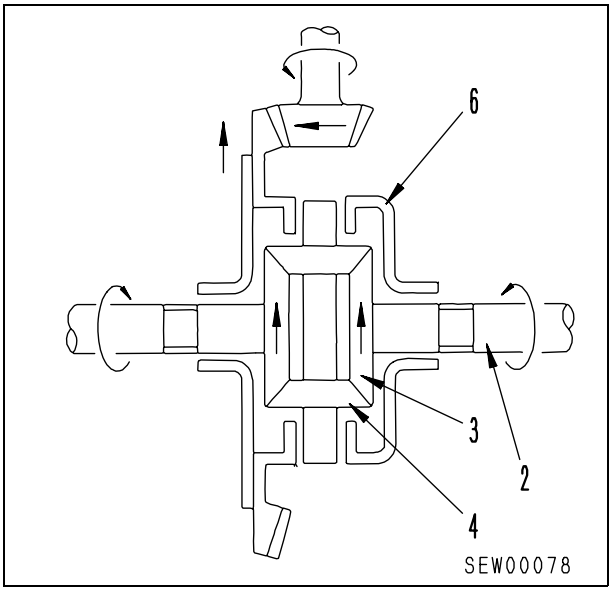
Outline

- The power from the engine is transmitted to the front and rear axles through the torque converter, transmission and drive shaft.
- In each axle, the direction of the power is changed by 90° and the speed is reduced by bevel pinion (1) and bevel gear (5). Then, the power is transmitted through pinion gears (4) to sun gear shafts (2).
- Speed of the power transmitted to the sun gear is further reduced by the final drive of the planetary gear type, and then transmitted to the axle shafts and wheels.



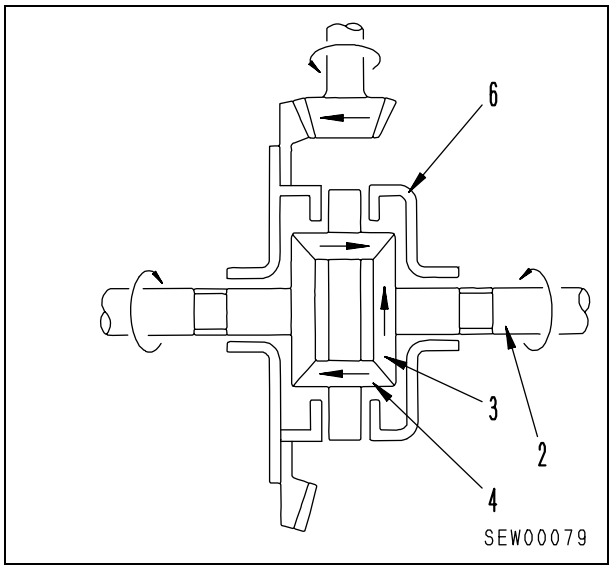
While machine is traveling straight

- 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 gear (4) and side gear (3) to right and left sun gear shafts (2) evenly.



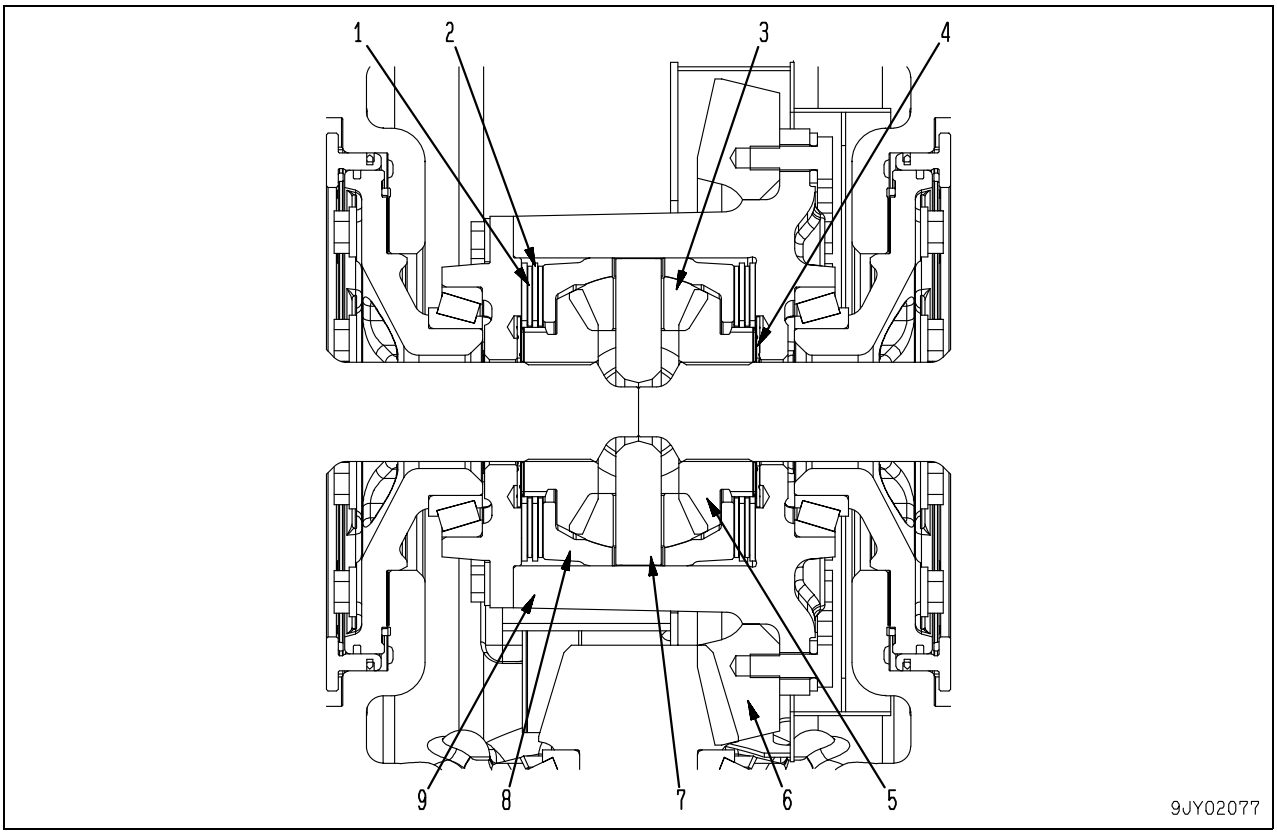
When machine is turning

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



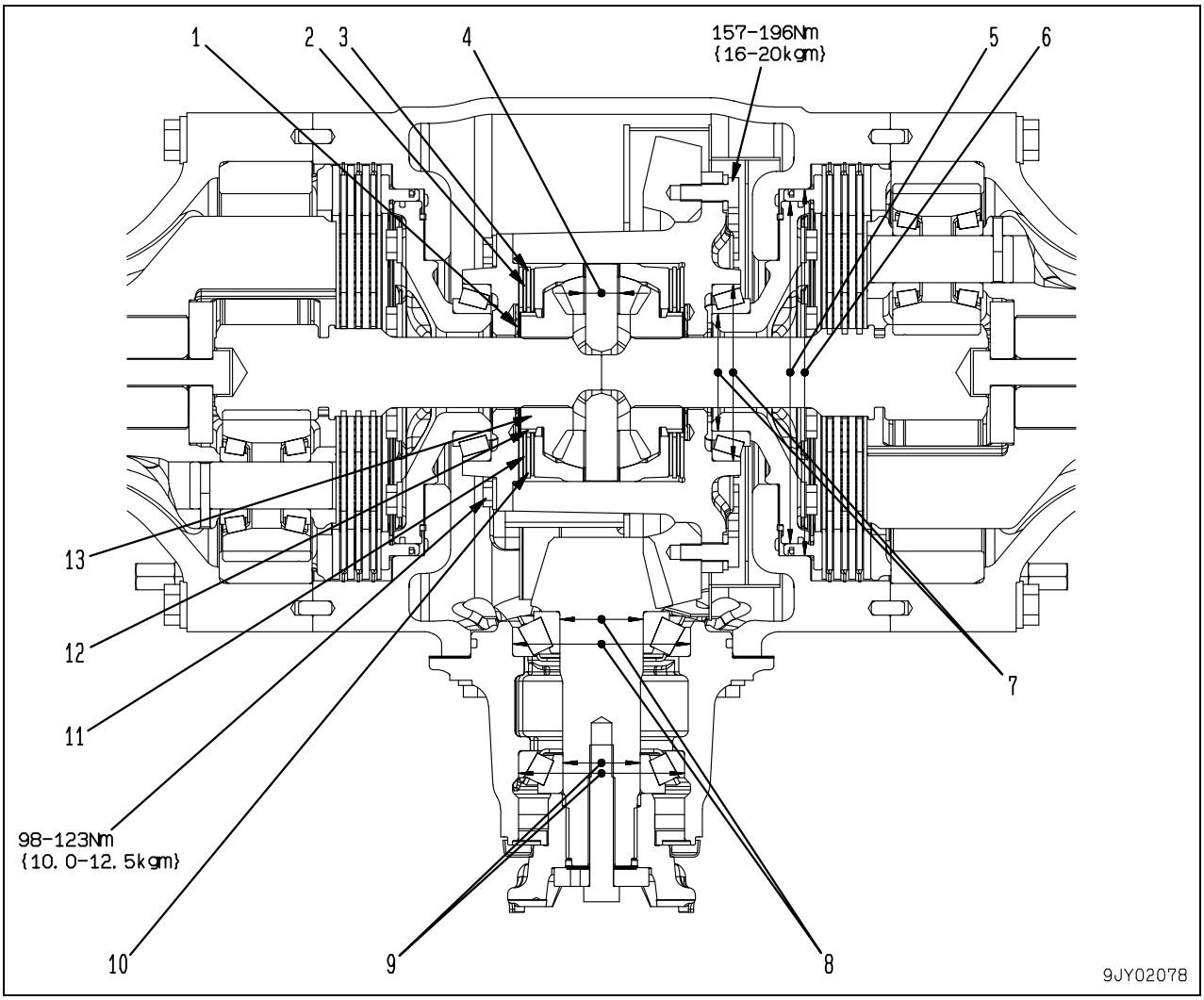
Limited slip differential

(If equipped)



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

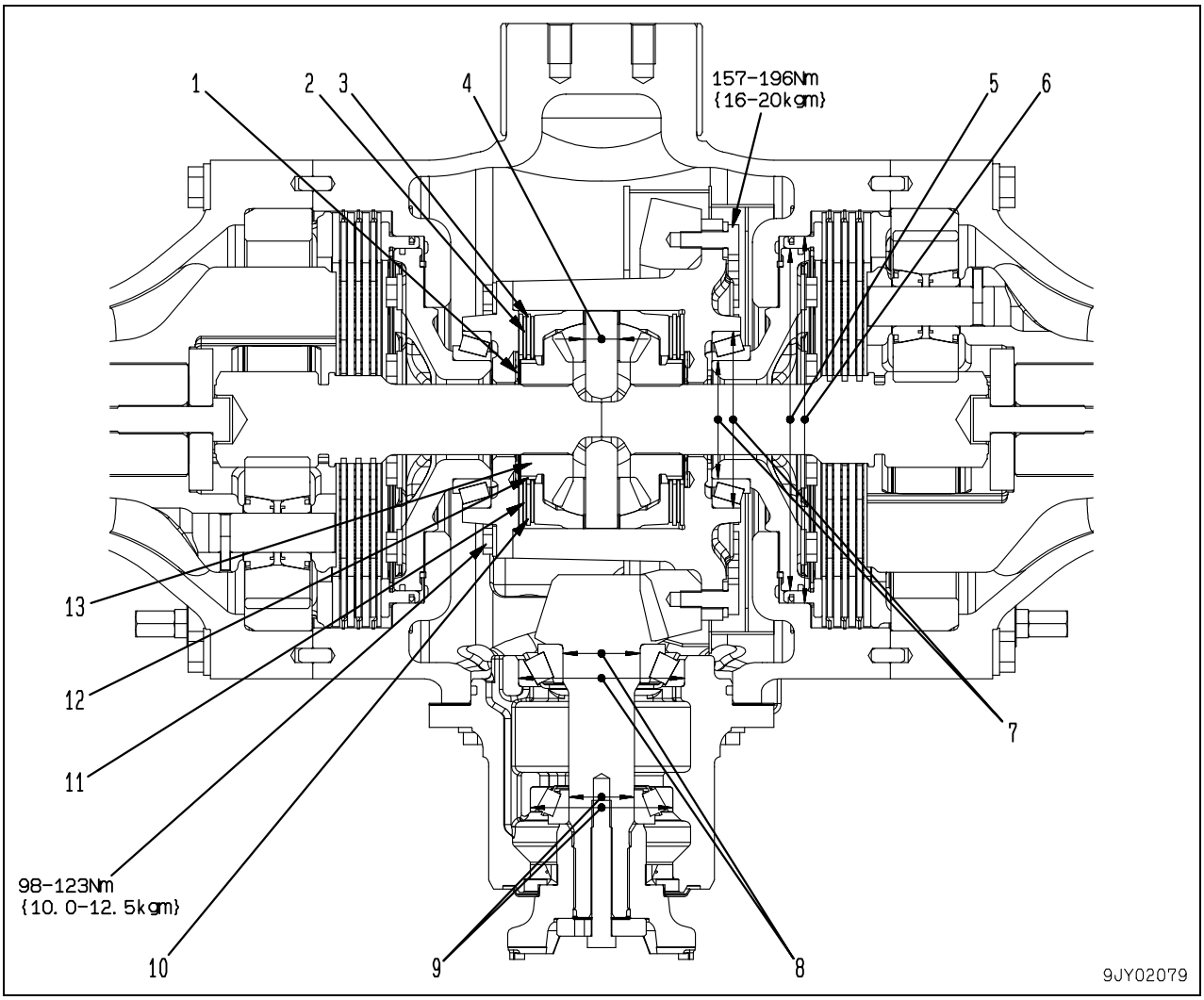
Front axle


1
2
3
4
157-196Nm
{16-20kgm}
5
6
13
12
11
98-123Nm
{10.0-12.5kgm}
10
9
8
7
9JY02078

Unit: mm

No.	Check item		Criteria					Remedy
1	Thicknesses of washers		Standard size		Tolerance		Repair limit	Replace
			2		±0.03		1.8	
			2.1					
2	Thickness of plate		3.1		±0.02		3.0	
			3.2					
3	Thickness of disc		3.2		±0.07		3.1	
4	Clearance between spider and differential pinion gear		Standard size	Shaft	Hole	Standard clearance	Clearance limit	
			30	–0.110 –0.160	+0.05 0	0.110 – 0.210	0.3	
5	Piston assembling section on differential housing (housing and piston)		290.5	–0.110 –0.191	+0.081 0	0.110 – 0.272	—	
6	Piston assembling section on bearing carrier (piston and carrier)		311	–0.110 –0.191	+0.081 0	0.110 – 0.272	—	
7	Clearance of differential side bearing	Outer race	150	0 –0.018	–0.045 –0.085	–0.085 – –0.027	—	
		Inner race	100	+0.059 +0.037	0 –0.020	–0.079 – –0.037	—	
8	Clearance of bearing on pinion shaft gear side	Outer race	150	0 –0.020	–0.054 –0.071	–0.071 – –0.034	—	
		Inner race	70	+0.039 +0.020	0 –0.015	–0.054 – –0.020	—	
9	Clearance of bearing on pinion shaft coupling side	Outer race	140	0 –0.018	–0.054 –0.082	–0.082 – –0.036	—	
		Inner race	65	+0.039 +0.020	0 –0.015	–0.054 – –0.020	—	
10	Backlash of case and plate		0 – 0.4					
11	Clearance between disc and plate (both sides)		0.2 – 0.75					
12	Backlash of side gear and disc		0.13 – 0.36					
13	End play of side gear in axial direction (one side)		0.15 – 0.35					

Rear axle


1
2
3
4
157-196Nm
{16-20kgm}
5
6
13
12
11
98-123Nm
{10.0-12.5kgm}
10
9
8
7
9JY02079

Unit: mm

No.	Check item		Criteria					Remedy
1	Thicknesses of washers		Standard size		Tolerance		Repair limit	Replace
			2		±0.03		1.8	
			2.1					
2	Thickness of plate		3.1		±0.02		3.0	
			3.2					
3	Thickness of disc		3.2		±0.07		3.1	
4	Clearance between spider and differential pinion gear		Standard size	Shaft	Hole	Standard clearance	Clearance limit	
			30	–0.110 –0.160	+0.05 0	0.110 – 0.210	0.3	
5	Piston assembling section on differential housing (housing and piston)		290.5	–0.110 –0.191	+0.081 0	0.110 – 0.272	—	
6	Piston assembling section on bearing carrier (piston and carrier)		311	–0.110 –0.191	+0.081 0	0.110 – 0.272	—	
7	Clearance of differential side bearing	Outer race	150	0 –0.018	–0.048 –0.085	–0.085 – –0.030	—	
		Inner race	100	+0.059 +0.037	0 –0.020	–0.079 – –0.037	—	
8	Clearance of bearing on pinion shaft gear side	Outer race	140	0 –0.018	–0.048 –0.088	–0.088 – –0.030	—	
		Inner race	65	+0.039 +0.020	0 –0.015	–0.054 – –0.020	—	
9	Clearance of bearing on pinion shaft coupling side	Outer race	120	0 –0.015	–0.041 –0.076	–0.076 – –0.026	—	
		Inner race	55	+0.039 +0.020	0 –0.015	–0.054 – –0.020	—	
10	Backlash of case and plate		0 – 0.4					
11	Clearance between disc and plate (both sides)		0.2 – 0.75					
12	Backlash of side gear and disc		0.13 – 0.36					
13	End play of side gear in axial direction (one side)		0.15 – 0.35					

Operation of limited slip differential

The power from the transmission is transmitted through bevel gear (6), case (9), pressure rings (8), shaft (7), and pinion (3) to side gears (5), and then distributed to the right and left shafts.

The brake unit consisting of disc (2) and plate (1) is installed to the back side of each side gear (5). It generates braking torque in proportion to the torque transmitted from pressure rings (8) to shaft (7).

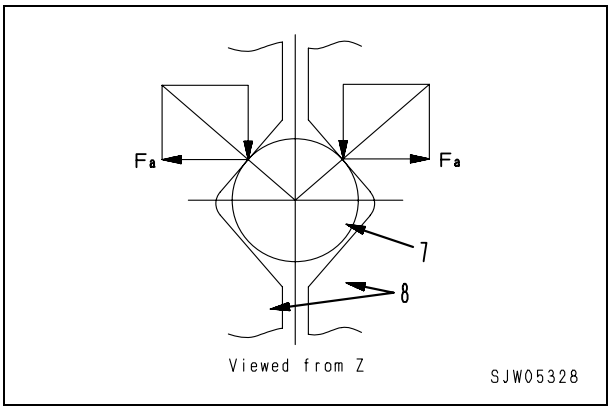
Since the brake torque restricts the rotation of side gears (5) and case (9), right and left side gears (5) cannot rotate freely, thus the operation of the differential is restricted.

Mechanism of generation of braking torque by right and left side gears (5)

Shaft (7) is supported on the cam surfaces being provided on the surfaces of pressure rings (8) that are facing each other.

The power (= torque) transmitted from pressure rings (8) to shaft (7) is transmitted on the cam surfaces. Force (Fa) to separate pressure rings (8) from each other 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 (5) to generate braking torque.



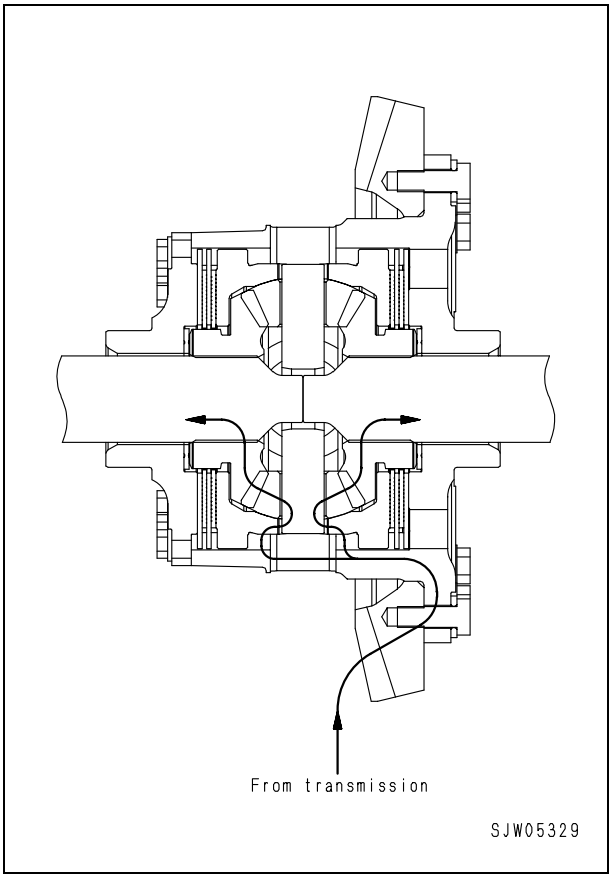
While machine is traveling straight

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, even if the power from the transmission may exceed 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]

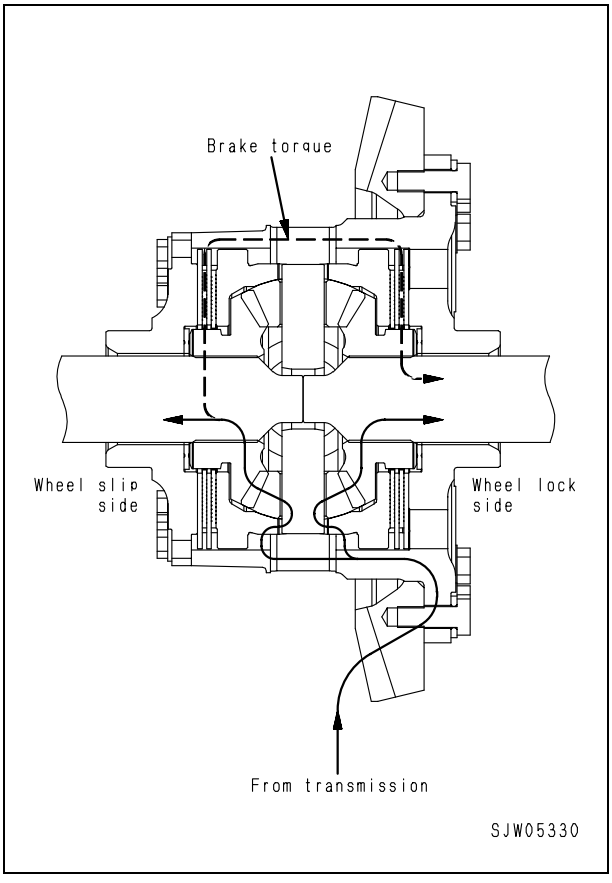
Example 1: When either wheel is on soft ground in digging work

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 evenly divided between the right and left by the differential gear. If, however, the divided drive force exceeds the wheel slip limit of the slip side, surplus of the driving force is transmitted to the opposite side (lock side) brake through the brake and case on the gear back side. Then the power is distributed to the lock side wheel.

The differential starts working only as this surplus portion of the drive force has exceeded the braking force.



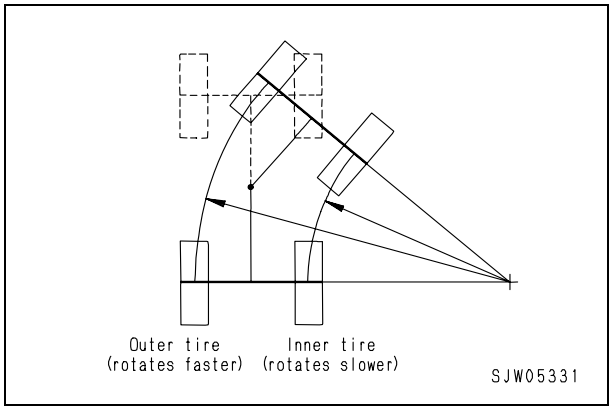
Difference in wheel drive force by type of differentials when either wheel slipped

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

On a road where either wheel slips easily, the drive force of the limited slip differential increases to 1.82 times of the normal differential.

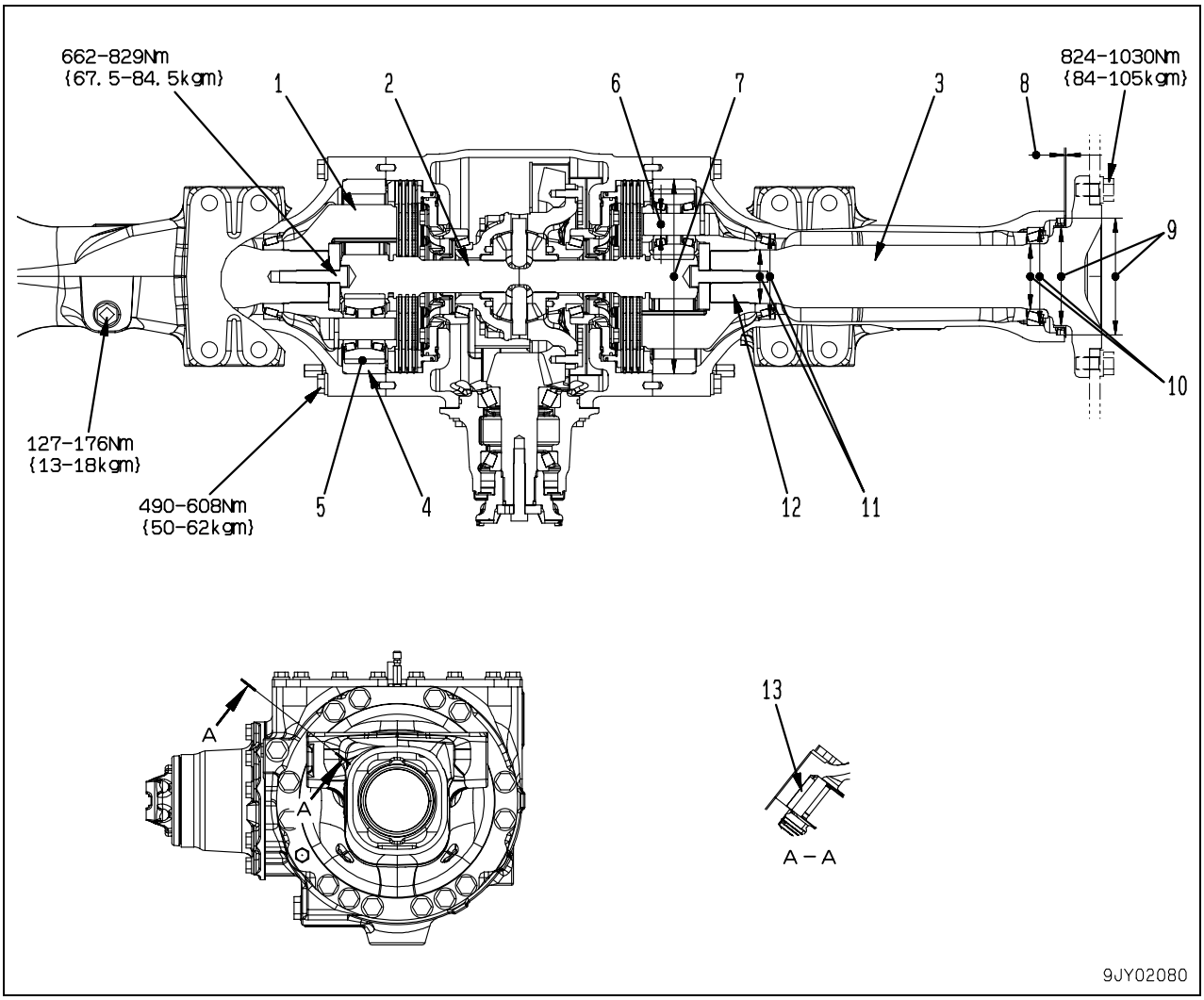
When machine is turning

The same differential gears as that for the normal differential are employed for the limited slip differential. Thus, they allow to smoothly generate a difference in rotation speed between the outer and inner tires that is necessary for tuning.



Final drive

★ The figure shows the front axle.



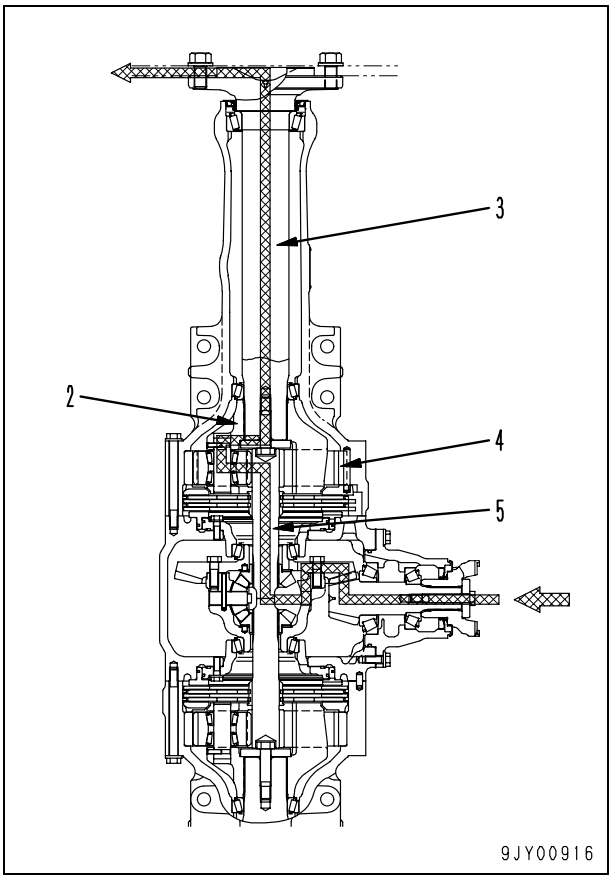
1. Planetary carrier
2. Sun gear shaft (Number of teeth: 15)
3. Axle shaft
4. Ring gear (Number of teeth: 69)
5. Planetary gear (Number of teeth: 26)

Unit: mm

No.	Check item		Criteria					Remedy
			Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
6	Clearance between pinion gear bearing and shaft		40	+0.013 +0.002	0 –0.012	–0.025 – –0.002	—	Replace
7	Clearance between axle housing and ring gear		358	+0.100 +0.030	+0.100 0	–0.100 – 0.070	—	
8	Clearance between oil seal and housing		Max. 0.2					Adjust
9	Press fitting part of axle shaft seal	Housing	215	+0.500 +0.300	+0.072 0	–0.050 – –0.228	—	Replace
		Shaft	180	0 –0.063	–0.300 –0.500	–0.500 – –0.0237	—	
10	Clearance of press fitting part of axle housing bearing	Outer race	180	0 –0.025	–0.045 –0.085	–0.085 – –0.020	—	
		Inner race	120	+0.045 +0.023	0 –0.020	–0.065 – –0.023	—	
11	Clearance of press fitting part of axle housing bearing	Outer race	157.162	+0.025 0	–0.012 –0.052	–0.077 – 0.012	—	
		Inner race	98.425	+0.059 +0.037	+0.025 0	–0.059 – –0.012	—	
12	End play of axle shaft		0 – 0.1					Adjust
13	Clearance of guide pin		12	+0.025 +0.007	+0.207 +0.145	0.120 – 0.200	—	Replace

Outline

- The final drive finally reduces speed of the power from the engine to increase the drive force.
- Ring gear (4) is press fitted to the axle housing and fixed with the pin.
- Speed of the power transmitted being from the differential through sun gear shaft (5) is reduced by the planetary gear unit to increase the drive force.
  The increased drive force is transmitted through planetary carrier (2) and axle shaft (3) to the tire.



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

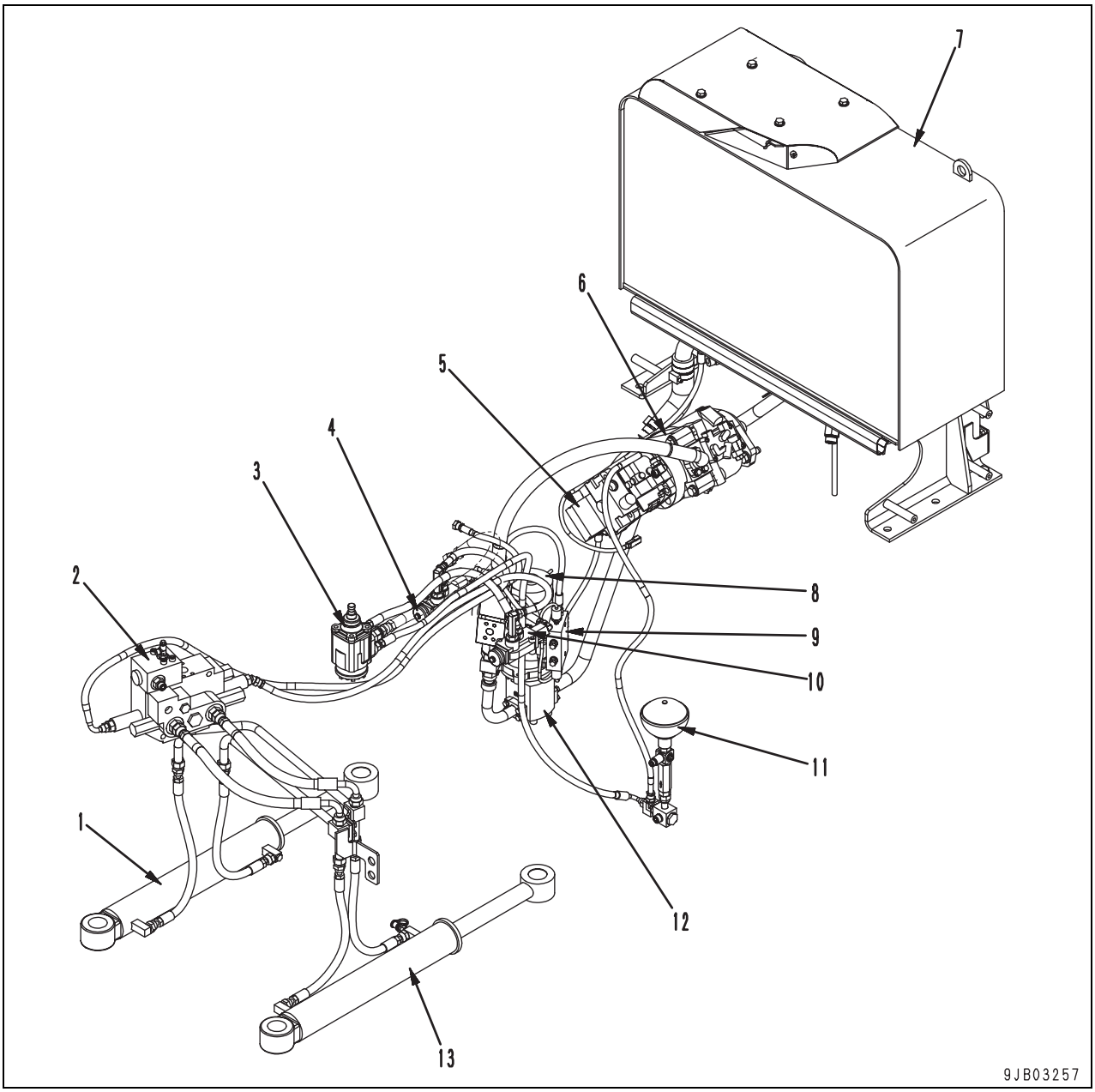
10 Structure, function and maintenance standard

Steering system

Steering system 2
Steering piping diagram 2
Steering column 3
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Steering valve 15
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Stop valve 34
Steering relief valve 35
Steering cylinder 36
Emergency steering motor 38
Emergency steering pump 39

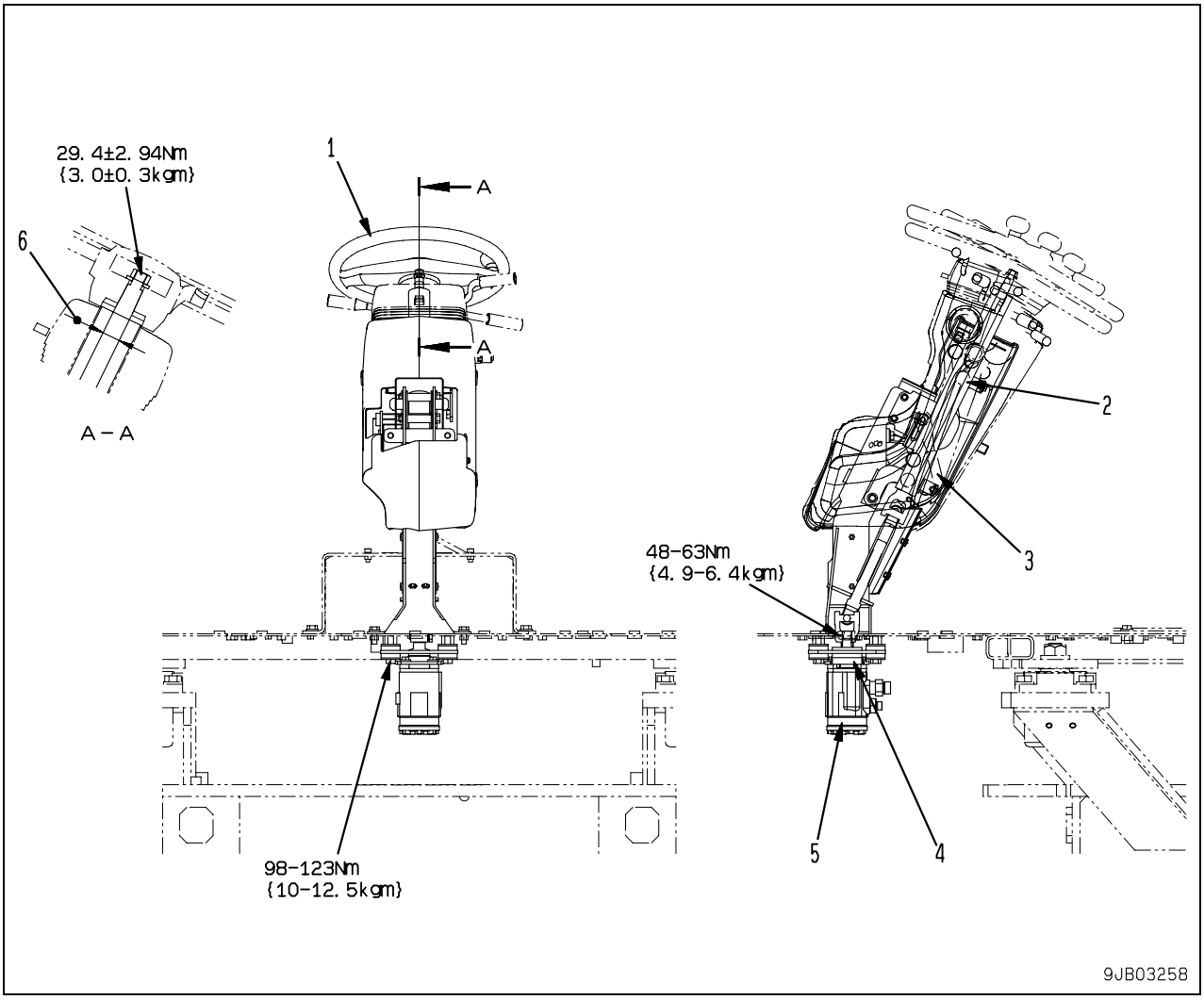
Steering system

Steering piping diagram



1. Steering cylinder (right)
2. Steering valve
3. Orbit-roll valve
4. Stop valve (right)
5. Cooling fan pump
6. Steering pump
7. Hydraulic tank
8. Emergency steering motor
9. Steering relief valve
10. Stop valve (left)
11. Accumulator (for PPC circuit)
12. Emergency steering pump
13. Steering cylinder (left)

Steering column



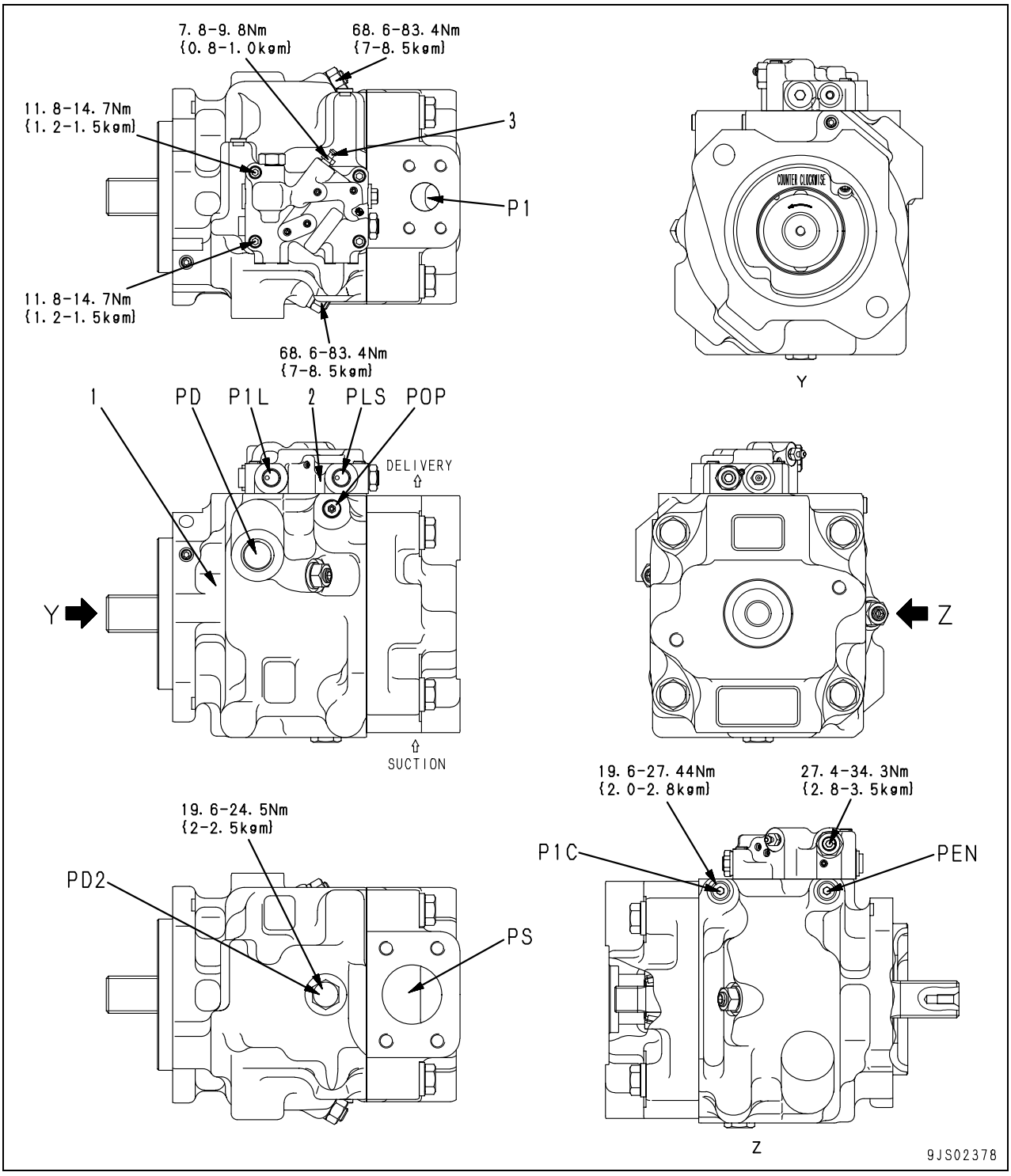
1. Steering wheel
2. Steering column
3. Tilt lever
4. Short column
5. Orbit-roll valve

Unit: mm

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

Steering pump

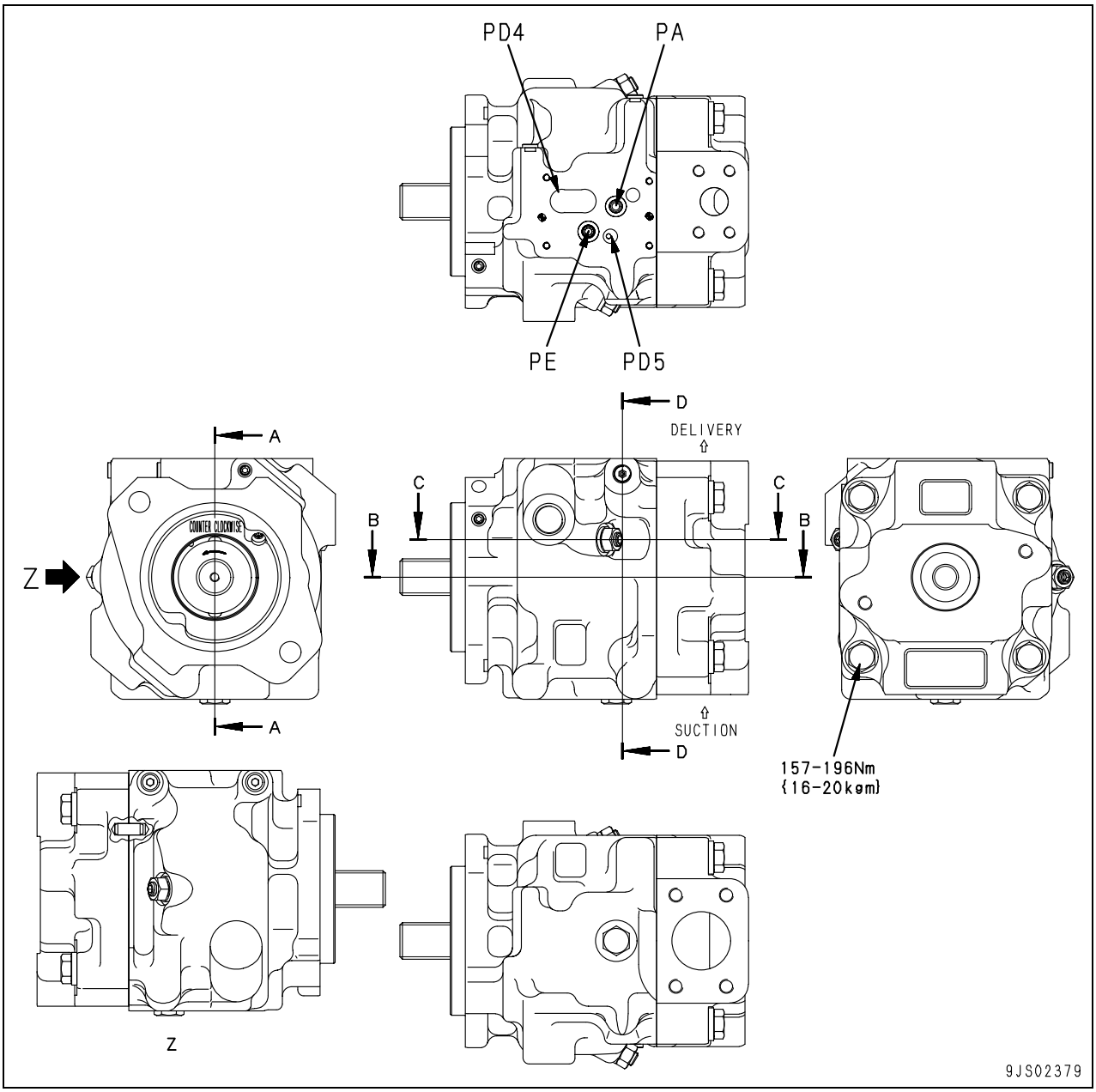
Type: LPV63



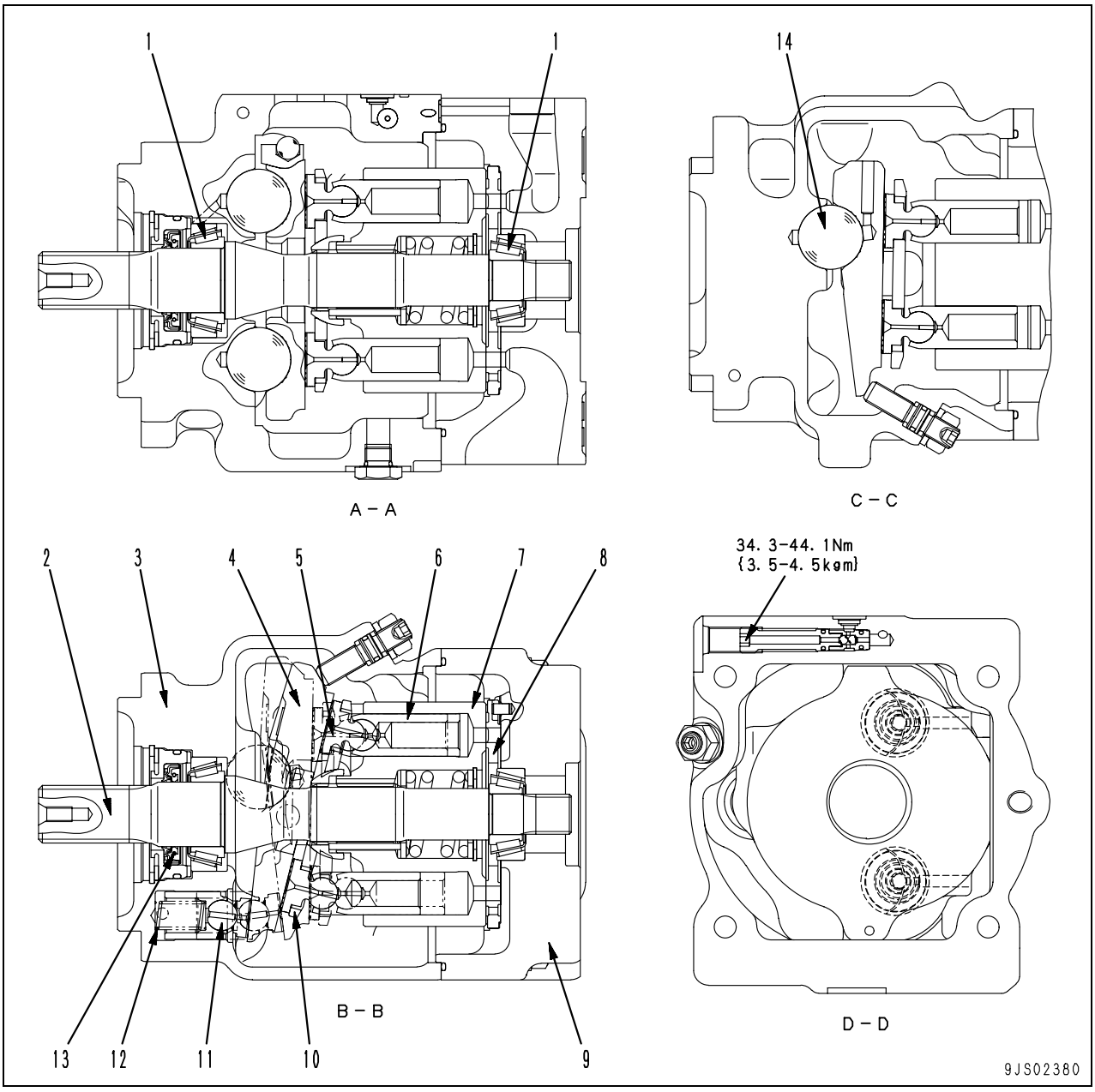
P1: Pump discharge port
PD: Drain port
PS: Pump suction port
P1C: Pump pressure pickup plug
P1L: Pump pressure input port
PD2: Drain plug
PEN: Control pressure pickup plug
PLS: Load pressure input port
POP: External pilot pressure input port

1. Pump unit
2. Servo valve
3. Air bleeder

1. Pump unit

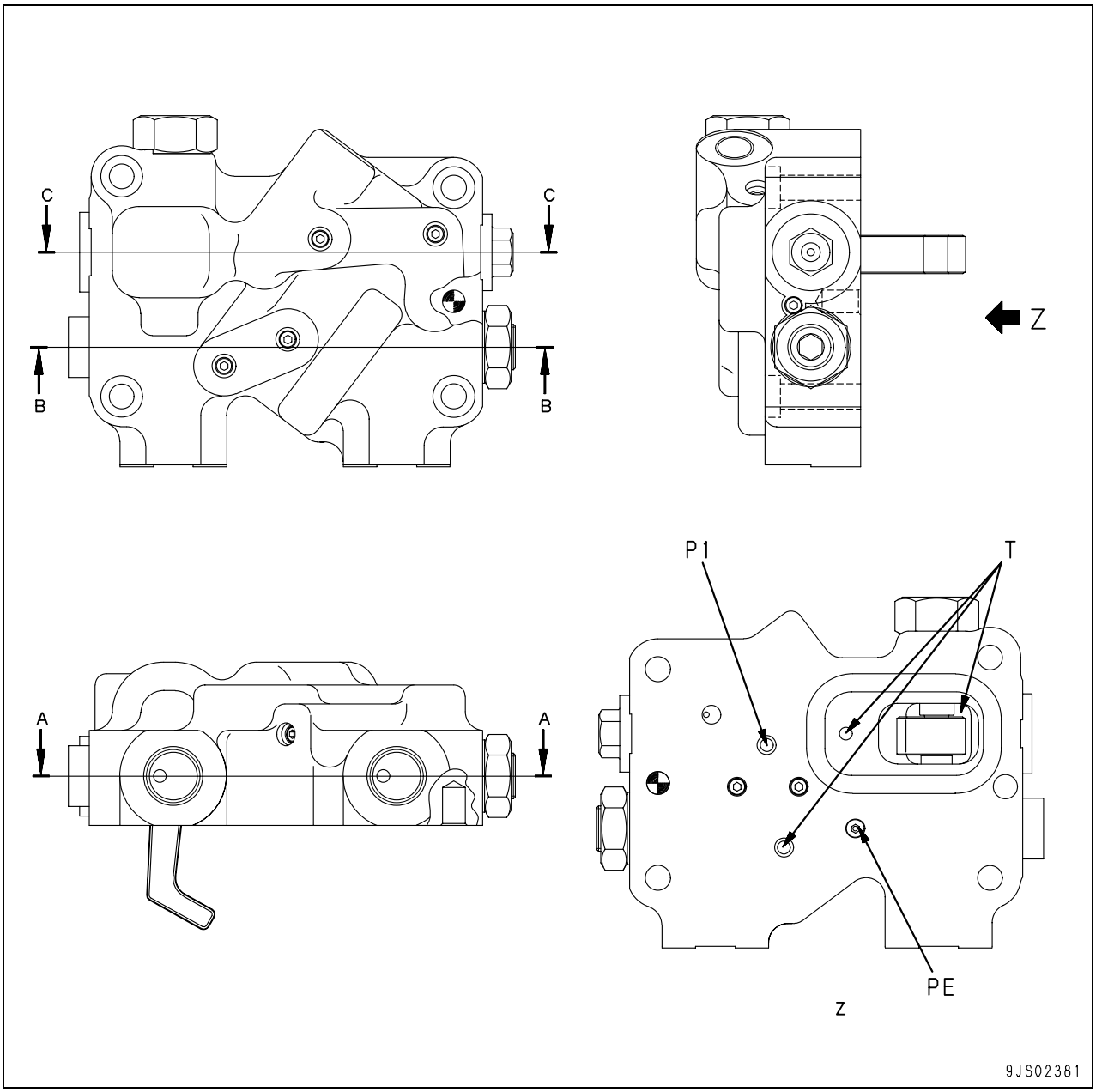


PA: Control basic pressure output port
PD4: Drain port
PD5: Drain port
PE: Control pressure input port

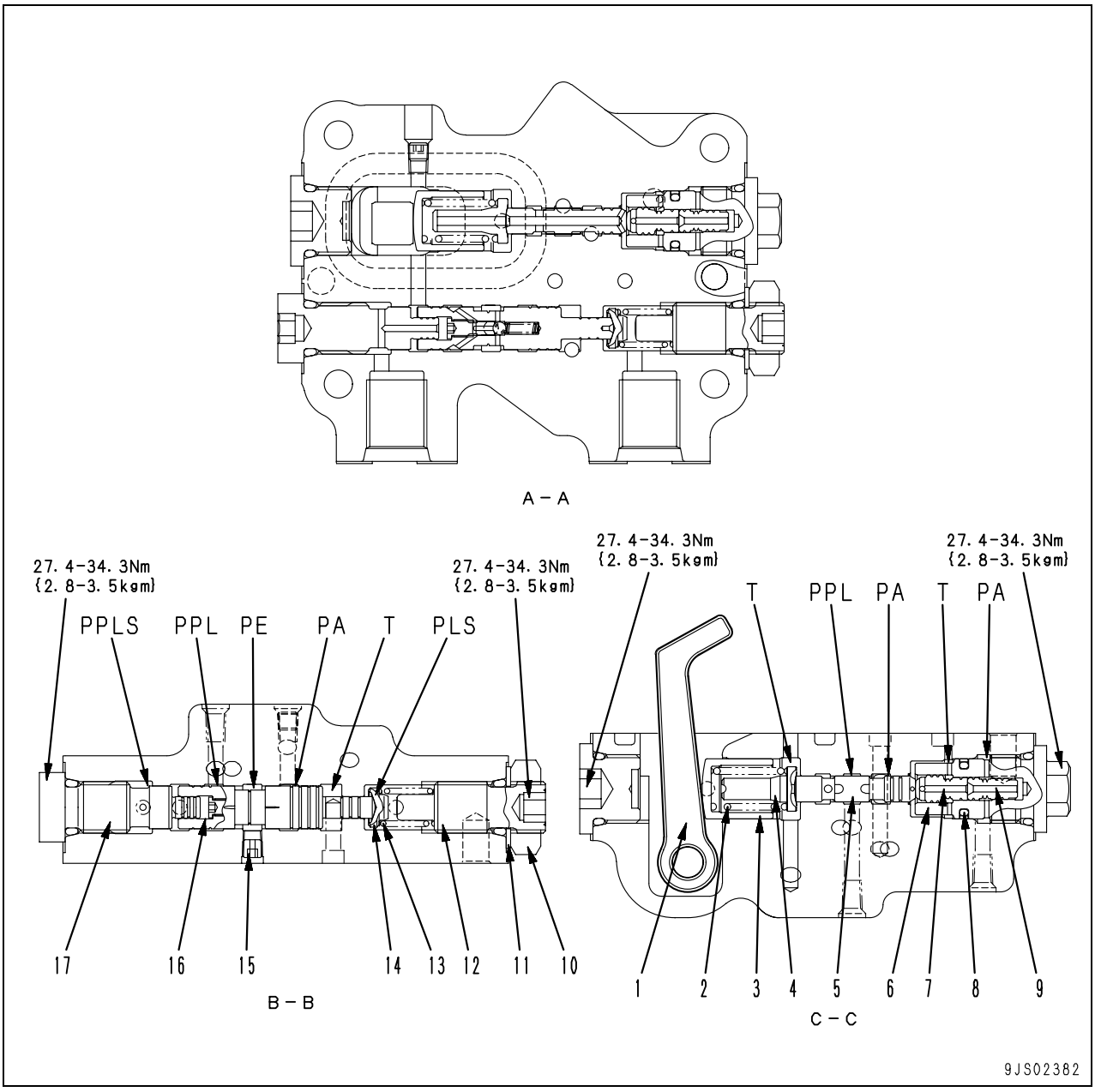


1. Bearing
2. Shaft
3. Case
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. End cap
10. Shoe retainer
11. Servo piston
12. Spring
13. Oil seal
14. Ball

2. Servo valve



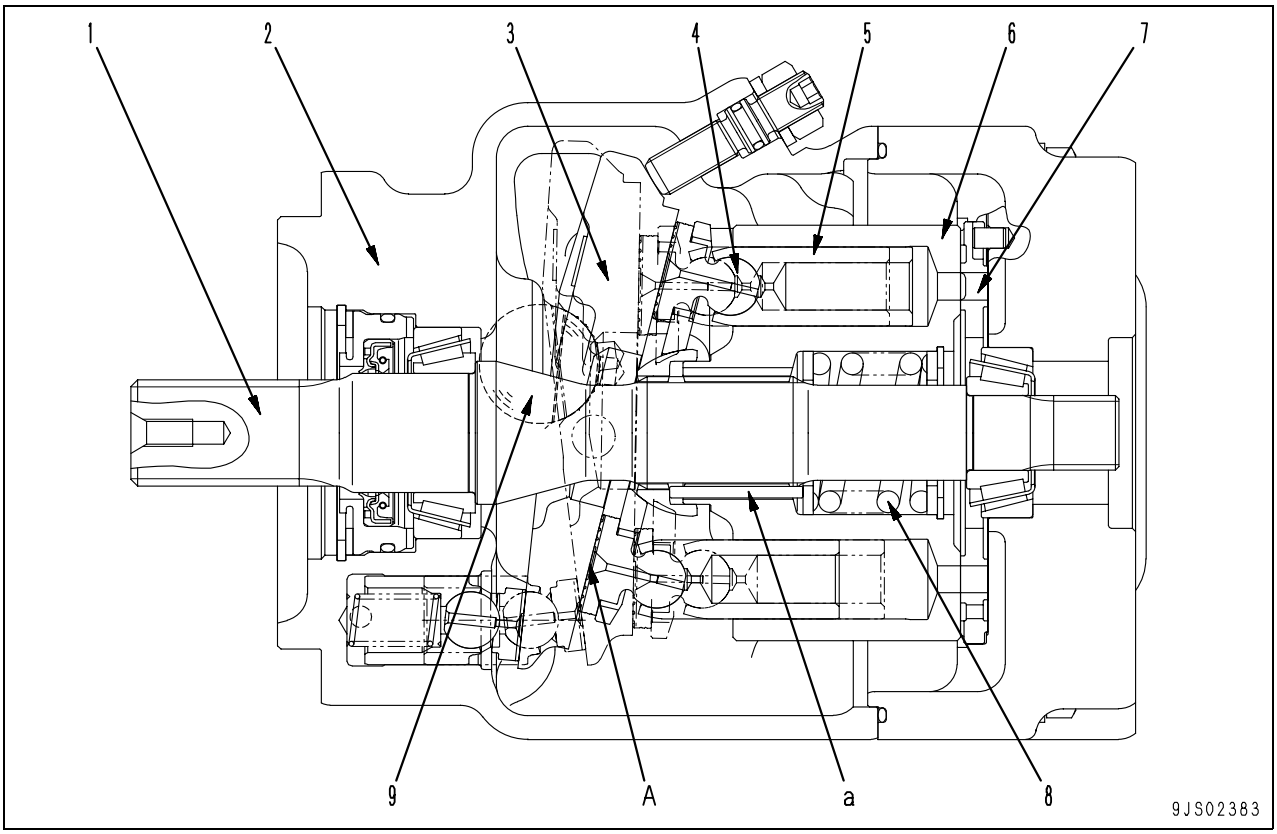
P1: Pump discharge pressure port
PE: Control pressure output port
T: Drain port



PC valve
T: Drain
PA: Pump pressure input
PPL: PC valve output pressure

LS valve
PA: Pump pressure input
PE: Control piston pressure
PLS: LS pressure input
PPL: PC valve output pressure
PPLS: LS pump pressure input

1. Lever
2. Spring
3. Retainer
4. Seat
5. Spool
6. Sleeve
7. Piston
8. Seal
9. Piston
10. Nut
11. Plate
12. Plug
13. Spring
14. Seat
15. Plug
16. Spool
17. Plug



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 delivery by changing the swash plate angle.

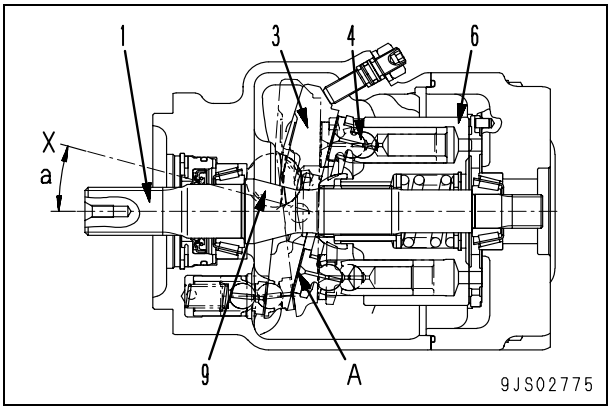
Structure

- Cylinder block (6) is supported on shaft (1) through spline (a). Shaft (1) is supported on the front and rear bearings.
- The end of piston (5) has a spherical hollow and is combined with shoe (4). Piston (5) and shoe (4) form a spherical bearing.
- Rocker cam (3) is supported on case (2) and ball (9) and has plane (A). Shoe (4) is kept pressed against the plane of rocker cam (3) and slid circularly. Shoe (4) leads high-pressure oil to form a static pressure bearing and slides.
- Piston (5) in each cylinder of cylinder block (6) moves relatively in the axial direction.
- Cylinder block (6) rotates relatively against valve plate (7), sealing the hydraulic oil. The hydraulic balance on the valve plate is maintained properly.
- The oil in each cylinder of cylinder block (6) can be sucked and discharged through valve plate (7).

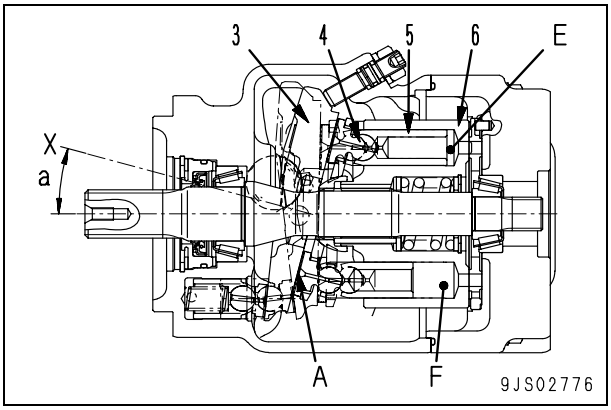
Operation

1. Operation of pump

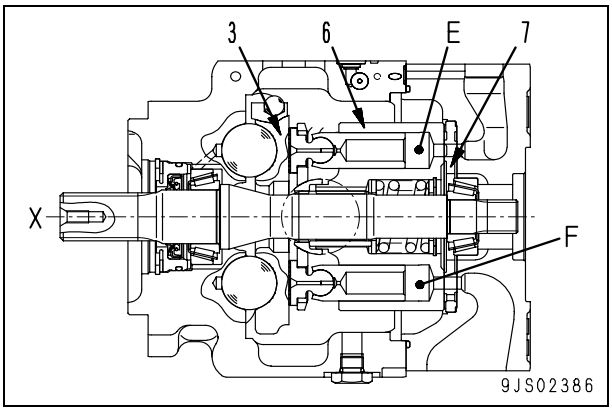
- Cylinder block (6) rotates together with shaft (1). Shoe (4) slides on plane (A). At this time, rocker cam (3) slants around ball (9). As a result, angle (a) between center line (X) of rocker cam (3) and the axis of cylinder block (6) changes. Angle (a) is called the swash plate angle.



- If angle (a) is made between center line (X) of rocker cam (3) and the axis of cylinder block (6), plane (A) works as a cam for shoe (4).
- Accordingly, piston (5) slides inside cylinder block (6) and a difference is made between volumes (E) and (F) in cylinder block (6). As a result, each piston sucks and discharges oil by (F) – (E).
- In other word, if cylinder block (6) rotates and the volume of chamber (E) is decreased, the oil is discharged from chamber (E). On the other hand, the volume of chamber (F) is increased and the oil is sucked in chamber (F). (In the figure, chamber (F) is at the end of the suction stroke and chamber (E) is at the end of the discharge stroke.)

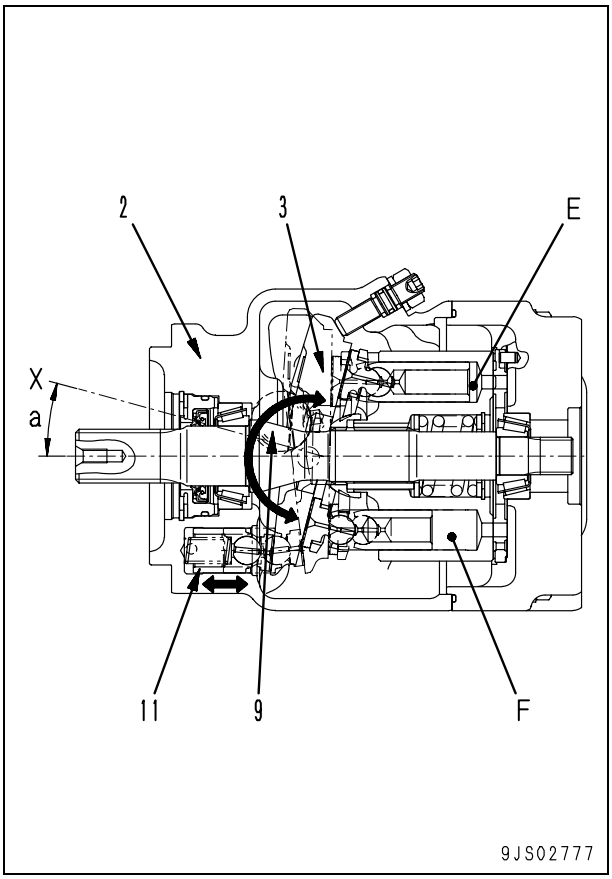


- If center line (X) of rocker cam (3) is equal to the axial direction of cylinder block (6) (the swash plate angle is 0), there is not a difference between volumes (E) and (F) in cylinder block (6) and the oil is not sucked or discharged. (The swash plate angle is not set to 0 actually, however.)
- In short, swash plate angle (a) is in proportion to the pump delivery.



2. Control of delivery

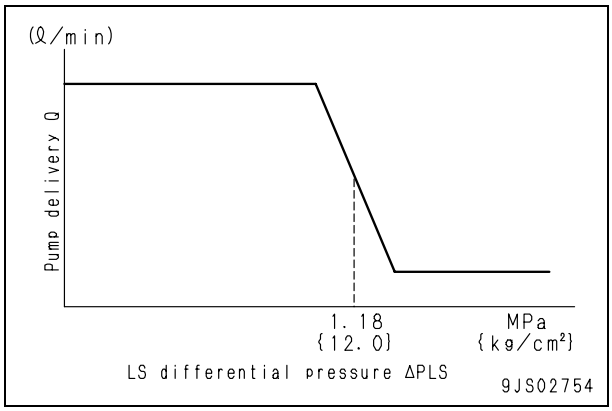
- If swash plate angle (a) is increased, the difference between volumes (E) and (F) is increased, or delivery (Q) is increased. Swash plate angle (a) is changed with servo piston (11).
- Servo piston (11) reciprocates straight according to the signal pressure of the PC valve and LS valve. This straight motion is transmitted to rocker cam (3). Then, rocker cam (3) supported on case (2) through ball (9) slides in rotational directions.



LS valve

Function

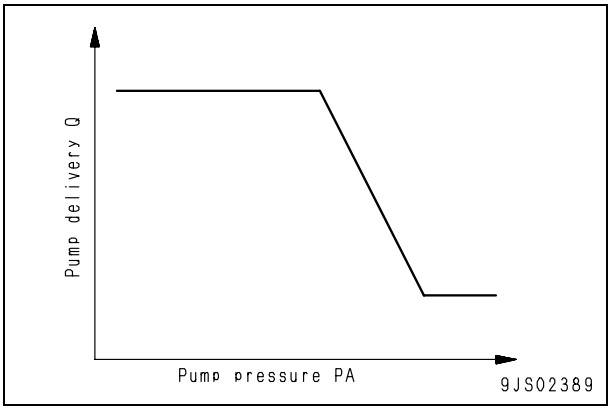
- The LS valve controls the pump delivery according to the stroke of the control lever, or the demand flow for the actuator.
- The LS valve detects the demand flow for the actuator from differential pressure (✕PLS) between control valve inlet pressure (PPLS) and control valve outlet pressure (PLS) and controls main pump delivery (Q). ((PPLS) is called the LS pump pressure, (PLS) the LS pressure, and (✕PLS) is the LS differential pressure.)
- In other words, the pressure loss caused by flow of oil through the opening of the control valve spool (= LS differential pressure ✕PLS) is detected, and then pump delivery (Q) is controlled to keep that pressure loss constant and supply the pump delivery according to the demand flow for the actuator.
- Main pump discharge pressure (PP), LS pump pressure (PPLS), and LS pressure (PLS) are led to the LS valve. The relationship between LS differential pressure (✕PLS) and pump delivery (Q) changes as shown below.



PC valve

Function

- The PC valve limits the oil flow to a certain level (according to the discharge pressure) even if the stroke of the control valve is increased extremely so that the horsepower absorbed by the pump will not exceed the engine horsepower, as long as pump discharge pressure (PA) is high.
- In other words, the PC valve decreases the pump delivery when the load is increased and the pump discharge pressure rises, and increases it when the pump discharge pressure lowers.
- The relationship between the pump pressure and pump delivery is shown below.



Operation

1. Operation of spring

- The spring load of spring (2) at the PC valve is decided by the position of the swash plate.
- If servo piston (6) moves to the right, spring (2) is compressed through lever (1) and its spring load changes.

2. When pump pressure (PA) is low

- The pressing force of spool (5) is decreased and spool (3) is a little to the right (Fig. 1). At this time, ports (C) and (D) are connected to each other and the pressure in the LS valve is drain pressure (PT).
- At this time, ports (F) and (G) of LS valve are connected each other. As a result, the pressure in port (J) becomes drain pressure (PT) and servo piston (6) moves to the left.
- Consequently, the pump delivery is increased.
- As servo piston (6) moves, lever (1) moves to the left and spring (2) expands, weakening its spring force. Consequently, spool (3) moves to the left, disconnecting ports (C) and (D) and connecting pump discharge ports (B) and (C).
- As a result, the pressure in port (C) rises and the piston pressure is increased and servo piston (6) stops moving to the left.

3. When pump pressure (PA) is high

- The pressing force of spool (5) is increased and spool (3) is a little to the left (Fig. 2). At this time, ports (C) and (B) are connected to each other and the pressure in the LS valve is pump pressure (PA).
- At this time, ports (F) and (G) of LS valve are connected each other. As a result, the pressure in port (J) becomes pump pressure (PA) and servo piston (6) moves to the right.
- Consequently, the pump delivery is decreased.
- As servo piston (6) moves, lever (1) moves to the right and spring (2) is compressed, strengthening its spring load. Consequently, spool (3) moves to the right, disconnecting ports (C) and (B) and connecting pressure ports (D) and (C).
- As a result, the pressure in port (C) lowers and the piston pressure is decreased and servo piston (6) stops moving to the right.
- Accordingly, the stopping position (= pump delivery) of servo piston (6) is decided by the position where the pressure caused by pressure (PA) applied to spool (5) is balanced with the force of spring (2) applied through spool (3). (Fig. 3)

When load is light

(Fig. 1)

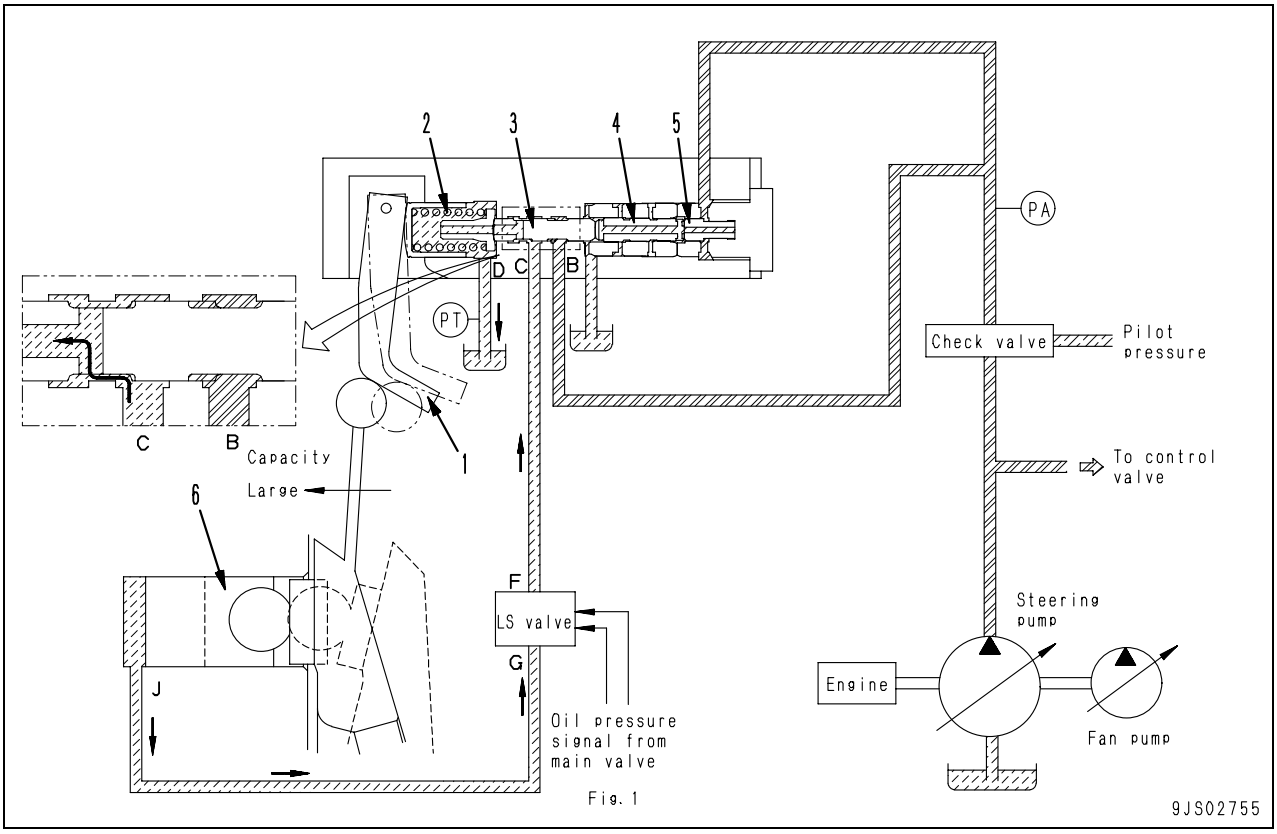


Fig. 1

When load is heavy

(Fig. 2)

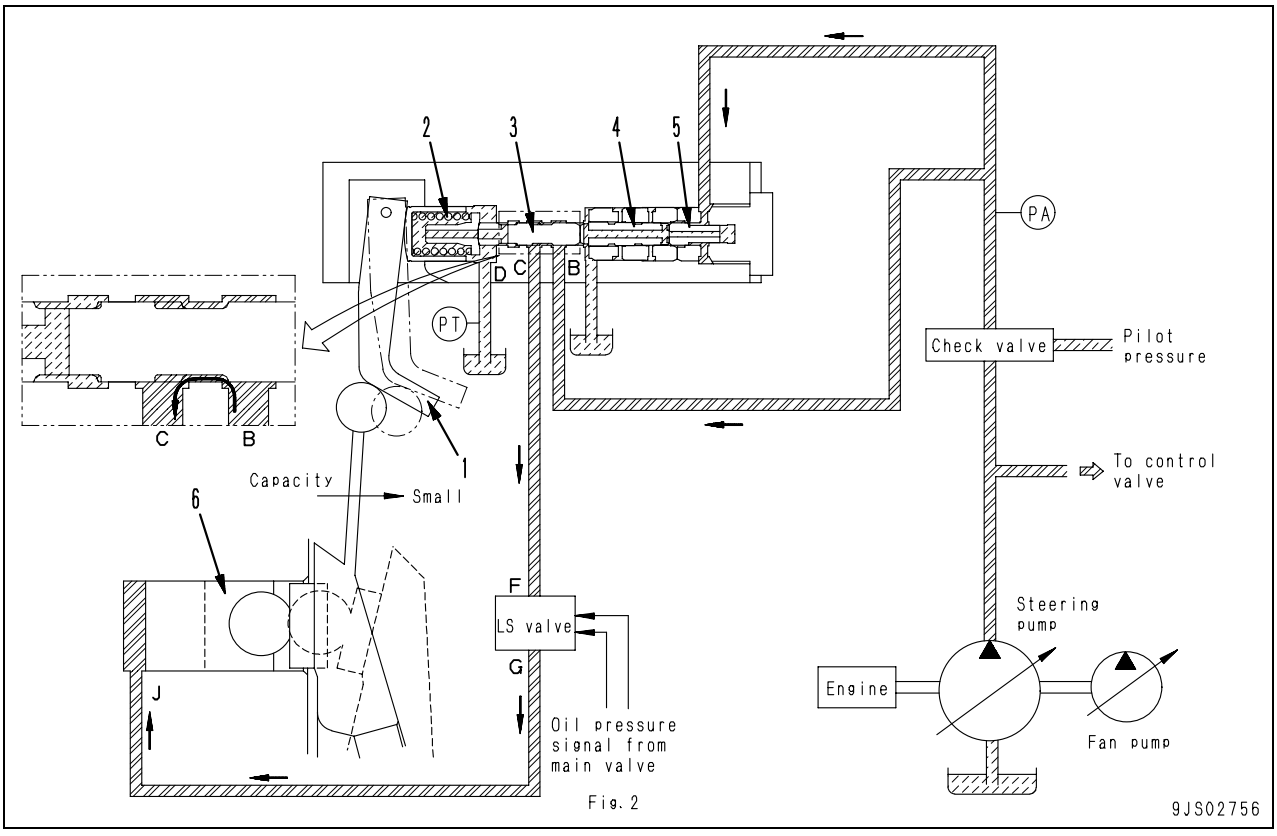


Fig. 2

When balanced

(Fig. 3)

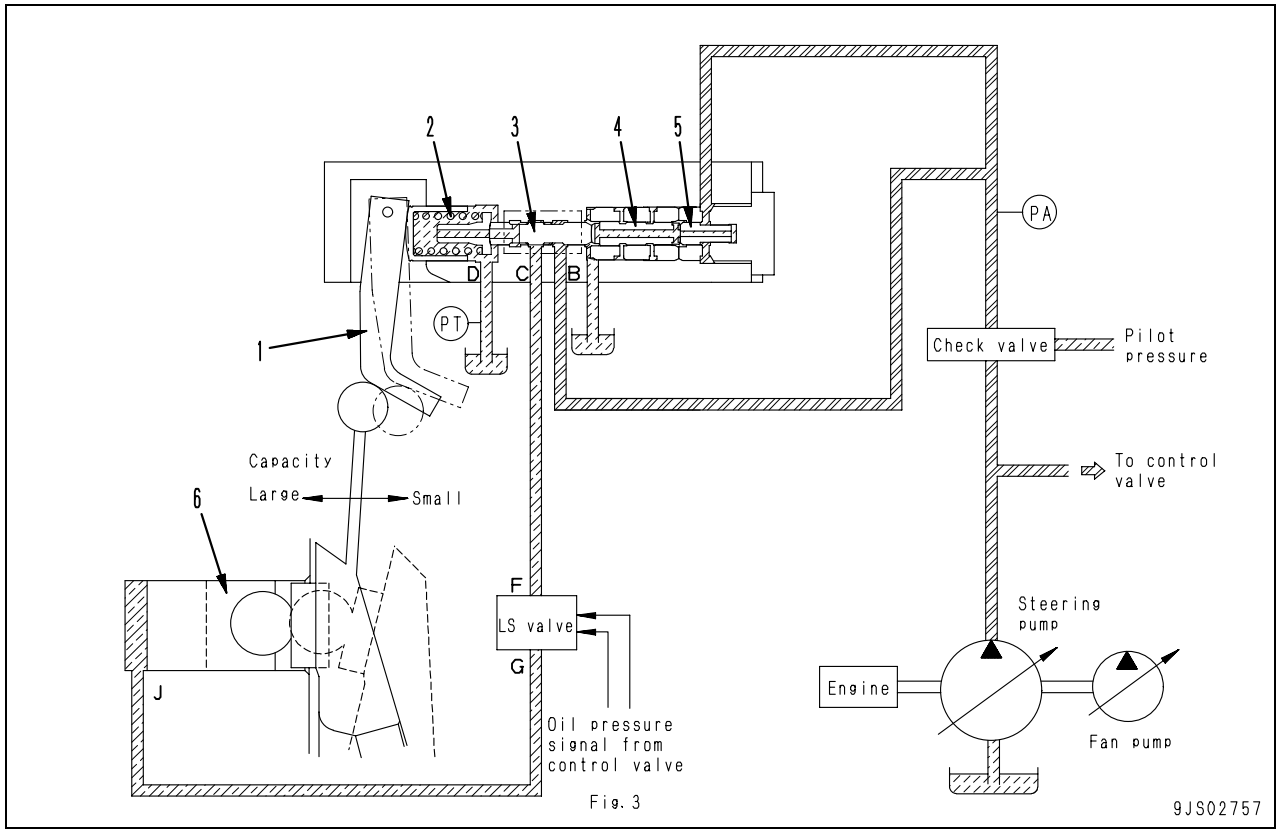
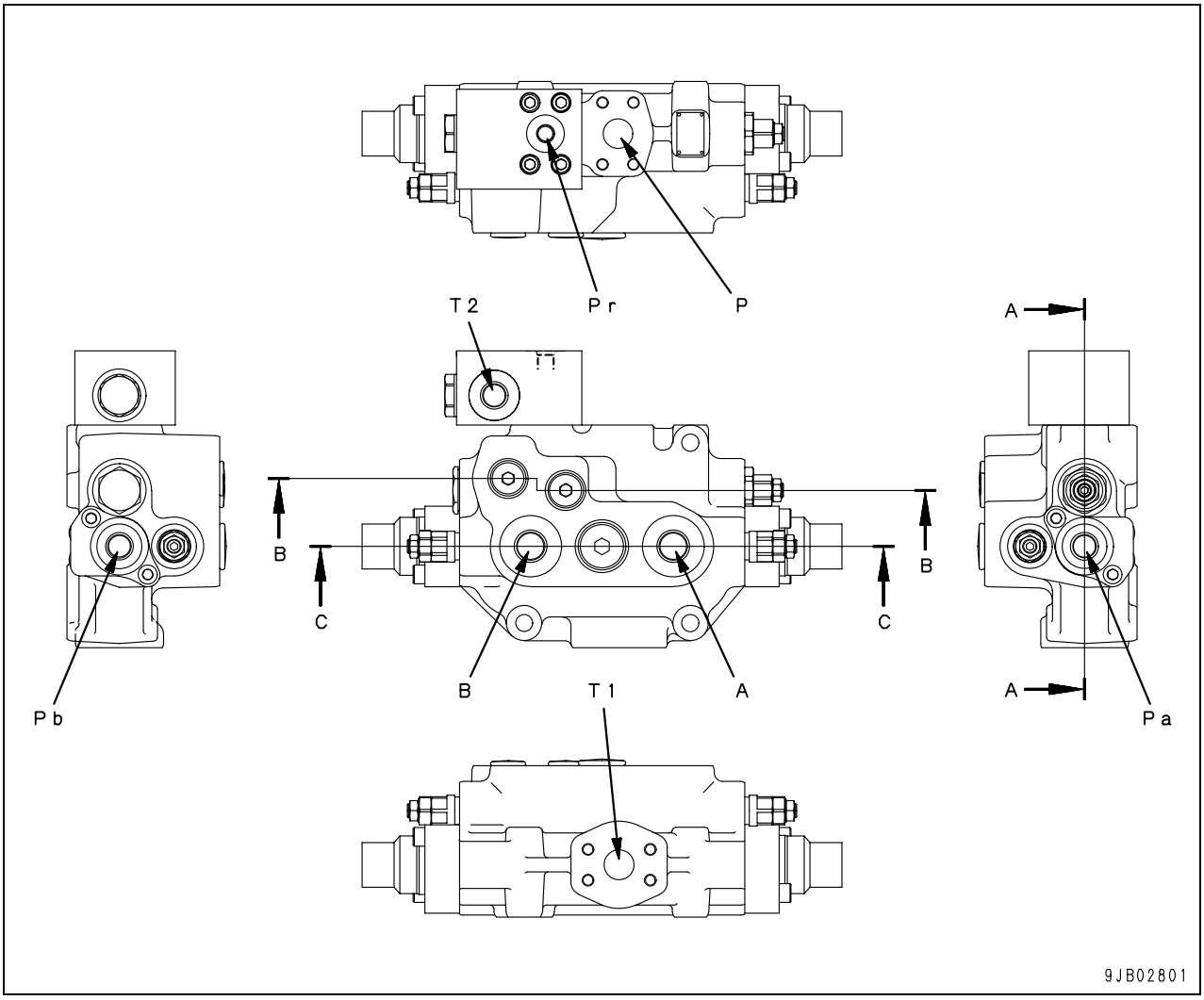
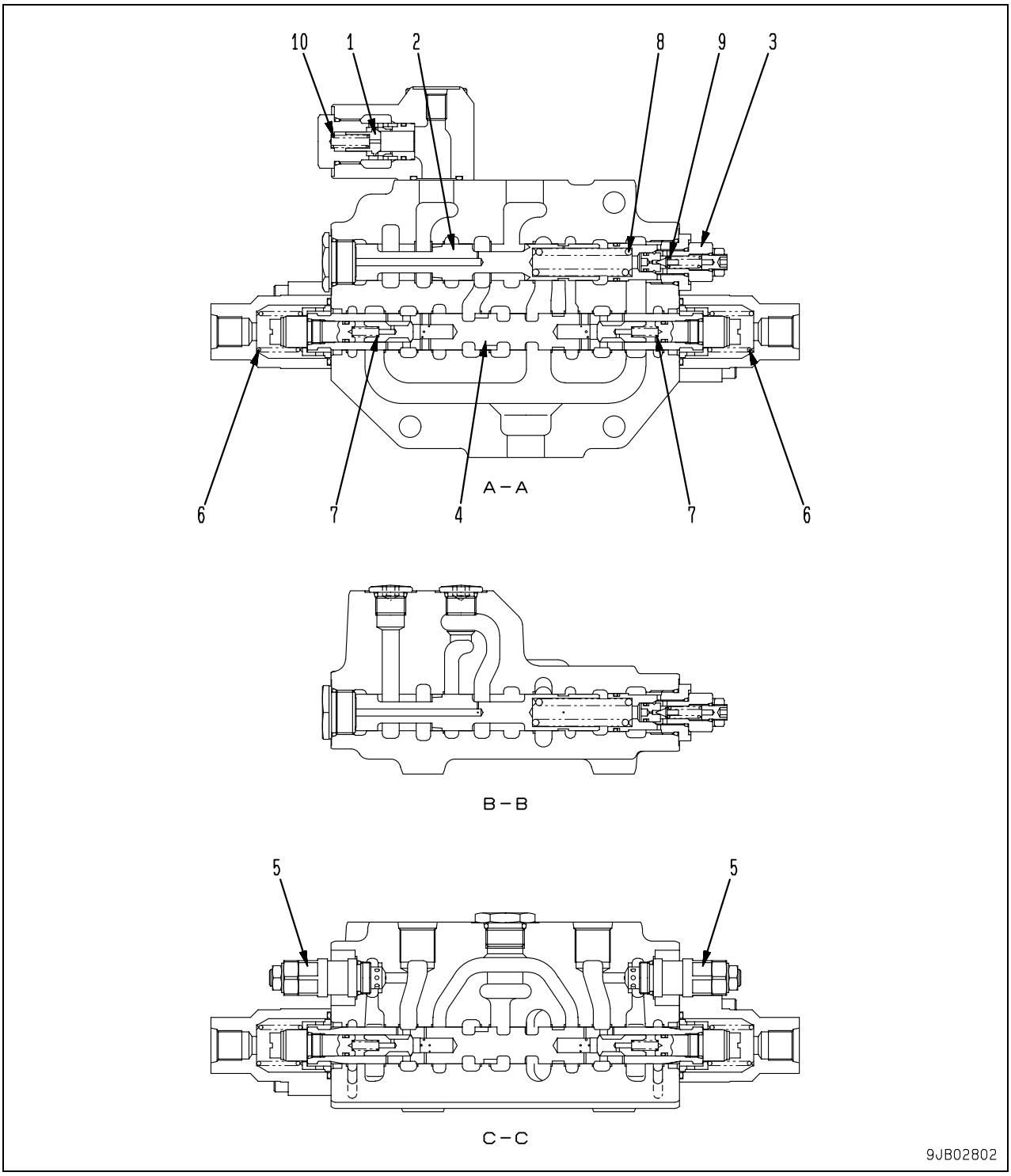


Fig. 3

Steering valve



P: From steering pump
Pr: To steering pump port P1L
Pa: From stop valve (left)
Pb: From stop valve (right)
A: To steering cylinder
B: To steering cylinder
T1: Drain
T2: Drain


10
1
2
8
9
3
A – A
6
7
4
7
6
B – B
5
5
C – C
9JB02802

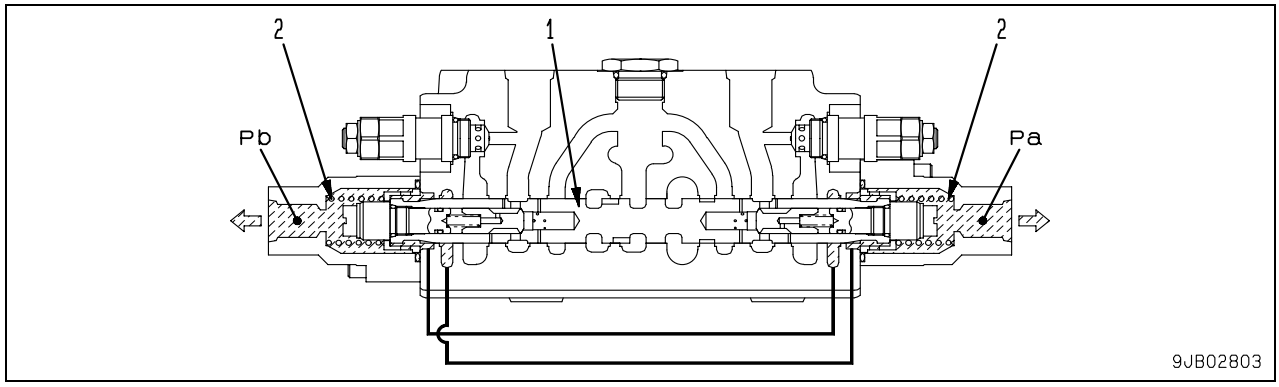
1. Relief valve
2. Flow control spool
3. Steering relief valve
4. Steering spool
5. Overload relief valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
6	Steering spool return spring	Free length	Installed length	Installed load	Free length	Installed load	
		37.2	32.0	56.9 N {5.80 kg}	—	45.5 N {4.64 kg}	
7	Poppet spring	20.9	13.2	8.8 N {0.9 kg}	—	7.0 N {0.72 kg}	Replace
8	Flow control spool return spring	69.65	68.5	147.1 N {15.0 kg}	—	117.7 N {12.0 kg}	
9	Steering relief valve spring	24.0	22.2	182 N {18.6 kg}	—	145.6 N {14.8 kg}	
10	Relief valve spring	29.75	26.5	55.3 N {5.64 kg}	—	44.2 N {4.51 kg}	

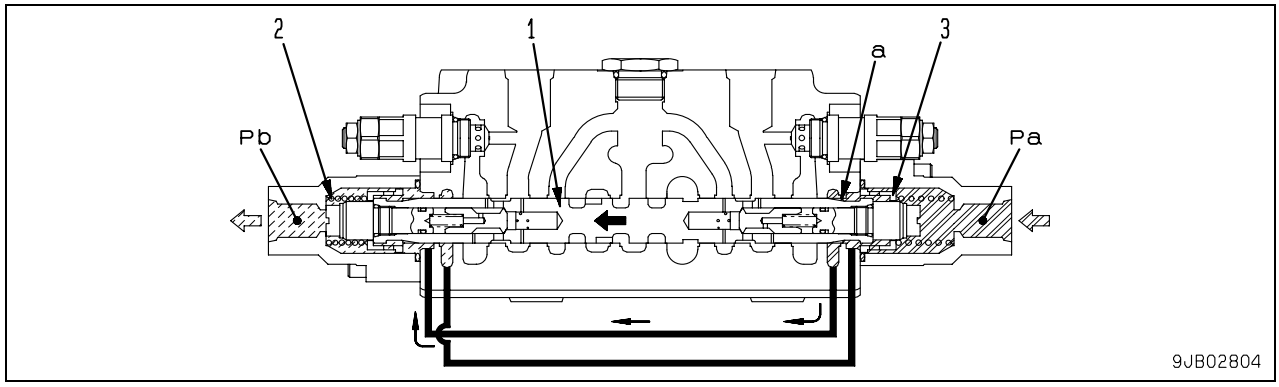
Operation of flow amplifier

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



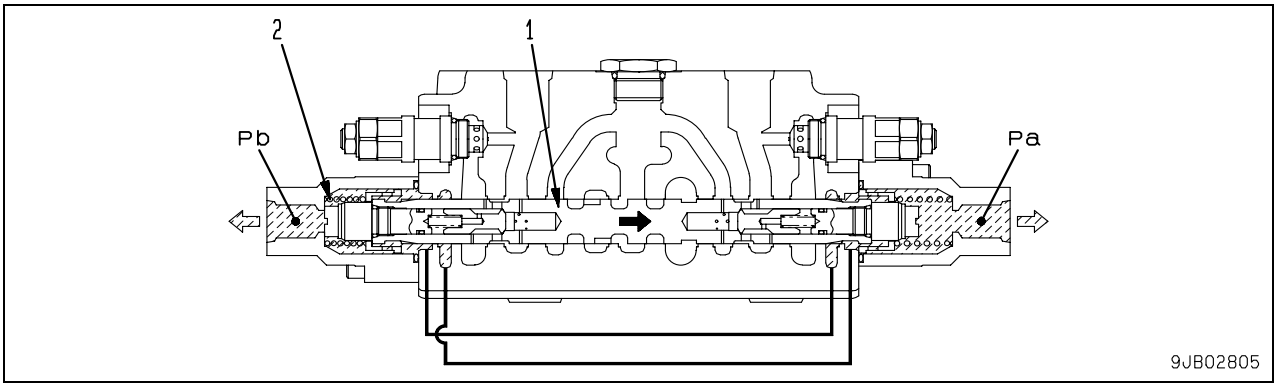
- Since both ports (Pa) and (Pb) are connected through the Orbit-roll valve to the drain circuit, steering spool (1) is kept at neutral position by right and left return springs (2).

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).

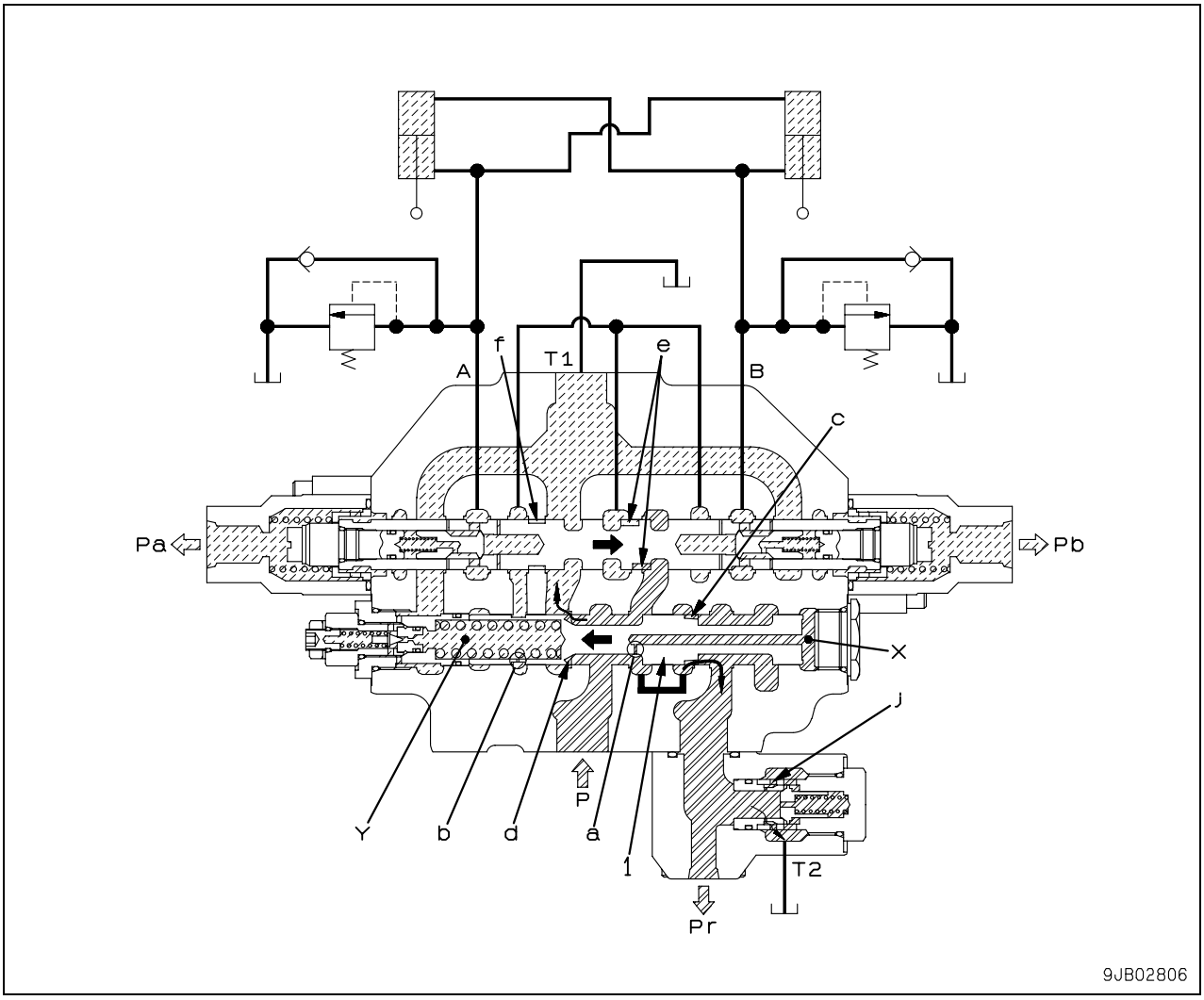
When spool is returned
(When steering wheel is stopped)



- 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).

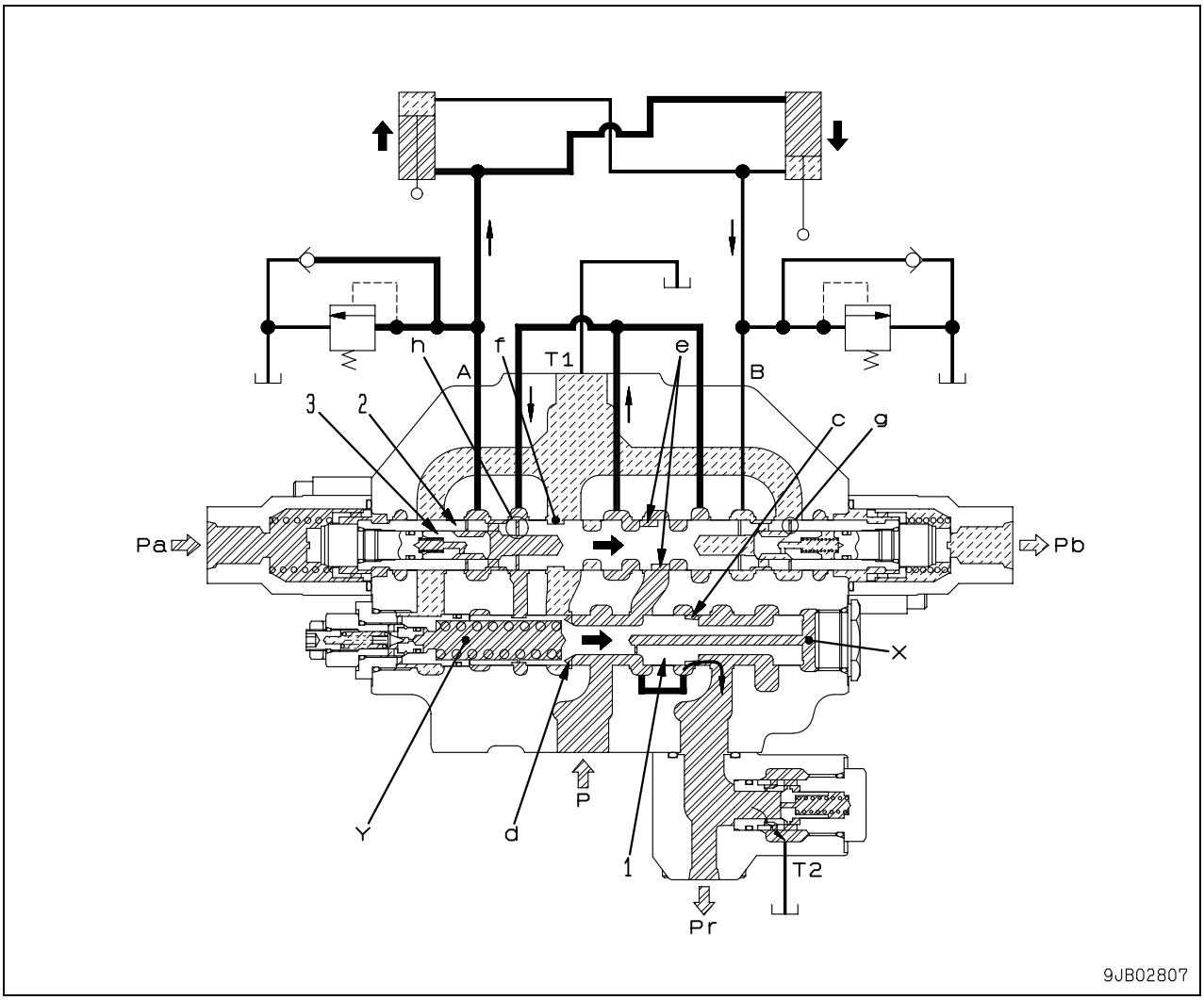
Operation of flow control spool

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) and notch (f).
- 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 (T2).
- The oil pressure in port (Pr) is set between the pump pressure and drain pressure of port (T2) 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 (T1).

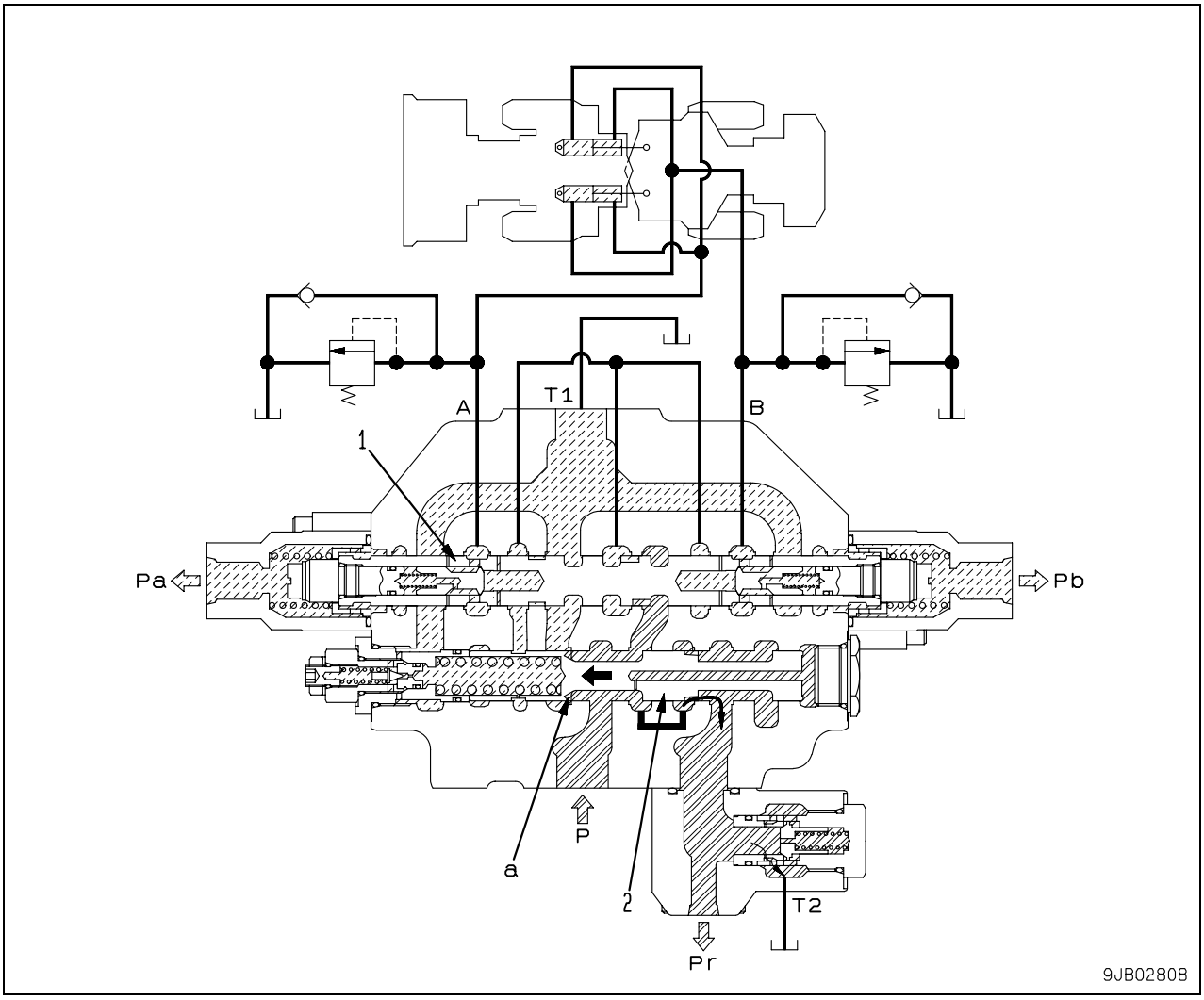
When steering spool operates



- If steering spool (2) operates, notch (f) closes and pressure receiving chamber (Y) and port (T1) 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 (T1).
- 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 discharges the amount of oil corresponding to the open rate of notch (e) in order to keep the oil pressure in port (Pr) constant.

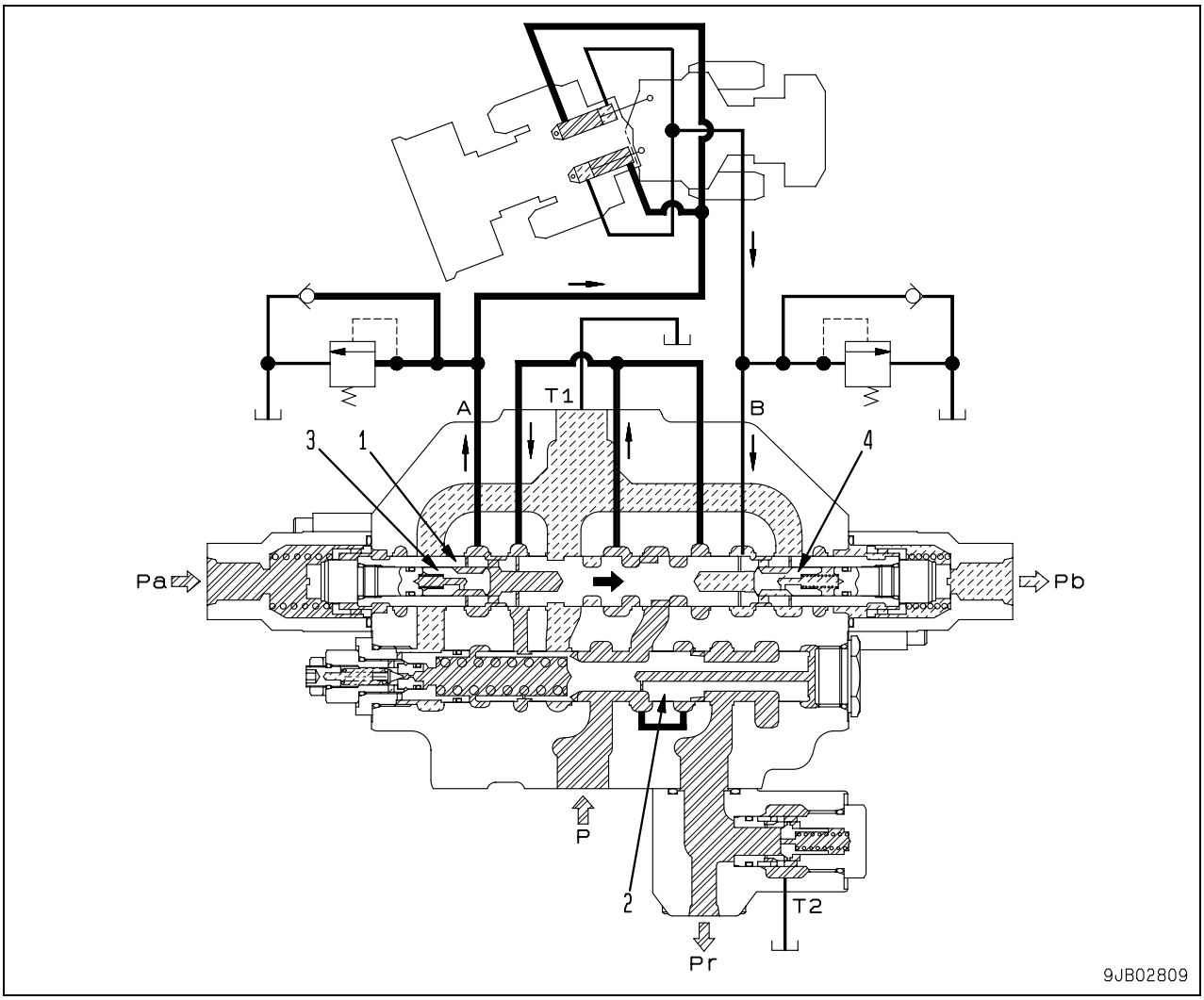
Operation of steering valve

At neutral



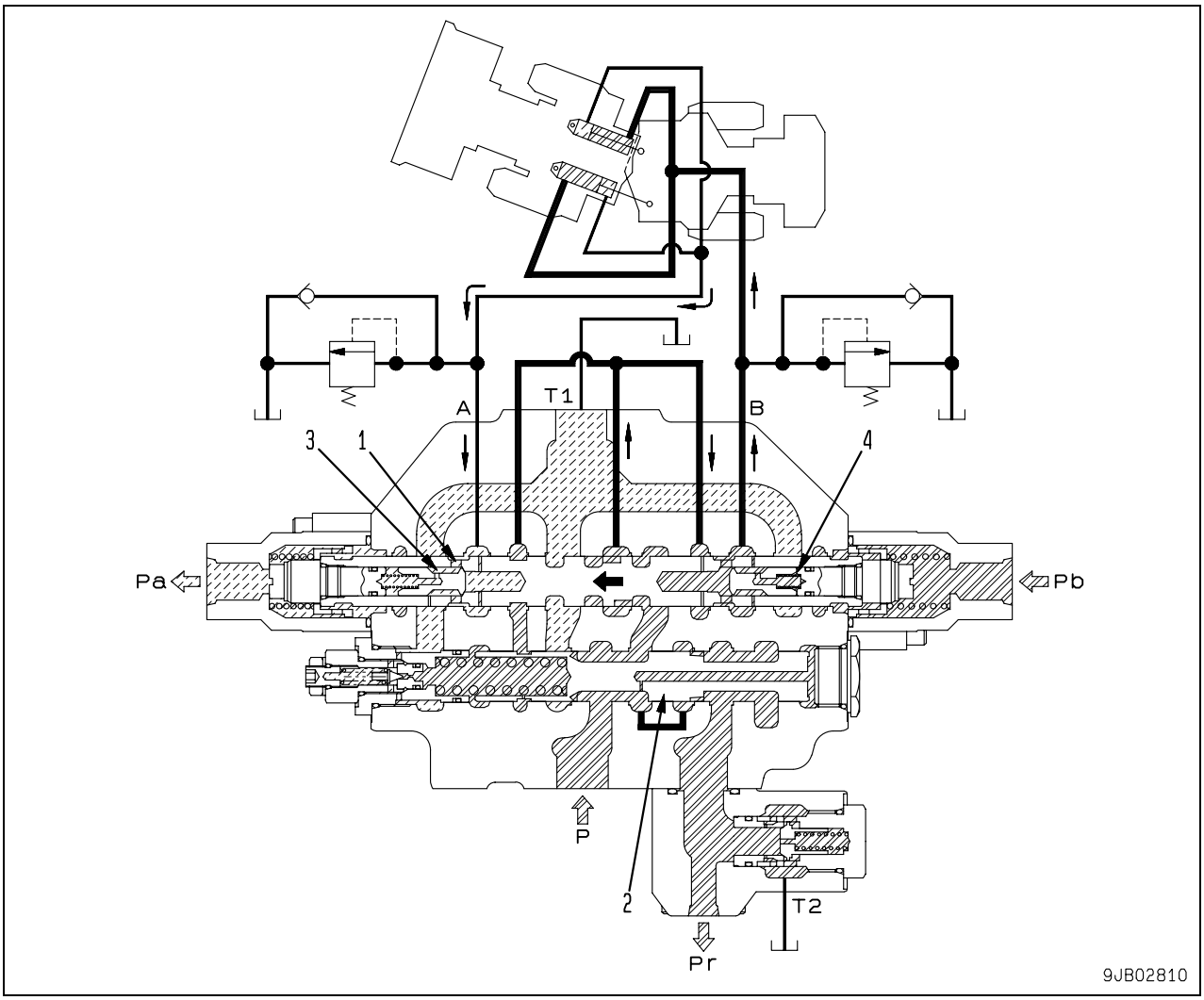
- Since the steering wheel is not operated, steering spool (1) does not move.
- The oil from the steering pump flows in port (P).
- If the oil pressure in port (P) rises, flow control spool (2) moves to the left and the oil from the steering pump is drained through notch (a) and port (T1).

Turning left



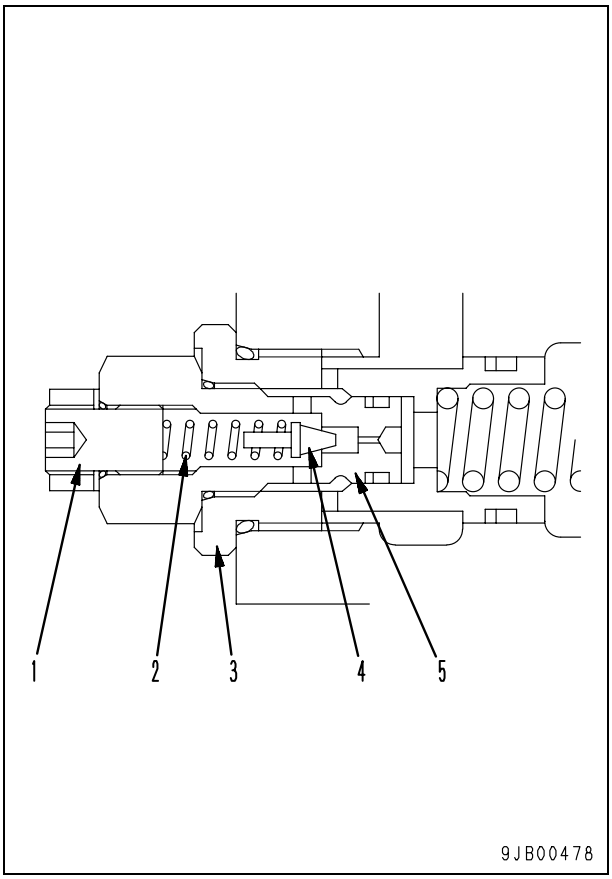
- If the steering wheel is turned to the left, the output pressure from the Orbit-roll valve enters port (Pa) and steering spool (1) is pushed to the right.
- The oil from the steering pump flows in port (P), and then flows through flow control spool (2) to steering spool (1).
- Load check valve (3) 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 (T1).

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 (T1).

Steering relief valve

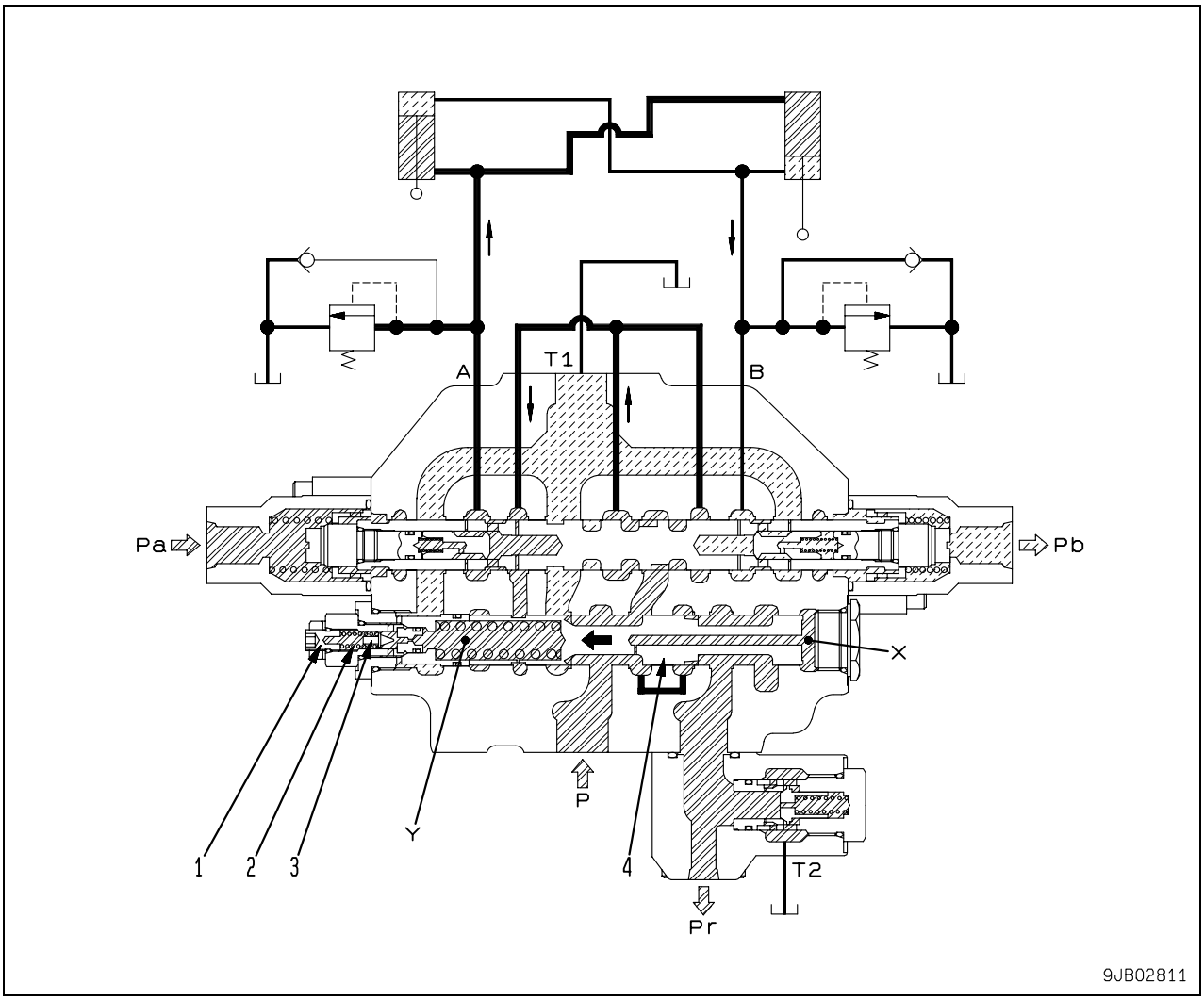


1. Adjustment screw
2. Spring
3. Plug
4. Pilot poppet
5. Valve seat

Function

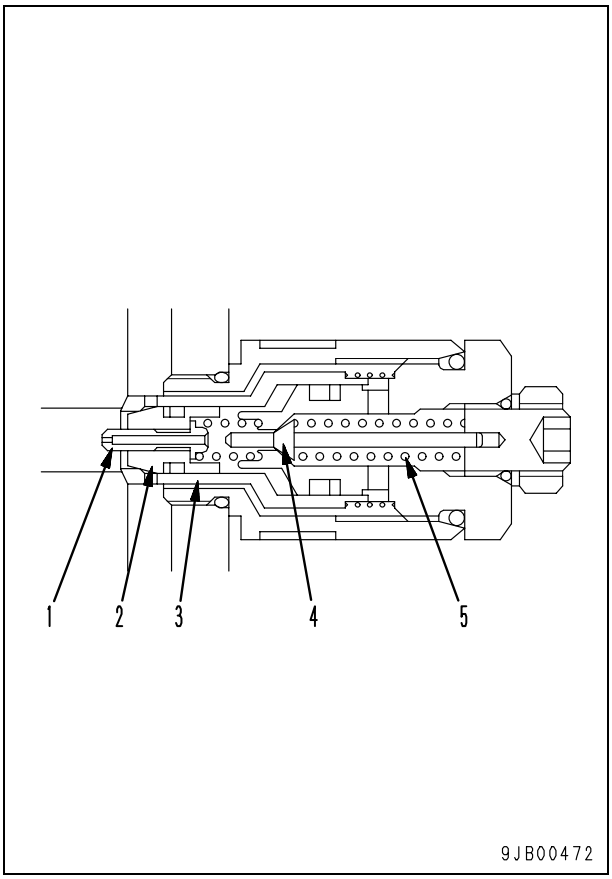
- The steering relief valve is installed to the steering valve. It maintains the oil pressure in the steering circuit to the set pressure during the steering operation.

Operation of steering 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 (T1).
- 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



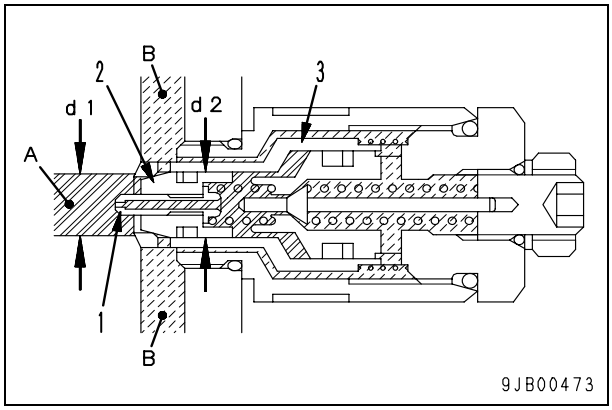
1. Poppet
2. Relief valve poppet
3. Check valve poppet
4. Pilot poppet
5. Spring

Function

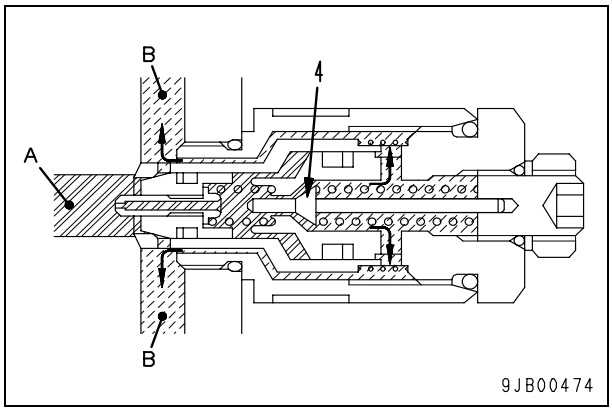
- The overload relief valve is installed to the steering valve. It protects the cylinder circuit from abnormally high pressure that can be generated if an impact is applied to the cylinder while the steering valve is in neutral.
- If abnormally high pressure is generated on the cylinder side, the overload 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

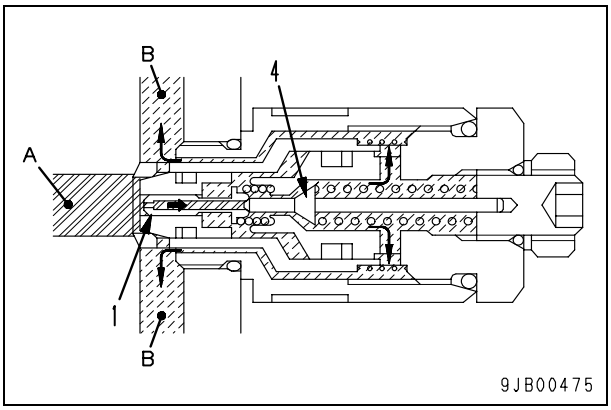
Operation as relief valve



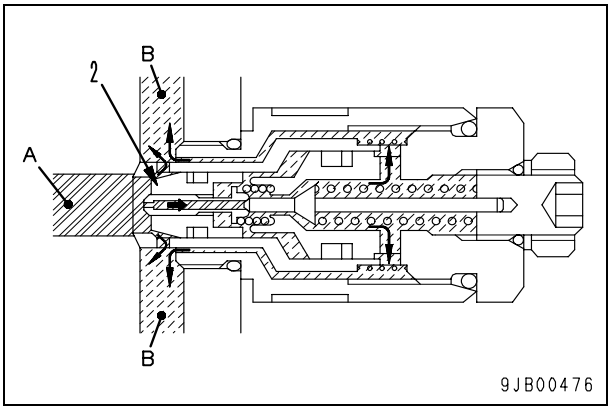
- Port (A) and port (B) are connected to the cylinder circuit and drain circuit, respectively.
- The oil flows through the hole of poppet (1) to the inside of relief valve poppet (2).
- Check valve poppet (3) and relief valve poppet (2) are seated securely by the area difference between diameters (d1)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

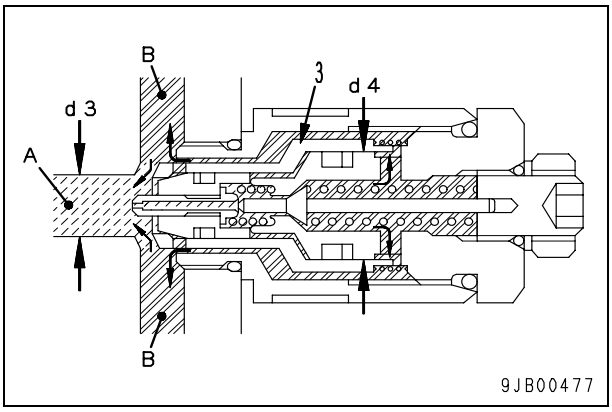


- As pilot poppet (4) opens, the oil pressure inside of poppet (1) lowers.
- Poppet (1) moves to the right to seat pilot poppet (4).



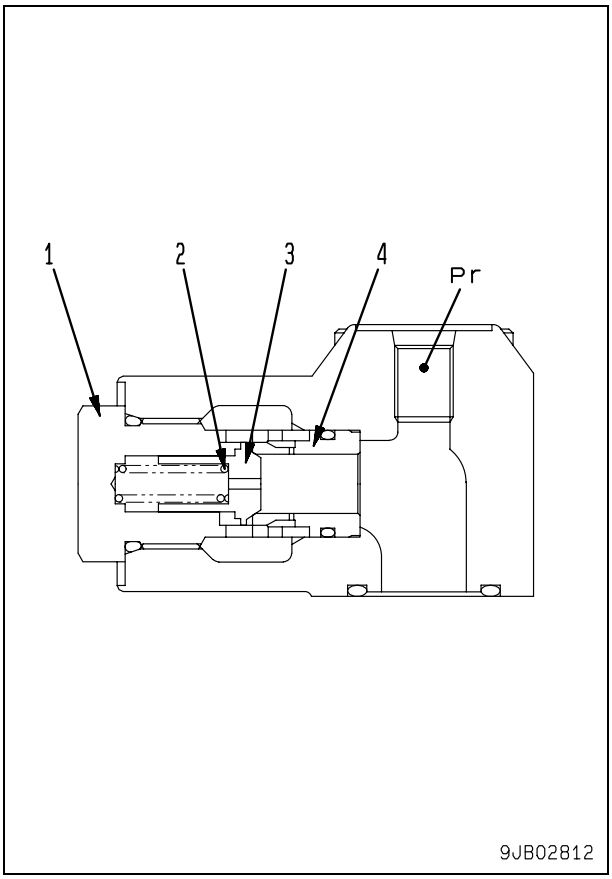
- The oil pressure of inside of relief valve poppet (2) becomes lower than the oil pressure in port (A).
- The oil pushes and opens relief valve poppet (2) to the right and flows through port (A) to port (B), thus the circuit is protected from abnormally high pressure.

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

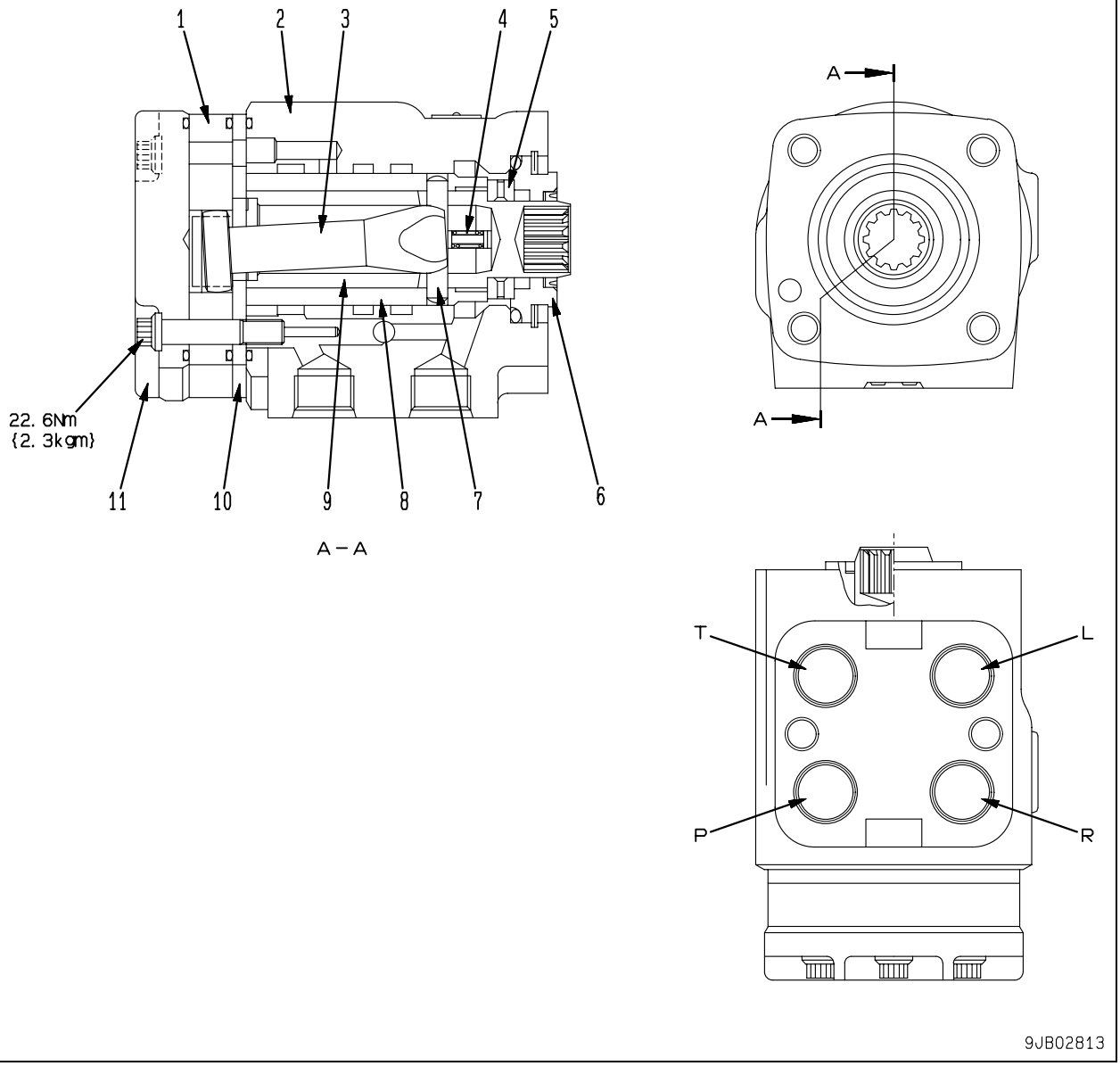


1. Plug
2. Spring
3. Valve
4. Valve seat

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.

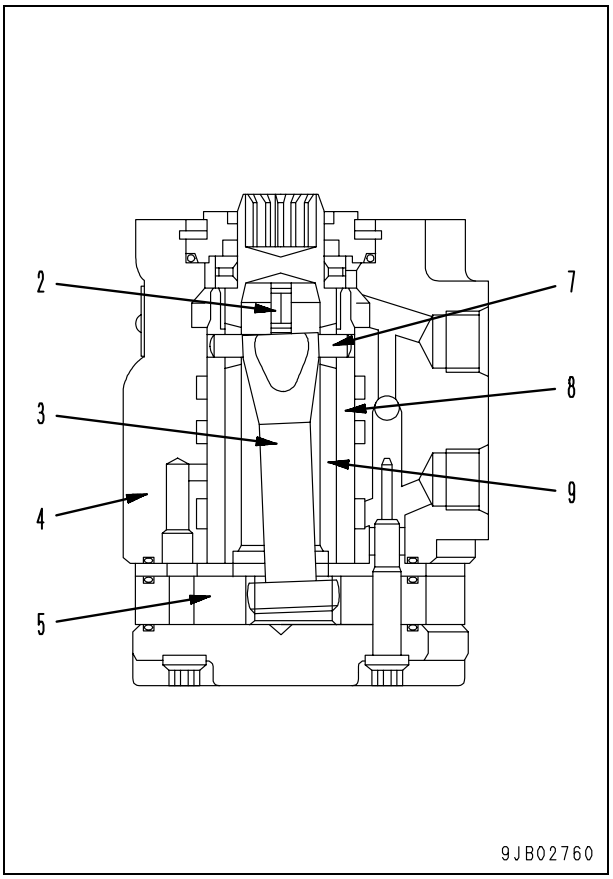
Orbit-roll valve



P: From charge valve
T: Drain
L: To left stopper valve
R: To right stopper valve

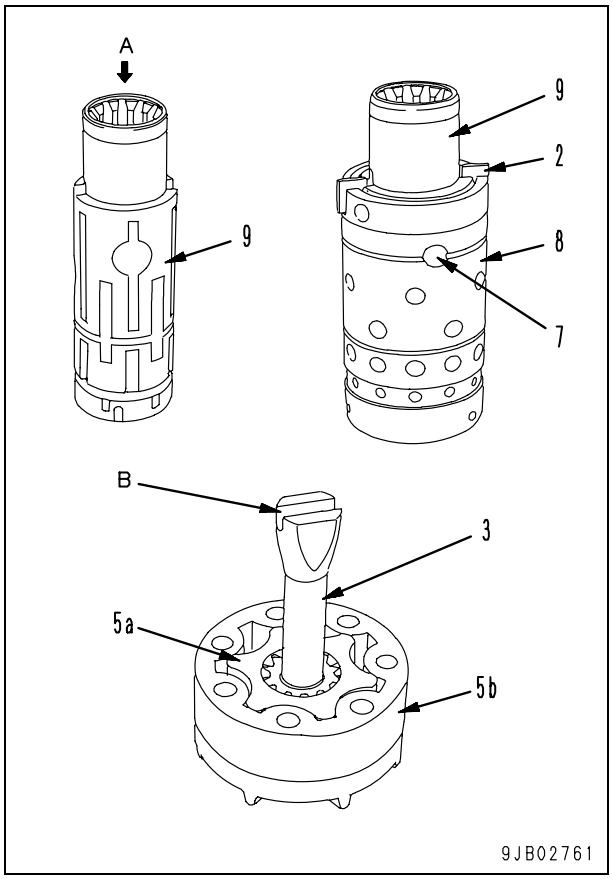
1. Gerotor
2. Valve body
3. Drive shaft
4. Centering spring
5. Needle bearing
6. Bushing
7. Center pin
8. Sleeve
9. Spool
10. Spacer
11. End cap

Outline



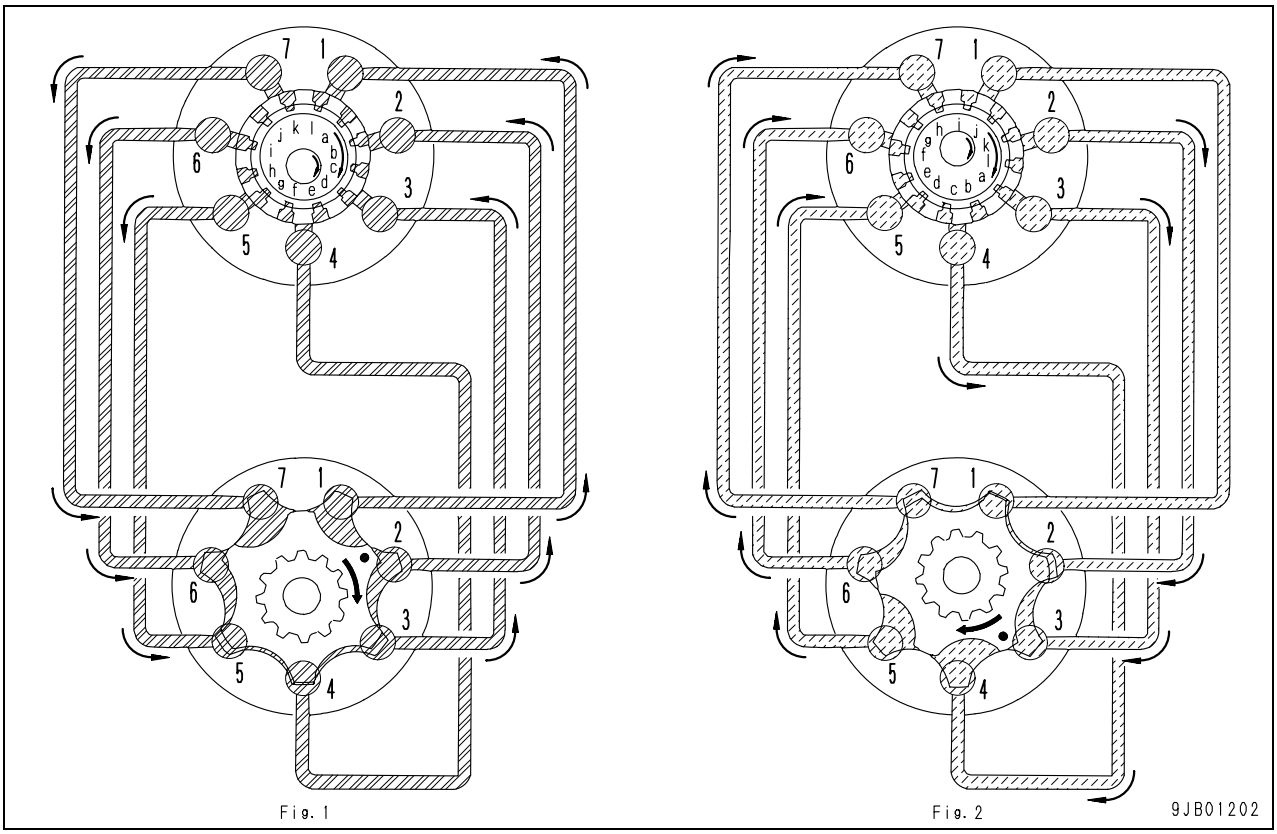
- The Orbit-roll valve is connected to the drive shaft of the steering column. It changes the oil flow from the steering pump to the right or left steering cylinder to decide the travel direction of the machine.
- The Orbit-roll valve is roughly divided into spool (9) and sleeve (8) which have rotary selecting function and gerotor (5) (combined rotor (5a) and stator (5b)) which operates as a hydraulic motor during the normal steering operation and as a hand pump (its operating effort is too high for you to operate it actually, however) when the oil is not supplied because of a trouble of the steering pump or engine.

Structure

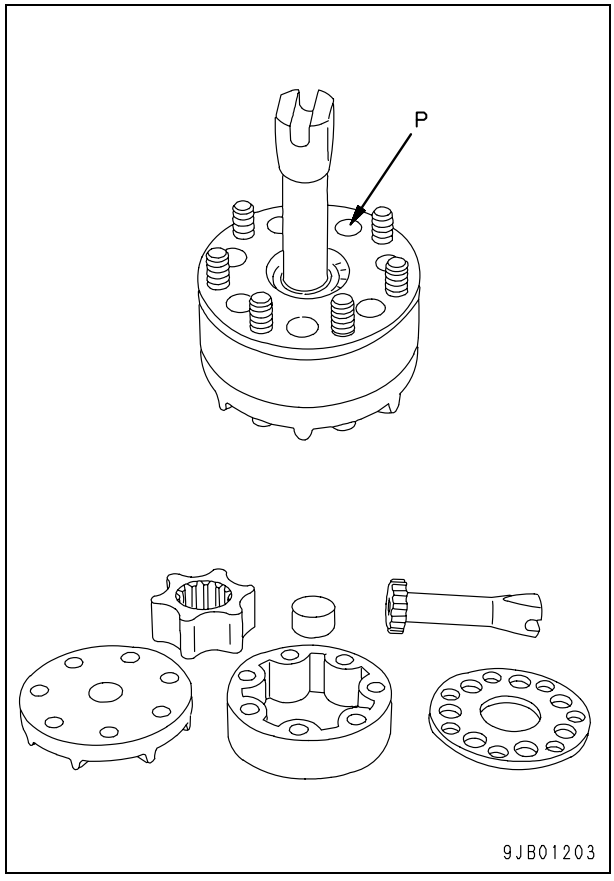


- Top (A) of spool (9) is connected to the drive shaft of the steering column and further connected to sleeve (8) through center pin (7) (which is not in contact with spool (9) while the steering wheel is in neutral) and centering spring (2).
- Top (B) of drive shaft (3) is engaged with center pin (7) and united with sleeve (8) and the bottom is engaged with the spline of rotor (5a) of the gerotor (5).
- Valve body (4) has 4 ports that are connected to the pump circuit, tank circuit, left steering circuit, and right steering circuit, respectively. The ports on the pump side and tank side are connected by the check valve in the body. If the pump or engine fails, the oil can be sucked through this check valve directly from the tank side.

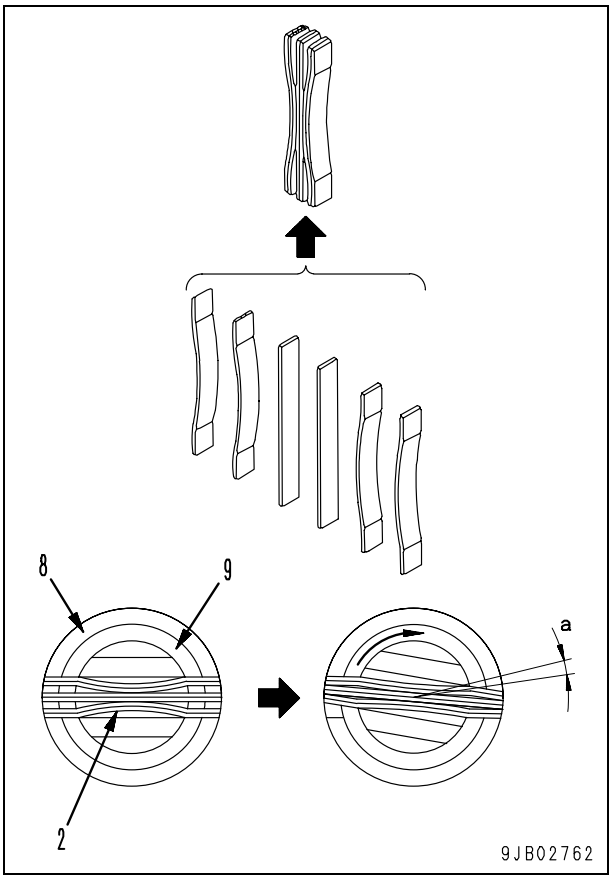
Connection of hand pump and sleeve



- Above figure shows the suction and discharge ports (P) of the gerotor and connections with the sleeve ports.
- If the steering wheel is turned to the right, ports (a), (c), (e), (g), (i), and (k) will be connected to the pump side by the vertical grooves of the spool. Similarly, ports (b), (d), (f), (h), (j), and (l) will be connected to the right steering cylinder head side.
  Under the condition in Fig. 1, the ports (1), (2), and (3) are in the discharge state of the gerotor and connected to ports (l), (b), and (d) and the oil is sent to the steering cylinder. Ports (5), (6), and (7) are also connected and the oil from the pump flows in them.
  Fig. 2 shows the state that has resulted from turning the steering wheel by 90° continued from above condition. Under this state, ports (2), (3), and (4) are in the suction state and connected to ports (k), (a), and (c). Ports (5), (6), and (7) are in the discharge state and connected to ports (d), (f), and (h).
- As shown above, the ports in the discharge state of the gerotor are connected to the ports being connected to the steering cylinder. The ports in the suction state are connected to the pump circuit.
- The internal gear of the gerotor advances by 1 tooth with every 1/7 turn of the steering wheel and discharges the oil from the pump according to the steering angle of the steering wheel.
  Accordingly, the discharge amount varies in proportion to the steering angle of the steering wheel.

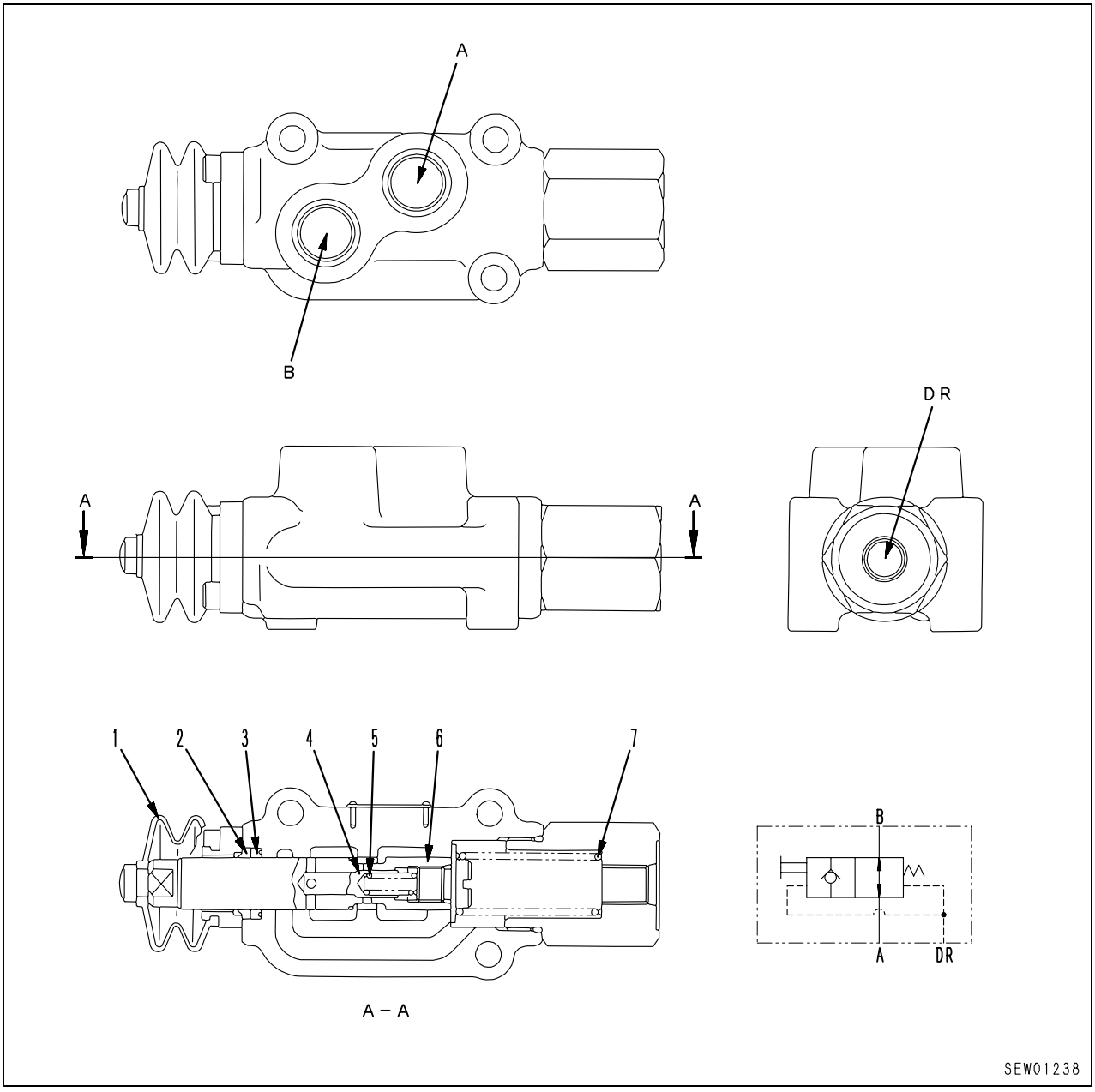


Role of centering spring



- Centering spring (2) is composed of 4 X-shaped leaf springs and 2 flat leaf springs and installed between spool (9) and sleeve (8) as shown in the figure.
- If the steering wheel is turned, spool (9) compresses centering spring (2) and angular displacement (a) is generated between spool (9) and sleeve (8).
  As a result, the ports of spool (9) and sleeve (8) are connected and the oil is sent to the steering cylinder. When the steering wheel stops turning, the gerotor also stops turning. Then, the oil to the steering cylinder is stopped, increasing the pressure.
  To prevent this, when the steering wheel stopped turning, gerotor is turned by the reaction force of centering spring (2) by angular displacement (a) of spool (9) and sleeve (8) by the reaction force of centering spring (2) to return the steering wheel to the “neutral” position.

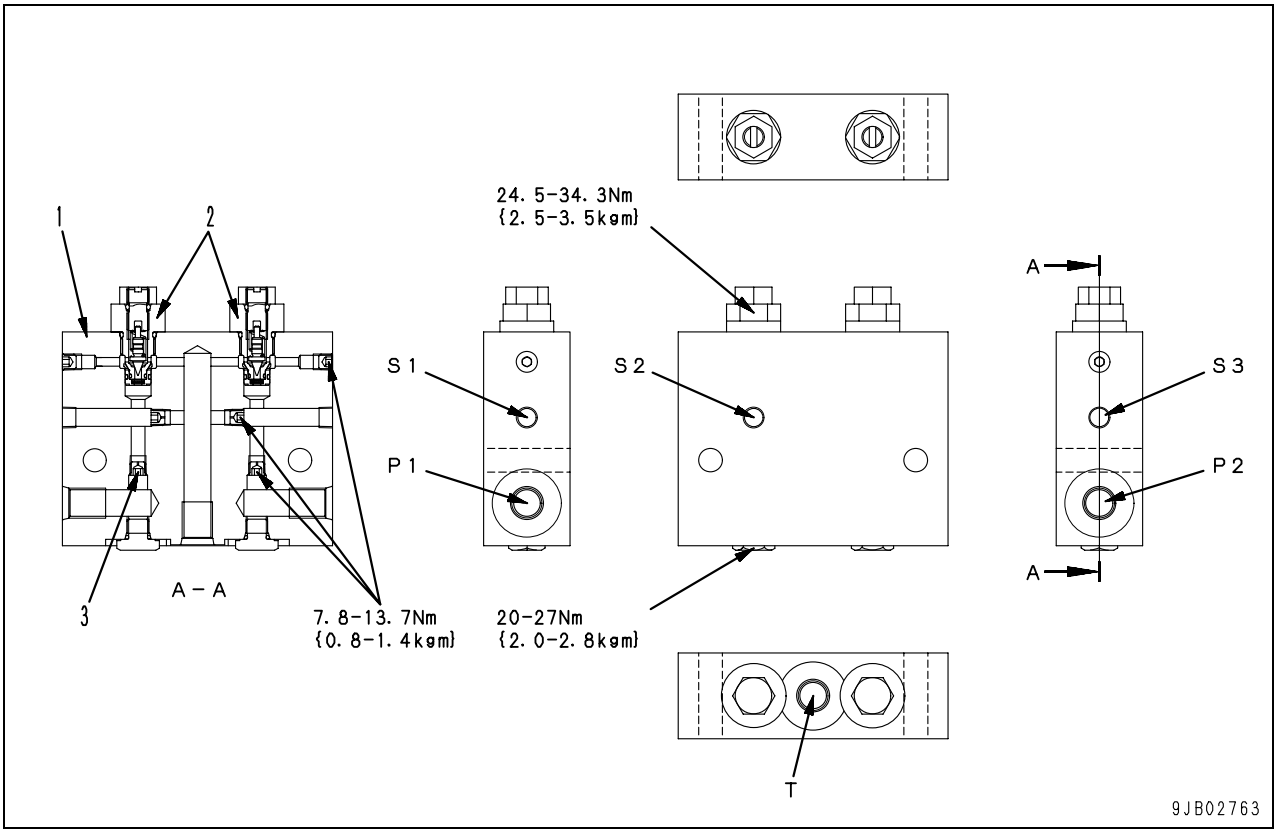
Stop valve



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

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

Steering relief valve



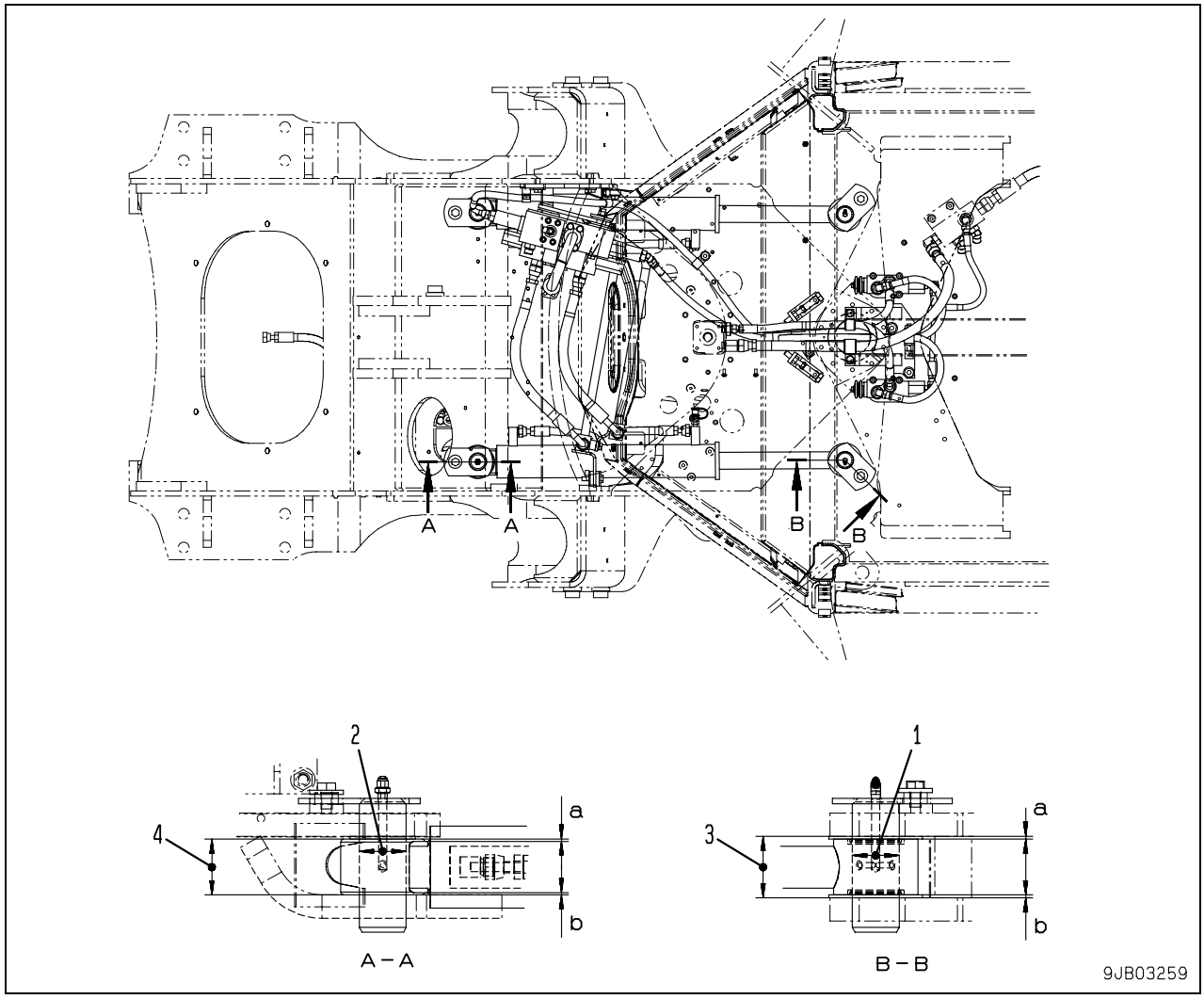
P1: From steering pump
P2: From emergency steering pump
T: Drain
S1: Steering pump oil pressure switch (Lo)
S2: Steering pump oil pressure switch (Hi)
S3: Emergency steering oil pressure switch

1. Block
2. Relief valve
3. Orifice

- The steering relief valve is installed to the right side of the transmission and used to hold the steering oil pressure to the set pressure.
  Set pressure: 1.96 MPa {20 kg/cm^2}
  (Cracking pressure at 0.5 ℓ/min)

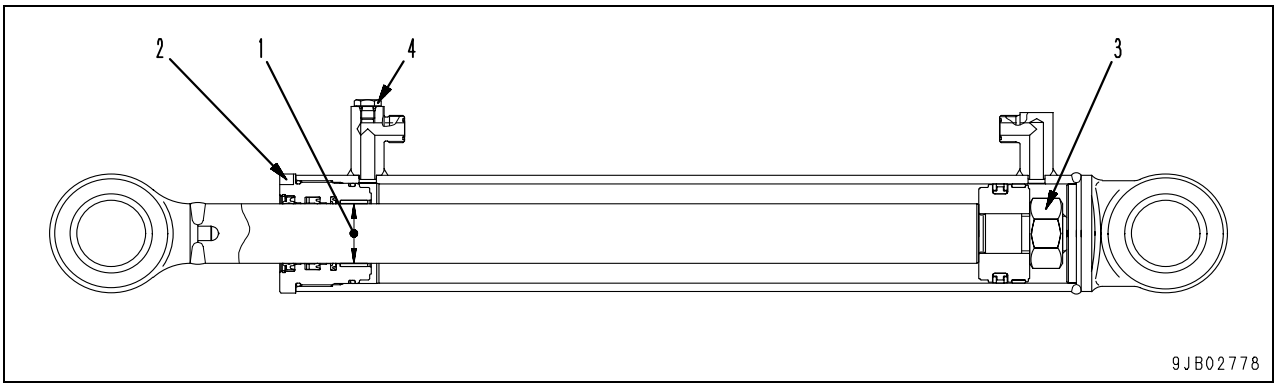
Outline

Steering cylinder



Unit: mm

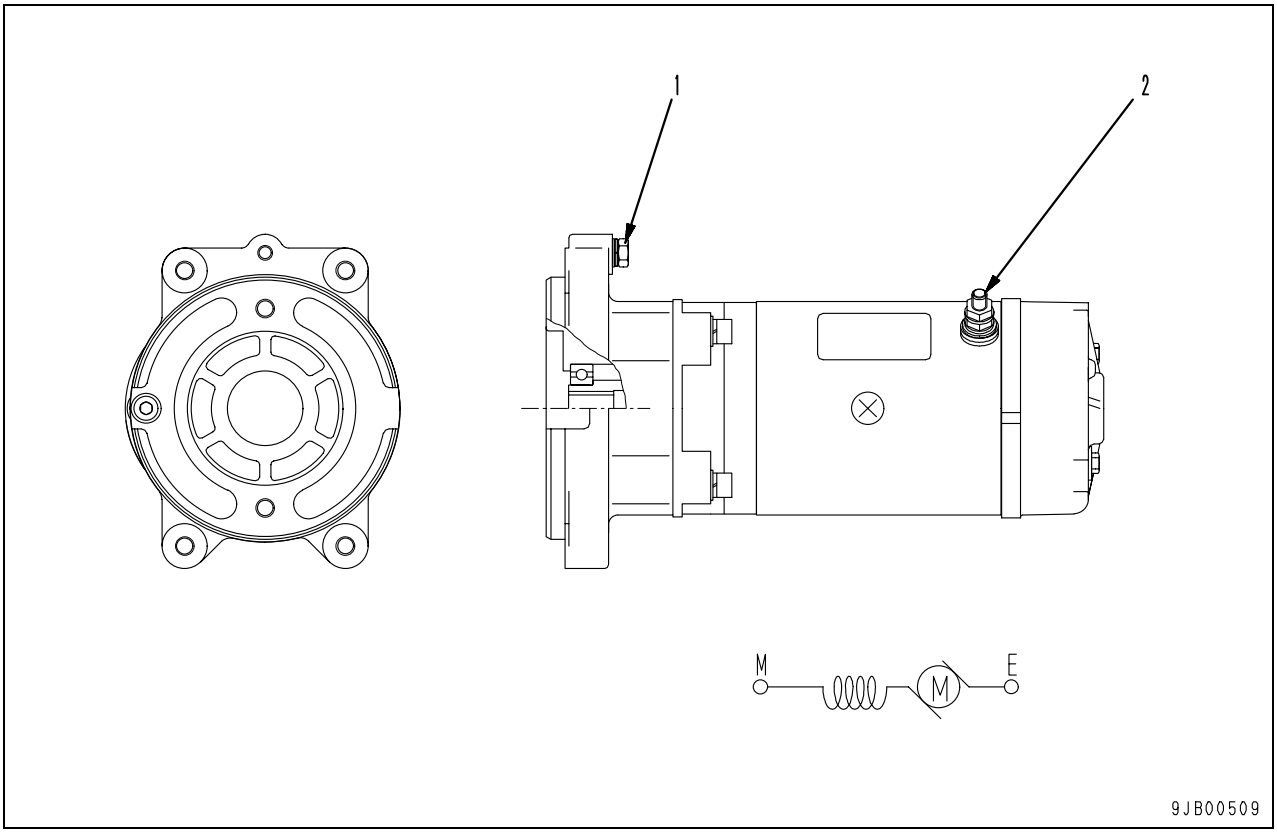
No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between bushing in cylinder rod frame connection part and mounting pin	50	0 –0.025	+0.142 +0.080	0.080 – 0.167	—	Replace
2	Clearance between bushing in cylinder bottom frame connection part and mounting pin	50	0 –0.025	+0.142 +0.080	0.080 – 0.167	—	
3	Connecting part of steering cylinder and rear frame	Boss width		Hinge width	Standard clearance (clearance of a + b)		
		60		66	Max. 0.5 (after shim is adjusted)		
4	Connecting part of steering cylinder and front frame	60		63	Max. 0.5 (after shim is adjusted)		



Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between piston rod and bushing	45	–0.025 –0.064	+0.141 –0.004	0.021 – 0.205	0.505	Replace pin and bushing
2	Tightening torque of cylinder head	569 ± 57.0 Nm {58 ± 5.8 kgm}					Retighten
3	Tightening torque of cylinder piston	785 ± 78.5 Nm {80 ± 8.0 kgm} (Width across flats: 46 mm)					
4	Tightening torque of cylinder head port side plug	9.8 – 12.74 Nm {1.0 – 1.3 kgm}					

Emergency steering motor



1. Terminal E
2. Terminal M

Function

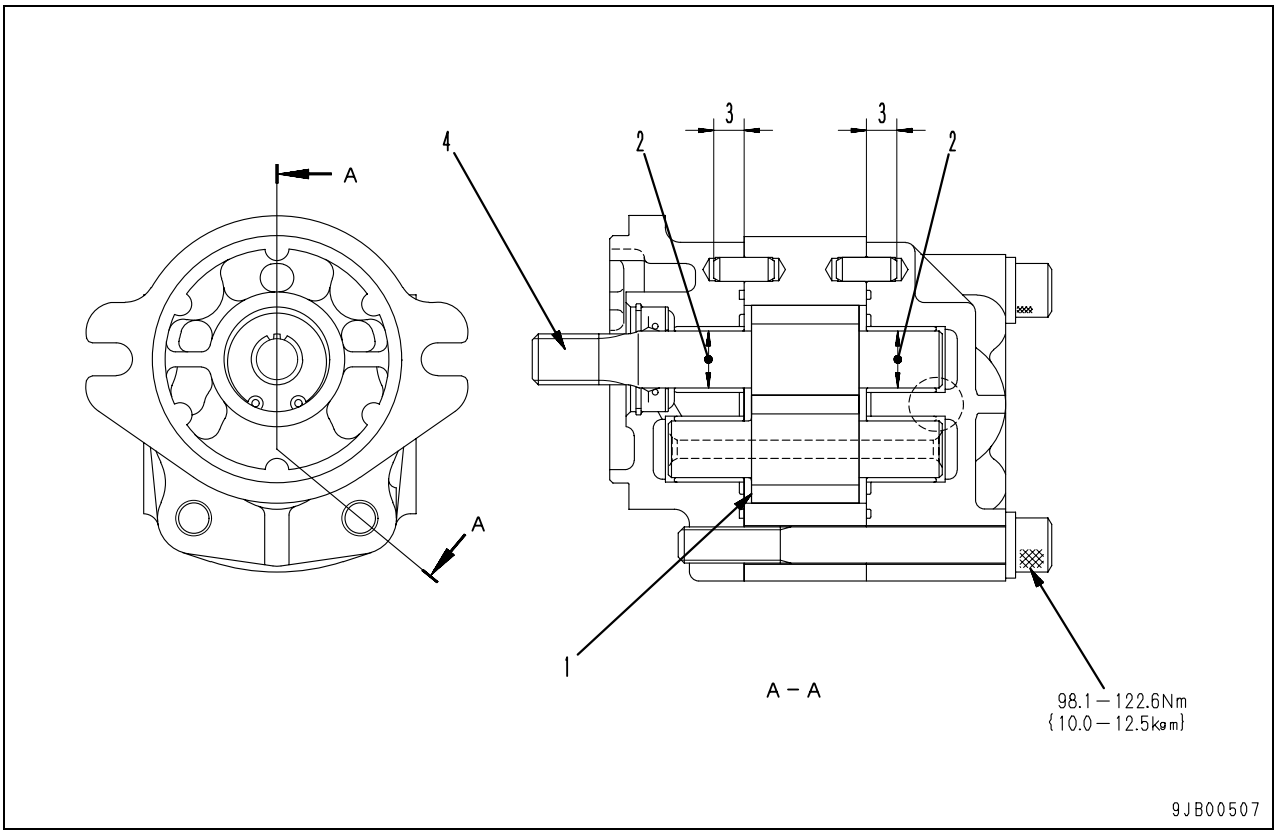
- When the oil pressure in the steering circuit lowers abnormally, the emergency steering motor drives the emergency steering pump responding to the signal from the transmission controller.

Specifications

Model name	Direct current motor
Rated voltage	24 V
Rated output	0.9 kW

Emergency steering pump

Type: SBL (1) 21



Unit: mm

No.	Check item	Criteria				Remedy
1	Side clearance	Standard clearance		Clearance limit		Replace
		0.10 – 0.15		0.19		
2	Clearance between plain bearing inside diameter and gear shaft outside diameter	0.060 – 0.119		0.20		
3	Driven depth of pin	Standard size	Tolerance	Repair limit		
		10	0 –0.5	—		
4	Torque of spline turning shaft	2.0 – 4.9 Nm {0.2 – 0.5 kgm}				—
—	Delivery Discharge oil: SAE10WCD Oil temperature: 45 – 55°C	Speed (rpm)	Discharge pressure (MPa {kg/cm^2})	Standard delivery (ℓ/min)	Allowable delivery (ℓ/min)	
		3,500	20.6 {210}	67.6	62.4	

Function

- The emergency steering pump is installed together with the emergency steering motor to the right side of the transmission. When the engine stops or the oil pressure in the steering circuit lowers below the specified level, the emergency steering pump supplies oil to the steering circuit.

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

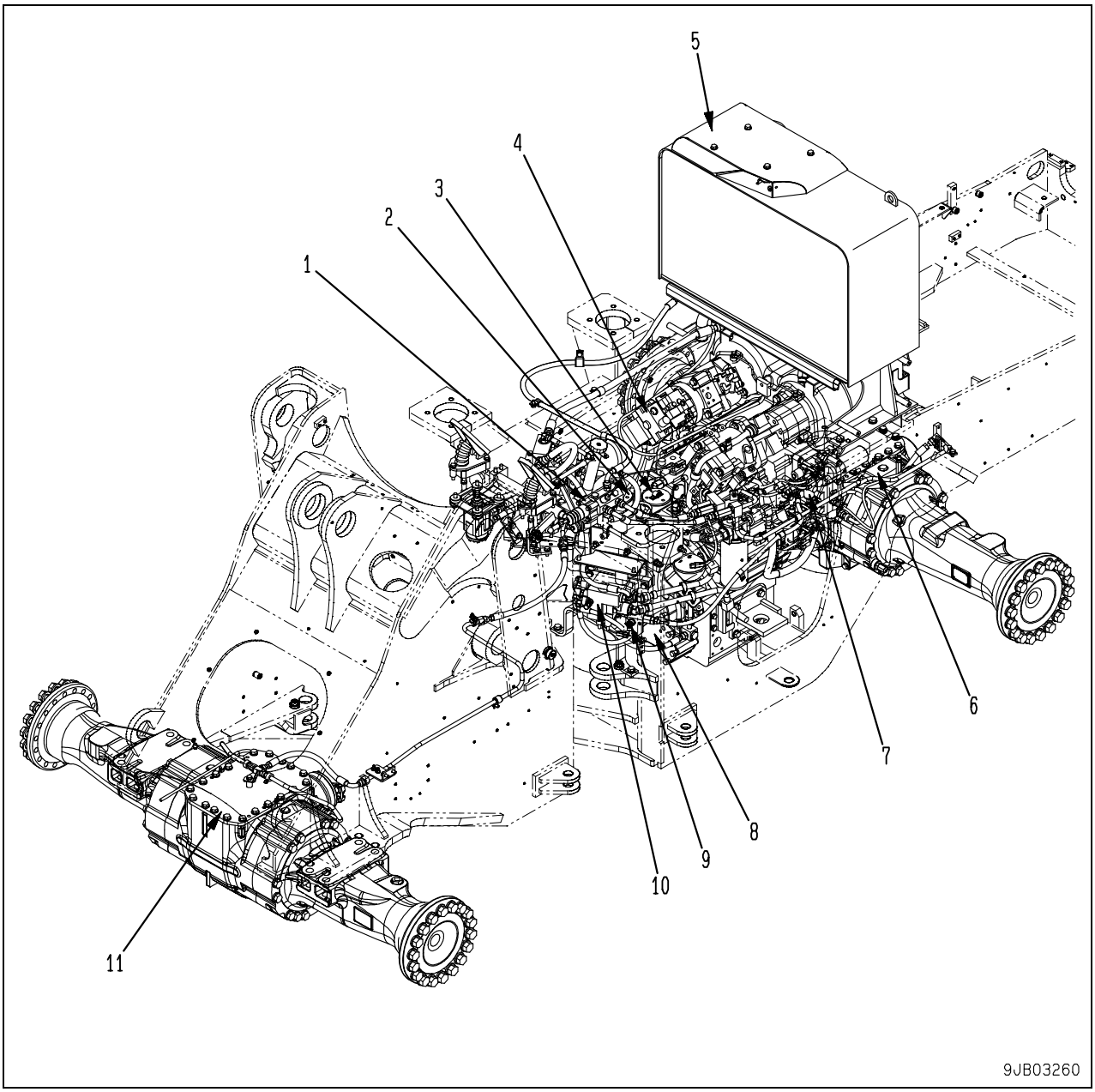
10 Structure, function and maintenance standard

Brake system

Brake system 2
Brake piping diagram 2
Charge valve 3
Brake valve 10
Accumulator (for brake) 15
Brake 16
Parking brake control 21
Parking brake 22
Parking brake solenoid valve 24
Emergency parking brake release valve 26

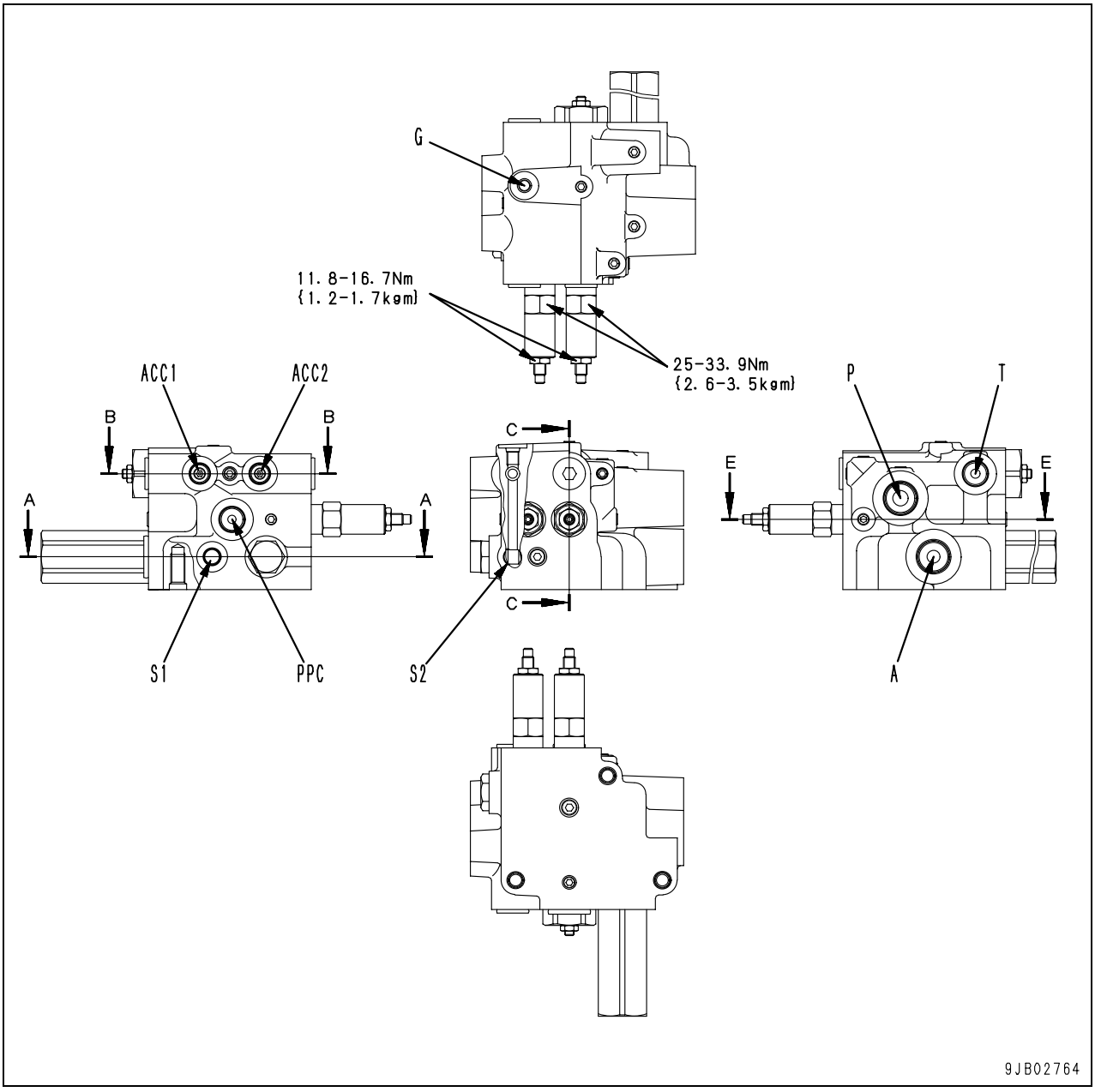
Brake system

Brake piping diagram

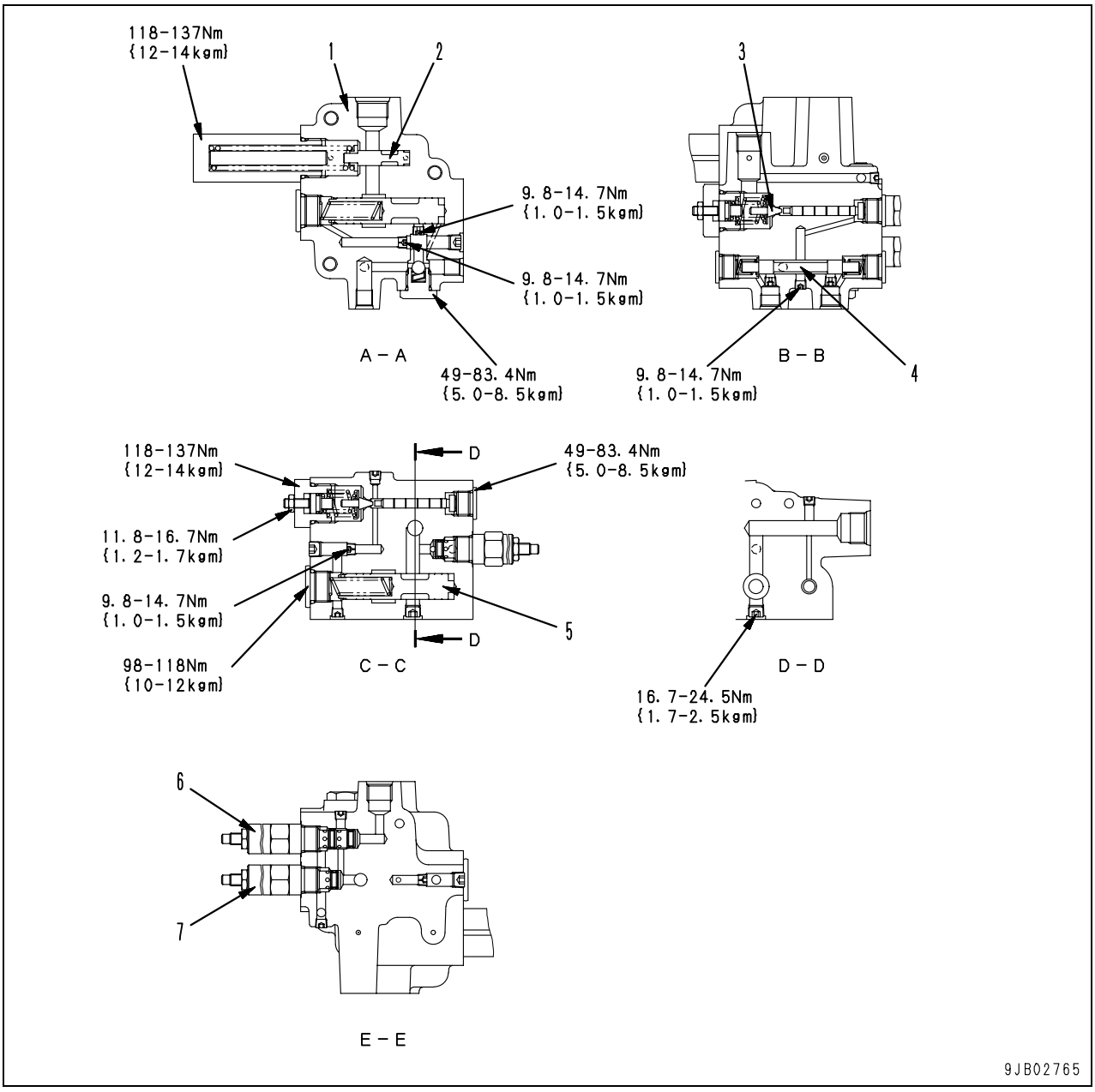


1. Brake valve
2. Accumulator (for rear)
3. Accumulator (for front)
4. Cooling fan pump
5. Hydraulic tank
6. Rear brake
7. Parking brake solenoid valve
8. Parking brake
9. Emergency parking brake release valve
10. Charge valve
11. Front brake

Charge valve



P: From pump
A: To cooling fan motor
PPC: To PPC valve
ACC1: To right brake valve port PA
ACC2: To right brake valve port PB
To left brake valve port P
T: Drain
S1: Brake oil pressure switch (Low)
S2: Emergency brake oil pressure switch
G: Accumulator charge pressure pickup port



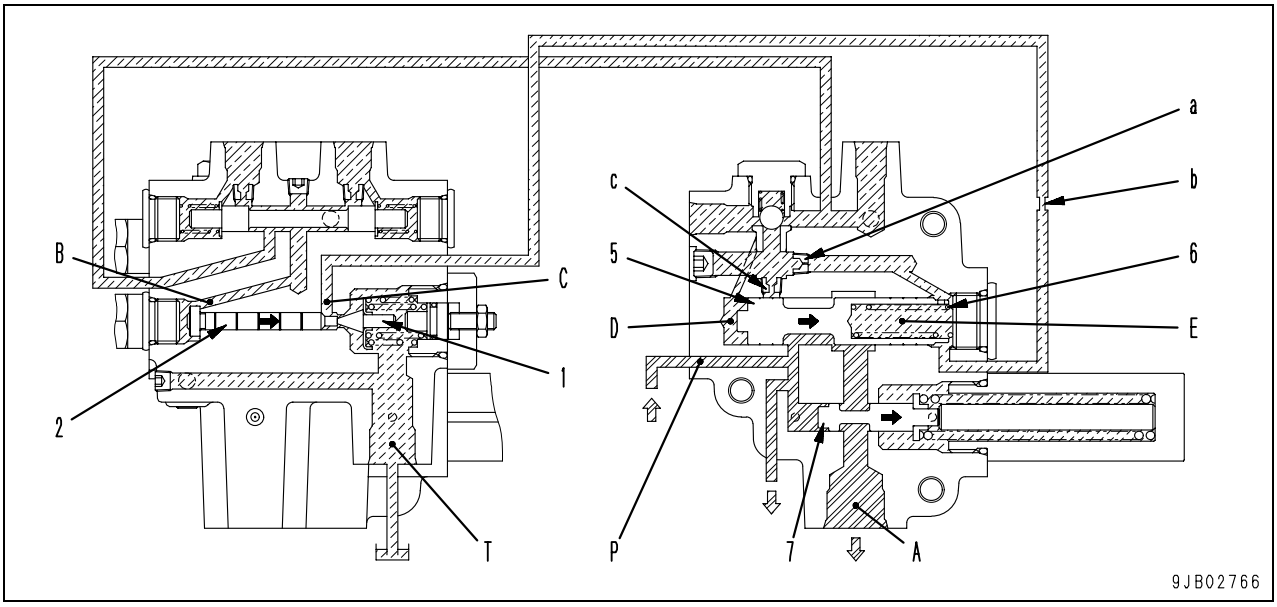
1. Valve body
2. Sequence valve (H1)
3. Relief valve (R2)
4. Shuttle valve (S1)
5. Priority valve
6. PPC relief valve (R3)
7. Main relief valve (R1)

Function

- The charge valve maintains the oil pressure from the pump to the set pressure and accumulates it in the accumulator.
- If the pressure is accumulated in the accumulator, the circuit to the cooling fan motor opens and the oil from the pump is output as cooling fan motor drive pressure.
- As 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.
- The charge valve reduces the pressure of the oil from the pump and outputs the basic pressure of the pilot circuit.

Operation

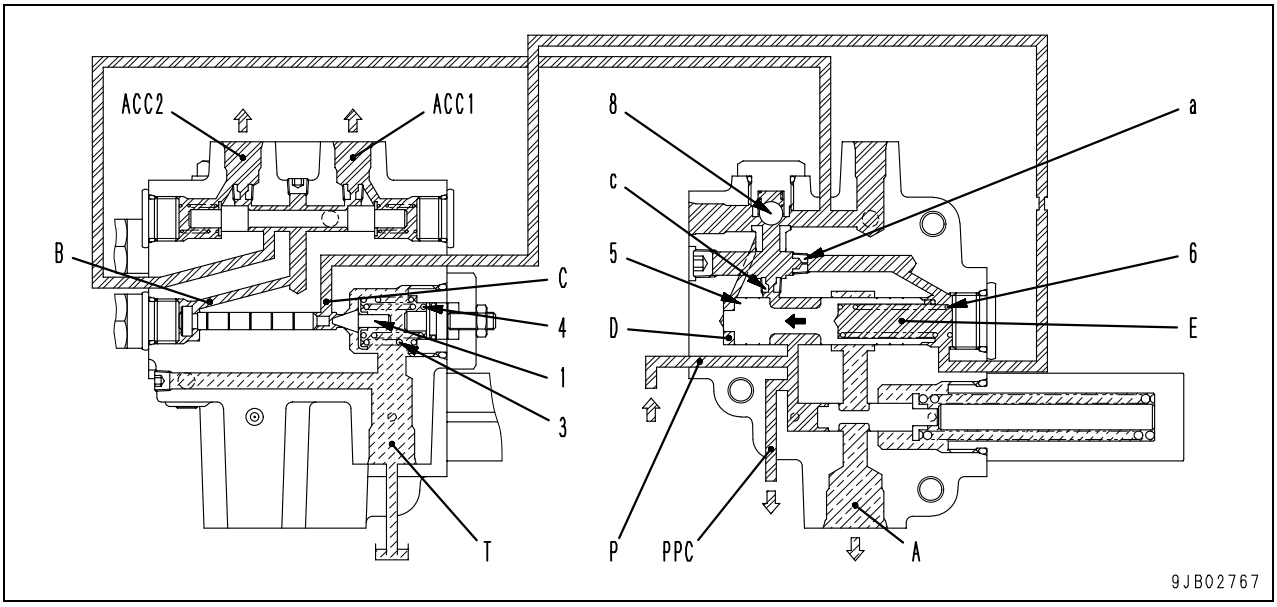
When oil is not supplied to accumulator (Cut-out state)



- Since the pressure in oil passage (B) is higher than the set pressure of relief valve (1), piston (2) is pushed to the right by the oil pressure from oil passage (B).
- Relief valve (1) opens and oil passage (C) is connected to port (T).
- The oil from the pump flows through orifices (a) and (b) and oil passage (C) to port (T).
- Since the oil pressure is reduced before and after orifice (a), a pressure difference is made between pressure receiving chambers (D) and (E).
- If the pressure in pressure receiving chamber (D) becomes higher than the set pressure of priority valve (5), priority valve (5) compresses spring (6) and moves to the right.
- The open area on the side of port (P) and orifice (c) is reduced and port (P) is connected to port (A) gradually.
- The oil from the pump flows through port (P), sequence valve (7), and port (A) to the cooling fan motor.

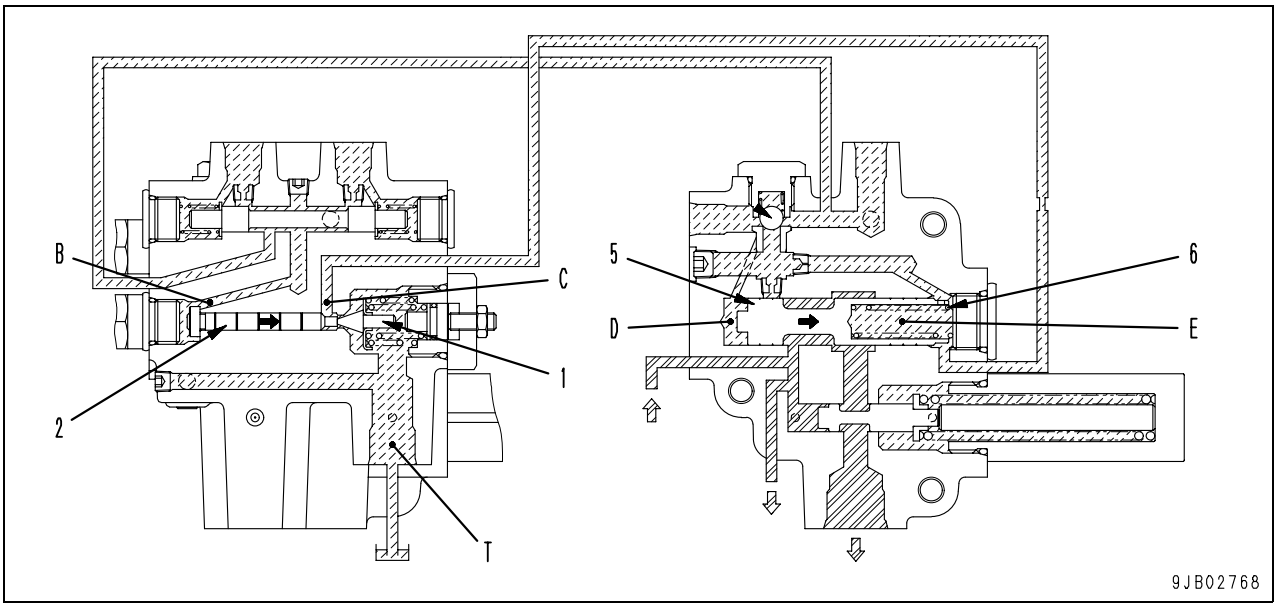
When oil is supplied to accumulator

1. Cut-in state



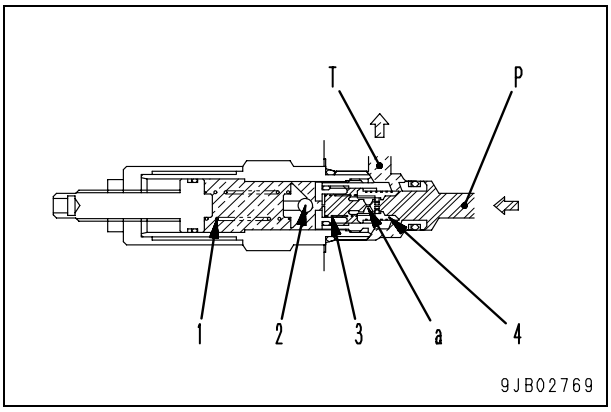
- If the pressure in oil passage (B) goes below the set pressure of relief valve (1), relief valve (1) is returned to the left by the repulsive force of springs (3) and (4).
- Relief valve (1) closes and oil passage (C) is disconnected from port (T).
- Since oil passage (C) is disconnected from port (T), pressure drop through orifice (a) is reduced and the pressure difference between pressure receiving chambers (D) and (E) is reduced.
- Priority valve (5) is moved to the left by the repulsive force of spring (6).
- The open area on the side of port (P) and orifice (c) is increased and port (P) is disconnected from port (A) gradually.
- If the oil pressure from the pump becomes higher than the pressure in ports (ACC1) and (ACC2), it pushes up check valve (8), starting feeding of pressure from ports (ACC1) and (ACC2) to the accumulator.
- The oil of a specific quantity being set by the size (area) of orifice (c) and the pressure difference between through it (equivalent to the load of spring (6)) is supplied through ports (ACC1) and (ACC2) to the accumulator. The excessive oil flows to ports (A) and (PPC).

2. When cut-out pressure is reached



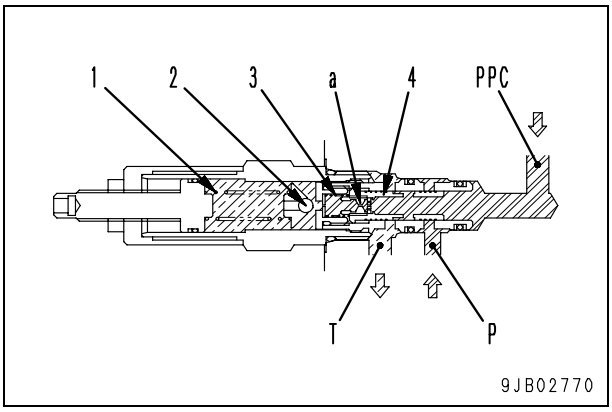
- If the pressure in oil passage (C) reaches the set pressure of relief valve (1), relief valve (1) is pushed to the right by the oil pressure from oil passage (C).
- Relief valve (1) opens and oil passage (C) is connected to port (T).
- A pressure difference is generated between the right side and left side of piston (2), and piston (2) moves to the right and opens relief valve (1) forcibly.
- Since pressure receiving chamber (E) of priority valve (5) is also connected to oil passage (C), the pressure in pressure receiving chamber (E) is set to the drain pressure.
- Since the pressure in pressure receiving chamber (D) also goes low by the level equivalent to the load of spring (6), oil supply to oil passage (B) is stopped.

Main relief valve (R1)



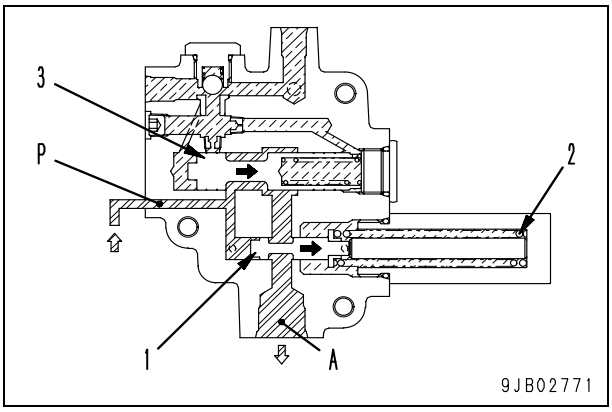
- If the pressure in port (P) (pump pressure) rises above the set pressure, it compresses spring (1) and moves ball (2) to the left.
- The pressure of the oil from the pump is reduced through orifice (a), and the resulting pressure difference compresses spring (3) and moves valve (4) to the left largely.
- Port (P) being connected to port (T) drains the pump pressure and, thereby, regulates the maximum pressure in the charge circuit to protect the circuit.

PPC relief valve (R3)



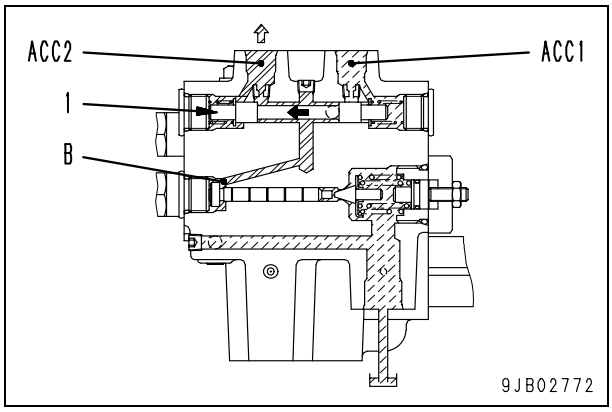
- If the pressure from port (PPC) (pilot pressure) rises above the set pressure, the oil from the pump compresses spring (1) and moves ball (2) to the left.
- The pressure of the oil from the pump is reduced when the oil flows through orifice (a), and the pressure difference compresses spring (3) and moves valve (4) to the left.
- Since the open area between port (A) and port (P) is reduced and the pressure drop results, the pressure in port (P) is at the current level without being not lowered to the set pressure of the relief valve.
- The pressure in port (A) is adjusted to a specific desired level according to the open area between port (A) and port (P) and supplied as the basic pressure of the pilot circuit.
- If abnormal pressure is generated in port (A), port (A) is connected to port (T) to release the abnormal pressure and protect the pilot circuit.

Sequence valve (H1)



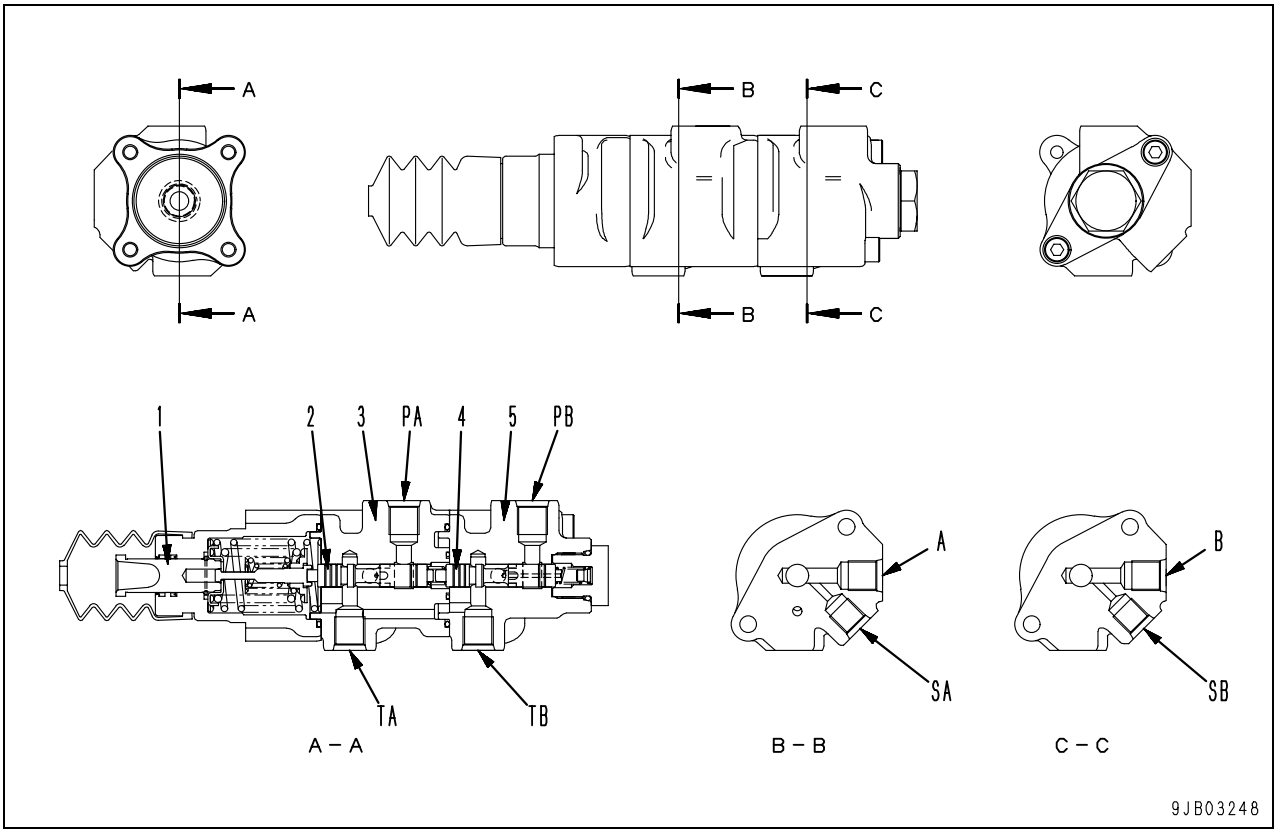
- The pressure in port (P) (pump pressure) is applied to the left end of sequence valve (1) and the drain pressure is applied to the right end.
- If the pump pressure rises above the set pressure of spring (2), sequence valve (1) moves to the right and port (P) is connected to port (A).
- The oil from the pump flows through priority valve (3) and port (A) to the cooling fan motor and is used to drive the motor.
- Even when the cooling fan motor drive pressure is low, the pump pressure is kept above the set pressure of spring (2) to protect the accumulator charge pressure and pilot circuit basic pressure from going low.

Shuttle valve (S1)



- When the pressure in port (ACC1) is higher than that in port (ACC2), shuttle valve (1) moves to the left to disconnect port (ACC1) from oil passage (B).
- The open area between port (ACC2) and oil passage (B) is increased and the oil is supplied to the accumulator on port (ACC2) side.
- When the pressure in port (ACC2) is higher than that in port (ACC1), the oil is supplied to the accumulator on port (ACC1) side.
- The oil from the pump is supplied first to the low-pressure side of the 2 systems.

Brake valve



PA: From charge valve ACC1 port
PB: From charge valve ACC2 port
A: To rear brake
B: To front brake

TA: Plug
TB: Drain
SA: Stop lamp oil pressure switch
SB: Plug

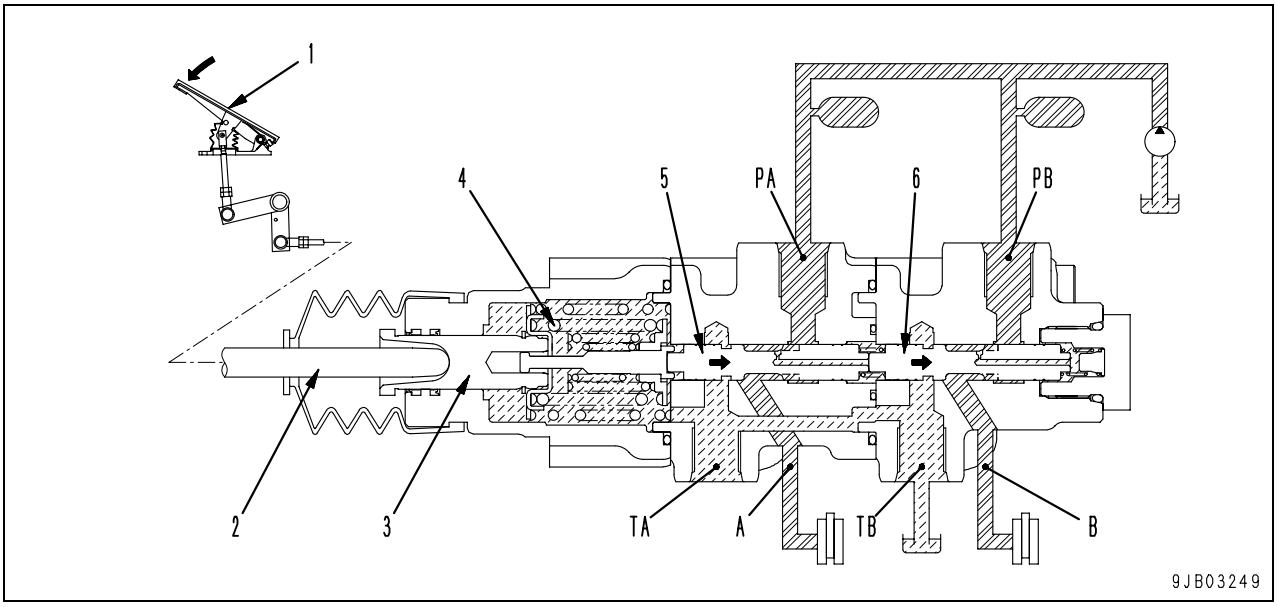
1. Piston
2. Spool (for rear)
3. Cylinder (for rear)
4. Spool (for front)
5. Cylinder (for front)

Outline

- The brake valve is installed in the lower front side of the operator's seat. Pressing the brake pedal conducts oil to the brake piston, operating the brake.
- The left side and right side brake pedals are mechanically interlocked. Pressing one of the pedals operates another pedal at the same time.
- As the brake pedal is pressed, the transmission cut-off oil pressure sensor is operated, sending the signal to the transmission controller and, as the result, setting the transmission to neutral.

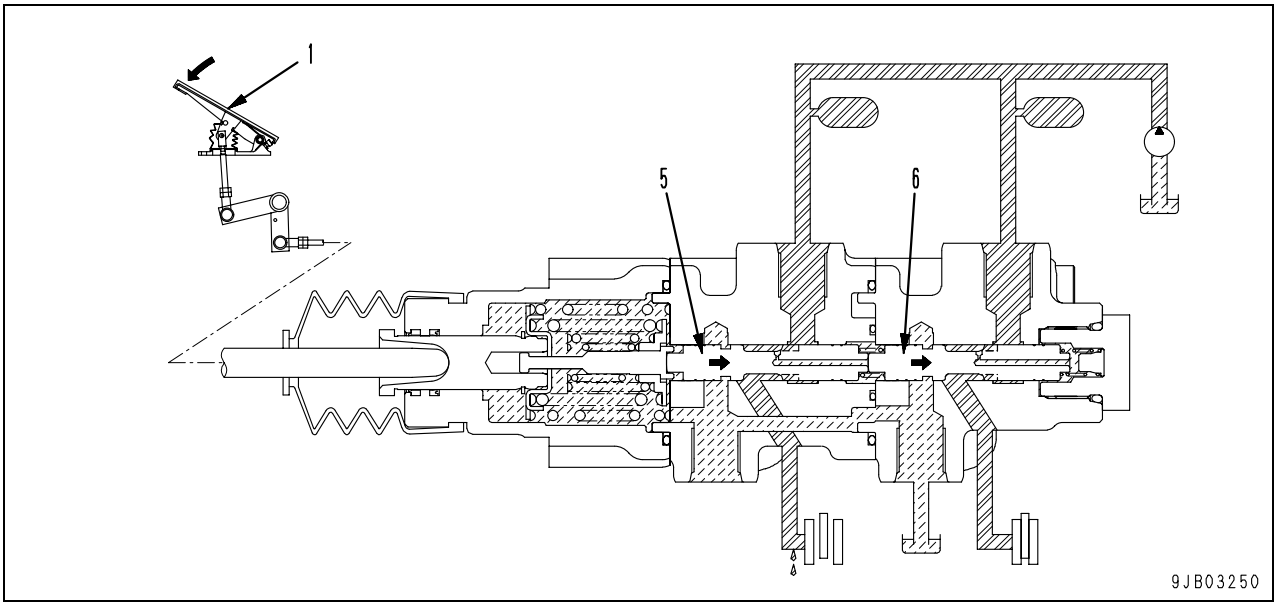
Operation

When the brake pedal is pressed down



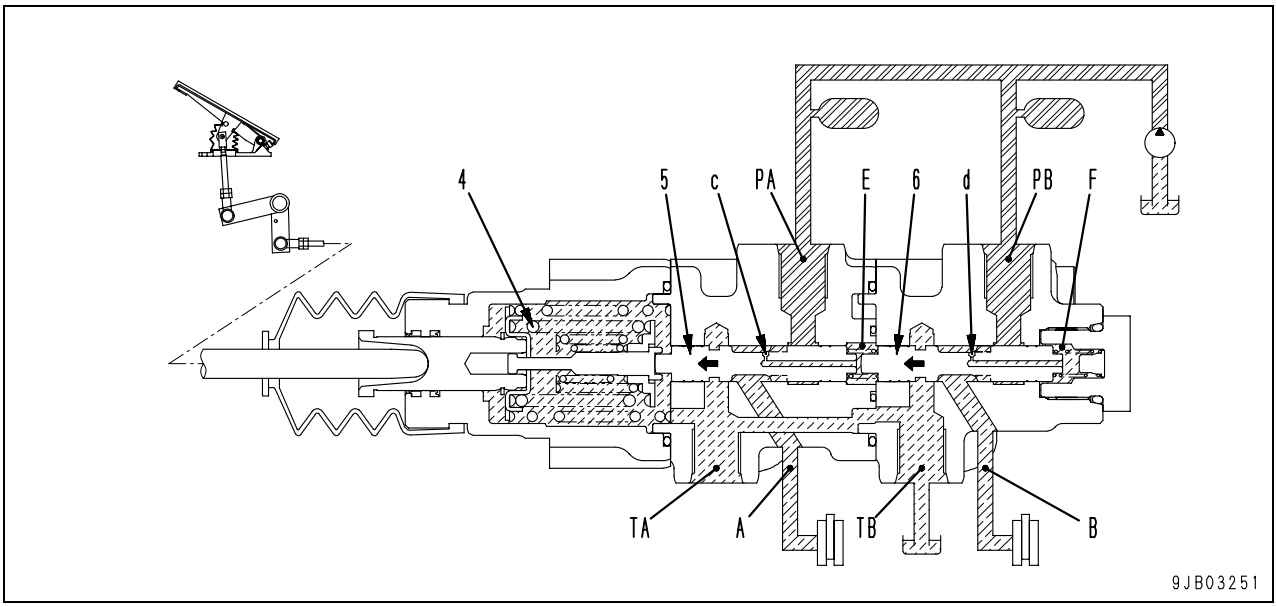
- Brake pedal (1) pressing effort is transmitted to spool (5) through rod (2), piston (3) and spring (4).
- As spool (5) is pushed to the right, port (TA) is closed and the oil from the pump activates the rear brake after being conducted through accumulator, port (PA), port (A) and rear brake piston.
- As spool (5) is pushed rightward, spool (6) is also pushed rightward, closing port (TB). The oil from the pump flows through the accumulator, port (PB) and port (B) to the front brake piston to activate the front brake.

When brake of one side operated
(When the other brake failed)



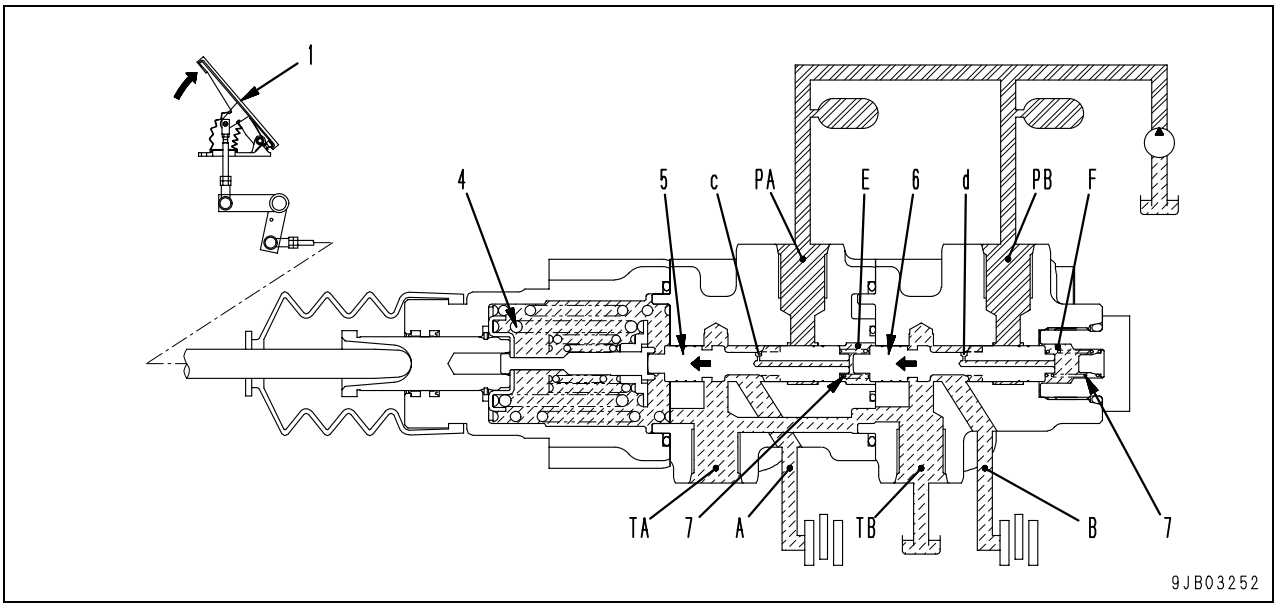
- When only one of the brakes failed due to leakage of oil in the front or rear brake system, brake pedal (1) pressing effort is capable of mechanically moving spools (5) and (6) to the right.
  Thus, the oil from the pump is normally supplied to the healthy brake piston, enabling it to continue the operation. The brake, therefore, is capable of stopping the machine as needed to ensure the intended safety level.

Balancing operation



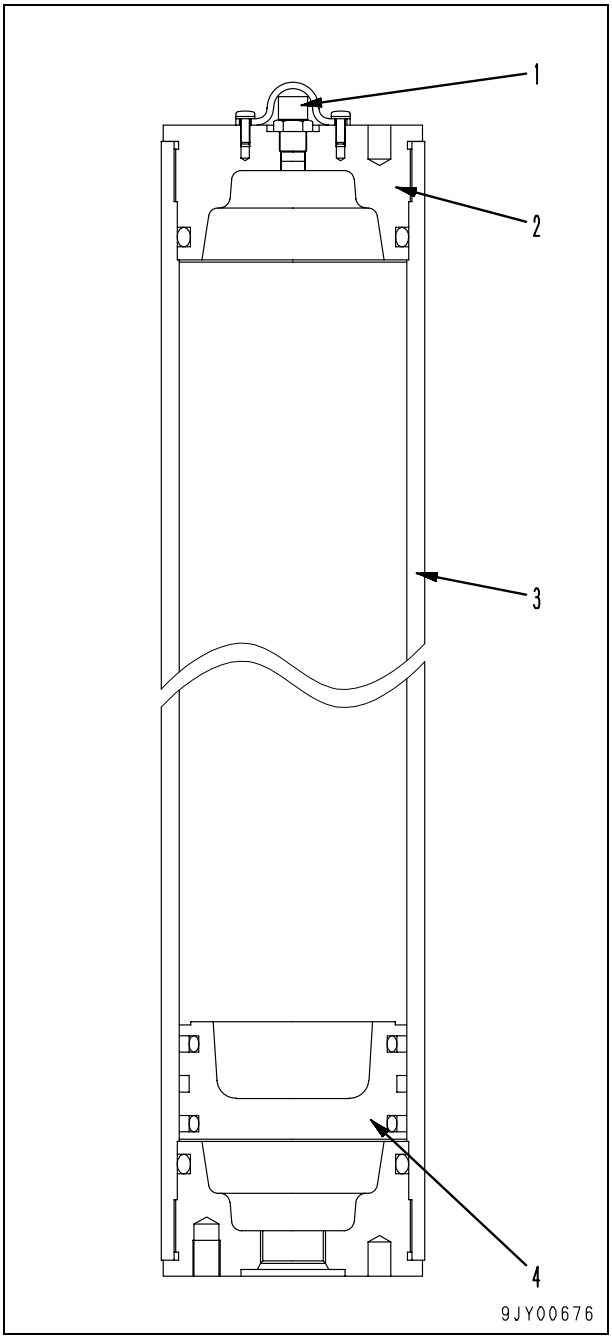
- As the rear brake piston is filled with oil and the oil pressure rises between port (PA) and port (A), the oil being conducted to chamber (E) through orifice (c) of spool (5) pushes spool (5) leftward resisting repulsive force of spring (4). As the result, port (PA) and port (A) are disconnected.
  At this time, port (TA) remains closed. Thus, the oil conducted to the brake piston is retained and the brake remains operable.
- At the same time as spool (5) moved to the left, the front brake piston is filled up with oil, increasing the oil pressure between port (PB) and port (B). Thus, the oil conducted to chamber (F) through orifice (d) of spool (6) pushes back spool (6) in leftward by the move distance of spool (5). As the result, port (PB) and port (B) are disconnected.
  At this time, port (TB) remains closed. Thus, the oil conducted to the brake piston is retained and the brake remains operable.
- Oil pressure in the rear brake circuit [port (A) side] and the brake pedal pressing effort are balanced and oil pressure in the front brake circuit [port (B) side] and oil pressure in the rear brake circuit [port (A) side] are balanced.
  As spools (5) and (6) are driven to the stroke end, port (PA) and port (A) as well as port (PB) and port (B) are connected completely. Thus, pressure of oil to the front and rear brake cylinders becomes equal to the oil pressure from the pump.
  Thus, the braking force is adjustable by adjusting the brake pedal pressing effort until spools (5) and (6) are driven in rightward to the stroke end.

When brake is released



- Releasing brake pedal (1) releases the pedal pressing effort being applied to spool (5).
- As spool (5) is pushed back to the left by back pressure of the rear brake piston and repulsive force of spring (7), port (PA) is closed and the oil in the rear brake piston is conducted through port (A) to port (TA) and then drained from port (TB) to the hydraulic tank. As the result, the rear brake is released.
- At the same as spool (5) is moved to the left, spool (6) is also pushed back to the left by back pressure of the front brake piston and repulsive force of spring (7). Thus, port (PB) is closed and the oil in the front brake piston is conducted through port (B) to port (TB) and then drained from port (TB) to the hydraulic tank. As the result, the rear brake is released.

Accumulator (for brake)



1. Valve
2. Top cover
3. Cylinder
4. Free piston

Function

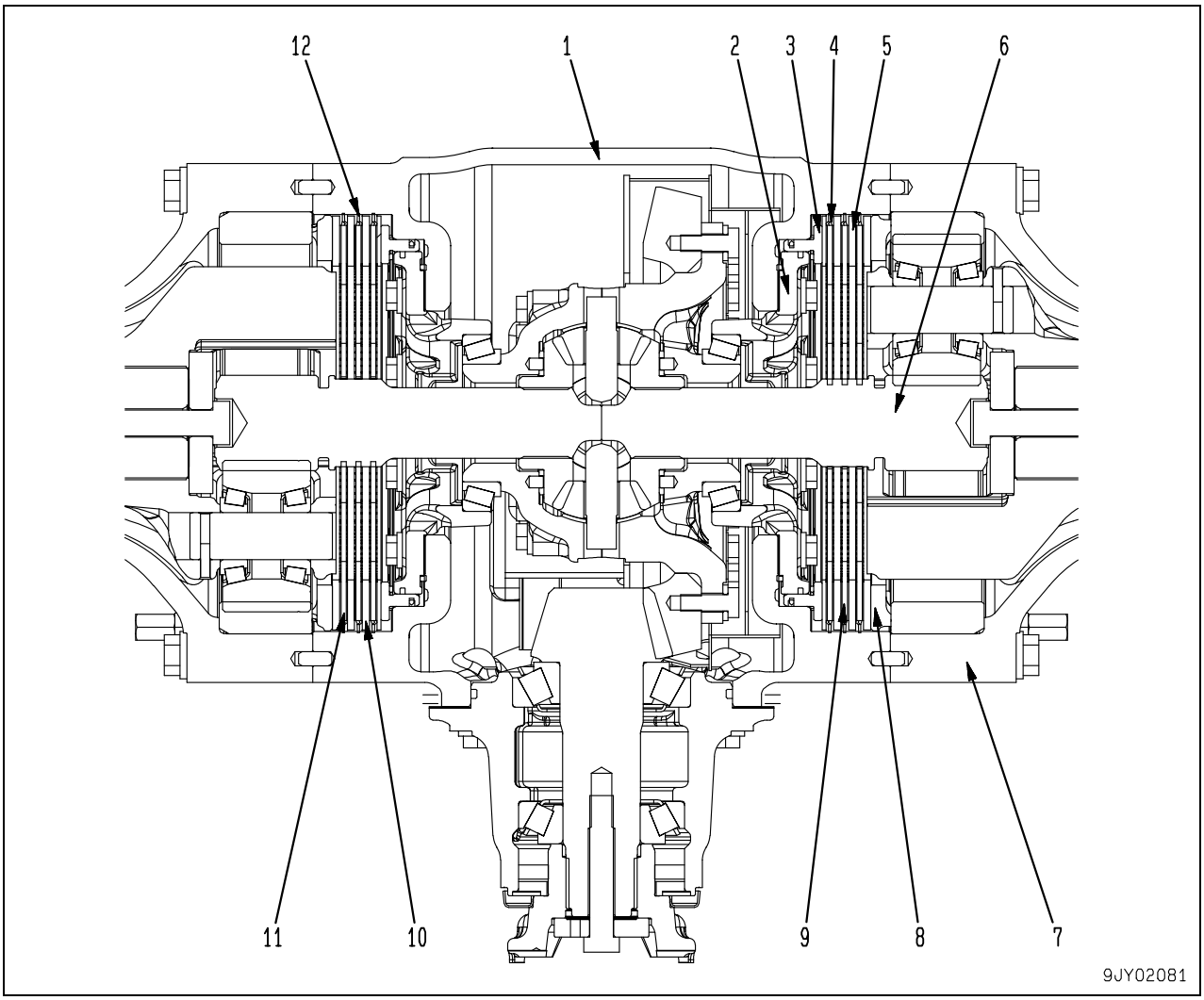
- The accumulator is installed between the charge valve and brake valve. The space between cylinder (3) and free piston (4) is filled with nitrogen gas. The nitrogen gas absorbs the hydraulic pulses generated by the hydraulic pump and secures the braking force and operability when the engine is stopped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

Specifications

Gas used:	Nitrogen gas
Amount of gas:	2,850 cc
Charging pressure:	3.43 ± 0.1 MPa {35 ± 1.0 kg/cm^2} (At 20°C)
Max. pressure used:	20.6 MPa {210 kg/cm^2}

Brake

Front



1. Differential housing
2. Bearing carrier
3. Piston
4. Spring
5. Inner ring
6. Sun gear shaft
7. Axle housing
8. Outer ring
9. Disc (3 pieces)

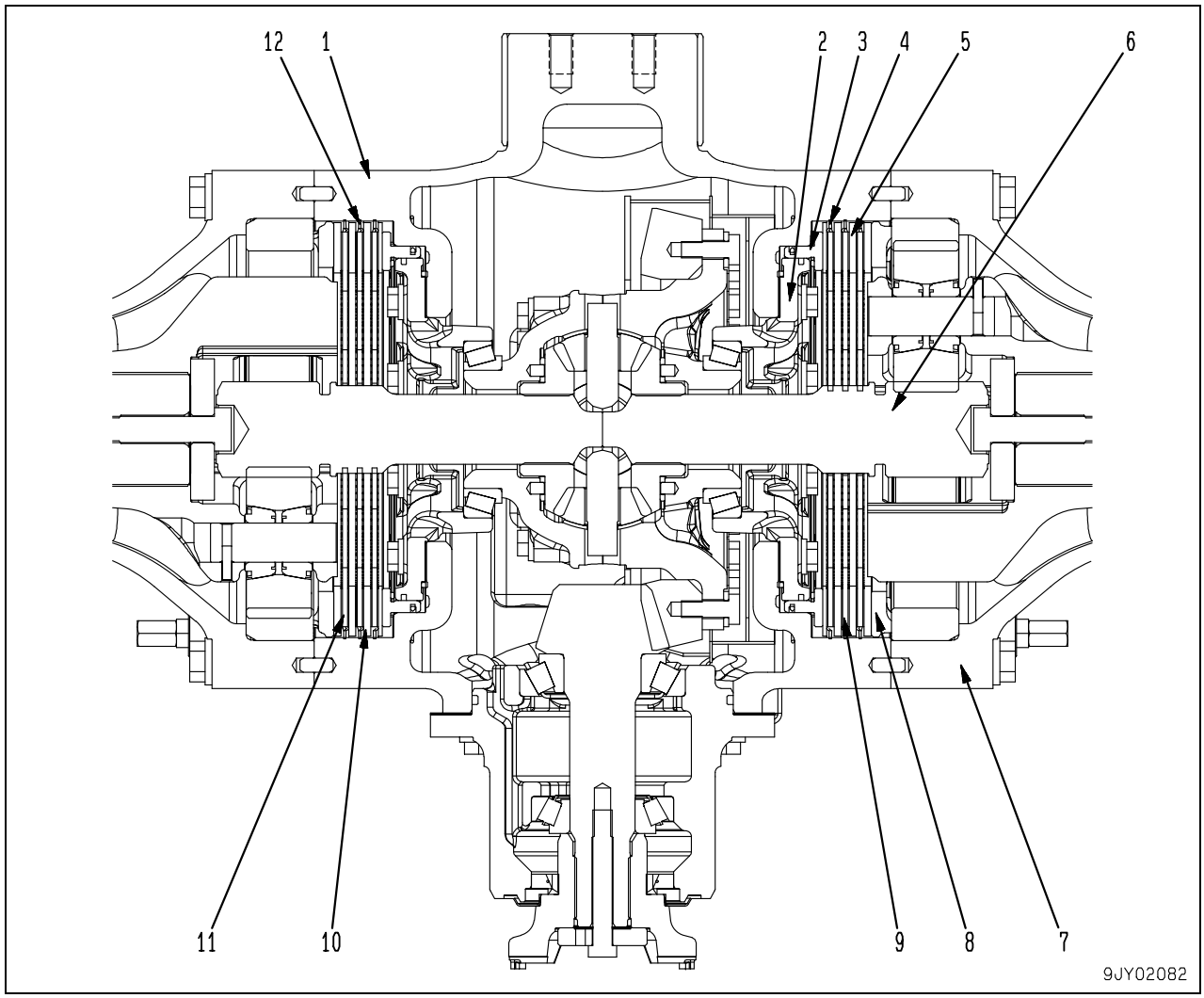
Unit: mm

No.	Check item	Criteria			Remedy
10	Thickness of plate	Standard size	Tolerance	Repair limit	Replace
		6	±0.1	5.5	
		3.2	±0.1	2.7	
11	Thickness of brake disc	6.5	±0.15	5.7	
	Depth of lining groove	0.8 (Min.)	—	0.4	
	Thickness of lining	1.0	0.9 (Min.)	—	
12	Load of spring	Standard size		Repair limit	
		Installed height	Installed load	Installed load	
		6.5	1,870 N {191 kg}	1,730 N {176 kg}	

Outline

- The front brake is a wet-type multi-disc brake, which consists of piston (3), inner ring (5), disc (9), outer ring (8), and spring (4).
- The brake cylinder consists of differential housing (1) and bearing carrier (2). And piston (3) is assembled to them.
  Inner ring (5) and outer ring (8) are coupled with the spline of axle housing (7).
- Disc (9) has liners stuck to its both sides and is installed between inner ring (5) and outer ring (8), and they are coupled together by the spline of sun gear shaft (6).

Rear



1. Differential housing
2. Bearing carrier
3. Piston
4. Spring
5. Inner ring
6. Sun gear shaft
7. Axle housing
8. Outer ring
9. Disc (3 pieces)

Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
10	Thickness of plate	6	±0.1	5.5	
		3.2	±0.1	2.7	
	Thickness of brake disc	6.5	±0.15	5.7	
11	Depth of lining groove	0.8 (Min.)	—	0.4	Replace
	Thickness of lining	1.0	0.9 (Min.)	—	
		Standard size		Repair limit	
12	Load of spring	Installed height	Installed load	Installed load	
		6.5	1,870 N {191 kg}	1,730 N {176 kg}	

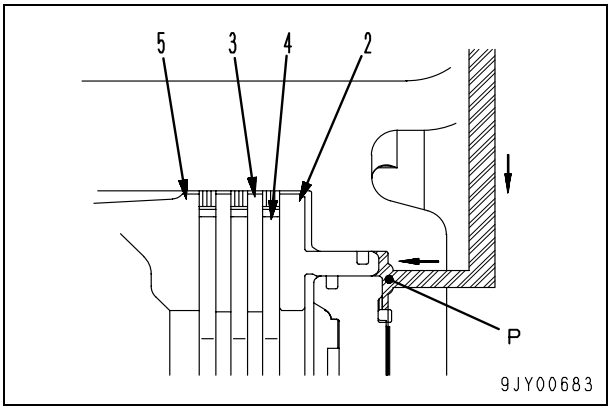
Outline

- The rear brake is a wet-type multi-disc brake, which consists of piston (3), inner ring (5), disc (9), outer ring (8), and spring (4).
- The brake cylinder consists of differential housing (1) and bearing carrier (2). And piston (3) is assembled to them.
  Inner ring (5) and outer ring (8) are coupled with the spline of axle housing (7).
- Disc (9) has liners stuck to its both sides and is installed between inner ring (5) and outer ring (8), and they are coupled together by the spline of sun gear shaft (6).

Operation

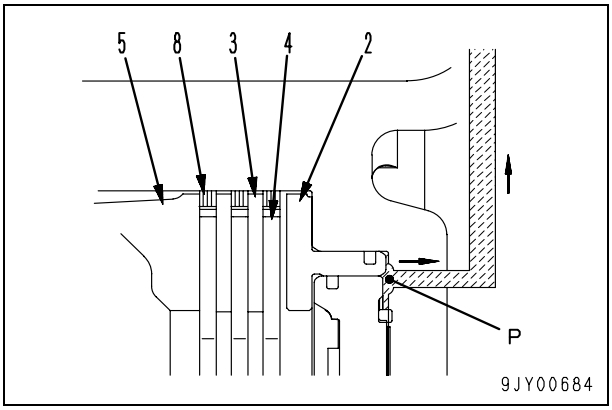
When brake is operated

- As the brake pedal is pressed, oil pressure (P) being supplied through the hydraulic tank, brake charge valve to the brake cylinder acts on piston (2) in the brake cylinder to move the piston. Accordingly, disc (4) between piston (2), inner ring (3), and outer ring (5) is stopped and the brake is applied to the machine.

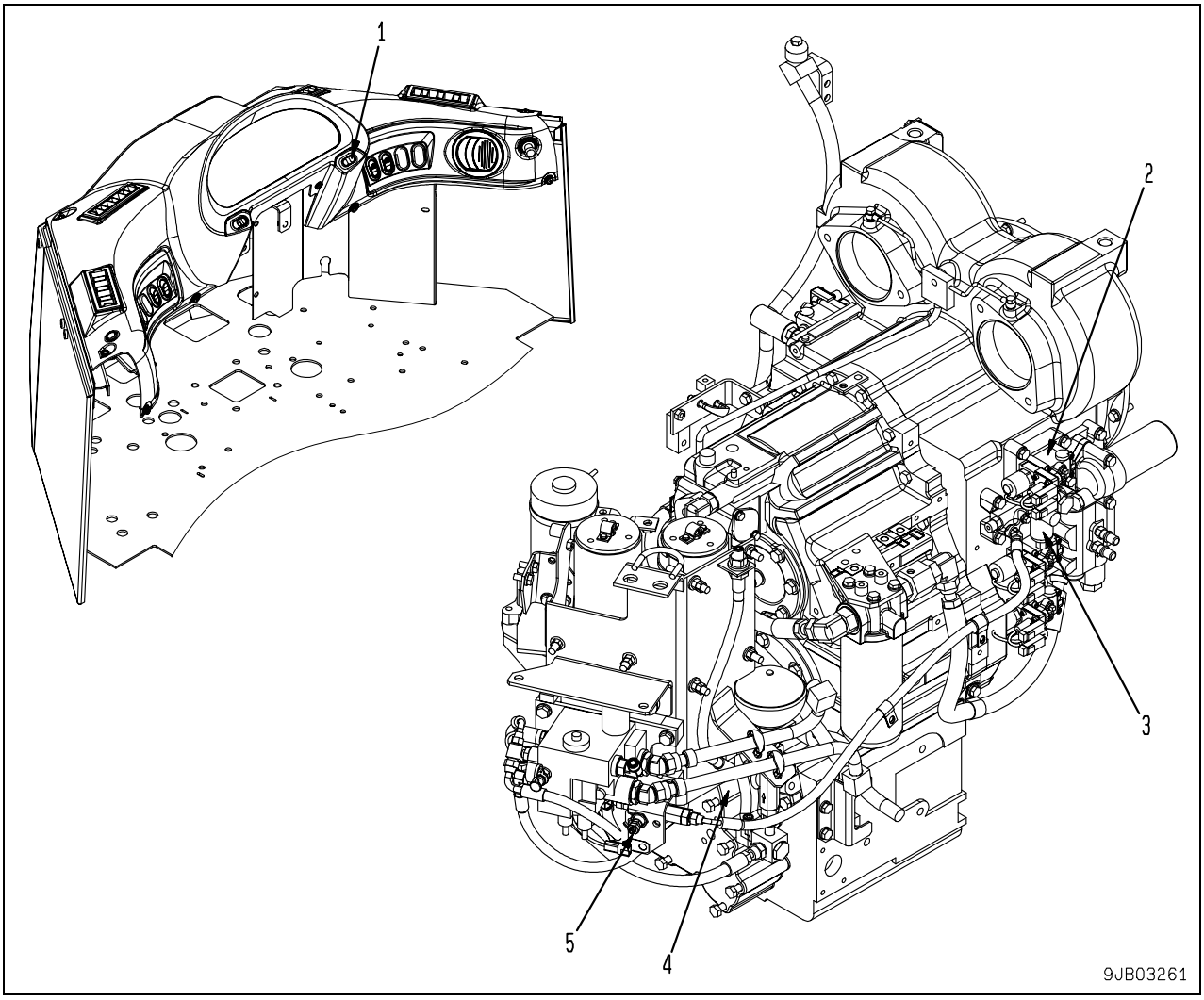


When brake is released

- If the oil pressure is released, piston (2) is returned by the returning force of spring (8) and clearance is made between inner ring (3) and outer ring (5), and disc (4) becomes free. The linings stuck to disc (4) have cross grooves on them. While disc (4) is turning, oil flows in those grooves to cool the linings.



Parking brake control

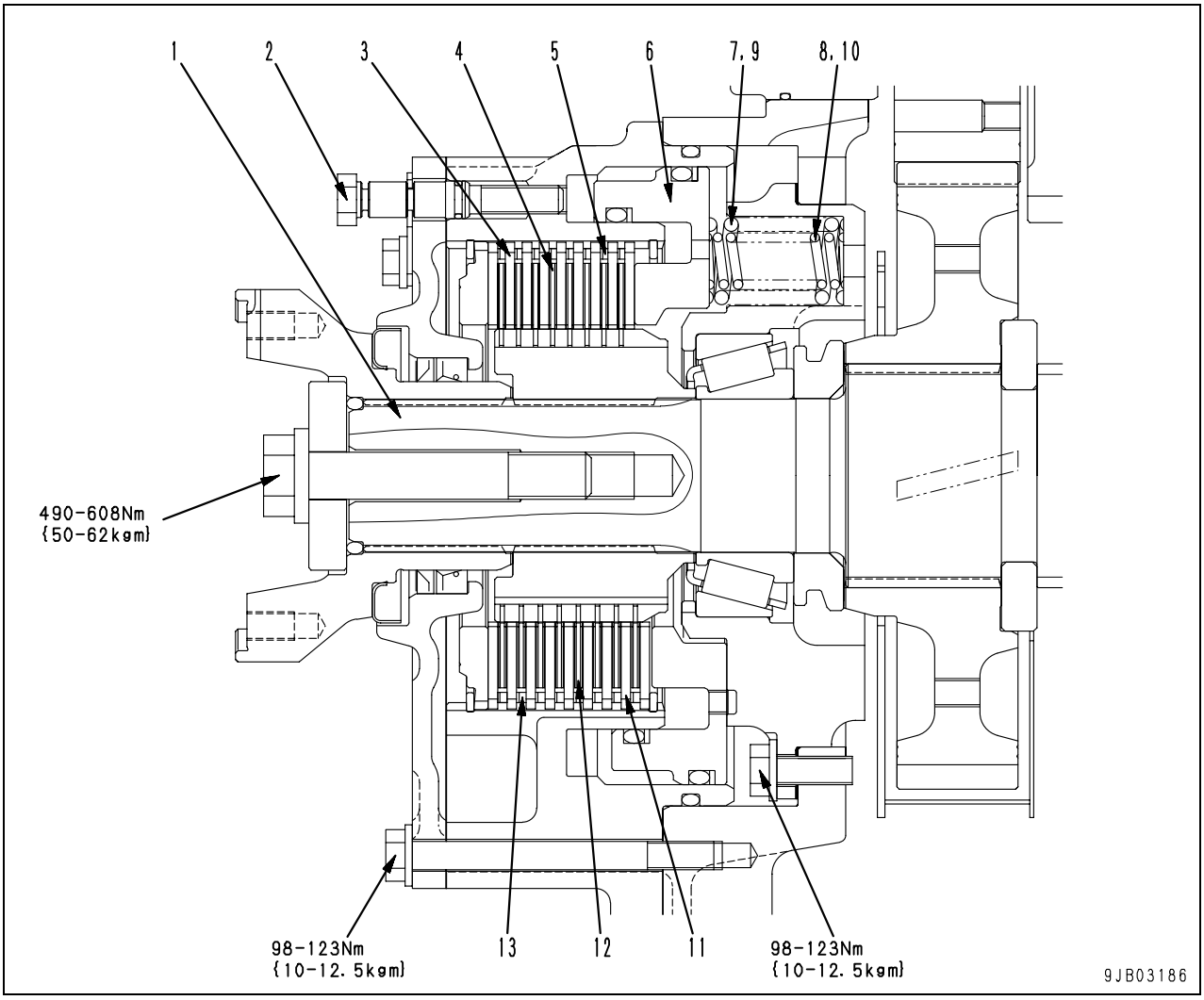


1. Parking brake switch
2. Valve assembly
3. Parking brake solenoid valve
4. Parking brake
5. Emergency parking brake release valve

Outline

- Parking brake (4) is a wet-type multi-disc brake built in the transmission. It is installed to the output shaft bearing and operated mechanically by the pressing force of the spring and released hydraulically.
- If parking brake switch (1) installed to the operator's seat is turned “ON”, parking brake solenoid valve (3) installed to valve assembly (2) shuts off the oil pressure and the parking brake is applied.
- If parking brake switch (1) is turned “OFF”, the hydraulic force in the cylinder releases the parking brake.
- While the parking brake is applied (While the solenoid valve is turned “OFF”), the signal from the transmission controller to the transmission solenoid valve is stopped by the neutralizer signal to keep the transmission in neutral.
- Emergency parking brake release valve (5) is installed to move the machine when it is stopped (and the parking brake is applied) because of a trouble in the engine or drive system.

Parking brake



1. Output shaft
2. Adjustment screw for manual release of parking brake
3. Plate
4. Disc
5. Wave spring
6. Piston
7. Spring (outside)
8. Spring (inside)

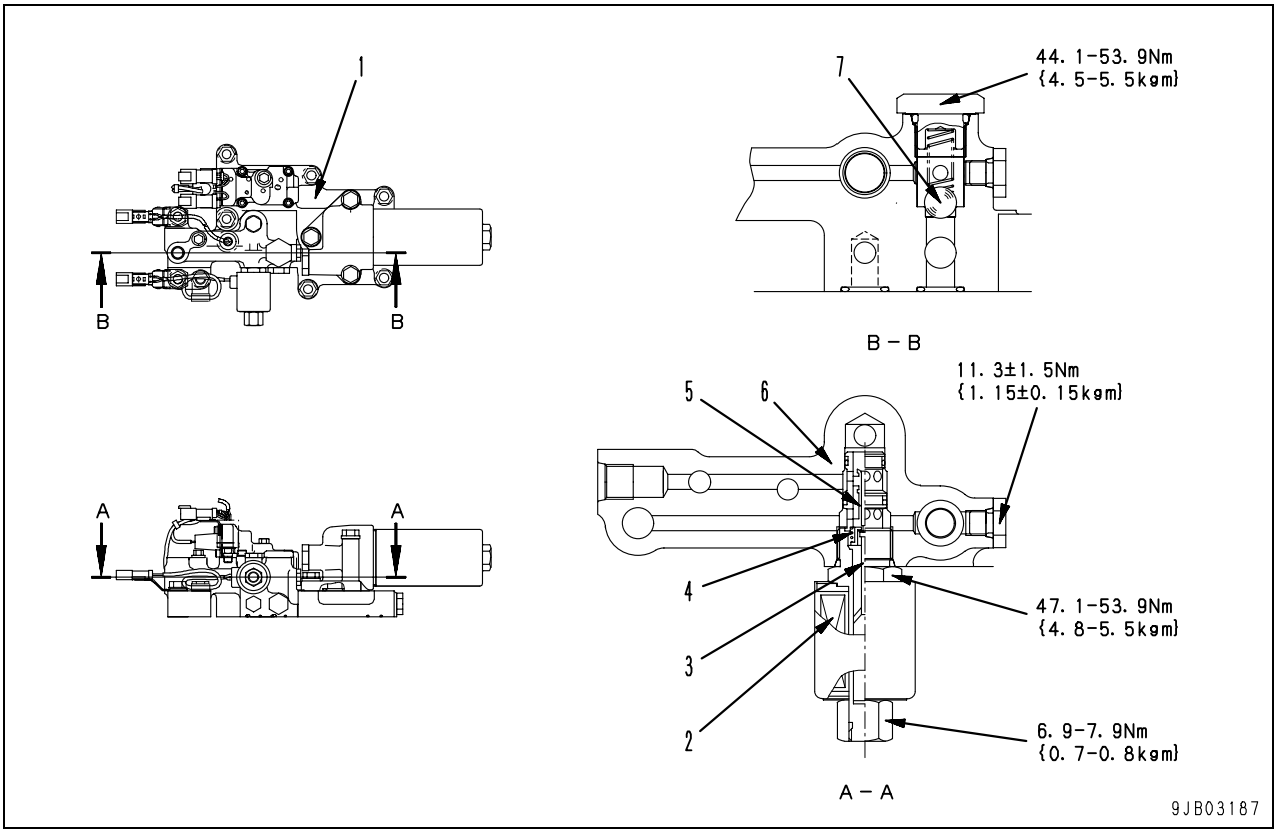
Outline

- The parking brake is a wet-type multi-disc brake being operated mechanically with springs (7) and (8) to apply braking to output shaft (1).
- The repulsive force of springs (7) and (8) presses disc (4) against plate (3) with piston (6) to stop output shaft (1).
- When releasing the brake, oil pressure is applied to the back side of piston (6) to separates plate (3) and disc (4) from each other. As the result, output shaft (1) is released.

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	
			78.6	56.4	981 N {100 kg}	76.2	932 N {95 kg}	
10	Parking brake spring (inside)		74.5	56.4	517 N {52.7 kg}	72.3	491 N {50.1 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)		1,106 N {112.8 kg}	±57 N {±5.8 kg}		940 N {95.9 kg}		

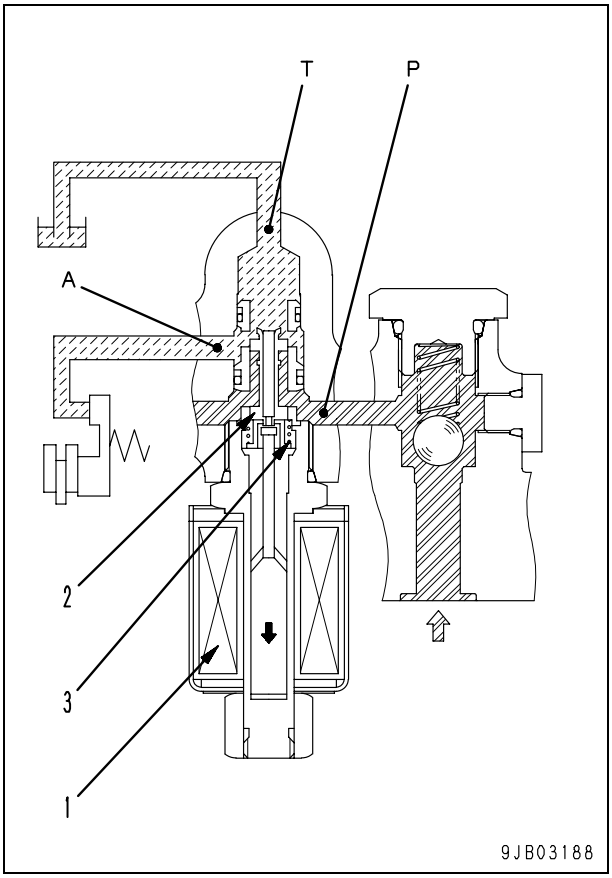
Parking brake solenoid valve



1. Valve assembly
2. Coil (ON/OFF type)
3. Push pin
4. Spring
5. Spool
6. Valve seat
7. Check valve

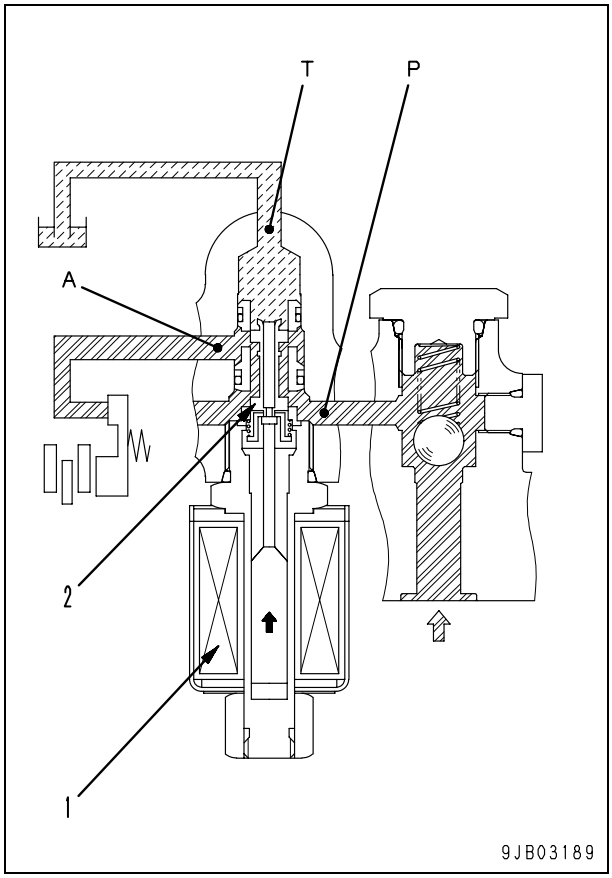
Operation

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



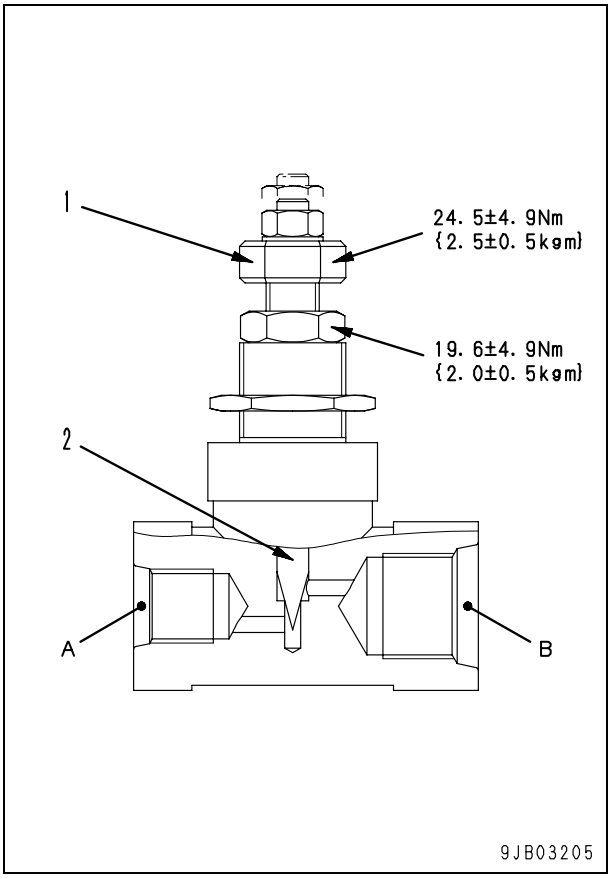
- Setting the parking brake switch to “ON” sets coil (1) to “OFF”. As the result, spool (2) is pushed back downward by the repulsive force of spring (3).
- Pump port (P) is disconnected from parking brake port (A), stopping flow of the oil from the pump to the parking brake. At the same time, the oil that was working as back pressure of the parking brake is drained through port (A) and port (T).
- As the back pressure of the piston is drained, the piston being pushed back by the spring contacts the plate and disc closely to enable the parking brake.

When parking brake is released
(When solenoid is energized)



- Setting the parking brake switch to “OFF” sets coil (1) to “ON”, moving spool (2) upward.
- The pressurized oil from the pump flows to the parking brake through port (P), inside of spool (2) and port (A). At the same time, port (T) is closed and the oil is not drained.
- As oil pressure is applied to the back side of the piston, it compresses the spring, separating the plate and disc from each other. As the result, the parking brake is released.

Emergency parking brake release valve



A: From accumulator
B: To parking brake solenoid valve

1. Grip
2. Valve

Function

- The emergency parking brake release valve is installed between the accumulator and parking brake solenoid in the brake circuit. When supply of oil pressure from the power train pump is stopped because of an engine trouble, etc., opening the valve with manually allows conducting the accumulator charge pressure in the brake circuit to the parking brake cylinder.

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

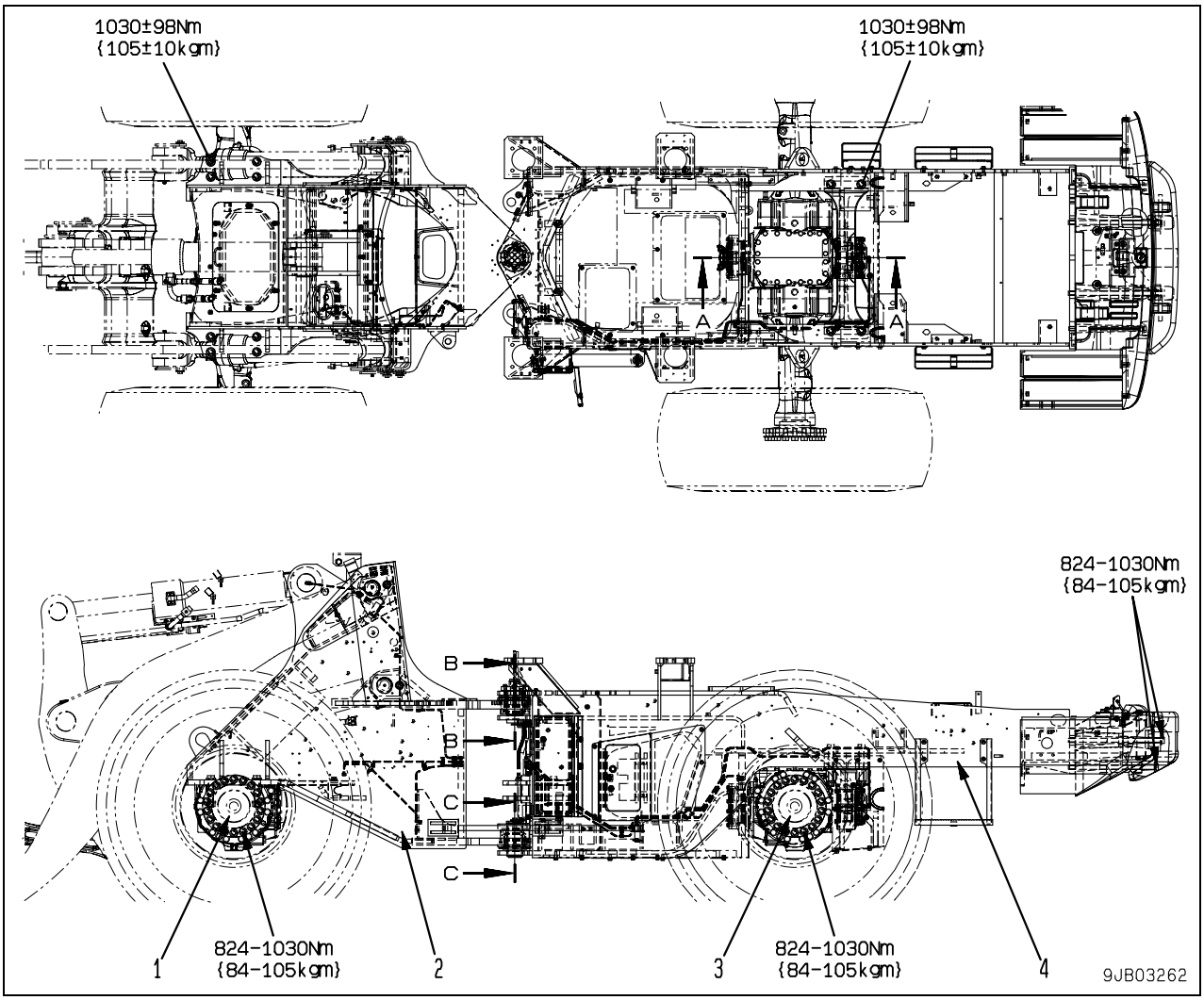
10 Structure, function and maintenance standard

Undercarriage and frame

Undercarriage and frame 2
Axle mount and center hinge pin 2
Tires 6

Undercarriage and frame

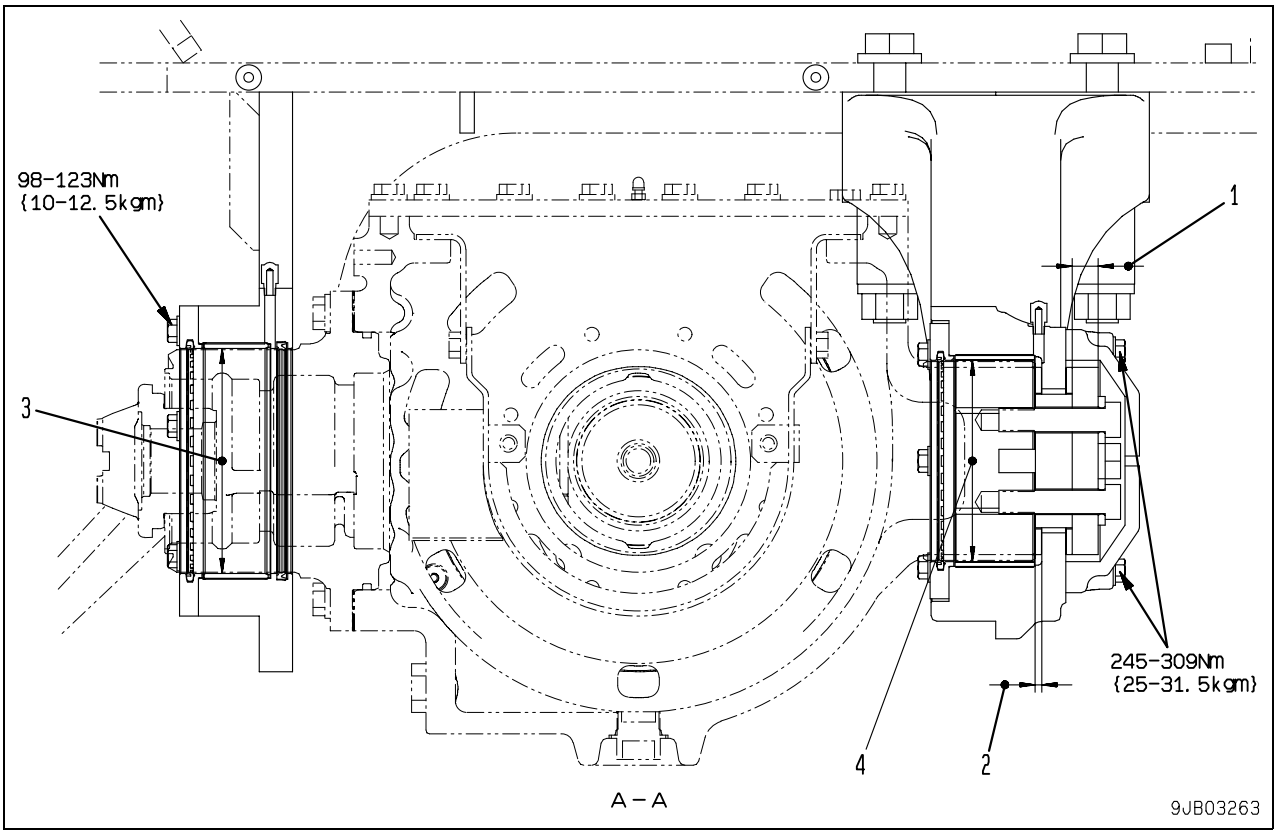
Axle mount and center hinge pin



1. Front axle
2. Front frame
3. Rear axle
4. Rear frame

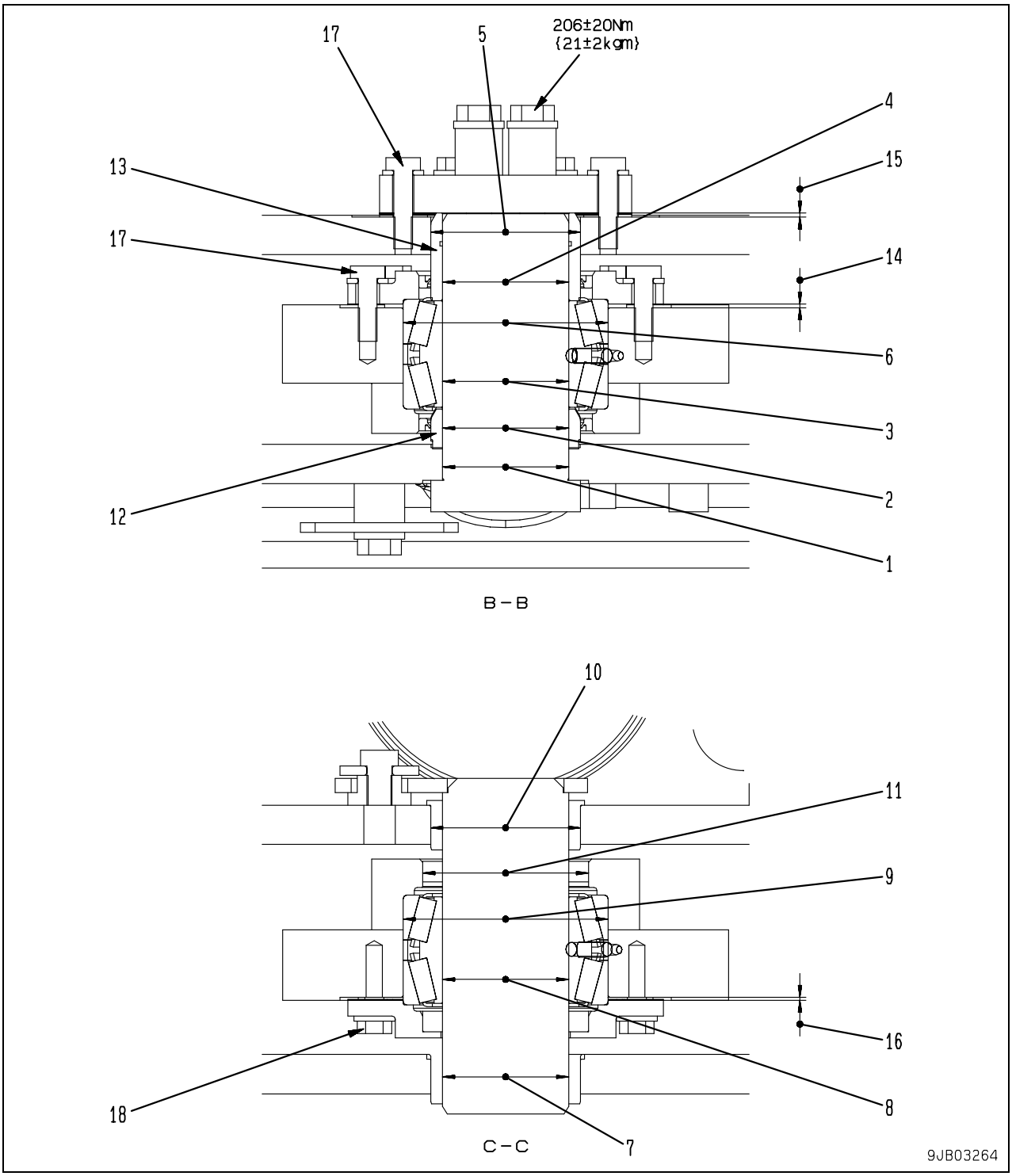
Outline

- Front frame (2) and rear frame (4) are coupled with each other by the bearing with center hinge pin between them. The right and left steering cylinders connect the front frame and rear frame. They adjust the bending angle or the turning radius of the frame according to move of the cylinder.



Unit: mm

No.	Check item	Criteria					Remedy
1	Thickness of thrust plate	Standard size		Tolerance		Repair limit	Replace
		22		±0.5		—	
2	Thickness of wear plate	5		+0.3 –0.1		—	
3	Clearance between shaft and hole on front support side	Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
		190	–0.050 –0.122	+0.472 0	0.050 – 0.594	—	
4	Clearance between shaft and hole on rear support side	170	–0.005 –0.124	+0.522 +0.050	0.055 – 0.646	—	


17
5
206±20Nm
{21±2kgm}
4
15
13
17
14
6
3
2
12
1
B – B
10
11
9
16
18
8
C – C
7
9JB03264

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between upper hinge pin and rear frame	80	–0.030 –0.049	+0.071 +0.036	0.066 – 0.120	—	Replace
2	Clearance between upper hinge pin and spacer (small)	80	–0.030 –0.049	+0.060 +0.030	0.060 – 0.109	—	
3	Clearance between upper hinge pin and bearing	80	–0.030 –0.049	0 –0.015	0.015 – 0.049	—	
4	Clearance between upper hinge pin and spacer (large)	80	–0.030 –0.049	+0.030 0	0.030 – 0.079	—	
5	Clearance between rear frame and spacer (large)	95	–0.036 –0.071	+0.071 +0.036	0.072 – 0.142	—	
6	Clearance between front frame and upper hinge bearing	130	0 –0.025	–0.048 –0.088	–0.088 – –0.023	—	
7	Clearance between lower hinge pin and rear frame bushing	80	–0.030 –0.076	+0.067 +0.027	0.057 – 0.143	—	
8	Clearance between lower hinge pin and bearing	80	–0.030 –0.076	0 –0.015	0.015 – 0.076	—	
9	Clearance between front frame and lower hinge bearing	130	0 –0.025	–0.048 –0.088	–0.088 – –0.023	—	
10	Clearance between rear frame and bushing	95	+0.089 +0.054	+0.054 0	–0.089 – 0	—	
11	Clearance in lower hinge pin and seal press fitting part	105	+0.17 +0.08	+0.054 0	–0.17 – –0.026	—	
12	Height of upper hinge spacer (small)	Standard size	Tolerance		Repair limit		
		25.5	±0.1		—		
13	Height of upper hinge spacer (large)	56	±0.1		—		
14	Standard thickness of shim between upper hinge and retainer	2.5					Adjust
15	Standard thickness of shim between upper hinge and retainer	2.5					
16	Standard thickness of shim between lower hinge and retainer	2					
17	Tightening torque of upper hinge retainer mounting bolt	20 ± 2 Nm {2 ± 0.2 kgm} (When shim is adjusted)					
		98 – 123 Nm {10 – 12.5 kgm} (Final value)					
18	Tightening torque of lower hinge retainer mounting bolt	20 ± 2 Nm {2 ± 0.2 kgm} (When shim is adjusted)					
		98 – 123 Nm {10 – 12.5 kgm} (Final value)					

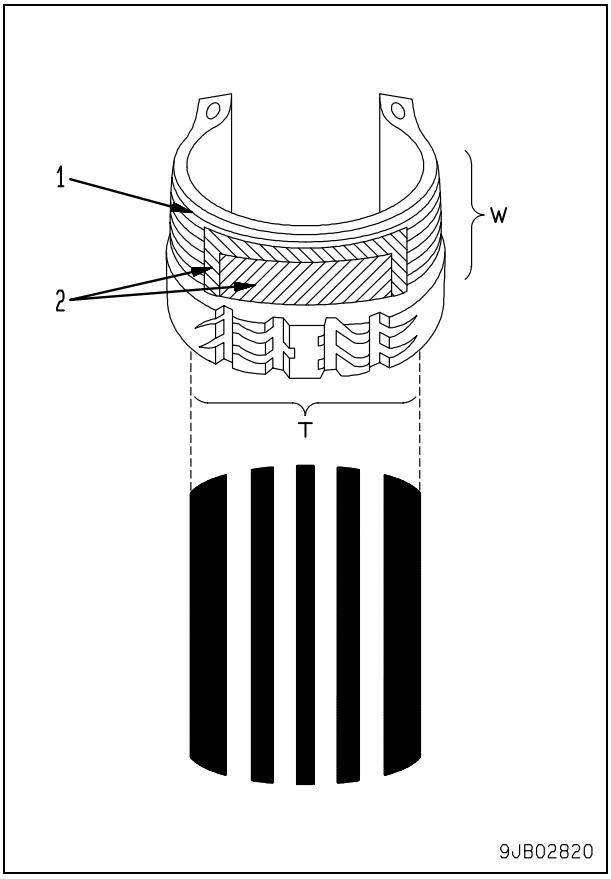
Tires

The radial tires of this machine have the following features.

- Large gripping force
- Less uneven wear
- Less machine damage
- High operator comfort
- Enhanced fuel consumption
- Less heat generation
- Fewer frequency of burst
- Longer life

Comparison of structures and characteristics of tires

Radial tire



Structure

- The cords of carcass (1) are arranged at right angles to the center line of tread (T) (radially).
- Tread (T) is stabilized and protected by several strong belts (2).
- Side wall (W) and tread (T) are independent from each other.

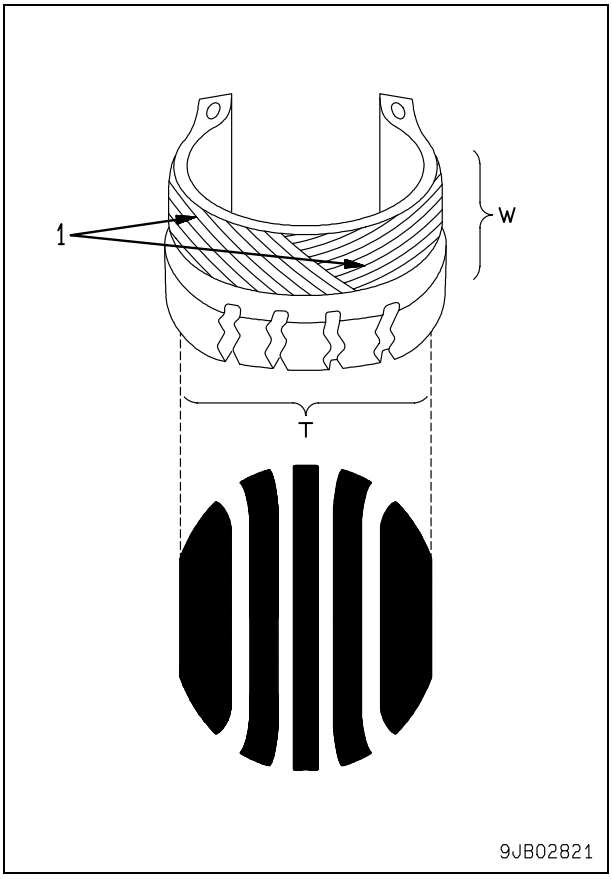
Ground contact characteristics

- Even if the tire is deformed by a load, it does not move uselessly in ground contact and uniform ground contact surface is secured stably.

Deformation characteristics

- Only side wall (W) is deformed as load is applied and tread (T) made of strong belts (2) keeps stability independently.

Bias tire



Structure

- The cords of carcass (1) are arranged bias from the center line of tread (T).
- Side wall (W) and tread (T) are integral.

Ground contact characteristics

- If the tire is deformed by a load, the ground contact surface is also deformed, leading to wasteful moves. As a result, the ground contact surface becomes unstable.

Deformation characteristics

- Side wall (W) which receives loads and tread (T) move as one unit.

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

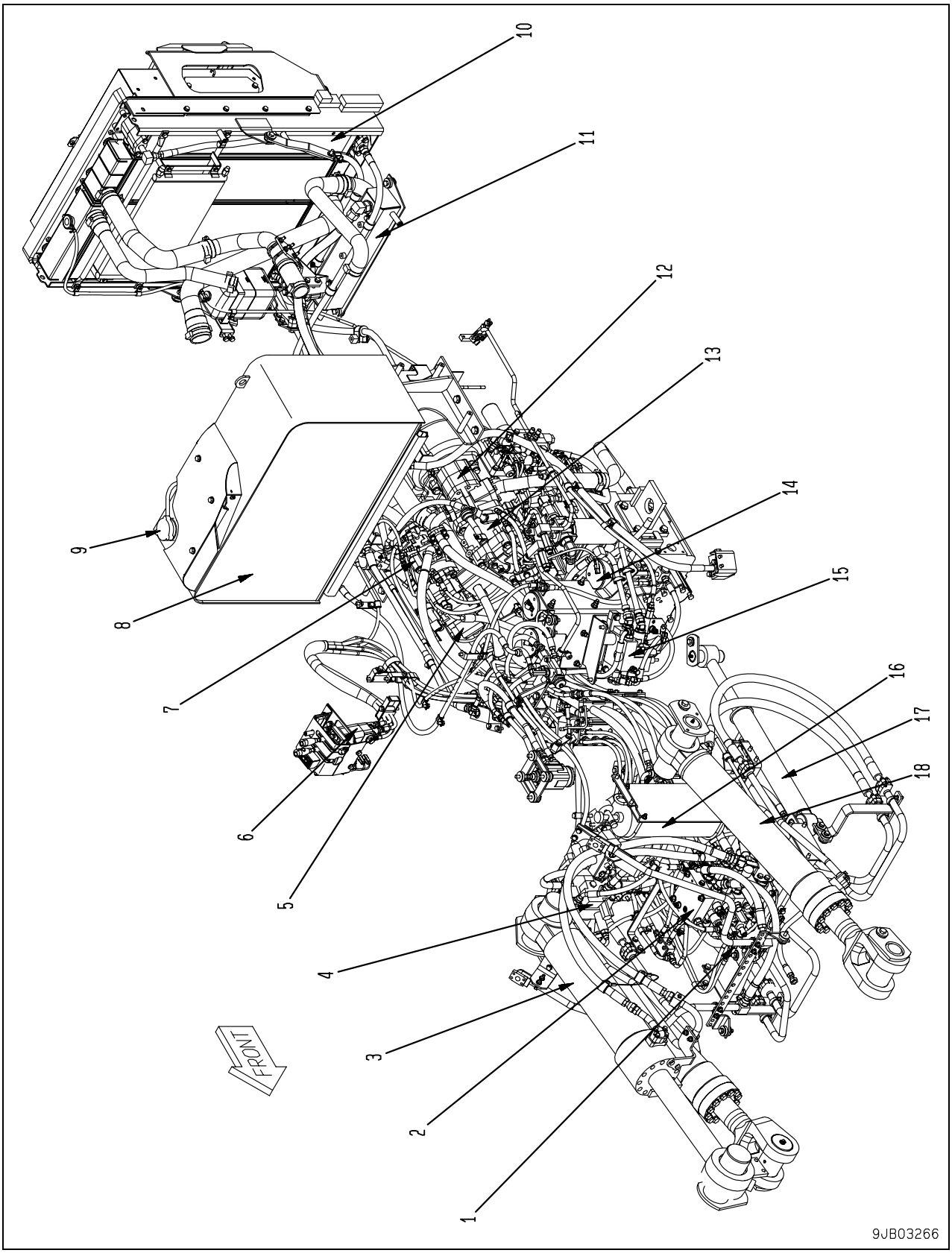
10 Structure, function and maintenance standard

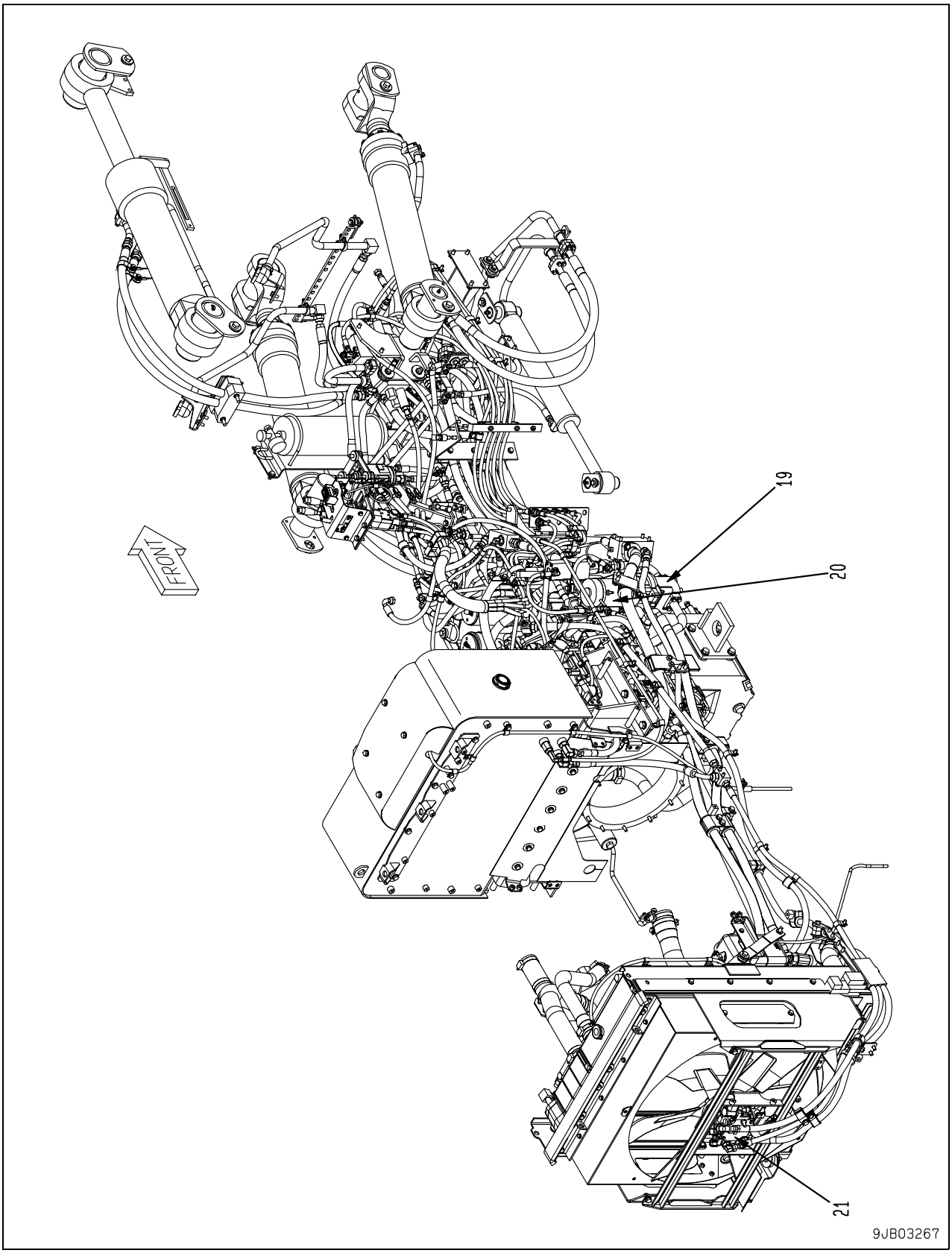
Hydraulic system, Part 1

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CLSS 34
Each function and operation of each valve 38

Hydraulic system, Part 1

Hydraulic piping diagram



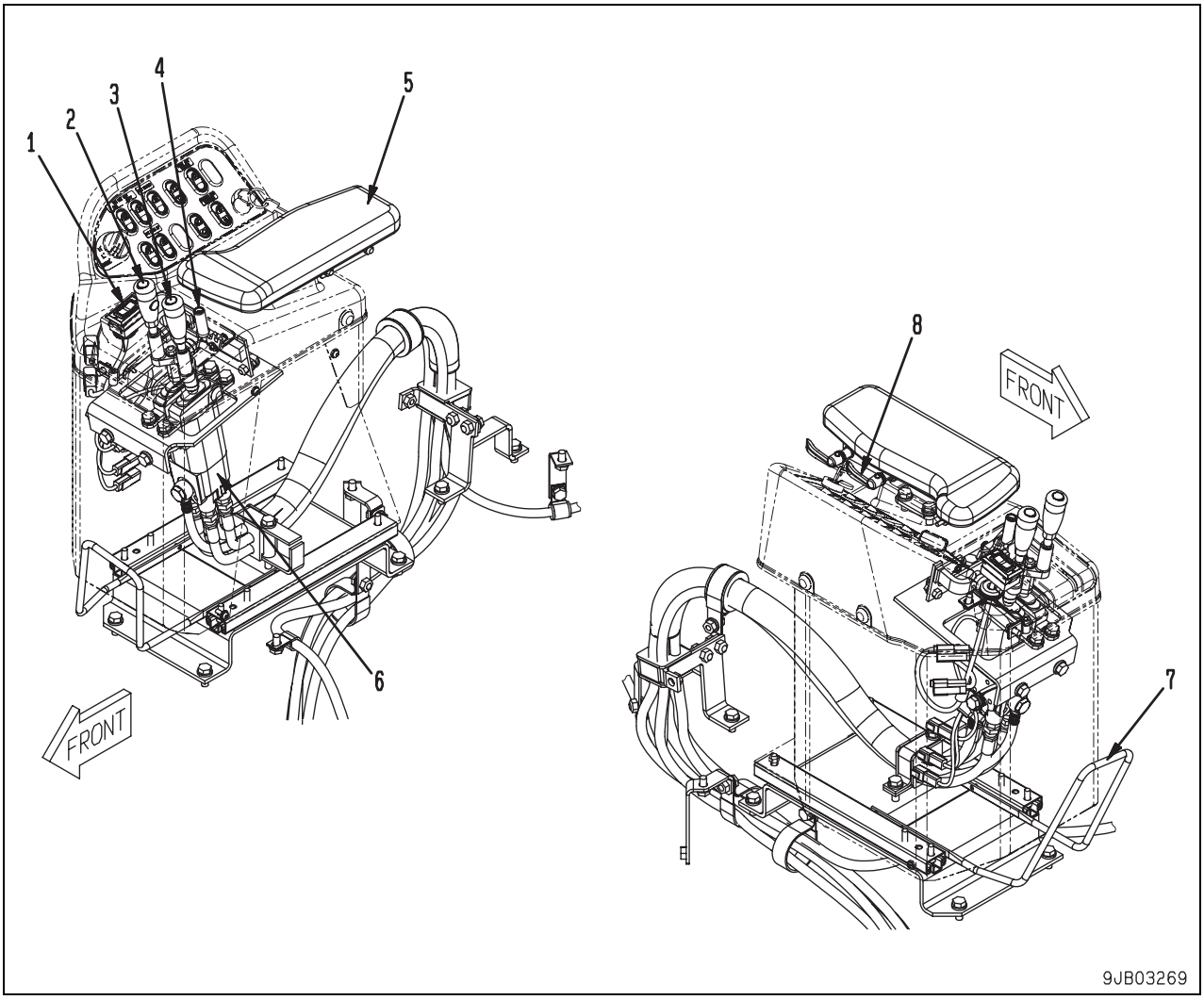

FRONT
19
20
21
9JB03267

1. Stabilizer valve
2. Work equipment control valve
3. Bucket cylinder
4. Steering valve
5. Cooling fan pump
6. Work equipment PPC valve
7. Steering pump
8. Hydraulic tank
9. Oil filler cap and breather
10. Oil cooler
11. Power train oil cooler
12. Power train pump
13. Work equipment pump
14. PPC accumulator
15. Charge valve
16. ECSS accumulator
17. Steering cylinder
18. Lift cylinder
19. Emergency steering pump
20. Emergency steering motor
21. Cooling fan motor

Outline

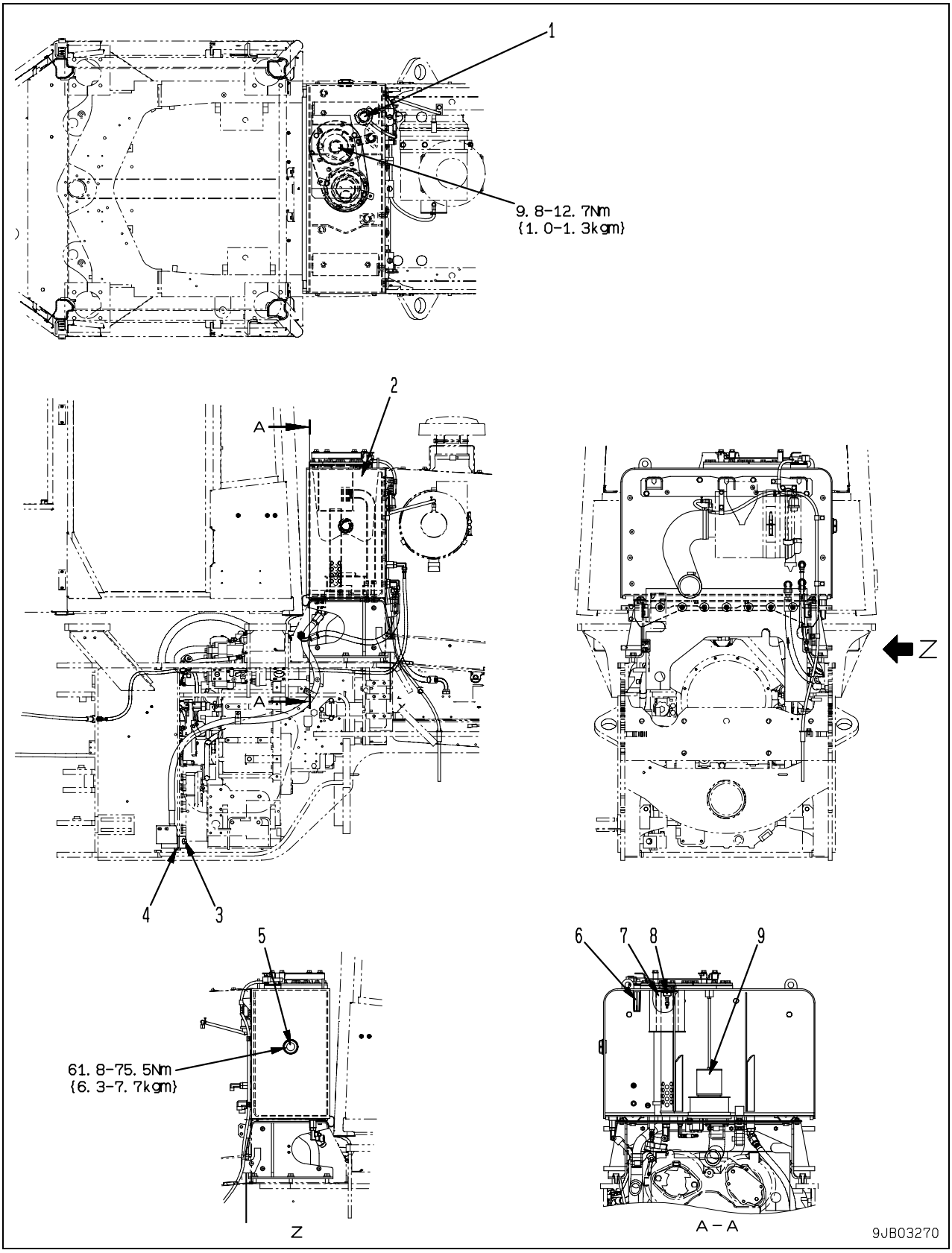
- The hydraulic system consists of the work equipment circuit and steering circuit. The work equipment circuit controls the operation of the bucket and attachments.
- The oil from hydraulic tank (8) is sent by work equipment pump (13) to work equipment control valve (2). If the bucket and lift arm spools of the work equipment control valve are in the HOLD position, the oil is sent through the drain circuit of the work equipment control valve, filtered by the filter in the hydraulic tank, and returned to the tank.
- If the work equipment control lever is operated, the bucket or lift arm spool of work equipment PPC valve (6) moves to operate each spool of the work equipment control valve (2) hydraulically. Then, the oil flows from the work equipment control valve to lift cylinder (18) or bucket cylinder (3) to move the lift arm or bucket.
- The maximum pressure in the hydraulic circuit is controlled with the relief valve in work equipment control valve (2). The bucket cylinder circuit is equipped with the safety-suction valve for protection of the circuit.
- PPC accumulator (14) is installed to the PPC pilot circuit so that the lift arm can be lowered to the ground even while the engine is stopped.
- Hydraulic tank (8) is pressurized, enclosed, and equipped with oil filler cap and breather (9) having the relief valve. Certain pressure is applied to this tank to prevent generation of negative pressure in the tank and cavitation in the pump.
- This machine is equipped with the emergency steering system. If the machine cannot be steered normally because of a stall of the engine, a trouble in the steering pump, oil leakage from the piping, etc., emergency steering motor (20) drives emergency steering pump (19) so that the machine can be steered.
- Cooling fan motor (21) installed to the radiator is driven hydraulically and variably with cooling fan pump (5).

Work equipment control lever linkage



1. Derectional selector switch
2. Lift arm control lever
3. Bucket control lever
4. Work equipment lock lever
5. Armrest
6. Work equipment PPC valve
7. Lever stand forward/backward adjustment lever
8. Wrist rest height and angle adjustment lever

Hydraulic tank

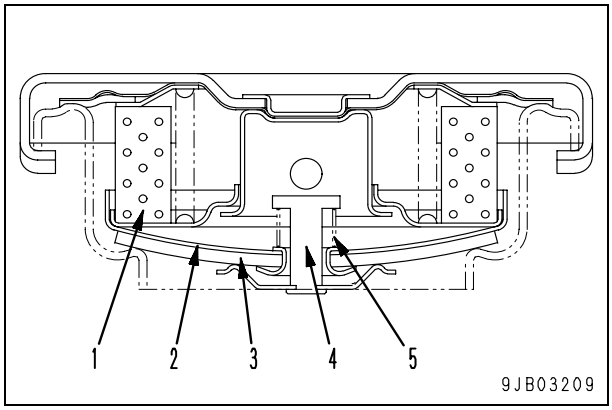


1. Oil filler cap and breather
2. Hydraulic tank
3. Drain valve
4. Drain plug
5. Sight gauge
6. Stainer
7. Filter element
8. Bypass valve
9. Suction strainer

Specifications

Capacity of hydraulic tank (ℓ)	232
Quantity of oil in hydraulic tank (ℓ)	139
Set pressure of bypass valve (MPa {kg/cm^2})	0.15 ± 0.03 {1.53 ± 0.31}

Breather



1. Filter element
2. Bottom plate
3. Gasket
4. Seam valve
5. Spring

Prevention of negative pressure in tank

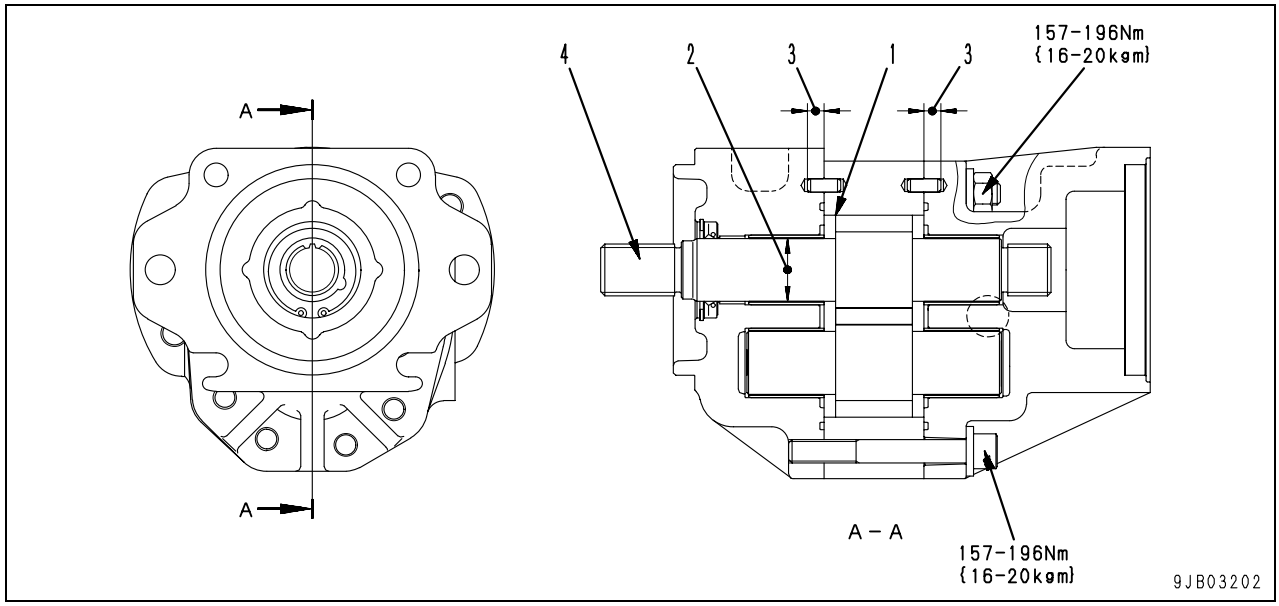
- Since the tank is pressurized and enclosed, if the oil level in it lowers, negative pressure is generated.
  At this time, seam valve (4) is opened by the differential pressure between the tank pressure and the atmospheric pressure to prevent generation of the negative pressure.
  (Set pressure of air intake valve:
  0 – 5.1 kPa {0 – 0.05 kg/cm^2})

Prevention of pressure rise in tank

- While the hydraulic circuit is in operation, the oil level in the tank varies as the hydraulic cylinders operate, and the temperature rises. Consequently, the pressure in the tank varies, too.
  If the pressure in the tank rises above the set level, bottom plate (2) is pushed up to release the pressure from the tank and thus to prevent pressure rise in the tank.
  (Set pressure of exhaust valve:
  75 ± 15 kPa {0.76 ± 0.15 kg/cm^2})

Power train pump

Type: SDL(30)80



Unit: mm

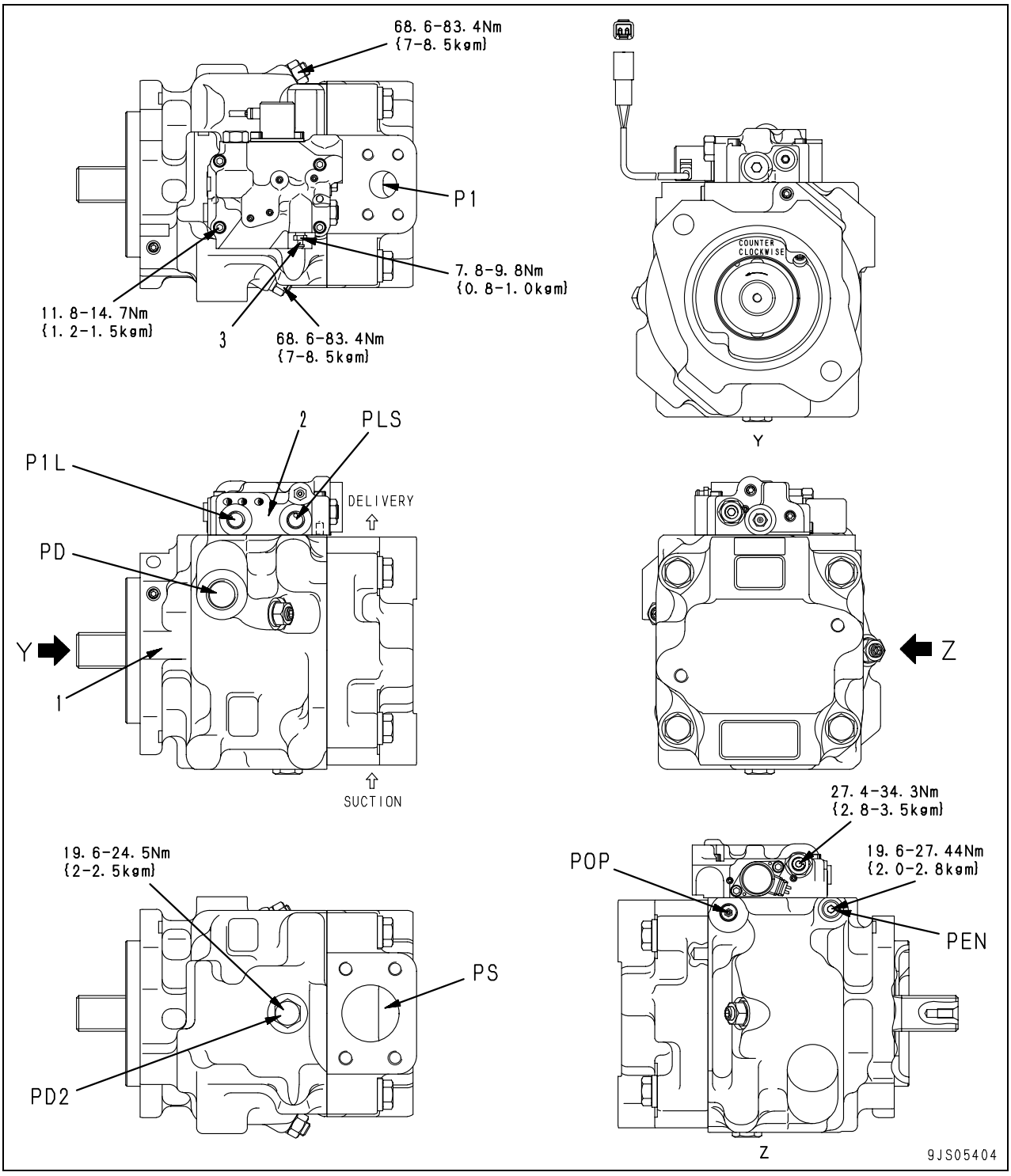
No.	Check item	Criteria					Remedy
1	Side clearance	Type	Standard clearance		Clearance limit		Replace
		SDL (30) 80	0.16 – 0.20		0.24		
2	Clearance between plain bearing inside diameter and gear shaft outside diameter	SDL (30) 80	0.06 – 0.13		0.20		
3	Driven depth of pin	Type	Standard size	Tolerance		Repair limit	
		SDL (30) 80	10	0 –0.5		—	
4	Torque of spline turning shaft	6.9 – 11.8 Nm {0.7 – 1.2 kgm}					—
—	Delivery Discharge oil: SAE10W Oil temperature: 45 – 55°C	Type	Speed (rpm)	Discharge pressure (MPa {kg/cm^2})	Standard delivery (ℓ/min)	Allowable delivery (ℓ/min)	
		SDL (30) 80	2,500	2.94 {30}	192.5	170.4	

Outline

- The power train pump is installed to the PTO shaft of the torque converter and driven by the shaft to supply oil to the torque converter and transmission circuits.

Work equipment pump

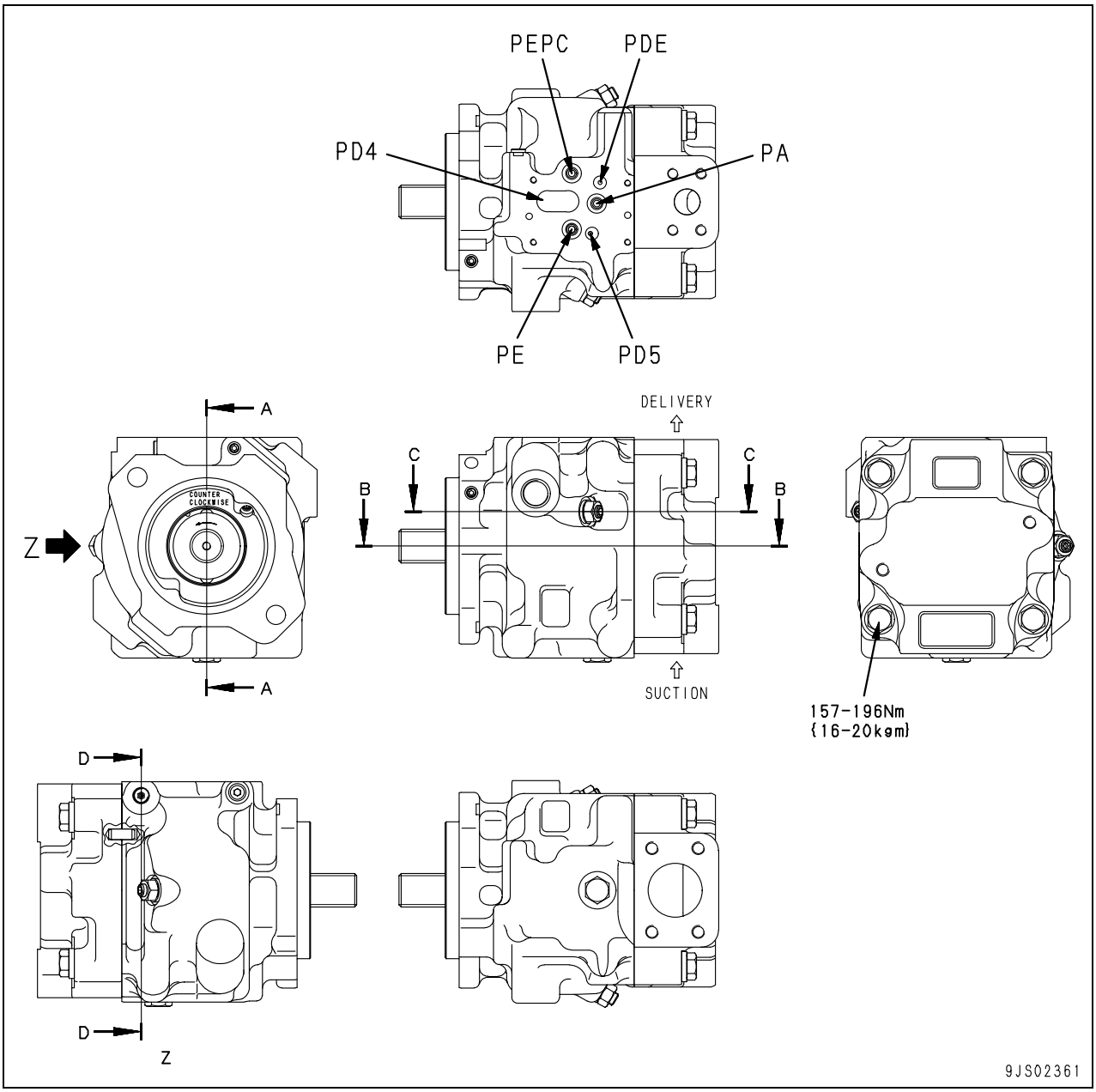
Type: LPV90



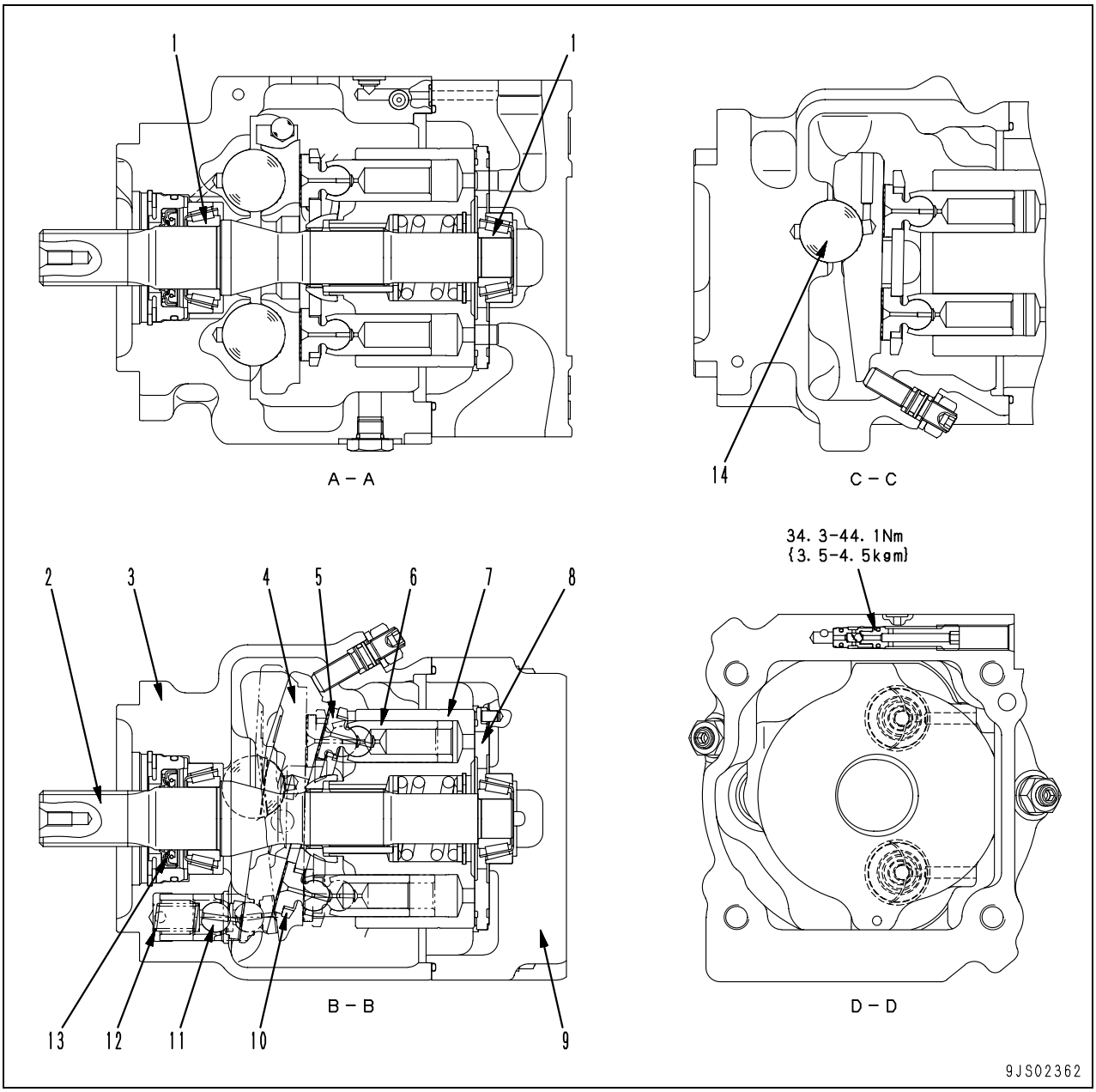
P1: Pump discharge port
P1L: Pump discharge pressure inlet port
PD: Drain port
PD2: Drain plug
PEN: Control pressure pickup plug
PLS: Load pressure input port
POP: External pilot pressure input port
PS: Pump suction port

1. Pump unit
2. Servo valve
3. Air bleeder

1. Pump unit

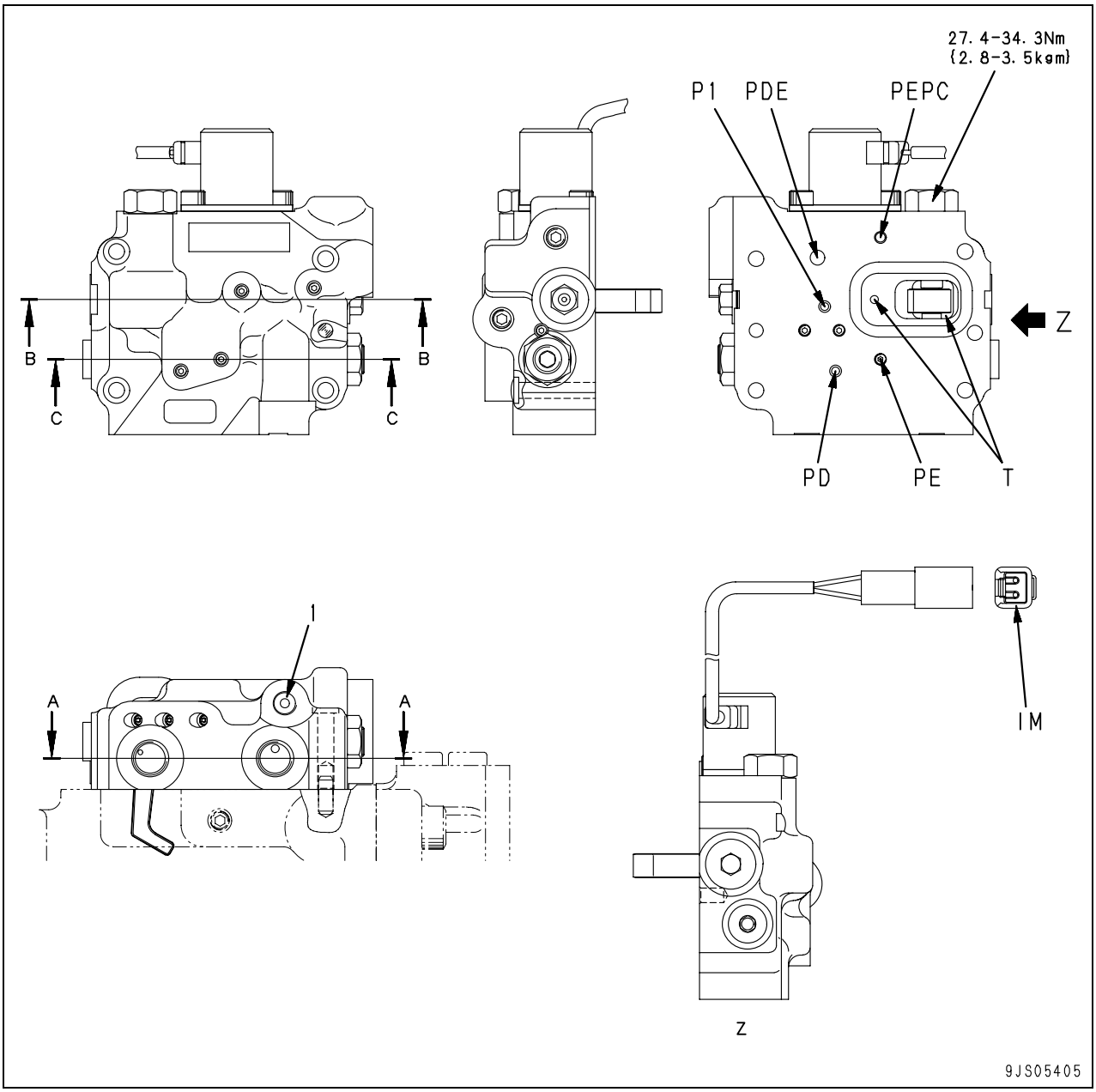


PA: Control basic pressure output port
PD4 : Drain port
PD5 : Drain port
PDE : EPC drain port
PE: Control pressure input port
PEPC EPC basic pressure input port



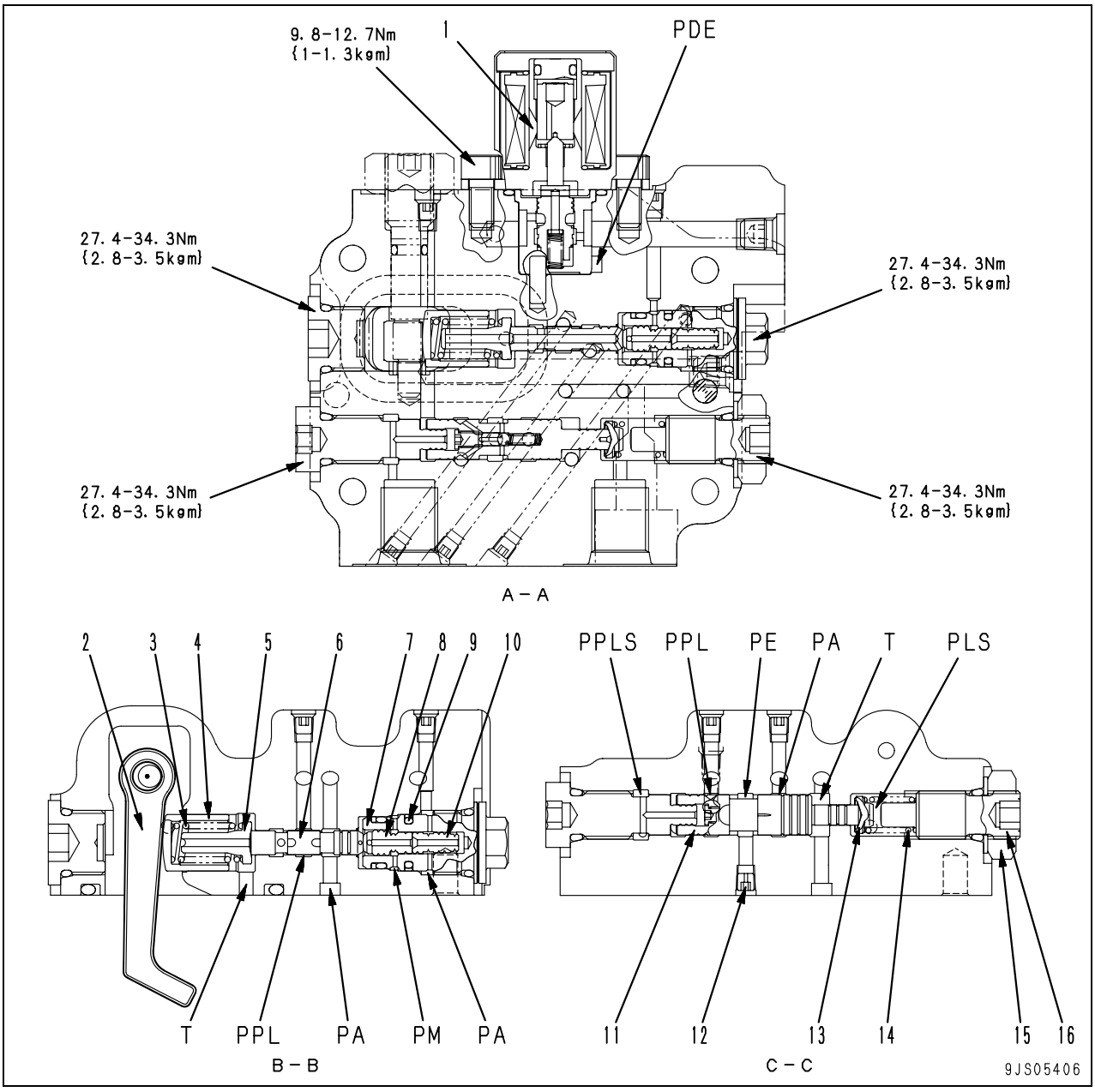
1. Bearing
2. Shaft
3. Case
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. End cap
10. Shoe retainer
11. Servo piston
12. Spring
13. Oil seal
14. Ball

2. Servo valve



T: Drain port
IM: PC mode selector current
P1: Pump discharge port
PD: Drain port
PE: Control piston pressure input port
PDE: EPC drain port
PEPC: EPC basic pressure input port

1. Air bleeder



PDE: EPC drain

1. EPC valve

PC valve

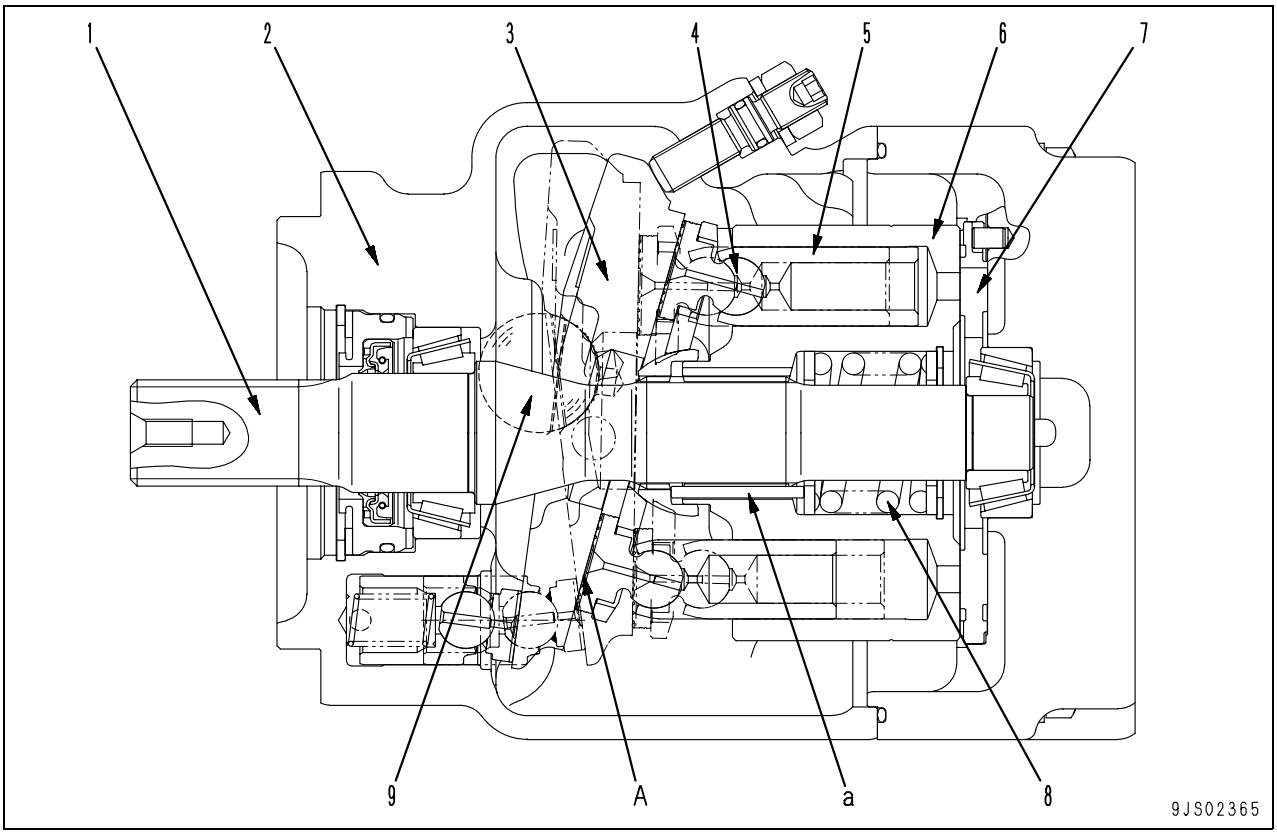
PA: Pump discharge pressure
PM : PC mode selector pressure
PPL: PC valve output pressure
T: Drain

2. Lever
3. Spring
4. Retainer
5. Seat
6. Spool
7. Sleeve
8. Piston
9. Seal
10. Piston

LS valve

PA: Pump discharge pressure
PE: Control piston pressure
PLS: LS pressure input
PPL: PC valve output pressure
PPLS: LS pump pressure input
T: Drain

11. Spool
12. Plug
13. Seat
14. Spring
15. Nut
16. Plug



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 delivery by changing the swash plate angle.

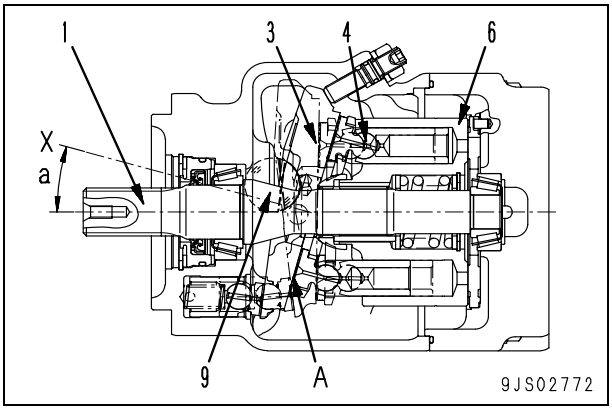
Structure

- Cylinder block (6) is supported on shaft (1) through spline (a). Shaft (1) is supported on the front and rear bearings.
- The end of piston (5) has a spherical hollow and is combined with shoe (4). Piston (5) and shoe (4) form a spherical bearing.
- Rocker cam (3) is supported on case (2) and ball (9) and has plane (A). Shoe (4) is kept pressed against the plane of rocker cam (3) and slid circularly. Shoe (4) leads high-pressure oil to form a static pressure bearing and slides.
- Piston (5) in each cylinder of cylinder block (6) moves relatively in the axial direction.
- Cylinder block (6) rotates relatively against valve plate (7), sealing the hydraulic oil. The hydraulic balance on the valve plate is maintained properly.
- The oil in each cylinder of cylinder block (6) can be sucked and discharged through valve plate (7).

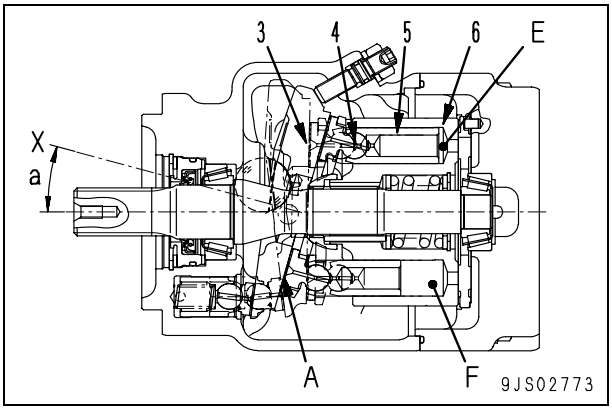
Operation

1. Operation of pump

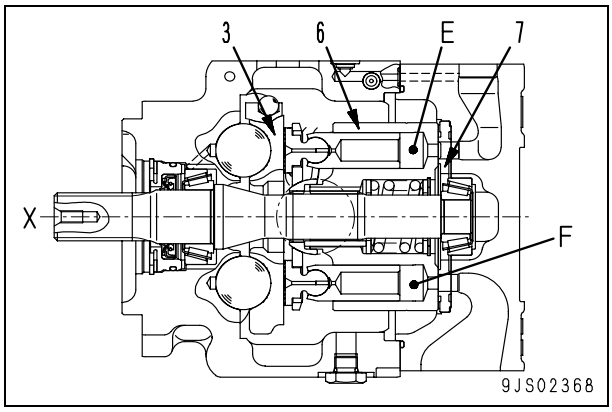
- Cylinder block (6) rotates together with shaft (1). Shoe (4) slides on plane (A). At this time, rocker cam (3) slants around ball (9). As a result, angle (a) between center line (X) of rocker cam (3) and the axis of cylinder block (6) changes. Angle (a) is called the swash plate angle.



- If angle (a) is made between center line (X) of rocker cam (3) and the axis of cylinder block (6), plane (A) works as a cam for shoe (4).
- Accordingly, piston (5) slides inside cylinder block (6) and a difference is made between volumes (E) and (F) in cylinder block (6). As a result, each piston sucks and discharges oil by (F) – (E).
- In other word, if cylinder block (6) rotates and the volume of chamber (E) is decreased, the oil is discharged from chamber (E). On the other hand, the volume of chamber (F) is increased and the oil is sucked in chamber (F). (In the figure, chamber (F) is at the end of the suction stroke and chamber (E) is at the end of the discharge stroke.)

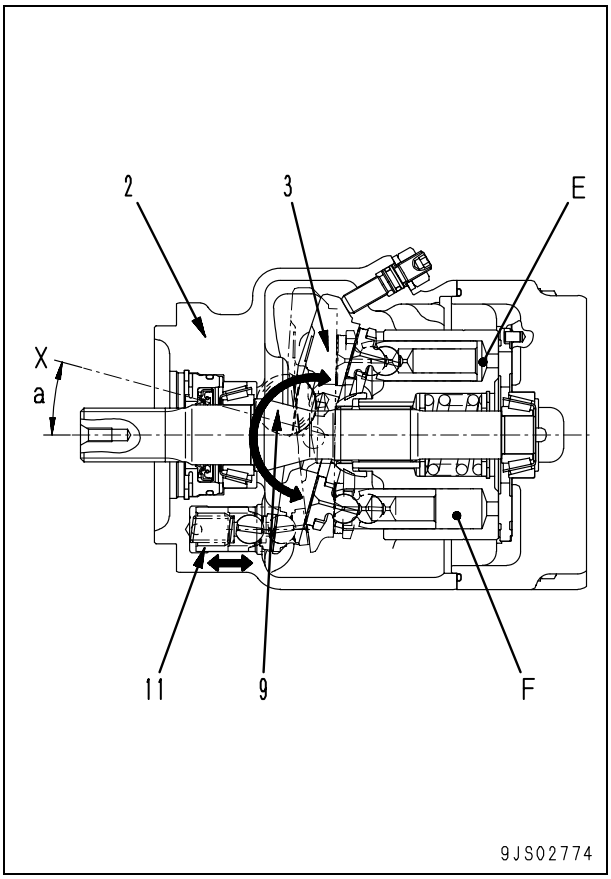


- If center line (X) of rocker cam (3) is equal to the axial direction of cylinder block (6) (the swash plate angle is 0), there is not a difference between volumes (E) and (F) in cylinder block (6) and the oil is not sucked or discharged. (The swash plate angle is not set to 0 actually, however.)
- In short, swash plate angle (a) is in proportion to the pump delivery.



2. Control of delivery

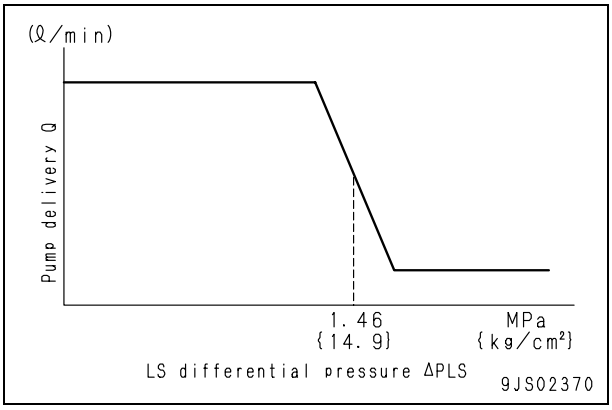
- If swash plate angle (a) is increased, the difference between volumes (E) and (F) is increased, or delivery (Q) is increased. Swash plate angle (a) is changed with servo piston (11).
- Servo piston (11) reciprocates straight according to the signal pressure of the PC valve and LS valve. This straight motion is transmitted to rocker cam (3). Then, rocker cam (3) supported on case (2) through ball (9) slides in rotational directions.



LS valve

Function

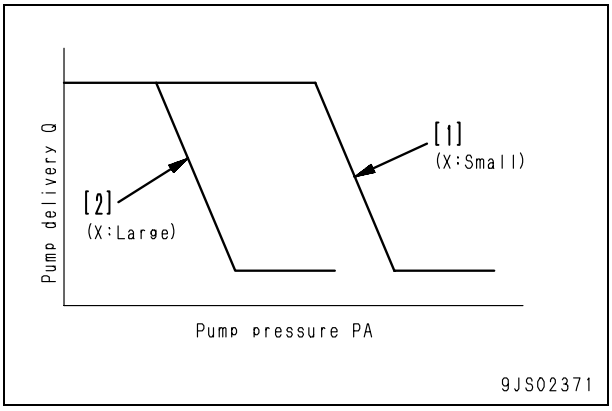
- The LS valve controls the pump delivery according to the stroke of the control lever, or the demand flow for the actuator.
- The LS valve detects the demand flow for the actuator from differential pressure (✕PLS) between control valve inlet pressure (PPLS) and control valve outlet pressure (PLS) and controls main pump delivery (Q). ((PPLS) is called the LS pump pressure, (PLS) the LS pressure, and (✕PLS) is the LS differential pressure.)
- In other words, the pressure loss caused by flow of oil through the opening of the control valve spool (= LS differential pressure ✕PLS) is detected, and then pump delivery (Q) is controlled to keep that pressure loss constant and supply the pump delivery according to the demand flow for the actuator.
- Main pump discharge pressure (PP), LS pump pressure (PPLS), and LS pressure (PLS) are led to the LS valve. The relationship between LS differential pressure (✕PLS) and pump delivery (Q) changes as shown below.



PC valve

Function

- The PC valve limits the oil flow to a certain level (according to the discharge pressure) even if the stroke of the control valve is increased extremely so that the horsepower absorbed by the pump will not exceed the engine horsepower, as long as pump discharge pressure (PA) is high.
- In other words, the PC valve decreases the pump delivery when the load is increased and the pump discharge pressure rises, and increases it when the pump discharge pressure lowers.
- If command current (X) sent to the EPC valve is increased, the relationship between the pump pressure (PA) and pump delivery (Q) is translated in proportion to the pressing force of the EPC valve solenoid.
- In other words, since the pressing force of the EPC valve solenoid is added to the pressing force on the left side caused by the pump pressure applied to spool (6), the relationship between pump pressure (PA) and (Q) is translated from [1] to [2] as (X) is increased.



Operation

1. Operation of spring

- The spring load of spring (3) at the PC valve is decided by the position of the swash plate.
- If servo piston (6) moves to the right, spring (3) is compressed through lever (2) and its spring load changes.

2. When pump pressure (PA) is low

- The pressing force of spool (10) is decreased and spool (6) is a little to the right (Fig. 1). At this time, ports (C) and (D) are connected to each other and the pressure in the LS valve is drain pressure (PT).
- At this time, ports (F) and (G) of the LS valve are connected to each other. As a result, the pressure in port (J) becomes drain pressure (PT) and servo piston (9) moves to the left.
- Consequently, the pump delivery is increased.
- As servo piston (9) moves, lever (2) moves to the left and spring (3) expands, weakening its spring force. Consequently, spool (6) moves to the left, disconnecting between ports (C) and (D) and connecting pump discharge pressure ports (B) and (C).
- As a result, the pressure in port (C) rises and the piston pressure is increased and servo piston (9) stops moving to the left.

3. When pump pressure (PA) is high

- The pressure of spool (10) is increased and spool (6) is a little to the left (Fig. 2). At this time, ports (C) and (B) are connected to each other and the pressure in the LS valve is pump pressure (PA).
- At this time, ports (F) and (G) of the LS valve are connected to each other. As a result, the pressure in port (J) becomes pump pressure (PA) and servo piston (9) moves to the right.
- Consequently, the pump delivery is decreased.
- As servo piston (9) moves, lever (2) moves to the right and spring (3) is compressed, strengthening its spring force. Consequently, spool (6) moves to the right, disconnecting ports (C) and (B) and connecting drain pressure ports (D) and (C).
- As a result, the pressure in port (C) lowers and the piston pressure is decreased and servo piston (9) stops moving to the right.
- Accordingly, the stopping position (= pump delivery) of servo piston (9) is decided by the position where the pressure caused by pressure (PA) applied to spool (10) is balanced with the force of spring (3) applied through spool (6). (Fig. 3)

4. When PC mode selector pressure rises or lowers

- The PC–EPC changes the output pressure (PM) with the input current from the controller similarly to when the pressing force of spool (8) changes and (PA) rises or lowers.

When load is light

(Fig. 1)

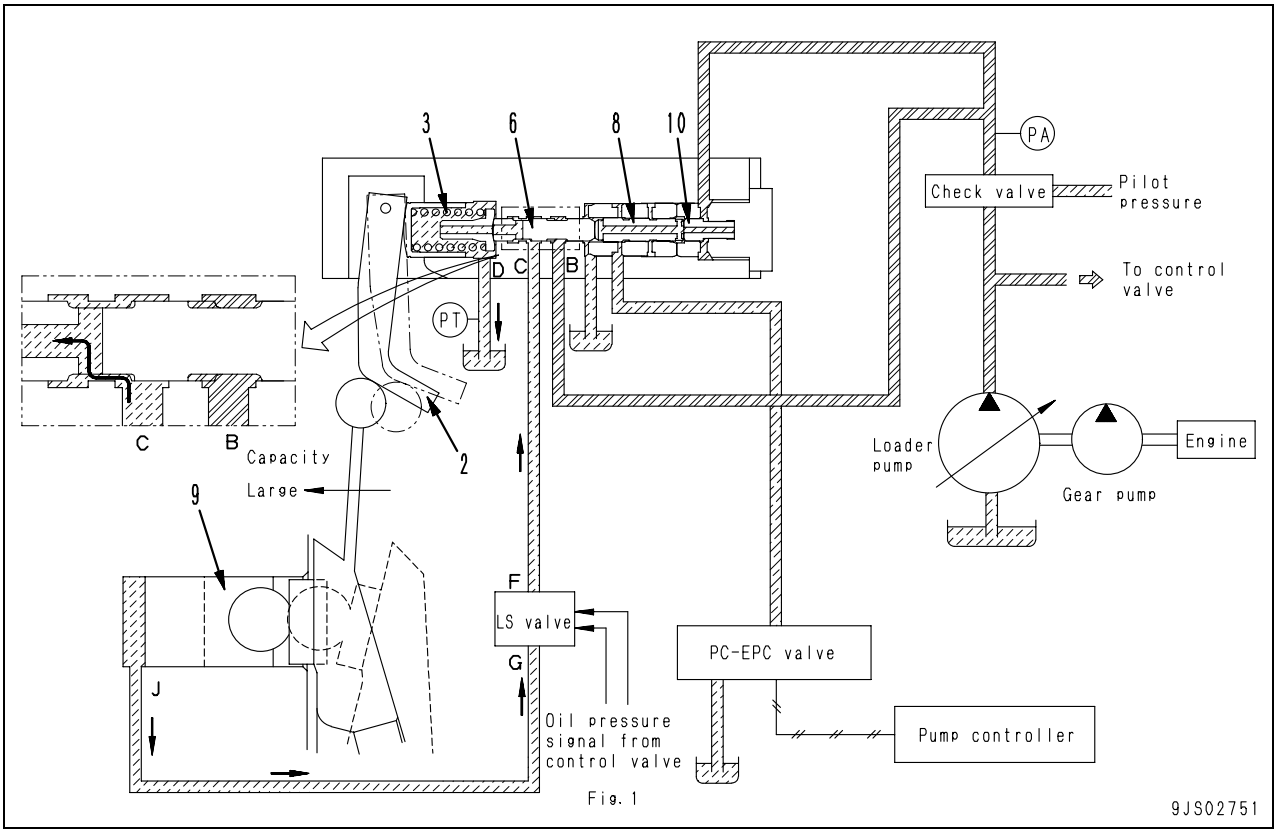


Fig. 1

When load is heavy

(Fig. 2)

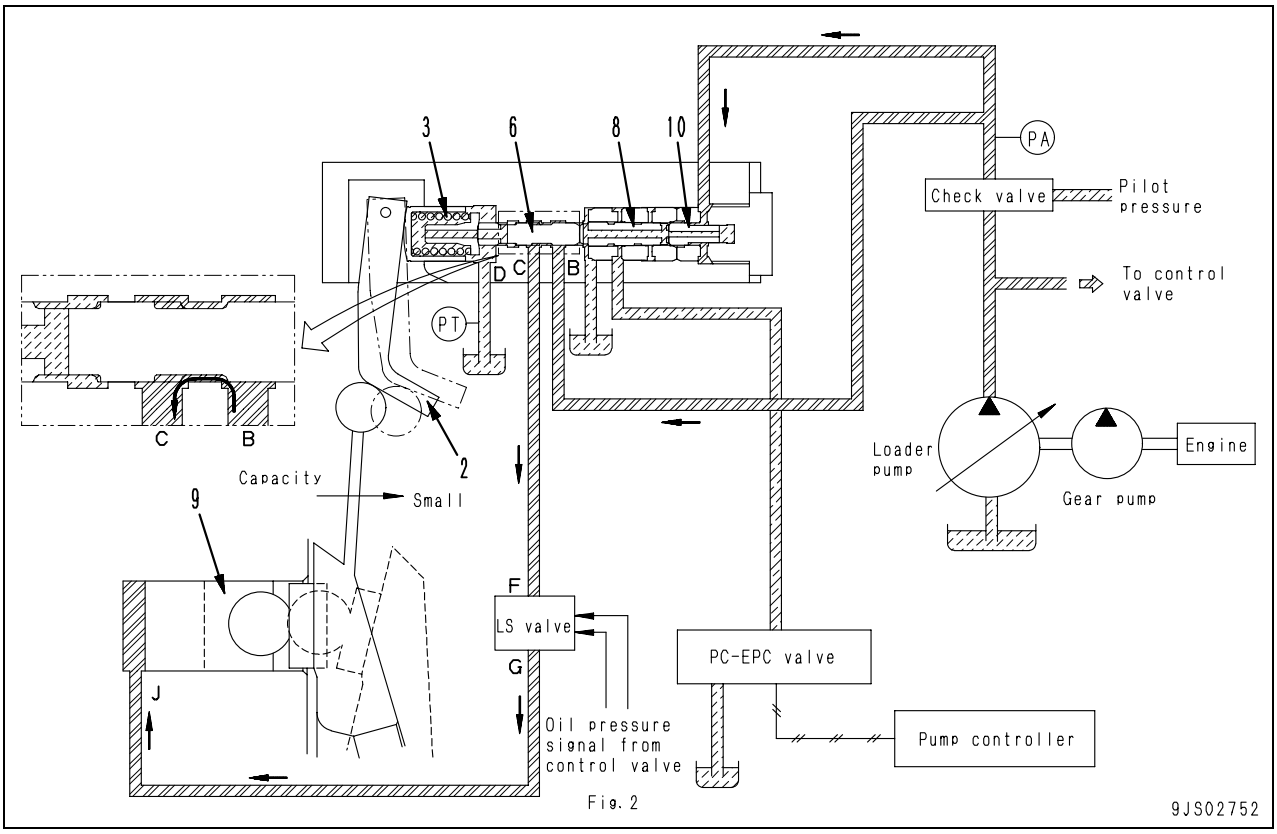


Fig. 2

When balanced

(Fig. 3)

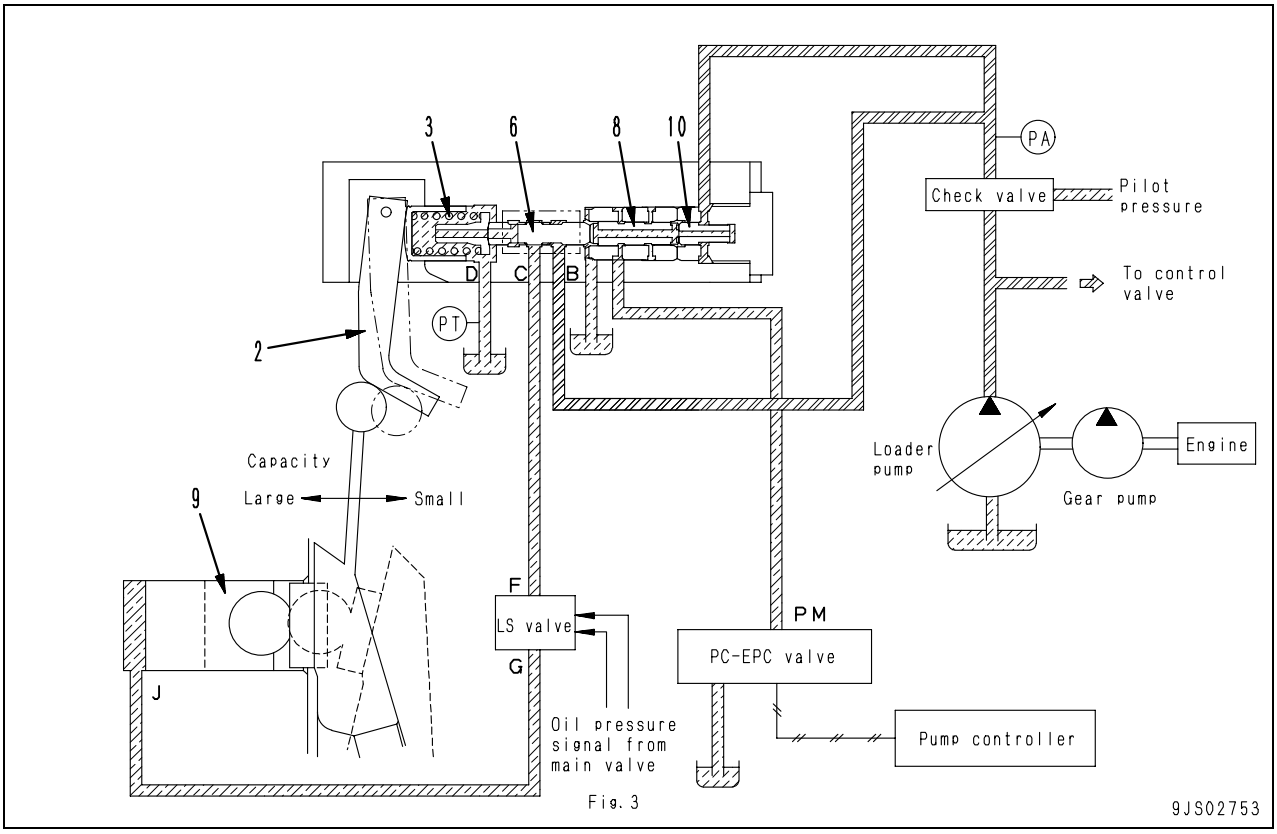


Fig. 3

Work equipment control valve

Outline

The control valves of the following 2 types are set.
- 3-spool valve (Without service valve)
- 4-spool valve (3-spool valve + service valve)

★ Since each service valve is add-on type, its later addition or removal is available.

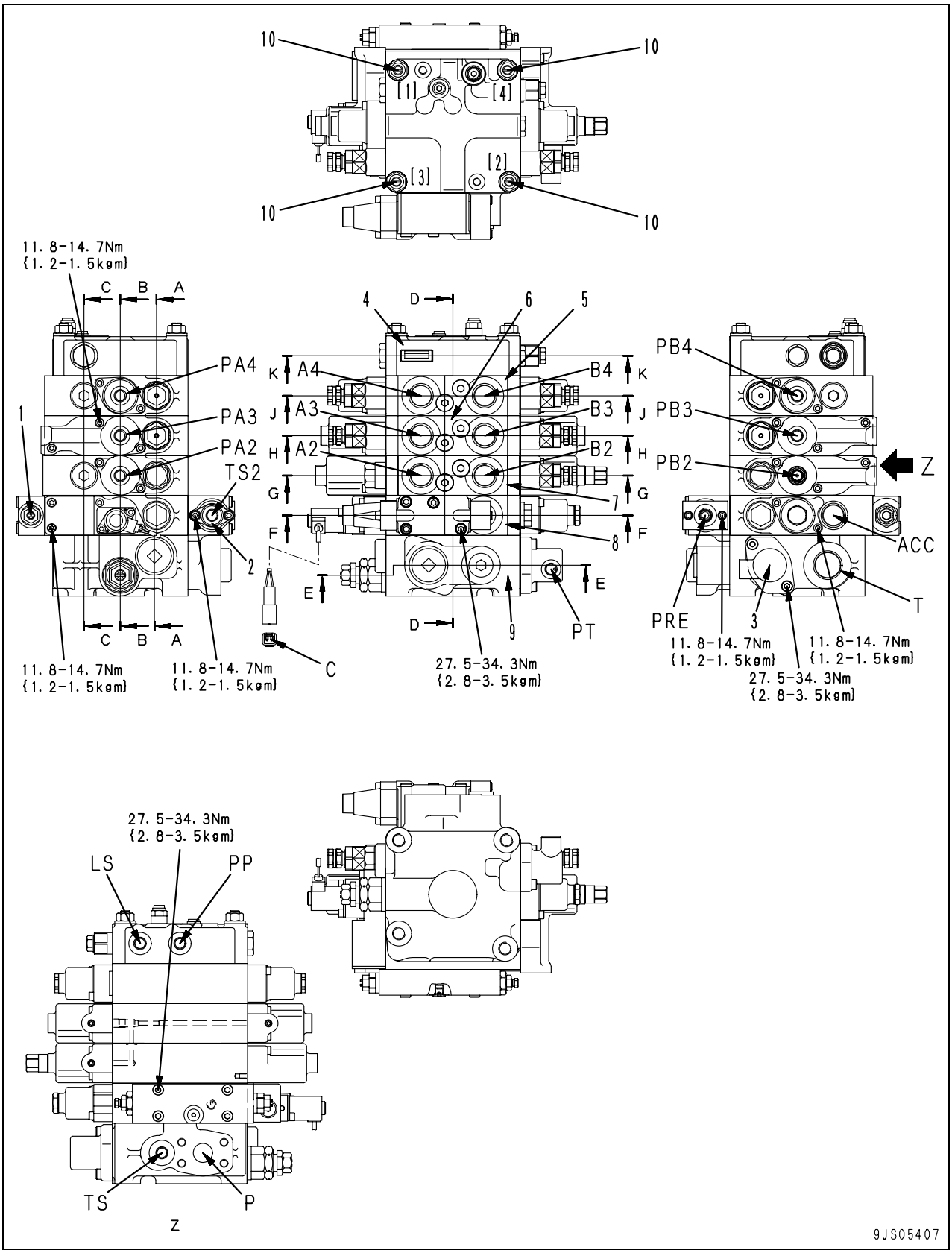
As for outside views and sectional views, only the 4-spool valve (3-spool valve + service valve) is shown.

A2 : To lift cylinder bottom
A3 : To bucket cylinder bottom
A4 : To service actuator
ACC: To ECSS accumulator
B2 : To lift cylinder head
B3 : To bucket cylinder head
B4 : To service actuator
C: To controller
LS : To main pump LS port
P: From main pump
PA2: From lift arm raise PPC valve
PA3: From bucket tilt PPC valve
PA4: From service PPC valve
PB2: From lift arm lower PPC valve
PB3: From bucket dump PPC valve
PB4: From service PPC valve
PP: To main pump
PRE: From lift arm lower PPC valve
PT : From lift arm lower PPC valve
T: To tank
TS : To tank
TS2: To tank

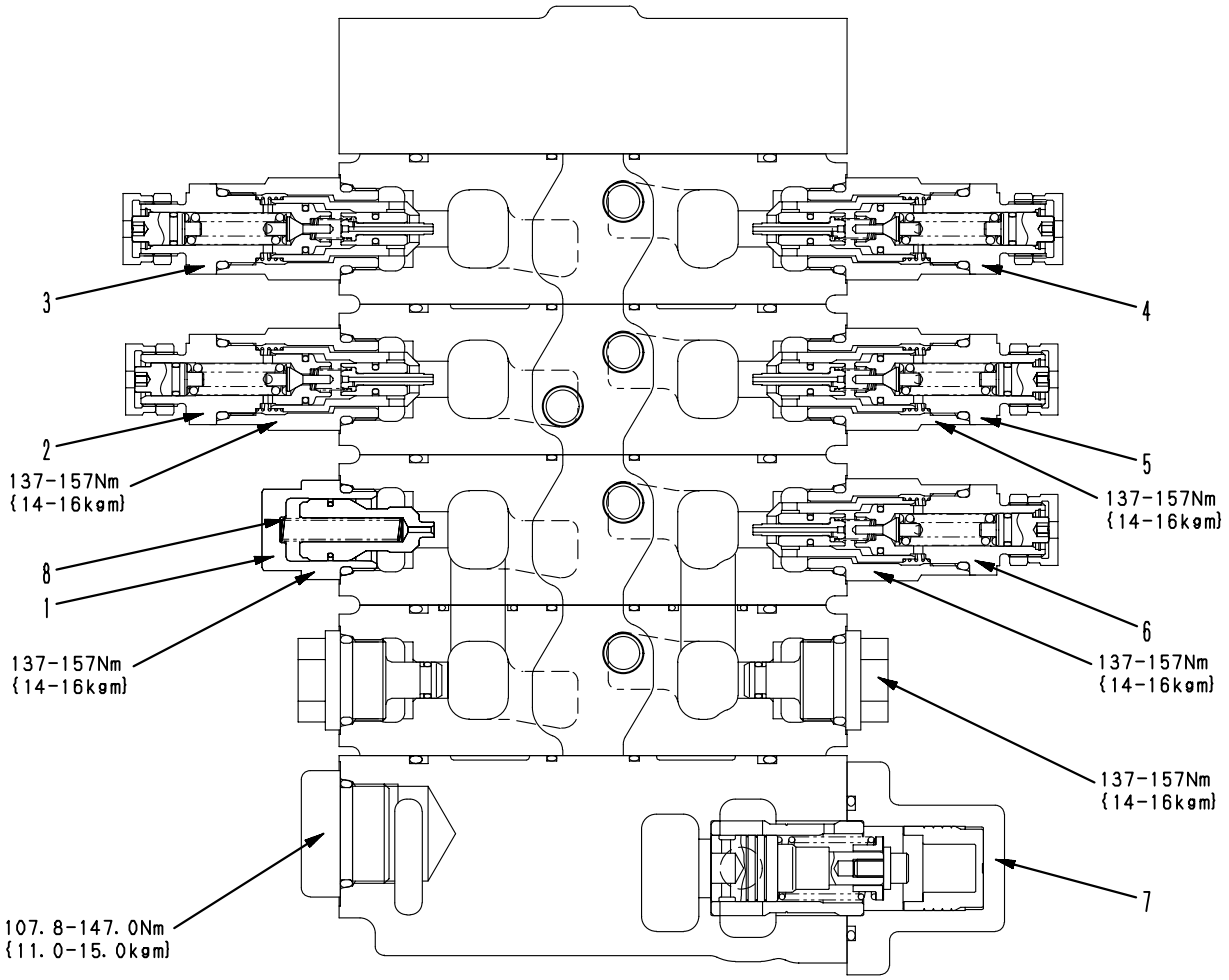
1. Accumulator charge valve
2. Lift arm regeneration valve
3. Lift check valve
4. Top cover
5. Service valve
6. Bucket valve
7. Lift arm valve
8. ECSS control valve
9. PT port block

★ Tighten mounting nuts (10) of top cover (4) in 3 times in the order of [1], [2], [3], and [4].
1st time tightening torque: 58.8 – 68.6 Nm {6 – 7 kgm}
2nd time tightening torque: 78.5 – 88.3 Nm {8 – 9 kgm}
3rd time tightening torque: 98.1 – 113 Nm {10 – 11.5 kgm}

4-spool valve



Sectional view
(1/7)

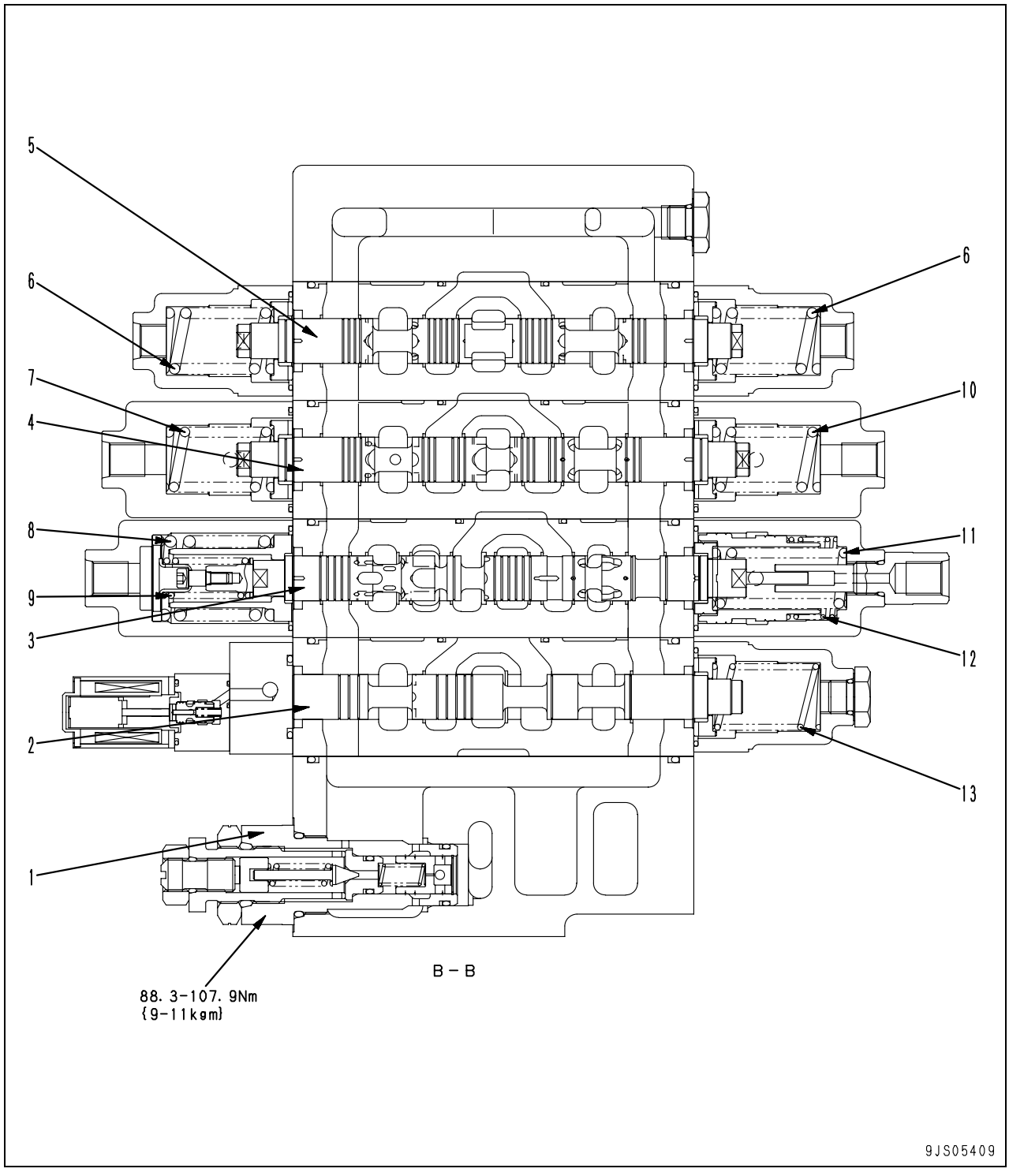


1. Suction valve (Lift arm bottom)
2. Safety-suction valve (Bucket bottom)
3. Safety-suction valve (Service actuator)
4. Safety-suction valve (Service actuator)
5. Safety-suction valve (Bucket head)
6. Suction valve (Lift arm head)
7. Variable back pressure valve (Lift check valve)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
8	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	5.50 N {0.56 kg}	—	4.40 N {0.45 kg}	

(2/7)

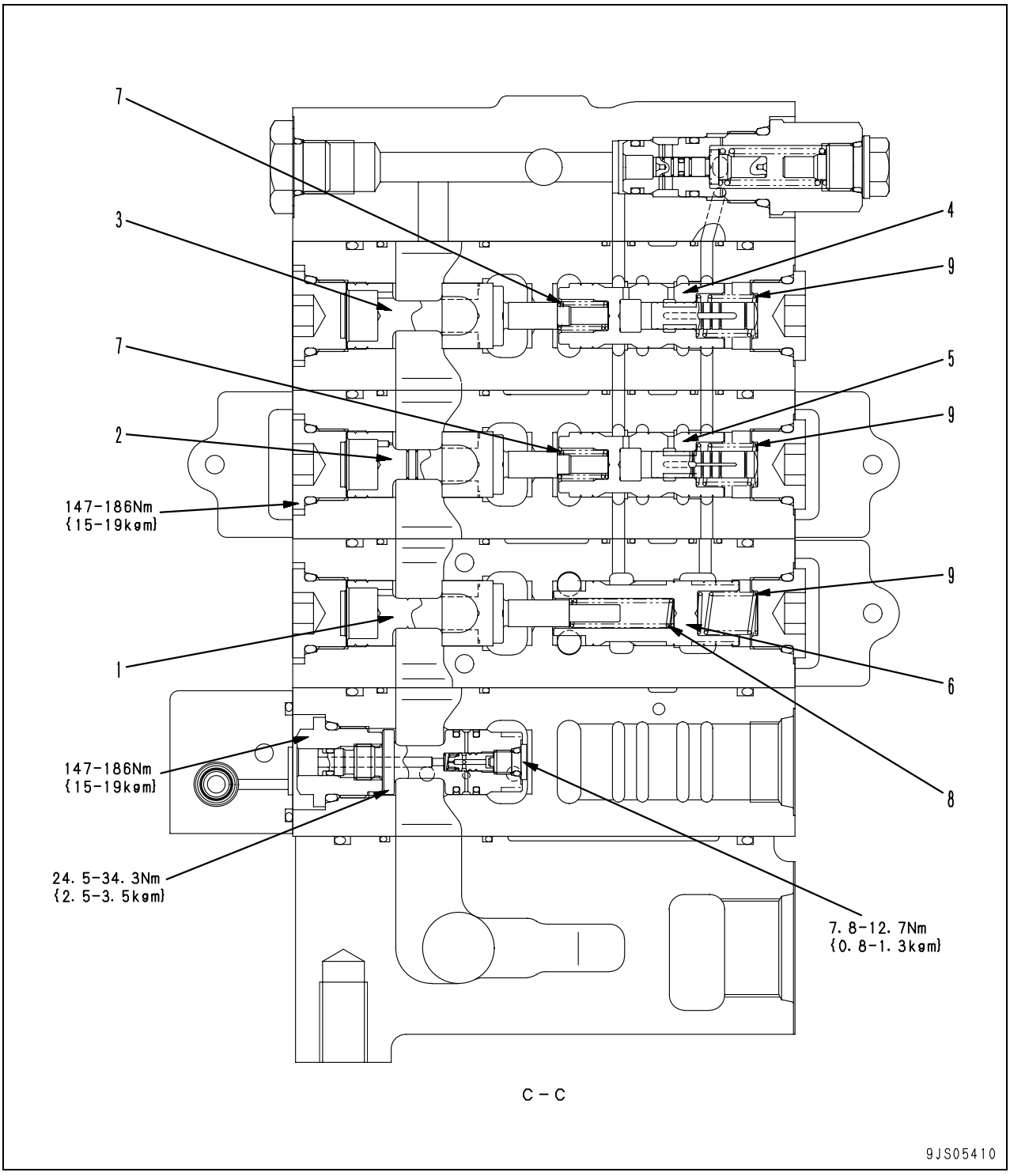


1. Main relief valve
2. Spool (ECSS control)
3. Spool (Lift arm)
4. Spool (Bucket)
5. Spool (Service)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
6	Spool return spring (Service)	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		45.6 x 28	43	230 N {23.5 kg}	—	184 N {18.8 kg}	
7	Spool return spring (Bucket)	47.8 x 27.4	45	125 N {12.7 kg}	—	100 N {10.2 kg}	
8	Spool return spring (Lift arm)	50.2 x 36	47	136 N {13.9 kg}	—	109 N {11.1 kg}	
9	Spool return spring (Lift arm)	53.2 x 17.2	36.8	263 N {26.8 kg}	—	210 N {21.4 kg}	
10	Spool return spring (Bucket)	47.1 x 27.4	45	114 N {11.6 kg}	—	91 N {9.28 kg}	
11	Spool return spring (Lift arm)	56.6 x 25.5	54	162 N {16.51 kg}	—	129 N {13.2 kg}	
12	Piston return spring (Lift arm)	77.1 x 34.7	21	55.9 N {5.7 kg}	—	44.7 N {4.56 kg}	
13	Spool return spring (ECSS)	61.3 x 28	45	83.6 N {8.52 kg}	—	66.9 N {6.82 kg}	

(3/7)


7
3
7
2
147-186Nm
{15-19kgm}
1
147-186Nm
{15-19kgm}
24.5-34.3Nm
{2.5-3.5kgm}
4
9
5
9
9
6
8
7.8-12.7Nm
{0.8-1.3kgm}
C - C
9JS05410

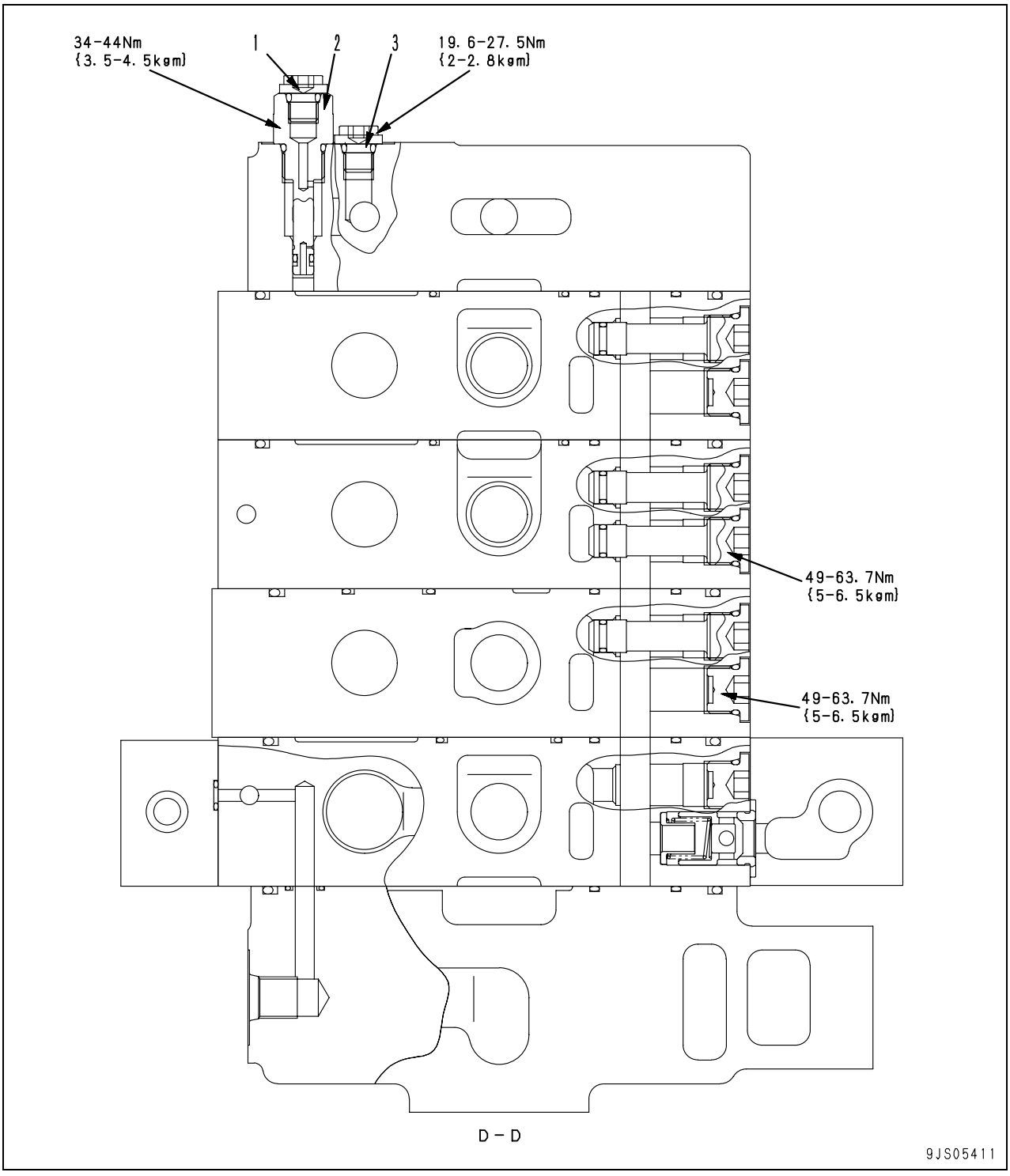
1. Pressure compensation valve F (Lift arm)
2. Pressure compensation valve F (Bucket)
3. Pressure compensation valve F (Service)
4. Pressure compensation valve R (Service)
5. Pressure compensation valve R (Bucket)
6. Pressure compensation valve R (Lift arm)

F: Flow control valve
R: Pressure reducing valve

Unit: mm

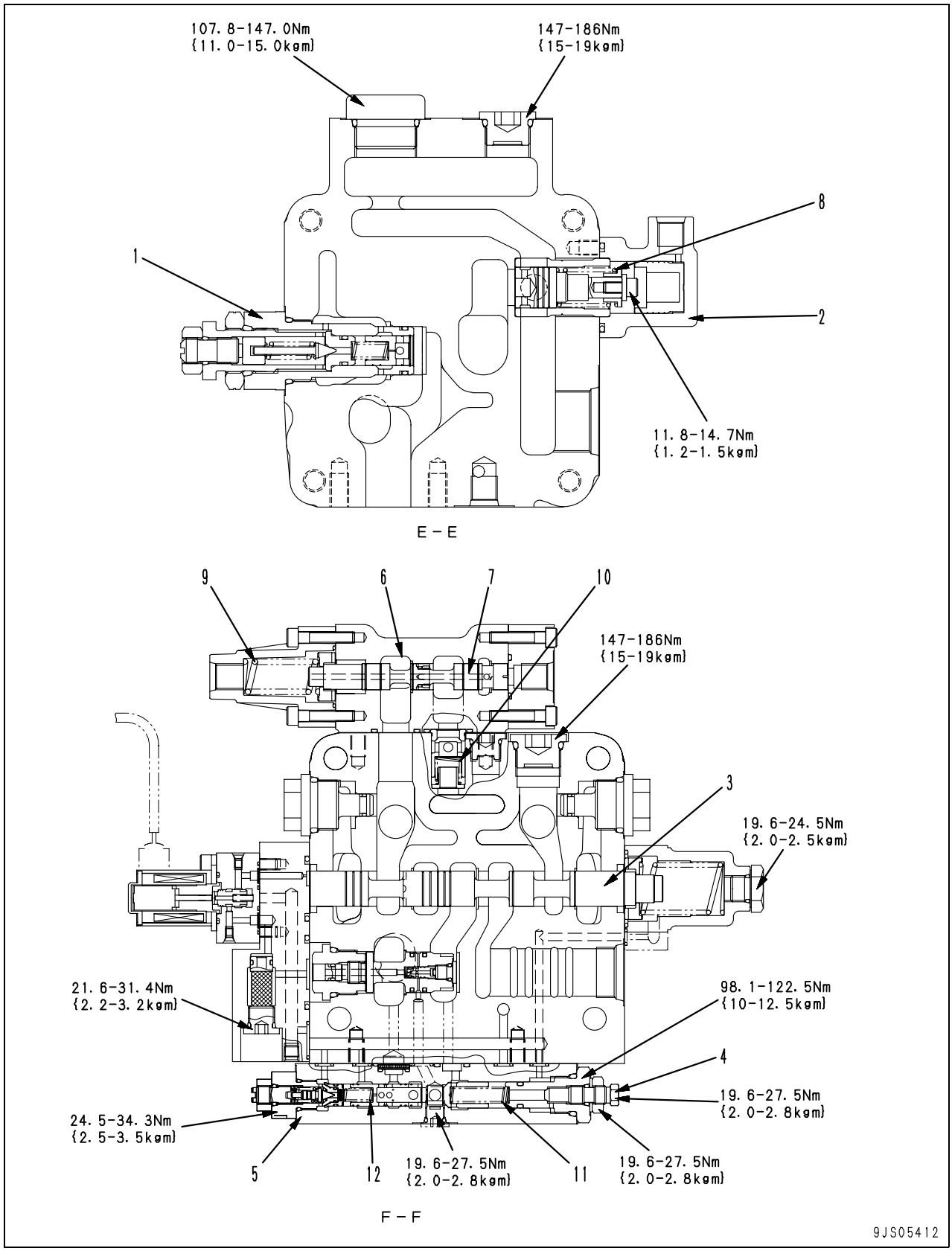
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
7	Flow control valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		33.2 x 9.5	26	24.5 N {2.5 kg}	—	19.6 N {2.0 kg}	
8	Flow control valve spring	45.7 x 9.5	35	24.5 N {2.5 kg}	—	19.6 N {2.0 kg}	
9	Pressure reducing valve spring	27.5 x 14.2	18	17.7 N {1.8 kg}	—	14.1 N {1.44 kg}	

(4/7)



1. LS pressure pickup plug
2. LS bypass plug
3. Pump pressure pickup plug

(5/7)

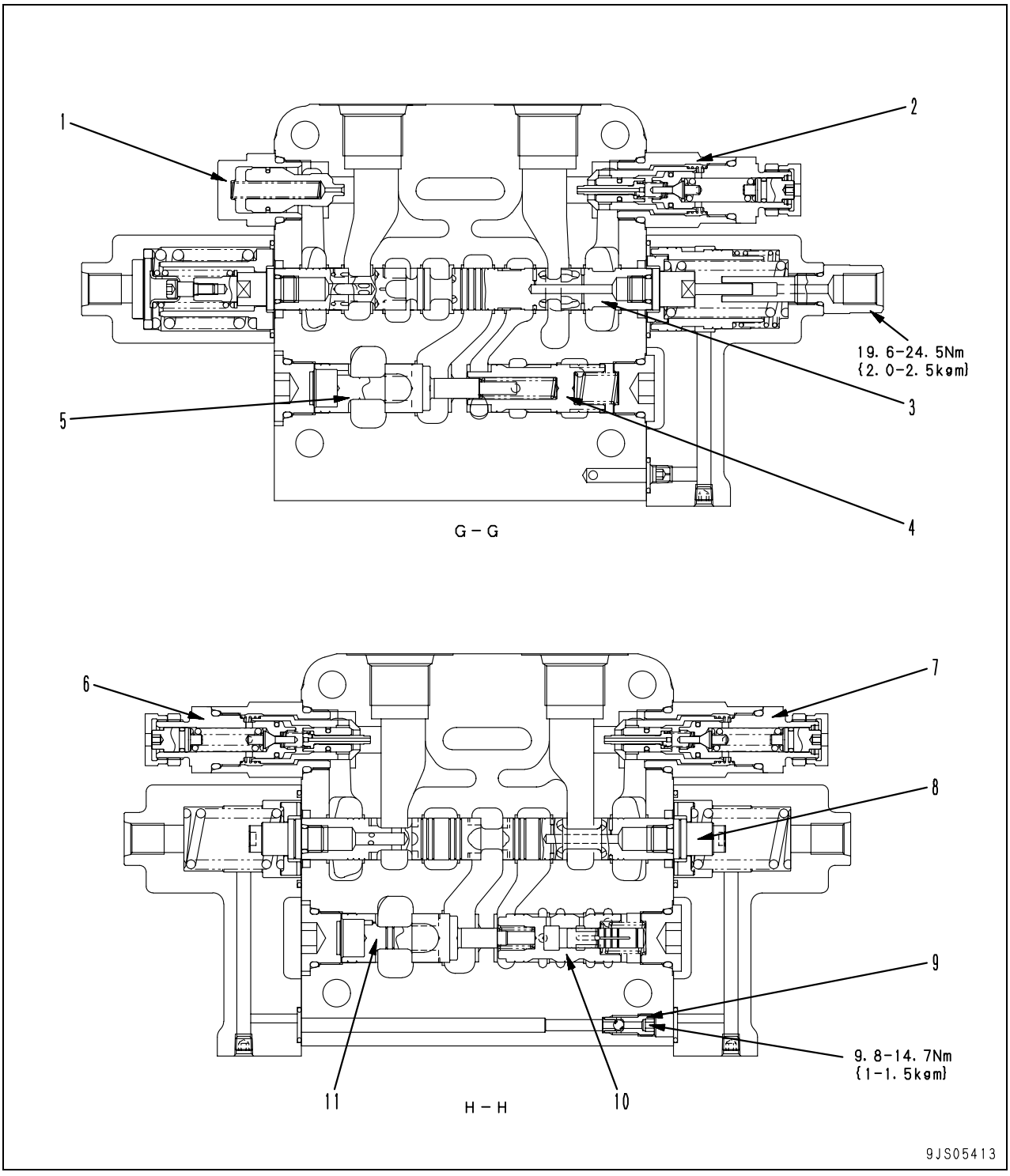

107.8-147.0Nm
{11.0-15.0kgm}
147-186Nm
{15-19kgm}
8
1
2
11.8-14.7Nm
{1.2-1.5kgm}
E-E
9
6
7
10
147-186Nm
{15-19kgm}
3
19.6-24.5Nm
{2.0-2.5kgm}
21.6-31.4Nm
{2.2-3.2kgm}
98.1-122.5Nm
{10-12.5kgm}
4
19.6-27.5Nm
{2.0-2.8kgm}
24.5-34.3Nm
{2.5-3.5kgm}
5
12
19.6-27.5Nm
{2.0-2.8kgm}
11
19.6-27.5Nm
{2.0-2.8kgm}
F-F
9JS05412

1. Main relief valve
2. Variable back pressure valve (Lift check valve)
3. Spool (ECSS control valve)
4. Accumulator pressure relief plug
5. Accumulator charge valve
6. Lift arm regeneration valve
7. Spool (Lift arm regeneration valve)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
8	Spring (Lift check valve)	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		34.04 x 21	32	10.4 N {1.06 kg}	—	8.34 N {0.85 kg}	
9	Spring (Lift arm regeneration valve)	41.71 x 19.2	40.5	45.1 N {4.6 kg}	—	36.1 N {3.68 kg}	
10	Spring (Check valve)	20.3 x 13.7	16	2.94 N {0.3 kg}	—	2.35 N {0.24 kg}	
11	Spring (Check valve)	41.5 x 8.5	31.5	5.9 N {0.6 kg}	—	4.71 N {0.48 kg}	
12	Spring	19.15 x 7.2	16.05	19.6 N {2 kg}	—	15.7 N {1.6 kg}	

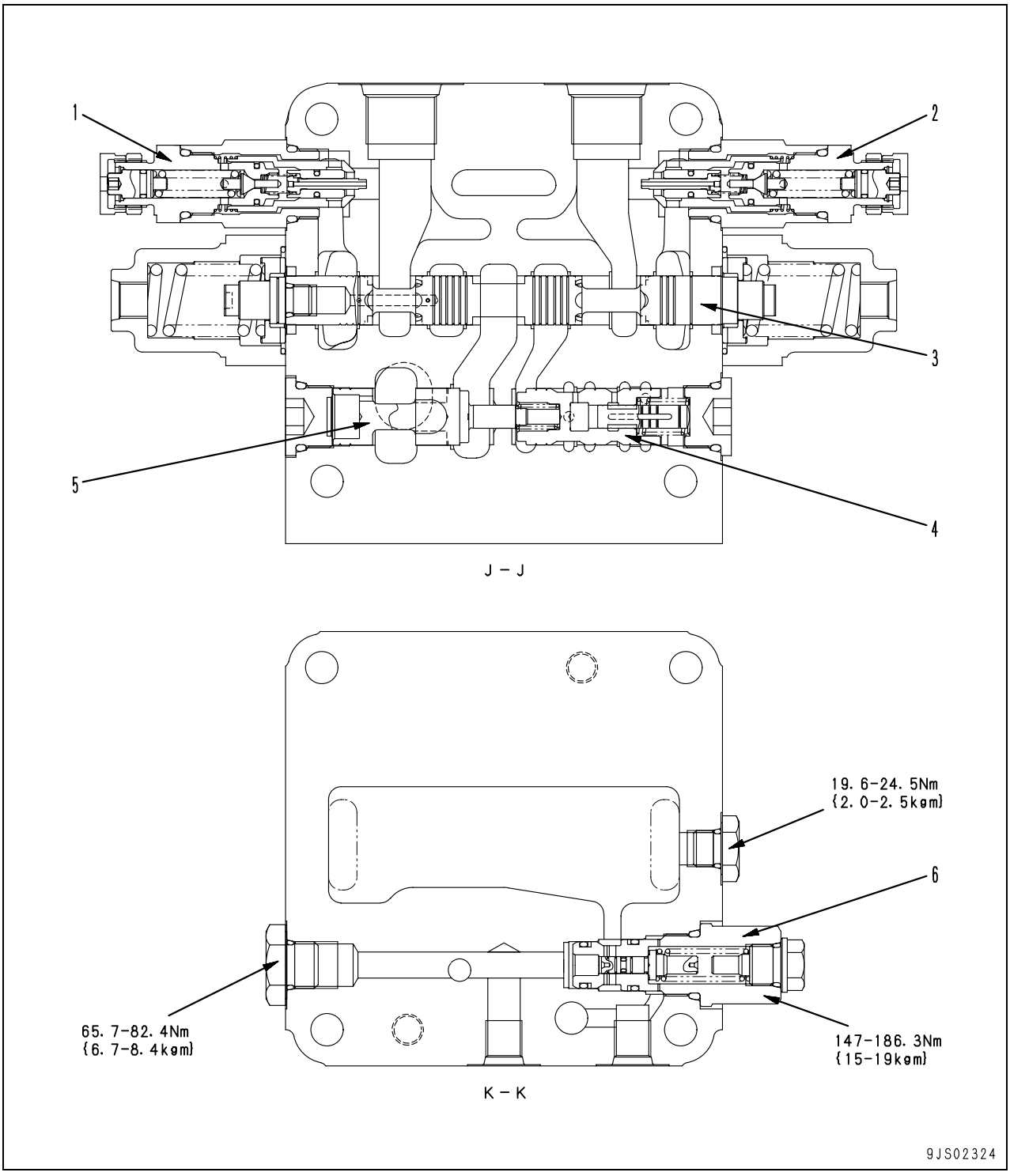
(6/7)



1. Suction valve
2. Safety-suction valve
3. Spool (lift arm)
4. Pressure compensation valve R
5. Pressure compensation valve F
6. Safety-suction valve
7. Safety-suction valve
8. Spool (Bucket)
9. Shuttle valve
10. Pressure compensation valve F
11. Pressure compensation valve R

F: Flow control valve
R: Pressure reducing valve

(7/7)

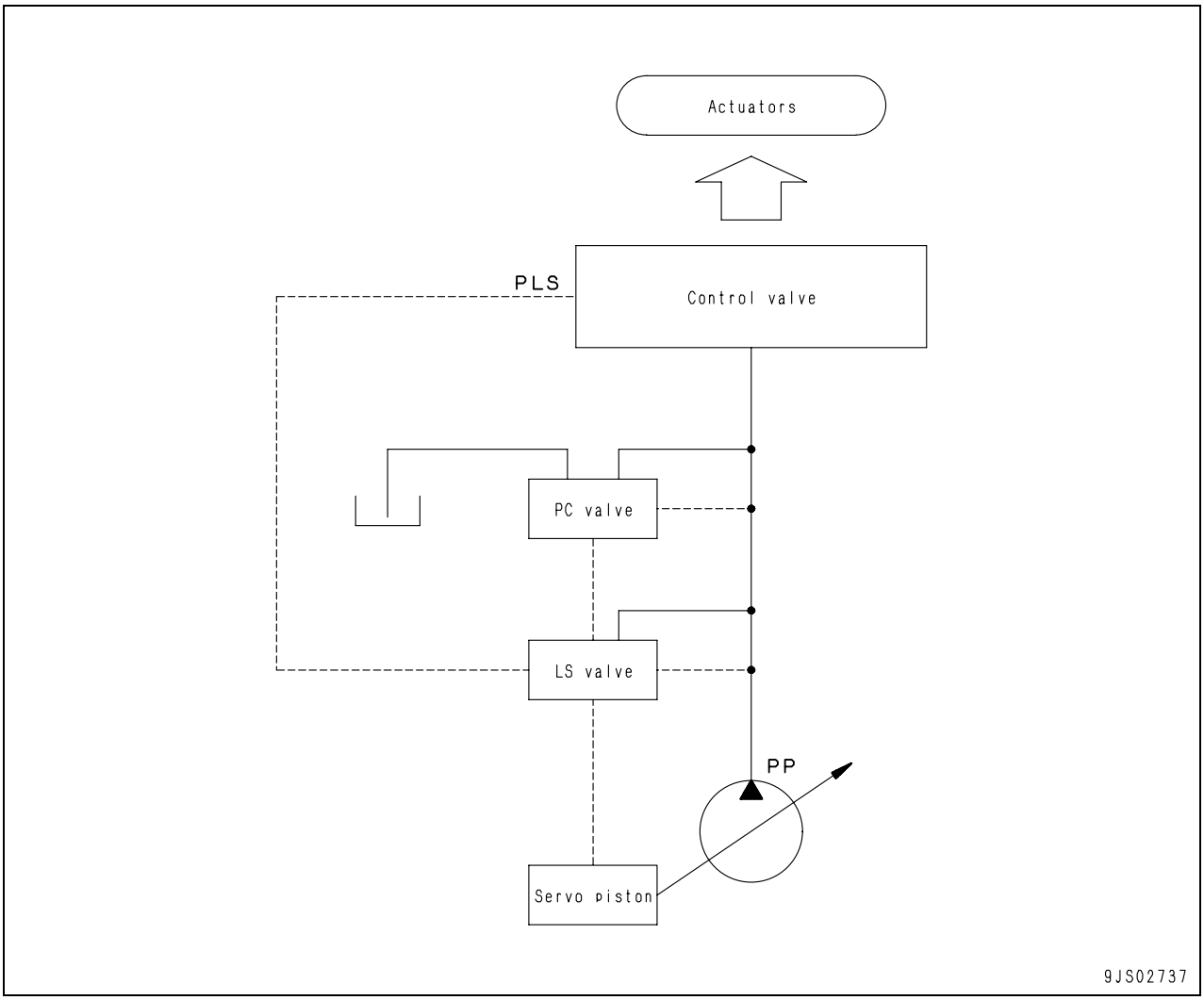


1. Safety-suction valve
2. Safety-suction valve
3. Spool (Service)
4. Pressure compensation valve F
5. Pressure compensation valve R
6. Unload valve

F: Flow control valve
R: Pressure reducing valve

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

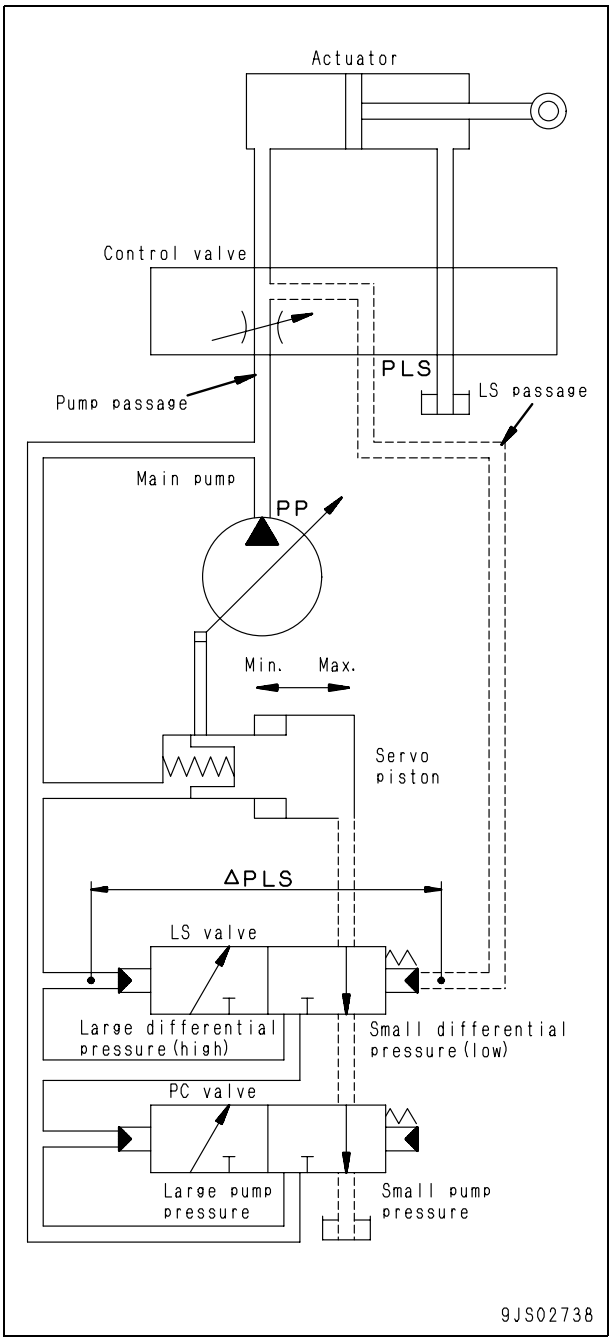
Structure

- CLSS is configured with a variable capacity piston pump, control valves, and respective actuators.
- The pump unit is composed of the main pump, PC valve, and LS valve.

Basic principle

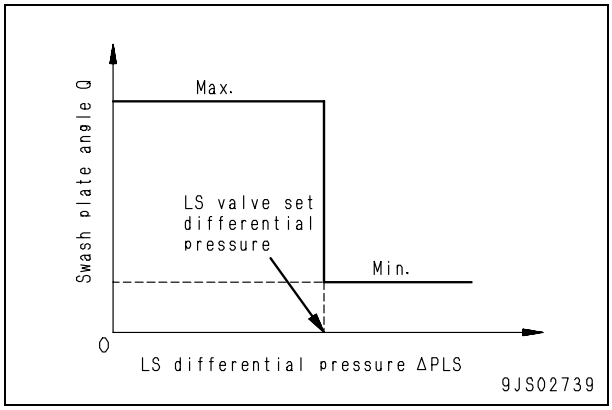
1. Pump swash plate angle control

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



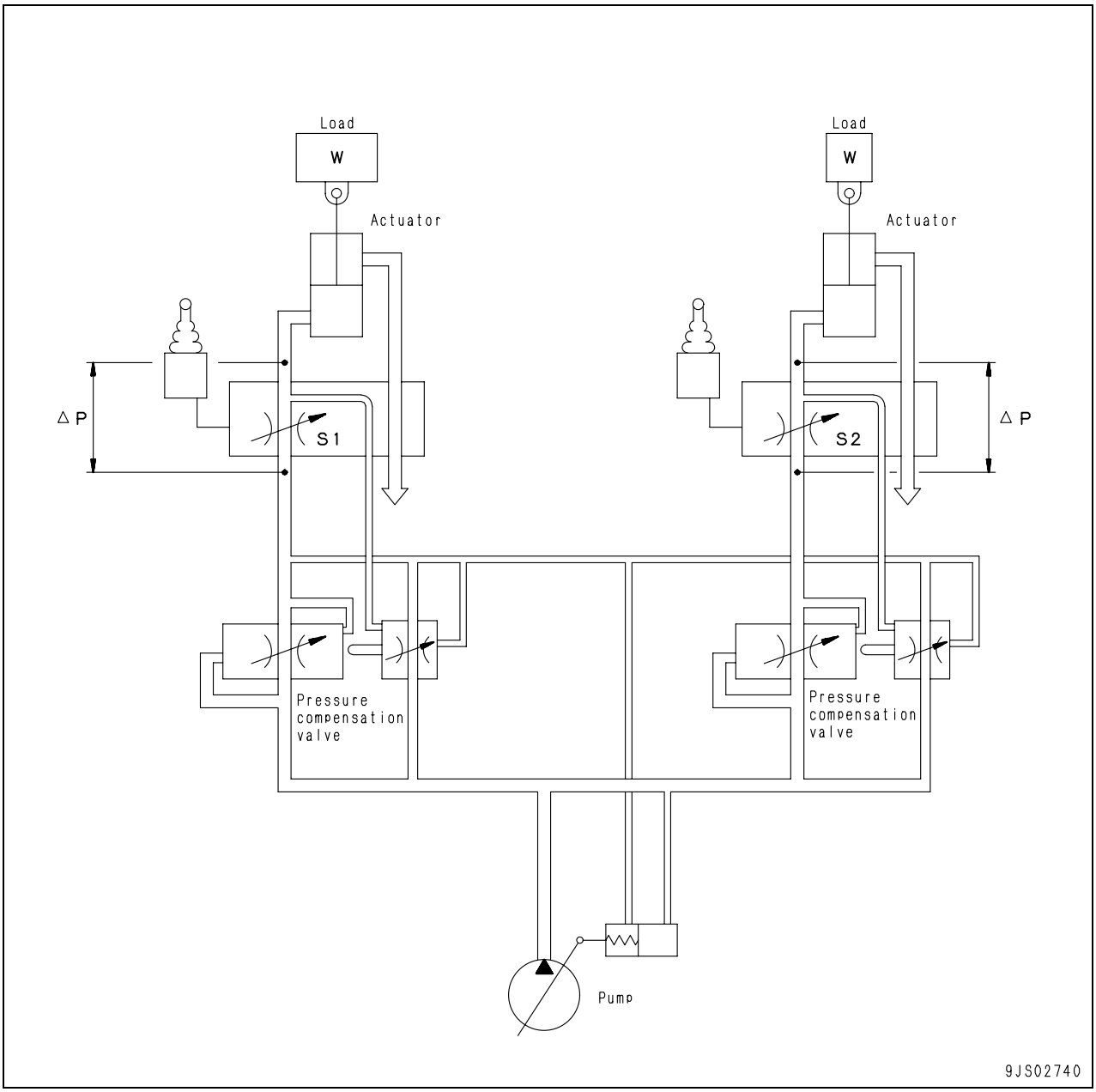
- If the LS differential pressure (✕PLS) lowers below the set pressure of the LS valve (the actuator load pressure is high), the pump swash plate angle is increased. If the LS differential pressure rises above the set pressure (the actuator load pressure is low), the pump swash plate angle is decreased.

LS differential pressure (✕PLS) and pump swash plate angle



★ For details of operation, see “Work equipment pump”.

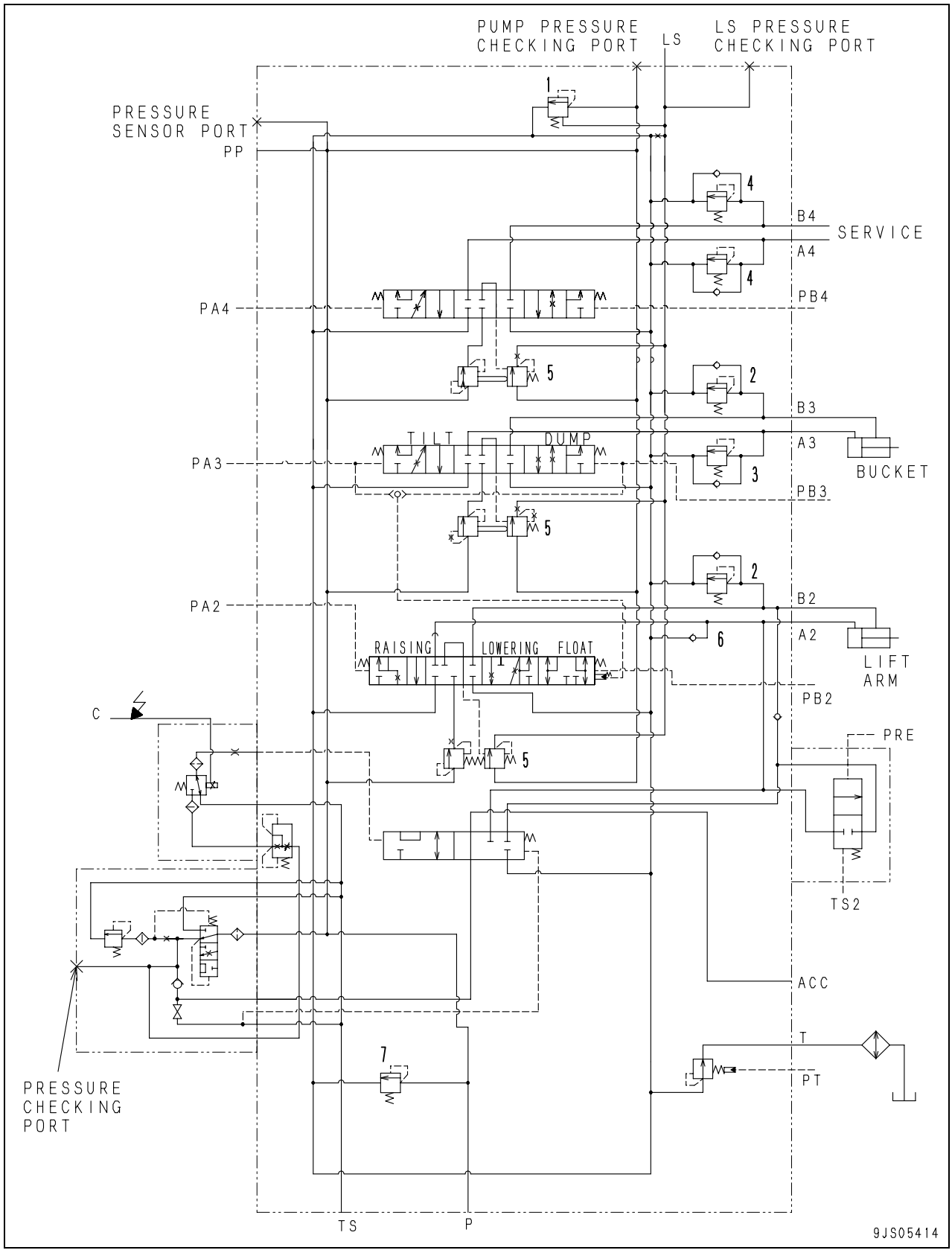
2. Pressure compensation control



- The valves (pressure compensation valves) to balance the load are installed to the outlet side of the control valve. With these valves, when multiple actuators are operated simultaneously, the pressure difference (✕P) between the upstream (inlet) side and downstream (outlet) side of each valve is kept constant, regardless of the load (pressure). Consequently, flow of oil from the pump is divided (compensated) in proportion to the open areas (S1) and (S2) of respective valves.

Each function and operation of each valve

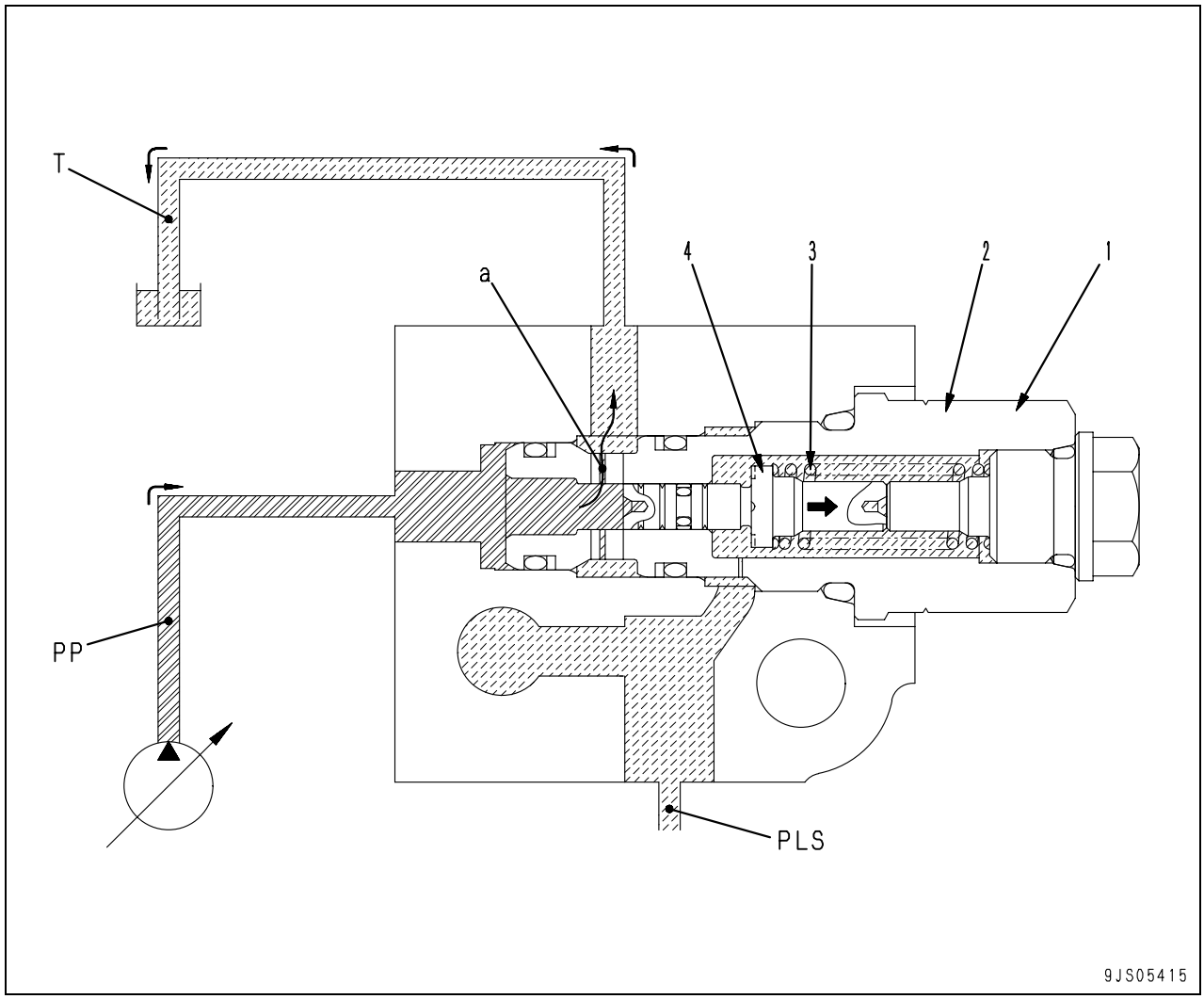
Hydraulic circuit diagram and names of valves



1. Unload valve
   Set pressure: 2.35 MPa {24.0 kg/cm^2}
2. Safety-suction valve
   Set pressure: 38.2 MPa {390 kg/cm^2}
3. Safety-suction valve
   Set pressure: 34.3 MPa {350 kg/cm^2}
4. Safety-suction valve
   Set pressure: 20.1 MPa {205 kg/cm^2}
5. Pressure compensation valve
6. Suction valve
7. Main relief valve
   Set pressure: 31.4 MPa {320 kg/cm^2}
8. Variable lift check valve

Unload valve

1. When control valve is at neutral



T: Tank circuit (pressure)
PP: Pump circuit (pressure)
PLS: LS circuit (pressure)

1. Unload valve
2. Sleeve
3. Spring
4. Spool

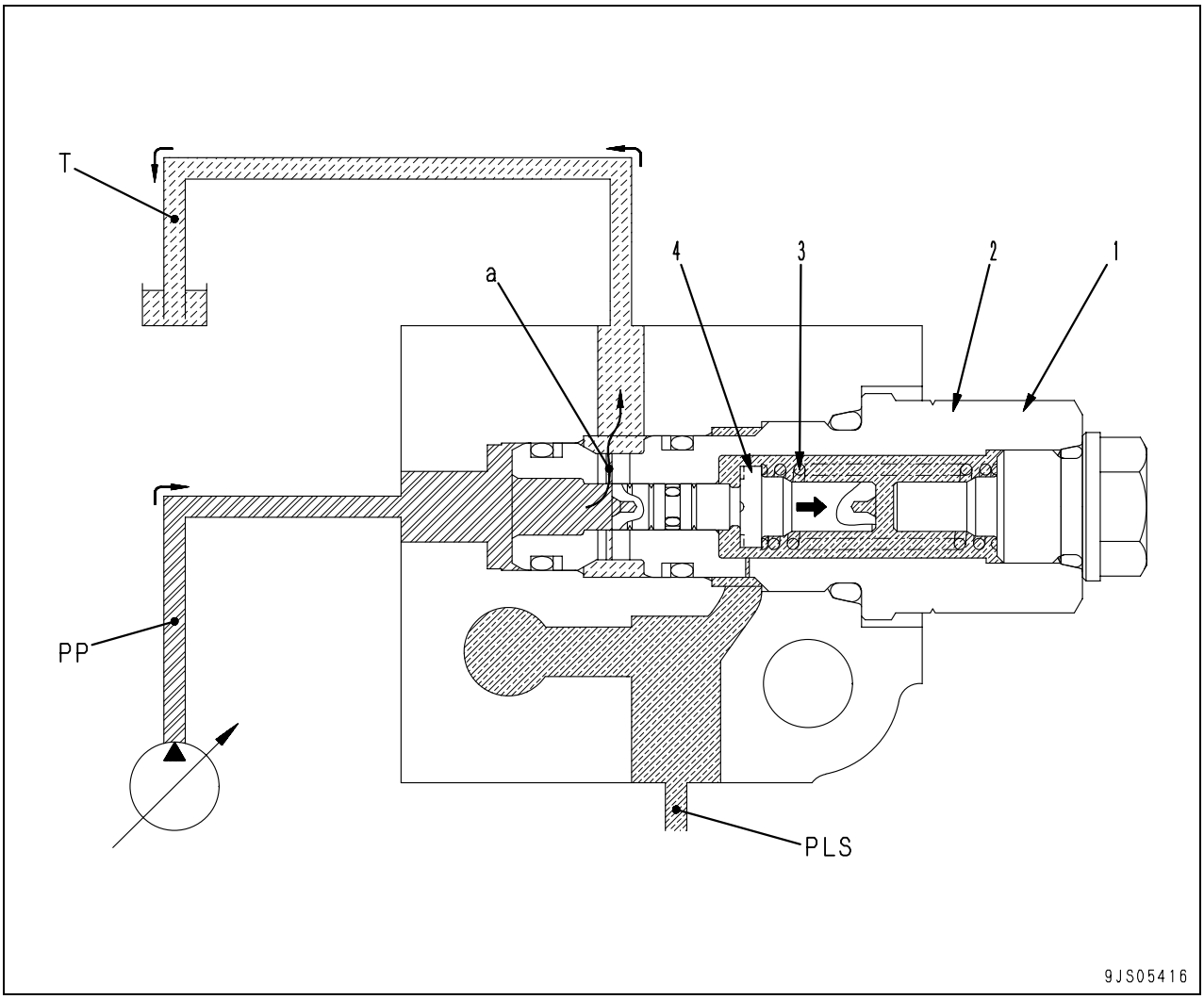
Function

- When the control valve is in neutral, delivery (Q) at the minimum pump swash plate angle is released to the tank circuit. At this point, pump discharge pressure (PP) is set to 1.77 MPa {18.0 kg/cm^2} by spring (3) of the valve. (LS pressure (PLS) is 0 MPa {0 kg/cm^2})

Operation

- Pump discharge pressure (PP) is applied to the left end of spool (4) and LS pressure (PLS) is applied to the right end.
- When the control valve is in neutral, LS pressure (PLS) is 0. Accordingly, only pump discharge pressure (PP) is applied and it is set with only the spring load of spring (3).
- If pump discharge pressure (PP) rises to the spring load of 1.77 MPa {18.0 kg/cm^2} of spring (3), spool (4) moves to the right and pump circuit (PP) is connected to tank circuit (T) through hole (a) of sleeve (2).
- By this operation, pump discharge pressure (PP) is set to 1.77 MPa {18.0 kg/cm^2}.

2. When control valve is controlled finely



T: Tank circuit (pressure)
PP: Pump circuit (pressure)
PLS: LS circuit (pressure)

1. Unload valve
2. Sleeve
3. Spring
4. Spool

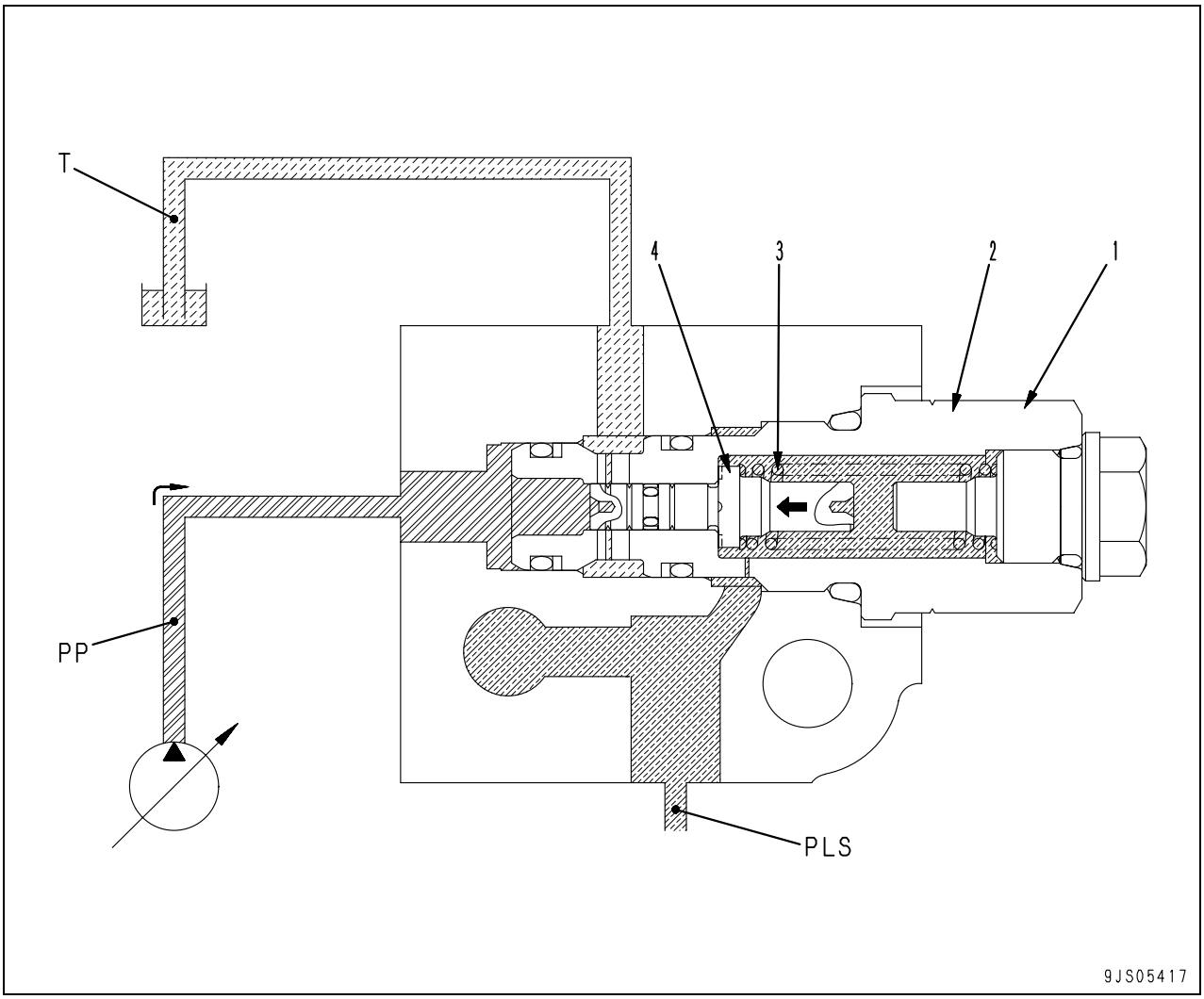
Function

- When the control valve is controlled finely, if the demand flow for the actuator is below the delivery at the minimum pump swash plate angle, pump discharge pressure (PP) is set to LS pressure (PLS) + 1.77 MPa {18.0 kg/cm^2}. If the differential pressure between discharge pressure (PP) and LS pressure (PLS) becomes the spring load of spring (3) (1.77 MPa {18.0 kg/cm^2}), the unload valve opens. Accordingly, LS differential pressure (✕PLS) becomes 1.77 MPa {18.0 kg/cm^2}.

Operation

- If the control valve is controlled finely, LS pressure (PLS) is generated and applied to the right end of spool (4). Since the open area of the control valve spool is narrow at this time, the difference between the LS pressure (PLS) and pump discharge pressure (PP) is large.
- If the differential pressure between pump discharge pressure (PP) and LS pressure (PLS) reaches the spring load (1.77 MPa {18.0 kg/cm^2}), spool (4) moves to the right and pump circuit (PP) is connected to tank circuit (T).
- Pump discharge pressure (PP) is set to the spring force (1.77 MPa {18.0 kg/cm^2}) + LS pressure (PLS) and the LS differential pressure (✕PLS) becomes 1.77 MPa {18.0 kg/cm^2}.

3. When control valve is operated



T: Tank circuit (pressure)
PP: Pump circuit (pressure)
PLS: LS circuit (pressure)

1. Unload valve
2. Sleeve
3. Spring
4. Spool

Function

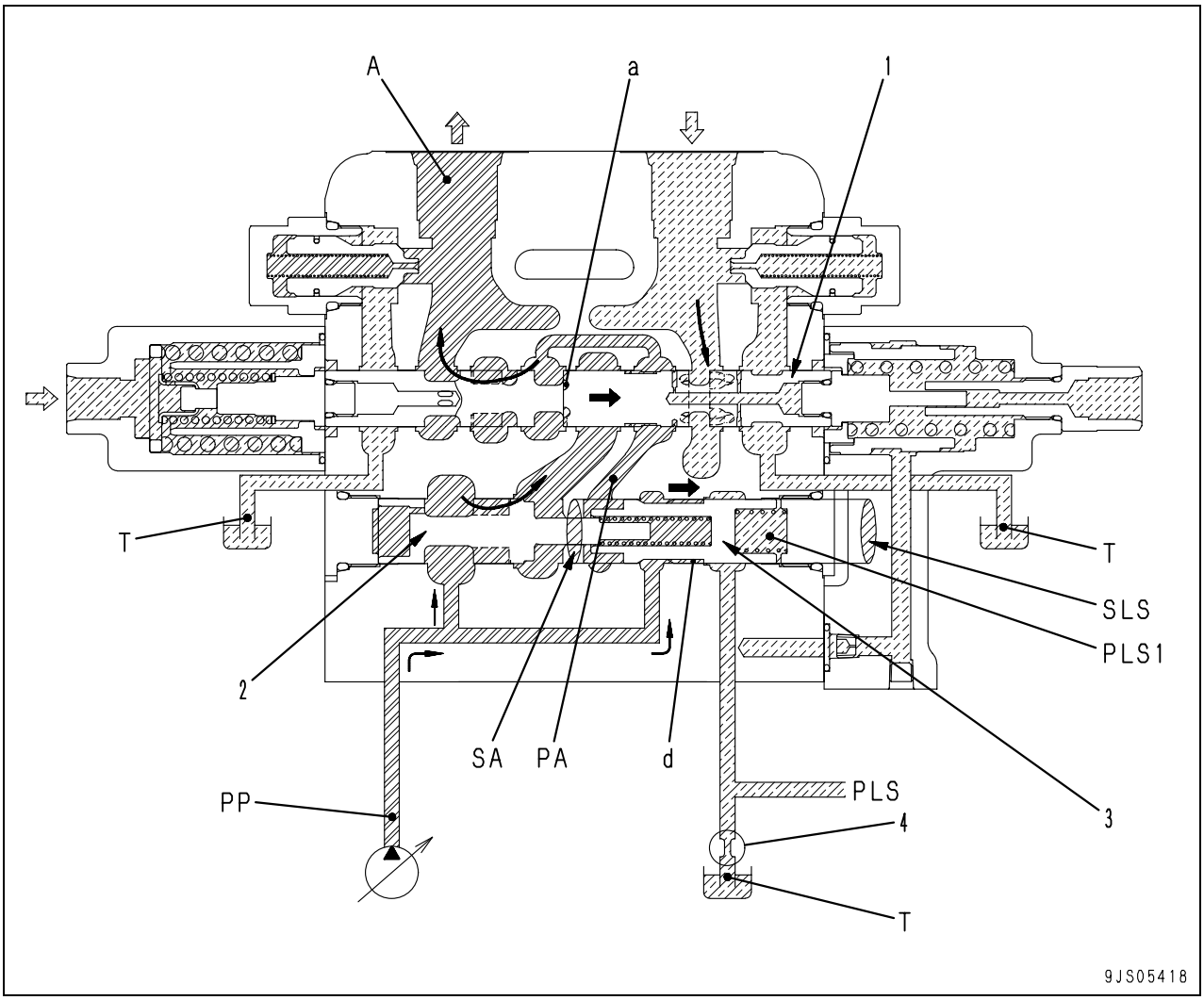
- When the control valve is operated, if the demand flow for the actuator exceeds the delivery at the minimum pump swash plate angle, the oil flow to tank circuit (T) is stopped and all of pump delivery (Q) is supplied to the actuator circuit.

Operation

- If the control valve is operated largely, LS pressure (PLS) is generated and applied to the right end of spool (4). At this time, since the open area of the control valve is wide, the difference between LS pressure (PLS) and pump discharge pressure (PP) is a little.
- Since the differential pressure between pump discharge pressure (PP) and LS pressure (PLS) does not reach the spring load of 1.77 MPa {18.0 kg/cm^2} of spring (3), spool (4) is pushed to the left by spring (3).
- Pump circuit (PP) is disconnected from tank circuit (T) and all of pump delivery (Q) is supplied to the actuator circuit.

Supply of LS pressure

1. Work equipment valve (Lift arm)



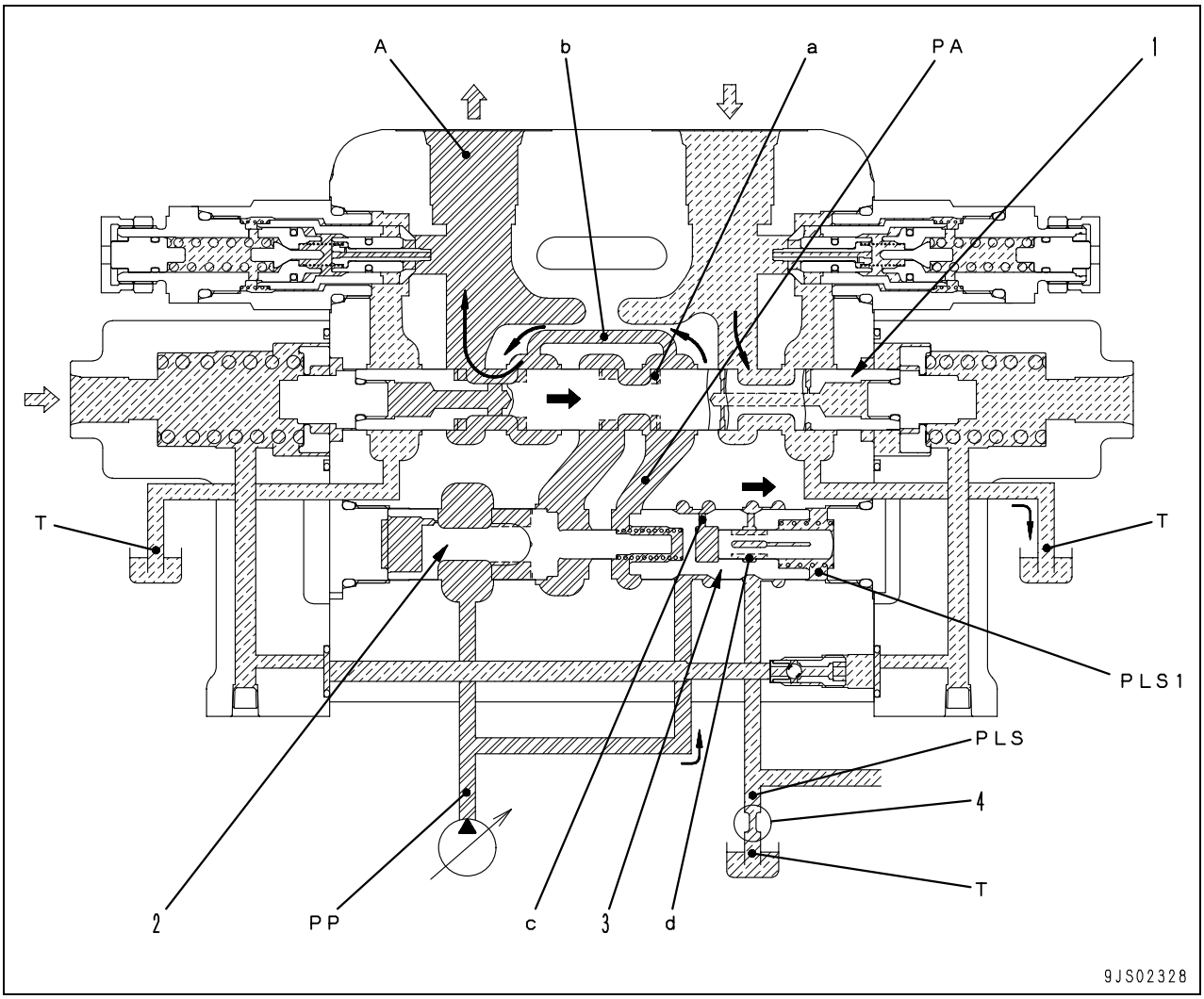
Function

- The LS pressure means the actuator load pressure on the outlet side of the control valve.
- In the work equipment valve, actually, pressure reducing valve (3) of the pressure compensation valve reduces pump discharge pressure (PP) to the level of actuator circuit pressure (A), and then supplies it to LS circuit (PLS).

Operation

- If spool (1) is operated, pump discharge pressure (PP) flows through flow control valve (2) and notch (a) of the spool to actuator circuit (A).
- Since pressure reducing valve (3) also moves to the right at this time, pump discharge pressure (PP) is reduced by the pressure loss in notch (d) and supplied to LS circuit (PLS), and then further led to spring chamber (PLS1).
- At this time, LS circuit (PLS) is connected to tank circuit (T) through LS bypass plug (4).
- Both ends of pressure reducing valve (3) has the same area (SA) = (SLS). Actuator circuit pressure (PA) = (A) is applied to the (SA) side and reduced pump discharge pressure (PP) is applied to the (SLS) side.
- Accordingly, pressure reducing valve (3) is balanced at a position where actuator circuit pressure (PA) and the pressure in spring chamber (PLS1) become the same. Pump discharge pressure (PP) being decreased by notch (d) is supplied as actuator circuit pressure (A) to LS circuit (PLS).

2. Work equipment valve (Bucket and service)



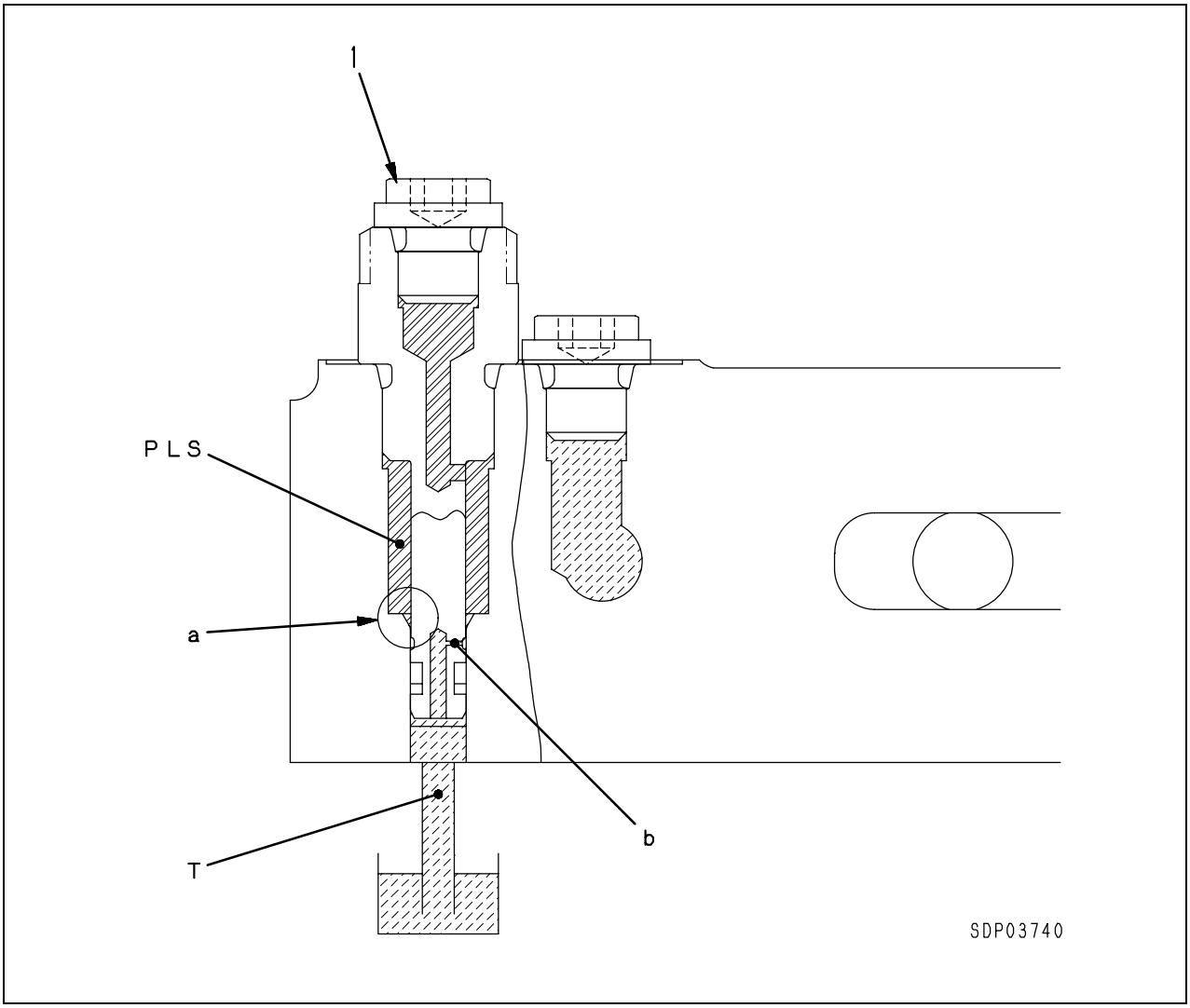
Function

- LS pressure means the actuator load pressure on the outlet side of the control valve.
- Actually, pressure reducing valve (3) of the pressure compensation valve reduces pump (discharge) pressure (PP) to the level of actuator circuit pressure (PA) = (A), and then supplies it to the LS circuit (PLS).

Operation

- If spool (1) is operated, pump discharge pressure (PP) flows through flow control valve (2), notch (a) of the spool, and bridge pass (b) to actuator circuit (A).
- Since pressure reducing valve (3) also moves to the right at this time, pump pressure (PP) is reduced by the pressure loss in notch (c) and supplied to LS circuit (PLS), and then further led to spring chamber (PLS1).
- At this time, LS circuit (PLS) is connected to tank circuit (T) through LS bypass plug (4). (See the section of the LS bypass plug.)
- Actuator circuit pressure (A) is applied to the left side of the pressure reducing valve (3) and reduced pump pressure (PP) is applied to the opposite side.
- Pressure reducing valve (3) is balanced at a position where actuator circuit pressure (A) and the pressure in spring chamber (PLS) become the same. Pump discharge pressure (PP) being decreased by notch (a) is supplied as actuator circuit pressure (A) to LS circuit (PLS).

LS bypass plug



T: Tank circuit (pressure)
PLS: LS circuit (pressure)

1. LS bypass plug

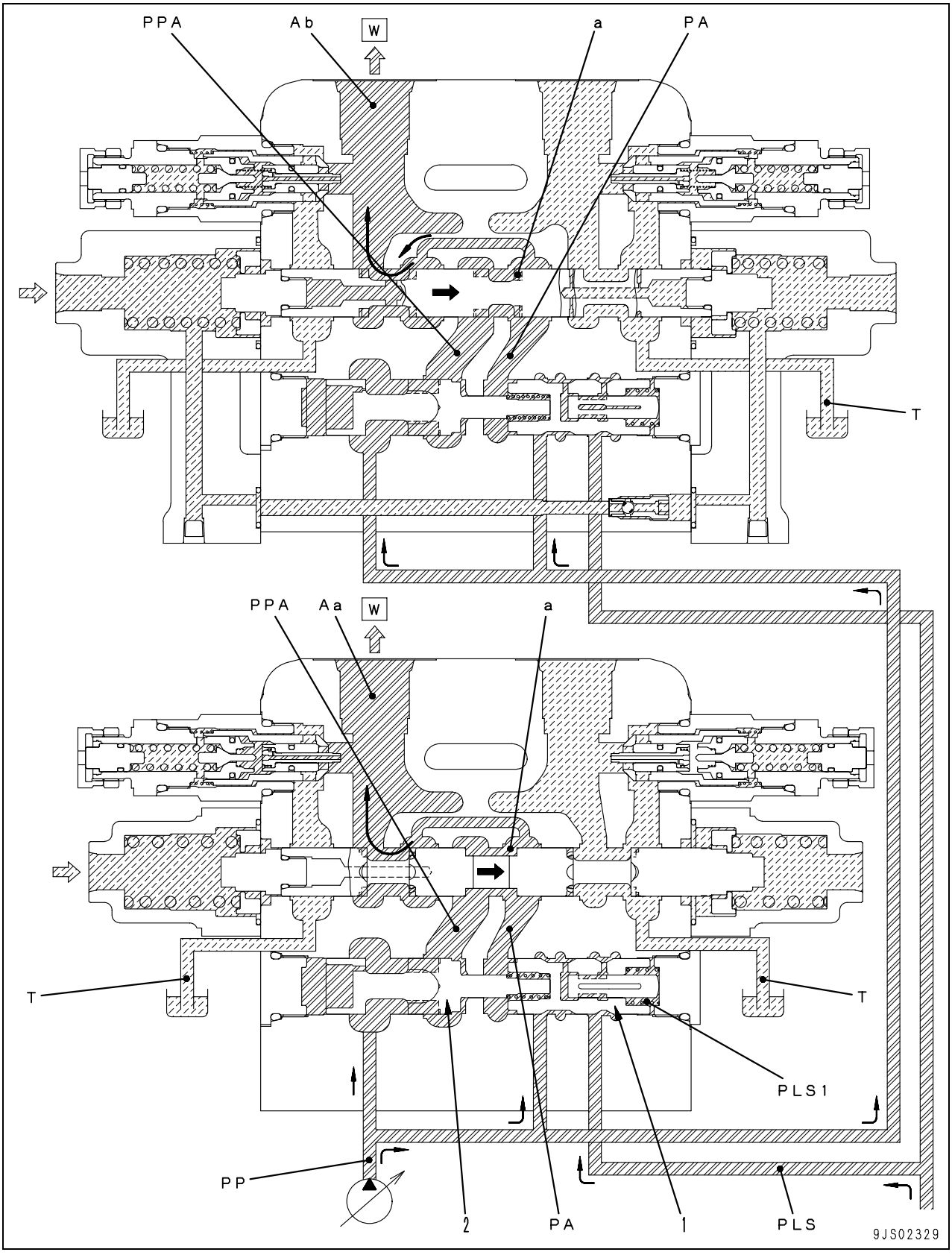
Function

- LS bypass plug releases residual LS pressure (PLS).
- The LS bypass plug lowers the rising speed of LS pressure (PLS) and makes pressure loss in the spool and shuttle valve with the discarded throttle flow to lower the effective LS differential pressure, and increases the stability.

Operation

- The pressurized oil in LS circuit (PLS) flows through clearance filter (a) formed by the clearance between LS bypass plug (1) and valve body, and then flows through orifice (b) to tank circuit (T).

Pressure compensation valve



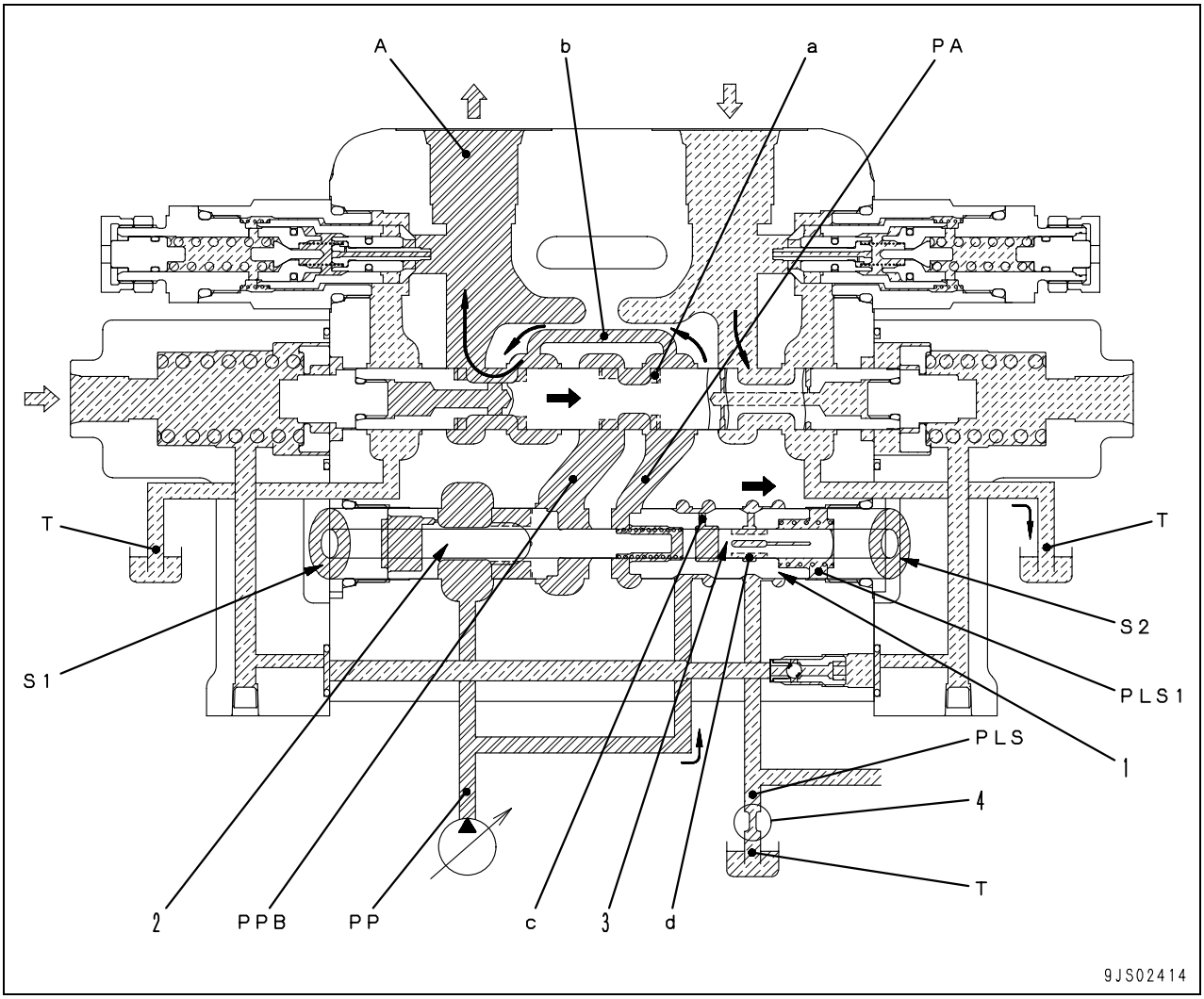
Function

- In the compound operation, if the load pressure becomes lower than the pressure in the other actuators and the flow rate starts increasing, the pressure compensation valve compensates the pressure. [At this time, the load pressure in the other actuator operated for the compound operation (on the upper side) is higher than the load pressure on this side (lower side).]

Operation

- In the same operation, if the load pressure in the other actuators (on the upper side) becomes high, the flow rate in actuator circuit (Aa) on this side (lower side) starts increasing.
- In this case, LS pressure (PLS) in the other actuator is applied to spring chamber (PLS1) to push pressure reducing valve (1) and flow control valve (2) to the left.
- Flow control valve (2) reduces the open area between pump circuit (PP) and spool upstream (PPA) to generate a pressure loss in the line between (PP) and (PPA).
- Flow control valve (2) and pressure reducing valve (1) are stopped at a position where the pressure difference between (PA) and (PLS) applied to both ends of pressure reducing valve (1) is the same as the pressure loss made in the line between (PP) and (PPA) at the front and rear of flow control valve (2).
- As a result, pressure difference between upstream pressure (PPA) and downstream pressure (PA) of the both spools engaged in the compound operation becomes even. Then, the pump flow is distributed in proportion to the open area of notch (a) of each spool.

Area ratio of pressure compensation valve



Function

- The pressure compensation valve finely adjusts the ratio of left area (S1) of flow control valve (2) to right area (S2) of pressure reducing valve (1) and decides the compensation characteristics according to the characteristics of each actuator.

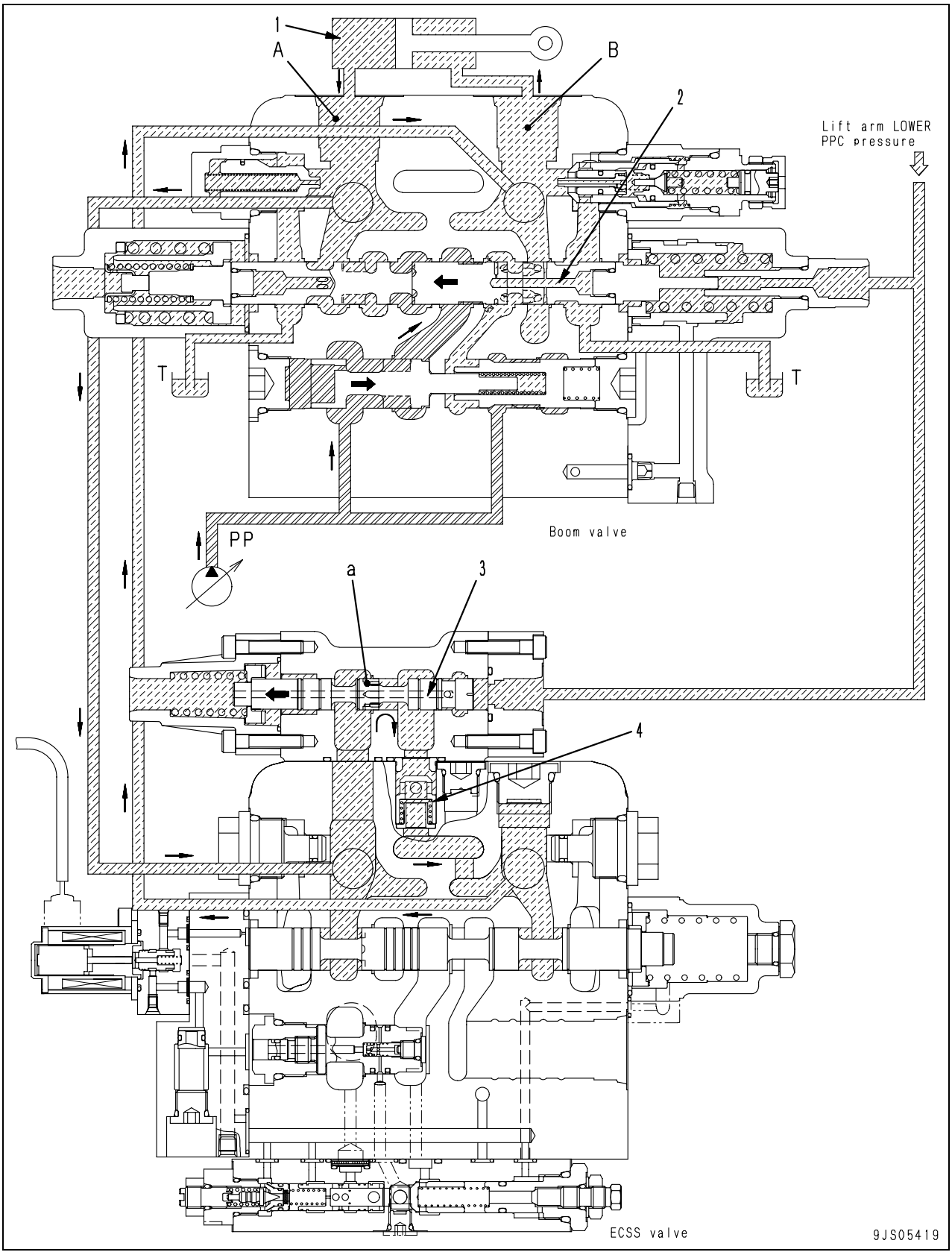
S1: Area of flow control valve (2) – Area of piston (3)
S2: Area of pressure reducing valve (1) – Area of piston (3)

Area ratio (S1): (S2) and compensation characteristics

- In the case of 1.00:
  Following relation becomes valid.
  [Pump (discharge) pressure (PP) – Spool notch upstream pressure (PPB)] ≒ [LS circuit pressure (PLS) – Actuator circuit pressure (PA) = (A)].
  And the oil is divided according to the opening area ratio of the spools.
- In the case of above 1.00:
  (PP) – (PPB) > (PLS) – (PA) = (A) and less oil is supplied to the compensated side by the area ratio of the spool.
- In the case of less than 1.00:
  (PP) – (PPB) < (PLS) – (PA) = (A) and more oil is supplied to the compensated side by the area ratio of the spool.

Lift arm regeneration circuit

1. When lift arm is lowered



A: Bottom circuit (pressure)
B: Head circuit (pressure)
PP: Pump circuit (pressure)

1. Lift cylinder
2. Lift arm spool
3. Lift arm regeneration spool
4. Check valve

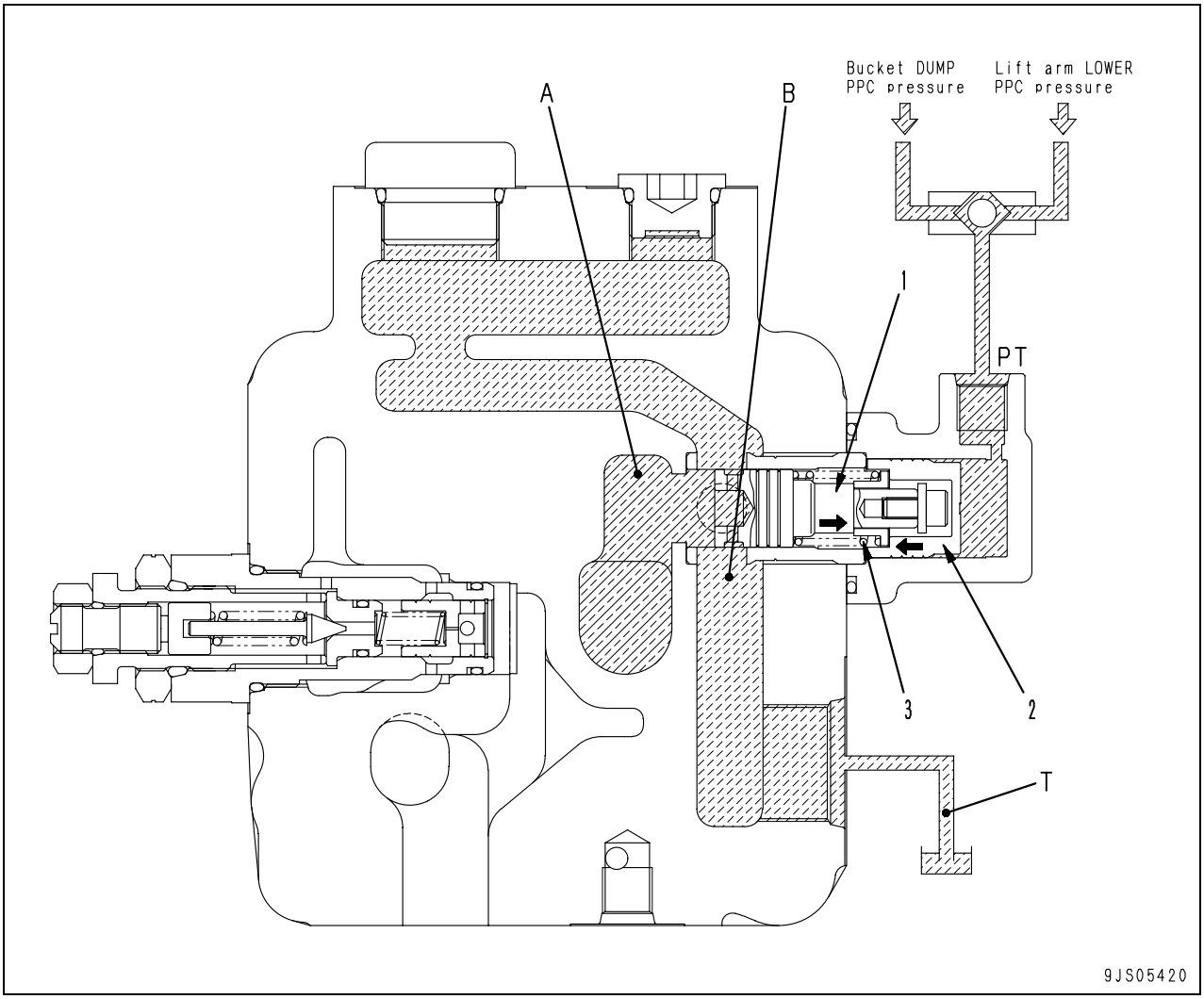
Function

- When bottom pressure (A) of lift cylinder (1) is higher than head pressure (B) and the lift arm is lowered by its weight, this circuit sends the return oil on the bottom side to the head side to increase the cylinder speed by that amount.

Operation

- While the lift arm is being lowered by its weight, pressure (A) on the bottom side of lift cylinder (1) is higher than pressure (B) on the head side.
- Part of the return oil to the bottom side flows through regeneration passage (a) of lift arm regeneration spool (3) to the head side pushing open check valve (4).
- As the result, the lift arm lowering speed is heightened.

Variable lift check valve



Function

- In order to prevent occurrence of vacuum on the cylinder head side and the resulting firing of diesel in lowering of the lift arm and bucket dumping, set pressure of the back pressure valve is increased with the lift arm and bucket dump PPC pressure.
- When an operation other than lift arm lowering and bucket dumping is carried out, the back pressure valve piston moves to prevent generation of back pressure.

Operation

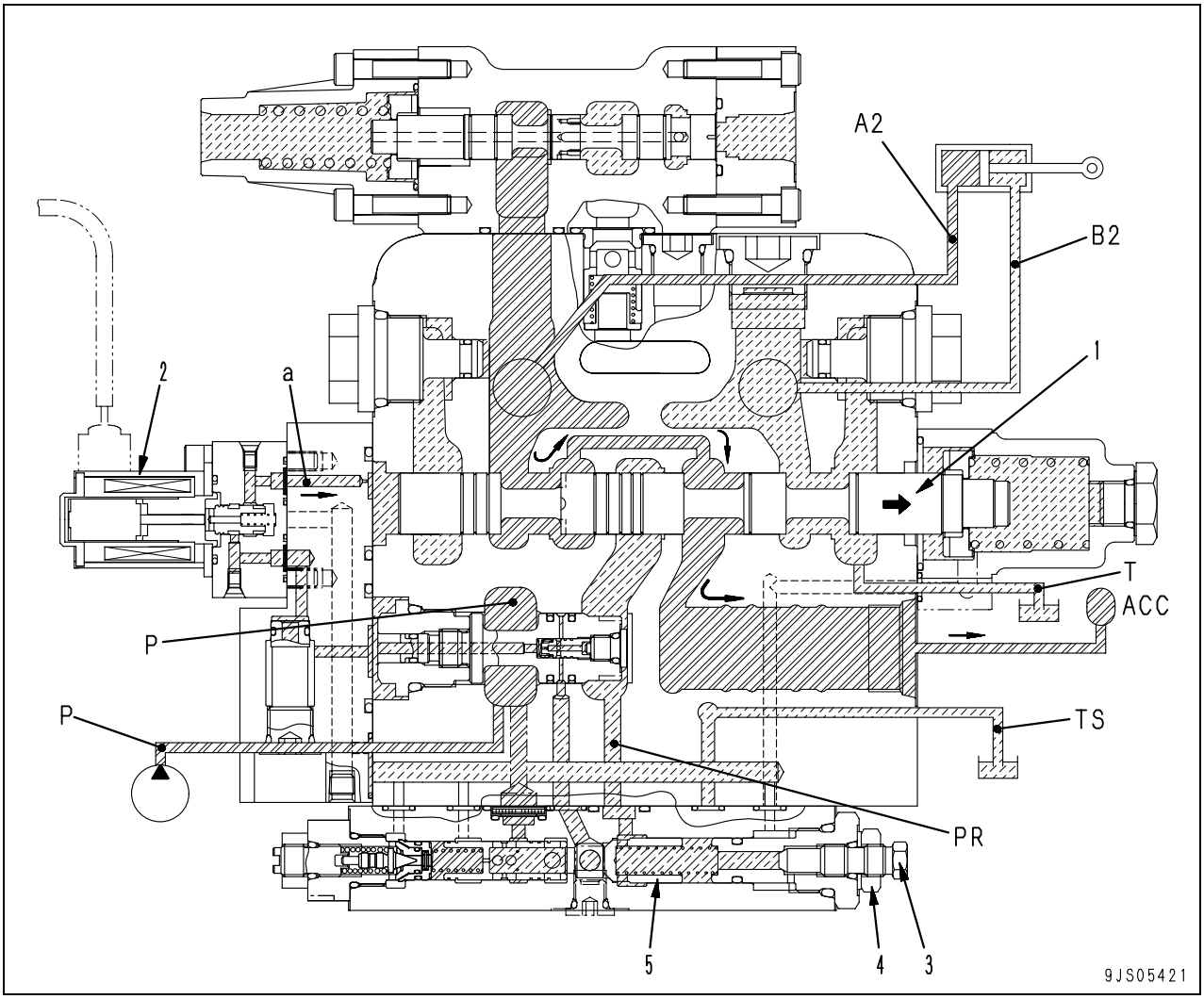
1. When lift arm lowering and bucket dumping operation are turned on

- As PPC pressure for the lift arm lowering or bucket dumping, whichever is higher, enters port (PT), large piston (2) and small piston (1) move leftward.
- When the lift arm lower return oil flows from (A) to tank (T), it pushes small piston (1) to the right. Small piston (1) decides the open area of (B) at the position where the pressure of (A) is balanced with spring (3), thus back pressure is generated.

2. When an operation other than lift arm lowering and bucket dumping is turned on (Lift arm raising and bucket tilting)

- The pilot pressure is not applied to pilot port (PT) while an operation other than lift arm lowering and bucket dumping is carried out.
- Under this condition, since small piston (1) and large piston (2) are moved to the right by pressure (A), the back pressure valve does not function.

ECSS control valve



Function

- The controller automatically turns on/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.

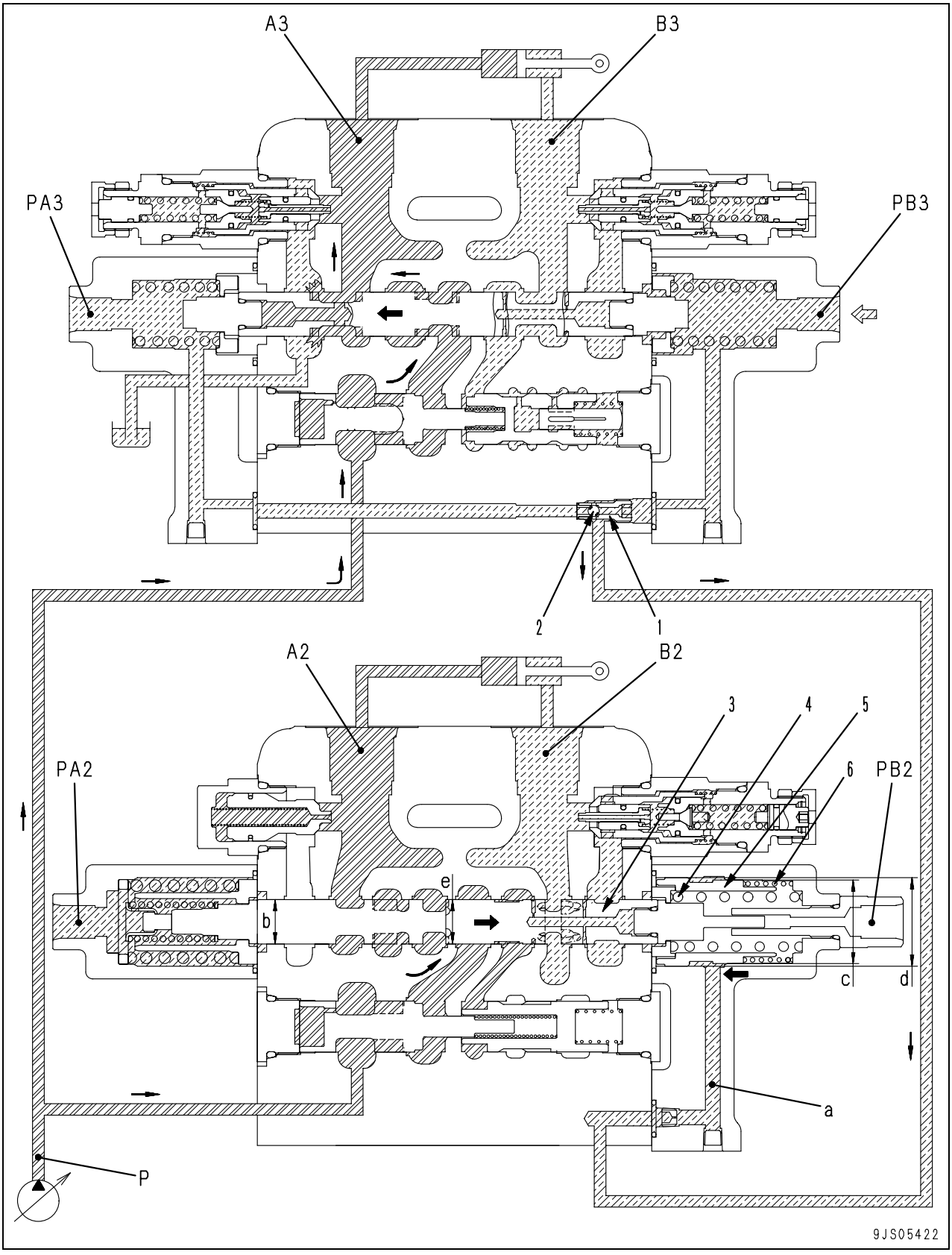
Operation

- 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 5 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 for maintenance of the machine, etc., loosen plug (3) and nut (4) to open circuits (PR) and (TS) and relieve the pressure in accumulator (ACC).

Restriction on lift arm raise stroke



Function

- If the lift arm is raised and the bucket is operated simultaneously, the stroke of lift arm spool (3) is restricted and more oil flows to the bucket. As a result, the bucket tilting (dumping) speed is increased.

Operation

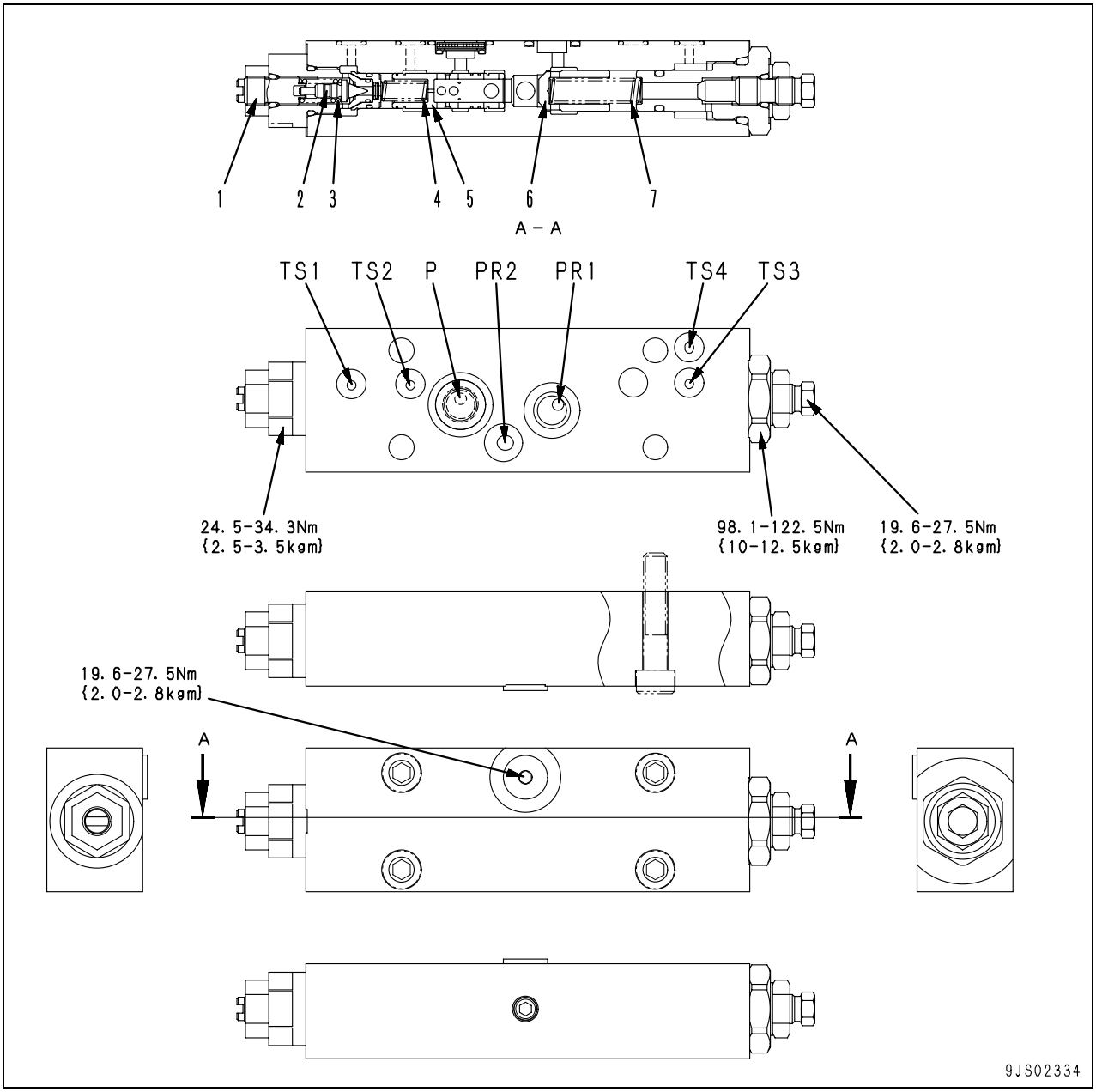
1. Single operation

- When the lift arm is raised, the PPC pressure is supplied to (PA2) and lift arm spool (3) and piston (5) move to the right.

2. Compound operation

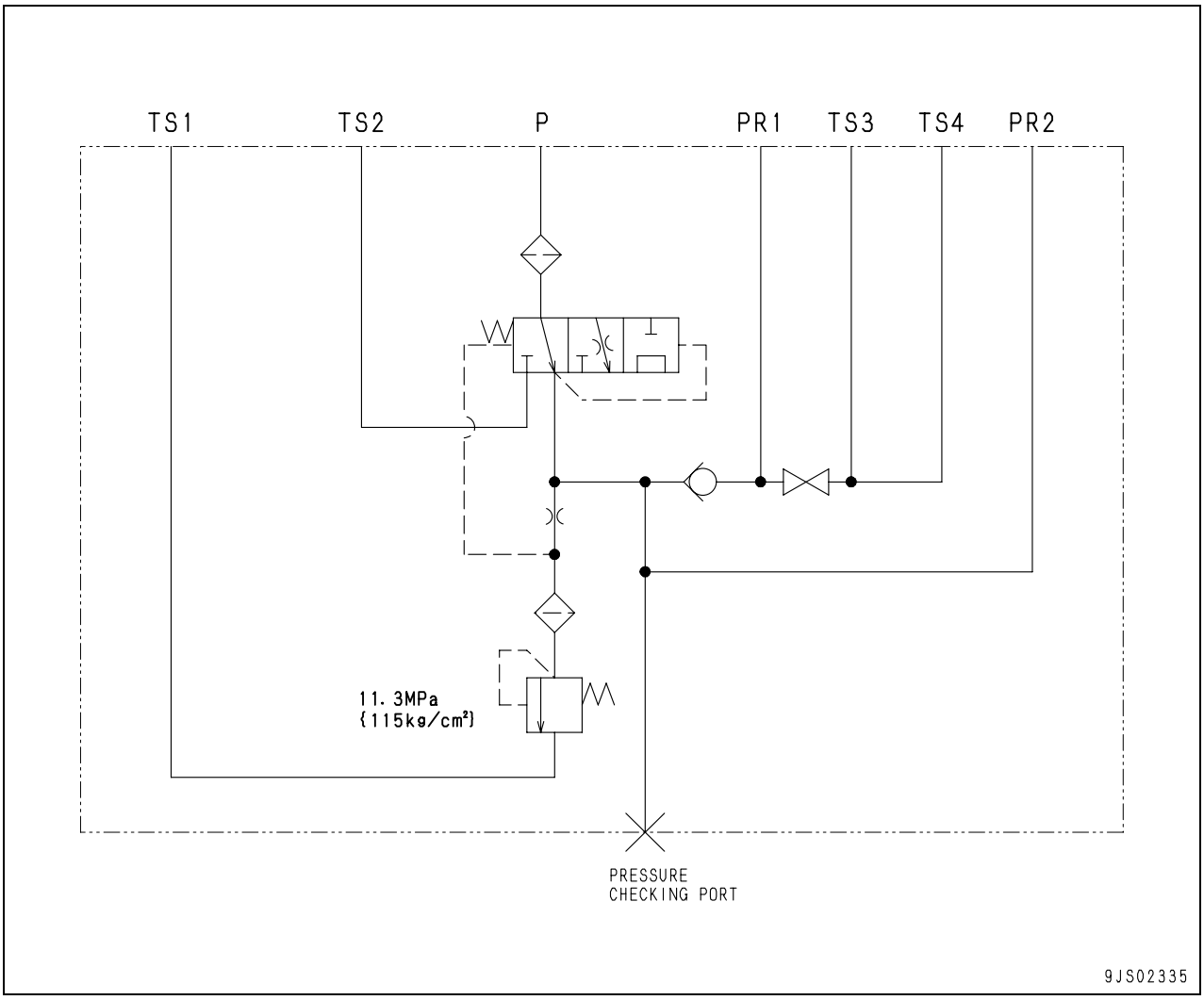
- When the lift arm is raised, if bucket dumping operation (PB3) is carried out, (PA3) is connected through the PPC valve to (T).
- Accordingly, ball (2) of shuttle valve (1) is pushed leftward, conducting pressure of (PB3) to passage (a).
- The pressure of (PB3) supplied to passage (a) pushes piston (5) to the left with the force of pressure receiving area piston (5) [$\pi/4$ (ϕd^2 – ϕc^2) x (PB3)].
- Accordingly, lift arm spool (3) is pushed leftward and then it balances at the stroke where the force is set to the following value. [ϕb^2 $\pi/4$ x (PA2)] = [(ϕd^2 – ϕc^2) $\pi/4$ x (PA3) + Force of springs (4) and (6)].
- As a result, the open area of notch (e) is reduced and less oil is supplied to port (A2). The excessive pressure oil flows to (B3) and the dumping speed is increased.

Accumulator charge valve

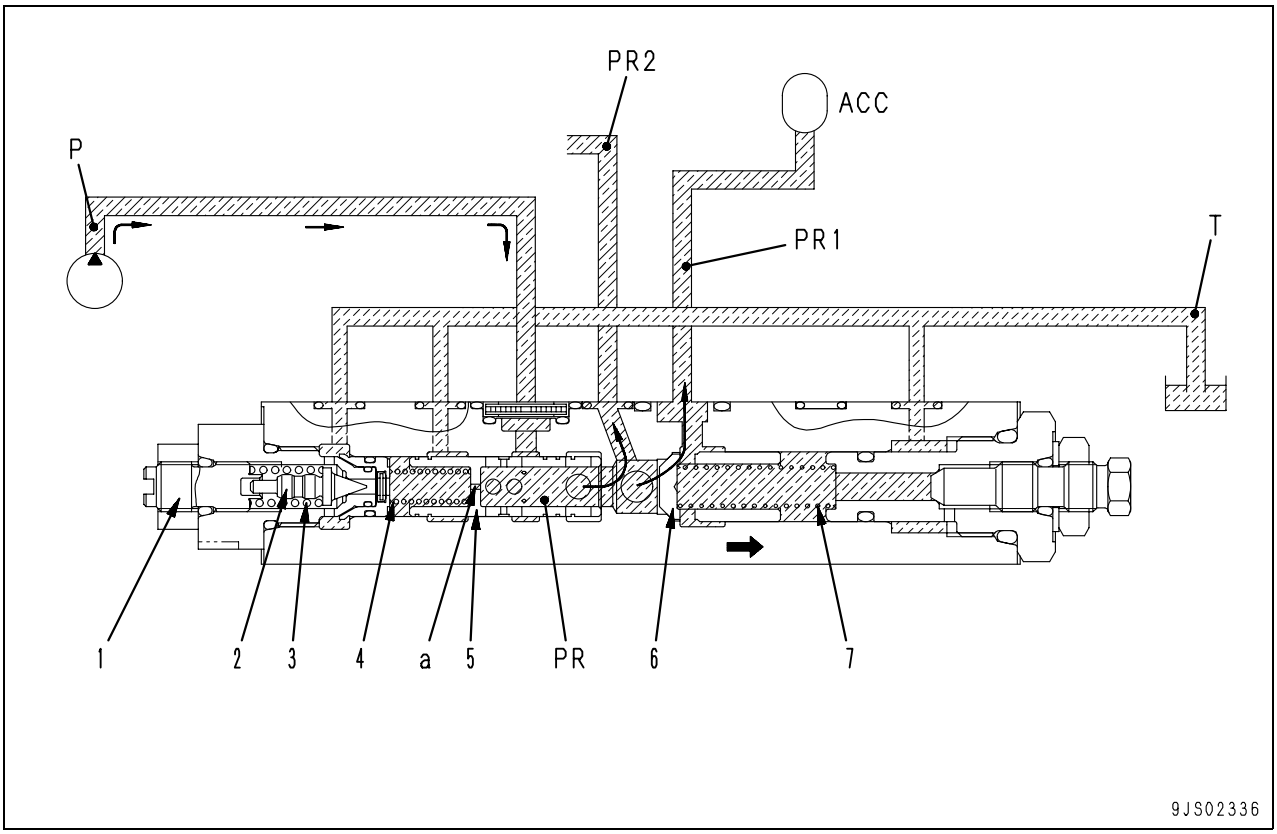


P: From main pump
PR1: To ECSS accumulator
PR2: To solenoid valve basic pressure
TS1: To tank
TS2: To tank
TS3: To tank
TS4: To tank

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


TS1
TS2
P
PR1
TS3
TS4
PR2
11.3MPa
{115kg/cm²}
PRESSURE
CHECKING PORT
9JS02335

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



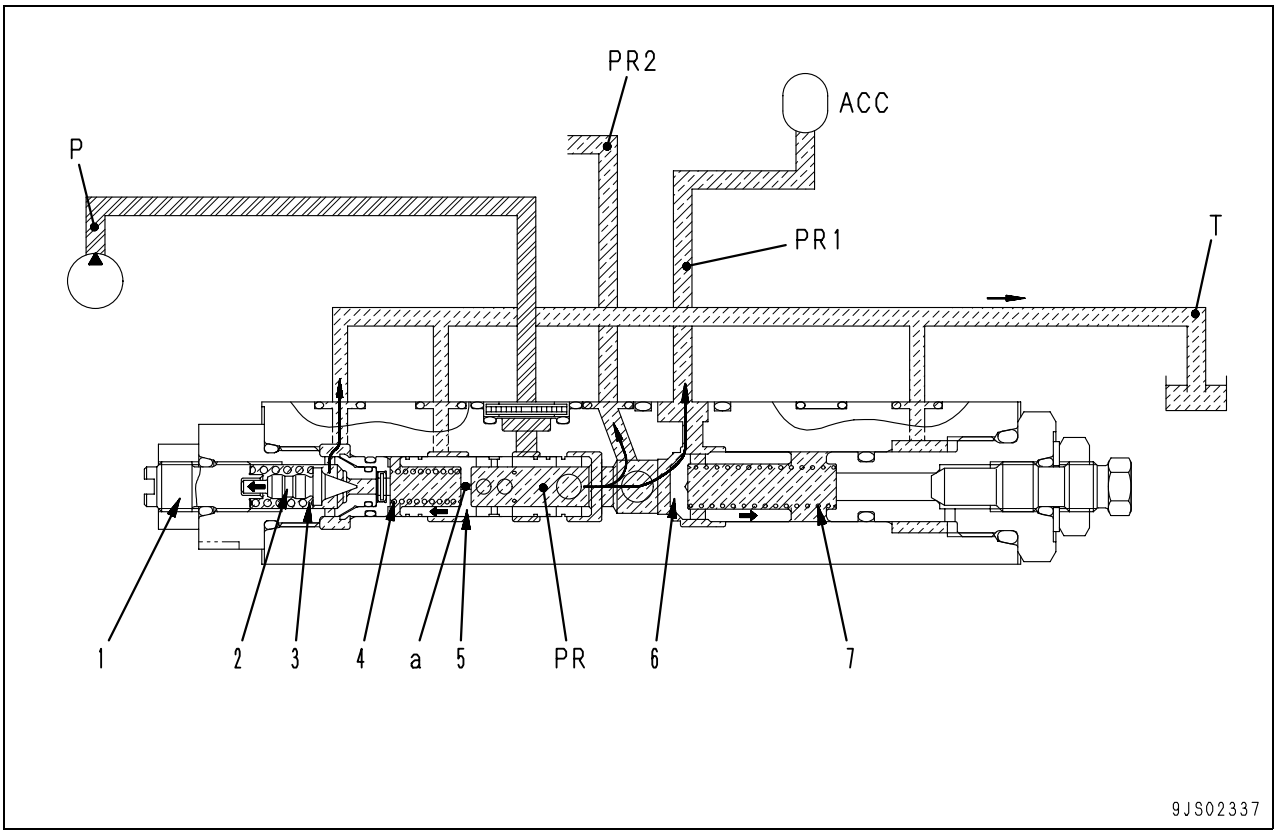
Function

- This valve reduces the discharge pressure of the main pump and supplies it as control pressure for the solenoid valves, PPC valves, etc.

Operation

- Poppet (2) is pressed by spring (3) against the seat and the line from port (P) to port (T) is closed.
- Poppet (6) is pressed to the left and the line from port (P) to port (PR2) is opened.
- Poppet (6) is moved to the right by pressure (PR) and the line from (PR) to (ACC) is opened. As (PR) < (ACC) results, poppet (6) is pressed leftward by spring (7) and the opening between (PR) to (ACC) is closed.

2. When load pressure (P) is high



Operation

- If pressure (PR) rises above the set pressure, poppet (3) opens and the hydraulic oil flows through port (P), 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 port (P) and (PR). Pressure (P) is reduced to a certain pressure (the set pressure) by the open area at this time and supplied as pressure (PR).

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

10 Structure, function and maintenance standard

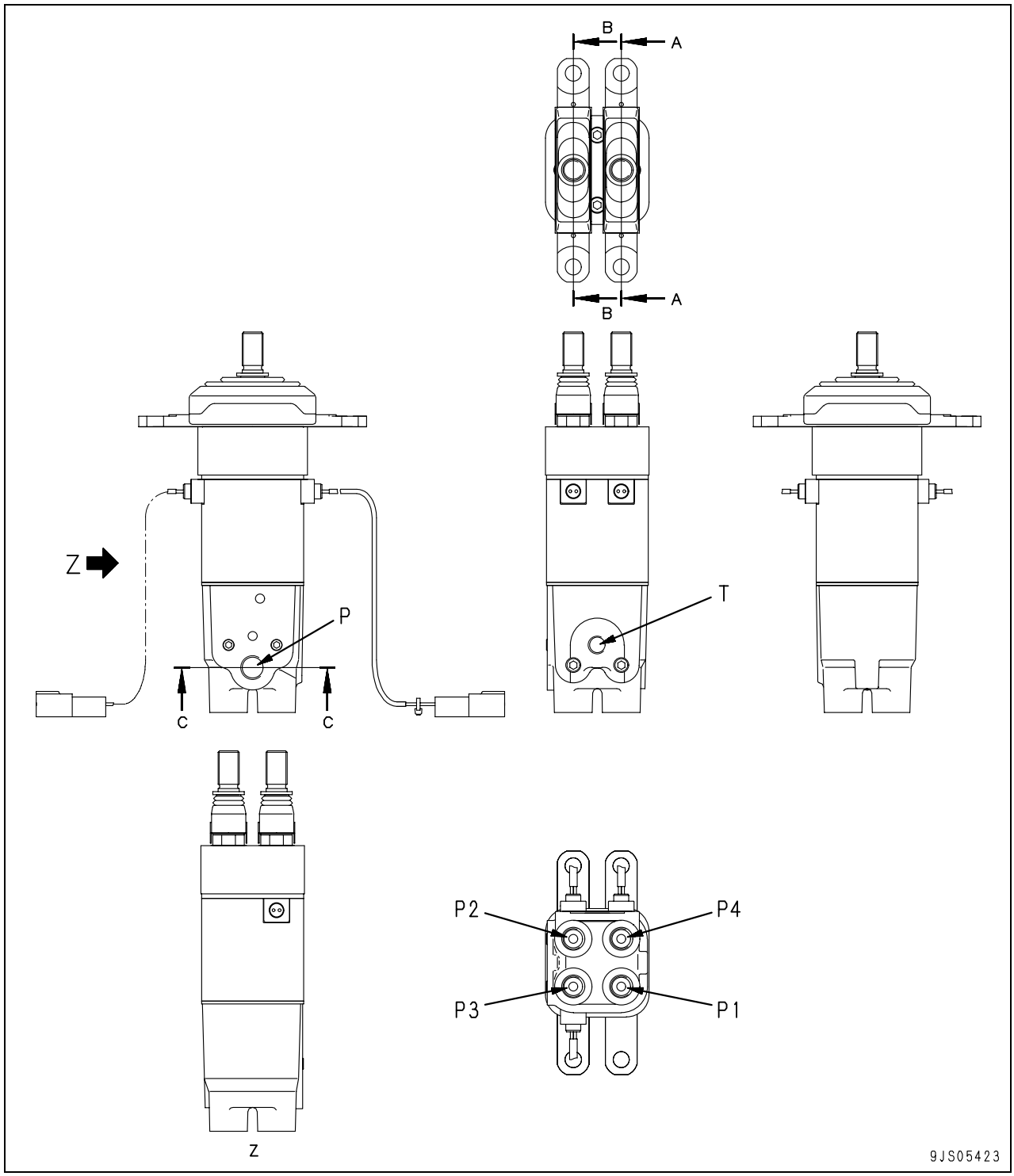
Hydraulic system, Part 2

Hydraulic system, Part 2 2
PPC valve 2
Stabilizer valve 8
Accumulator (for PPC circuit) 13
Accumulator (for ECSS) 14

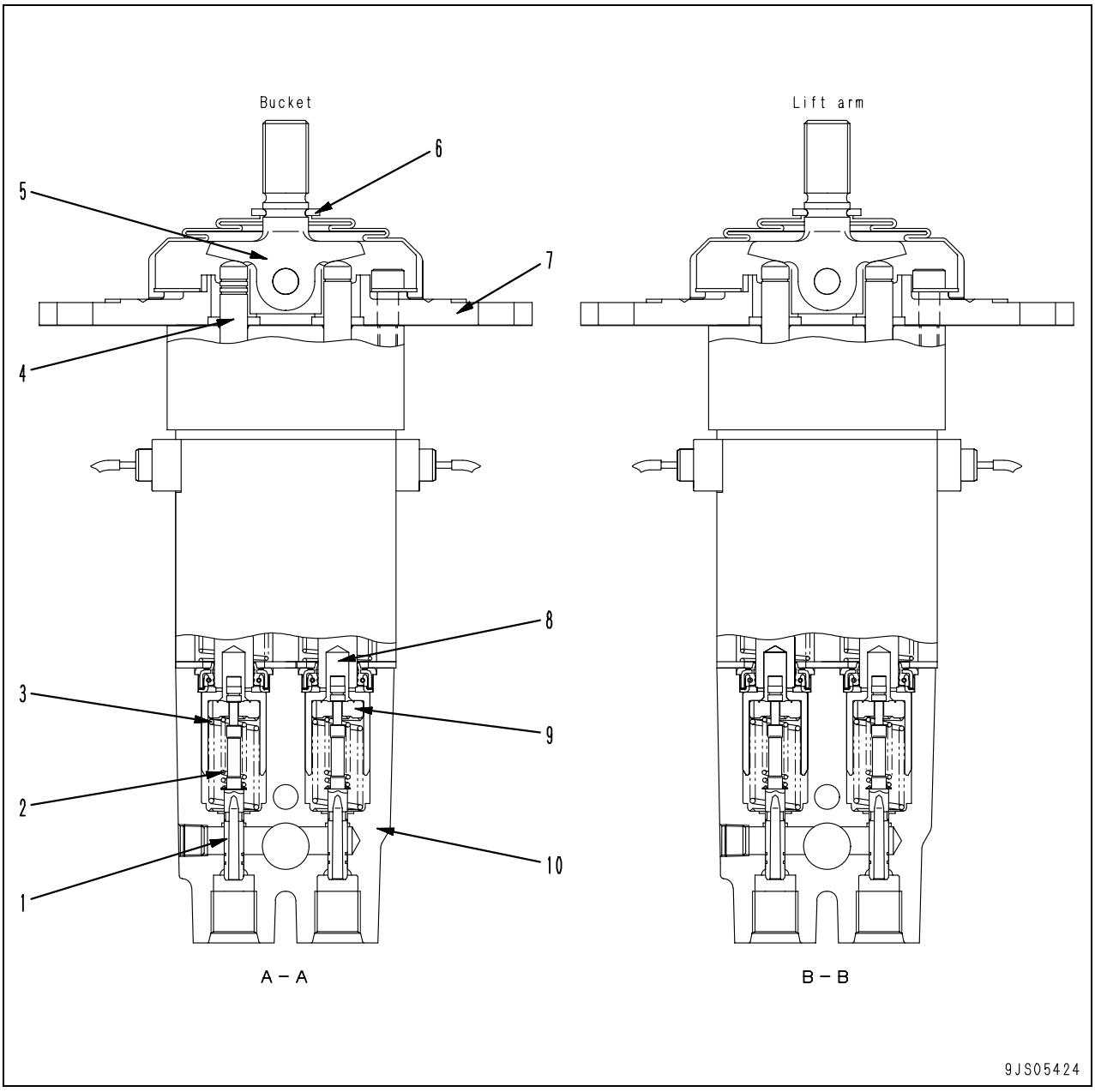
Hydraulic system, Part 2

PPC valve

Work equipment PPC valve



P: From charge valve
P1: To bucket valve (Tilt)
P2: To lift arm valve (Lower, float)
P3: To lift arm valve (Raise)
P4: To bucket valve (Dump)
T: To hydraulic tank

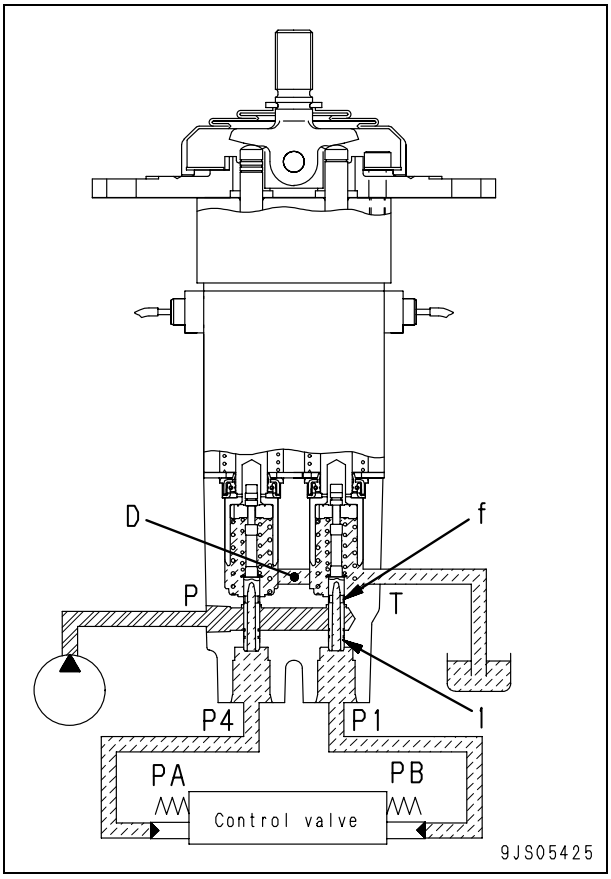


1. Spool
2. Metering spring
3. Centering spring
4. Rod
5. Lever
6. Ring
7. Plate
8. Piston
9. Retainer
10. Body

Operation

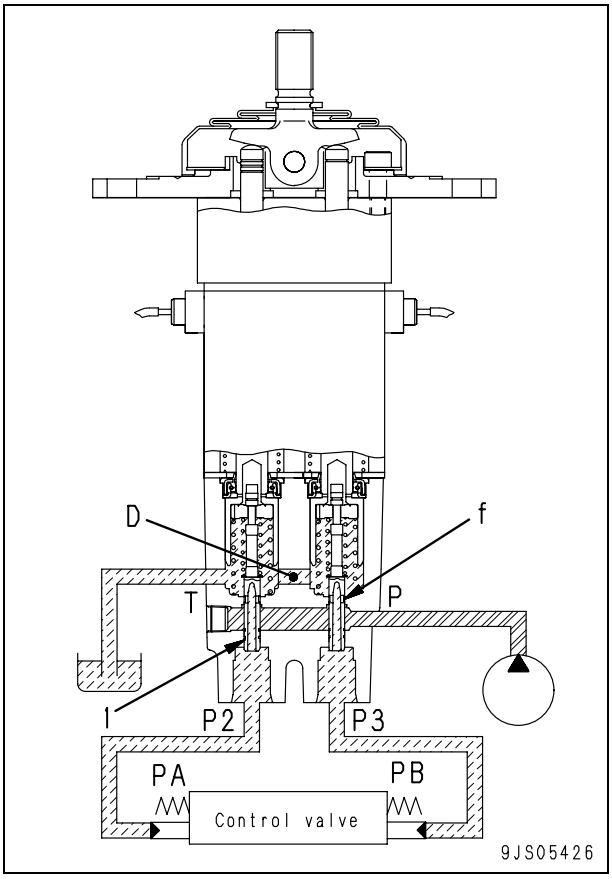
1. When in neutral

1) PPC valve for bucket



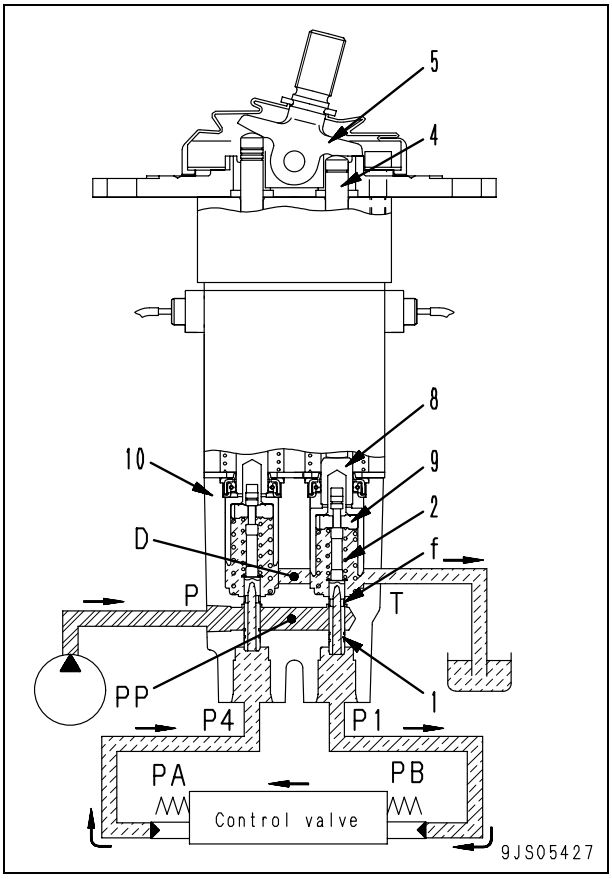
- Ports (PA) and (PB) of the bucket control valve and ports (P1) and (P4) of the PPC valve are connected through fine control hole (f) of spool (1) to drain chamber (D).

2) PPC valve for lift arm



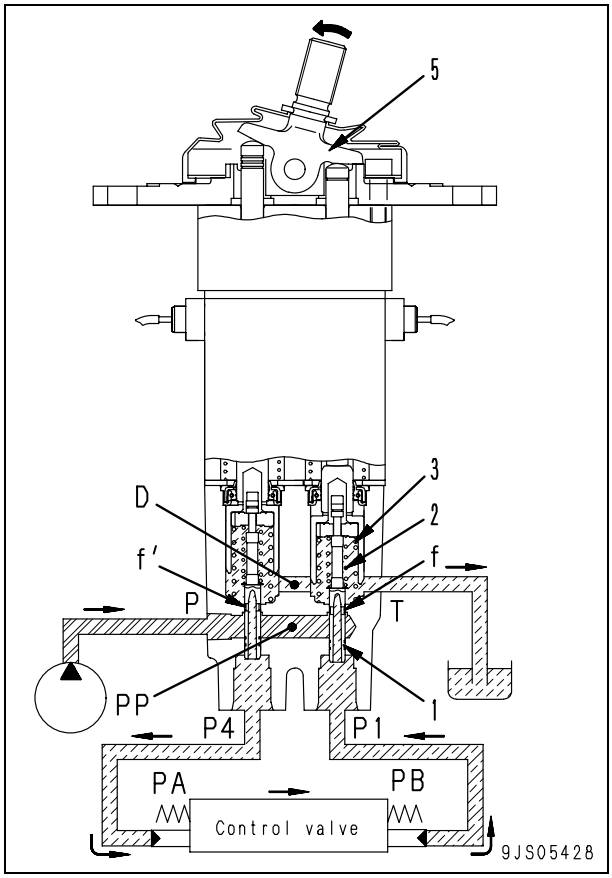
- Ports (PA) and (PB) of the lift arm control valve and ports (P2) and (P3) of the PPC valve are connected through fine control hole (f) of spool (1) to drain chamber (D).

2. During fine control (Neutral → fine control)



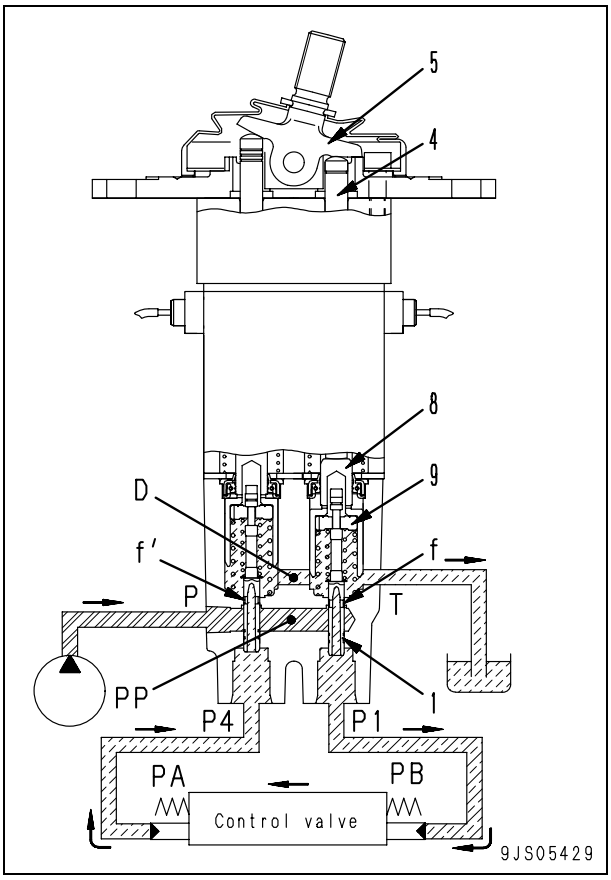
- If rod (4) and piston (8) are pushed by lever (5), retainer (9) is pushed and spool (1) is also pushed downward through metering spring (2).
- As fine control hole (f) is disconnected from drain chamber (D), it is connected to pump pressure chamber (PP) almost simultaneously, and then the pilot oil of the main pump flows from port (P1) to port (PB).
- If the pressure in port (P1) rises, spool (1) is pushed back and fine control hole (f) is disconnected from pump pressure chamber (PP) and connected to drain chamber (D) almost simultaneously to release the pressure in port (P1).
- As a result, spool (1) moves up and down to balance the force of metering spring (2) with the pressure in port (P1). The positional relationship between spool (1) and body (10) (where fine control hole (f) is between drain chamber (D) and pump pressure chamber (PP)) does not change until retainer (9) comes in contact with spool (1).
- Since metering spring (2) is compressed in proportion to the stroke of the control lever, the pressure in port (P1) also rises in proportion to the stroke of the control lever.
- The control valve spool moves to a position where the pressure in chamber (PB) (equal to the pressure in port (P1)) is balanced with the force of the control valve spool return spring.

3. During fine control (When control lever is returned)



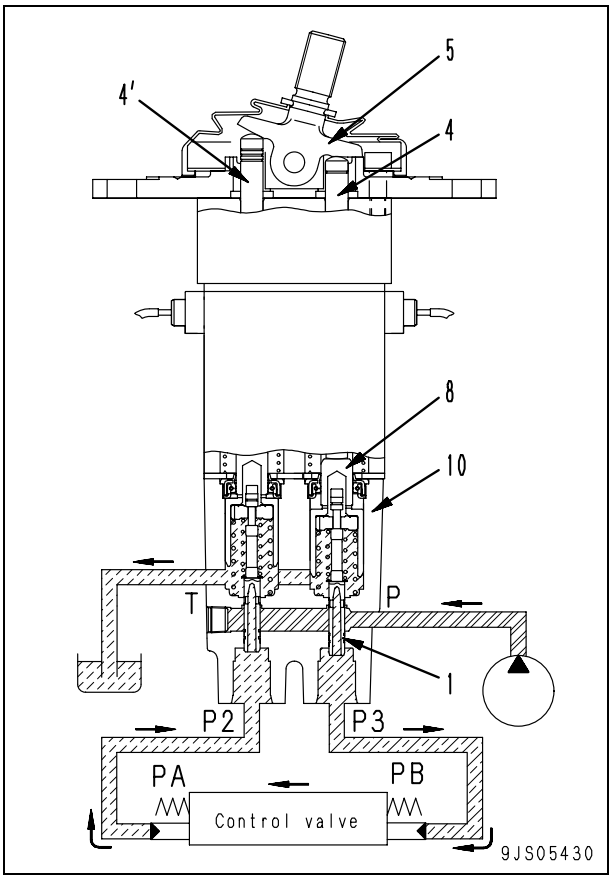
- If lever (5) begins to return, the force of centering spring (3) and the pressure in port (P1) push up spool (1).
- Because of this, fine control hole (f) is connected to drain chamber (D), and the pressurized oil at port (P1) is released.
- If the pressure at port (P1) goes down too far, spool (1) is pushed down by metering spring (2). Fine control hole (f) is shut off from drain chamber (D), and almost simultaneously, it is connected to pump pressure chamber (PP). Pump pressure is supplied until the pressure at port (P1) recovers to a pressure equivalent to the position of the lever.
- When the control valve spool returns, the oil in drain chamber (D) flows in through fine control hole (f') of the valve which is not in operation and then flows through port (P4) into chamber (PA).

4. At full stroke



- If lever (5) and rod (4) push down piston (8) and retainer (9) pushes down spool (1), fine control hole (f) is disconnected from drain chamber (D) and connected to pump pressure chamber (PP).
- The pilot oil from the main pump flows through fine control hole (f) and port (P1) into chamber (PB) to push the control valve spool.
- The oil returning from chamber (PA) flows through port (P2) and fine control hole (f') into drain chamber (D).

5. When lift arm is "float"



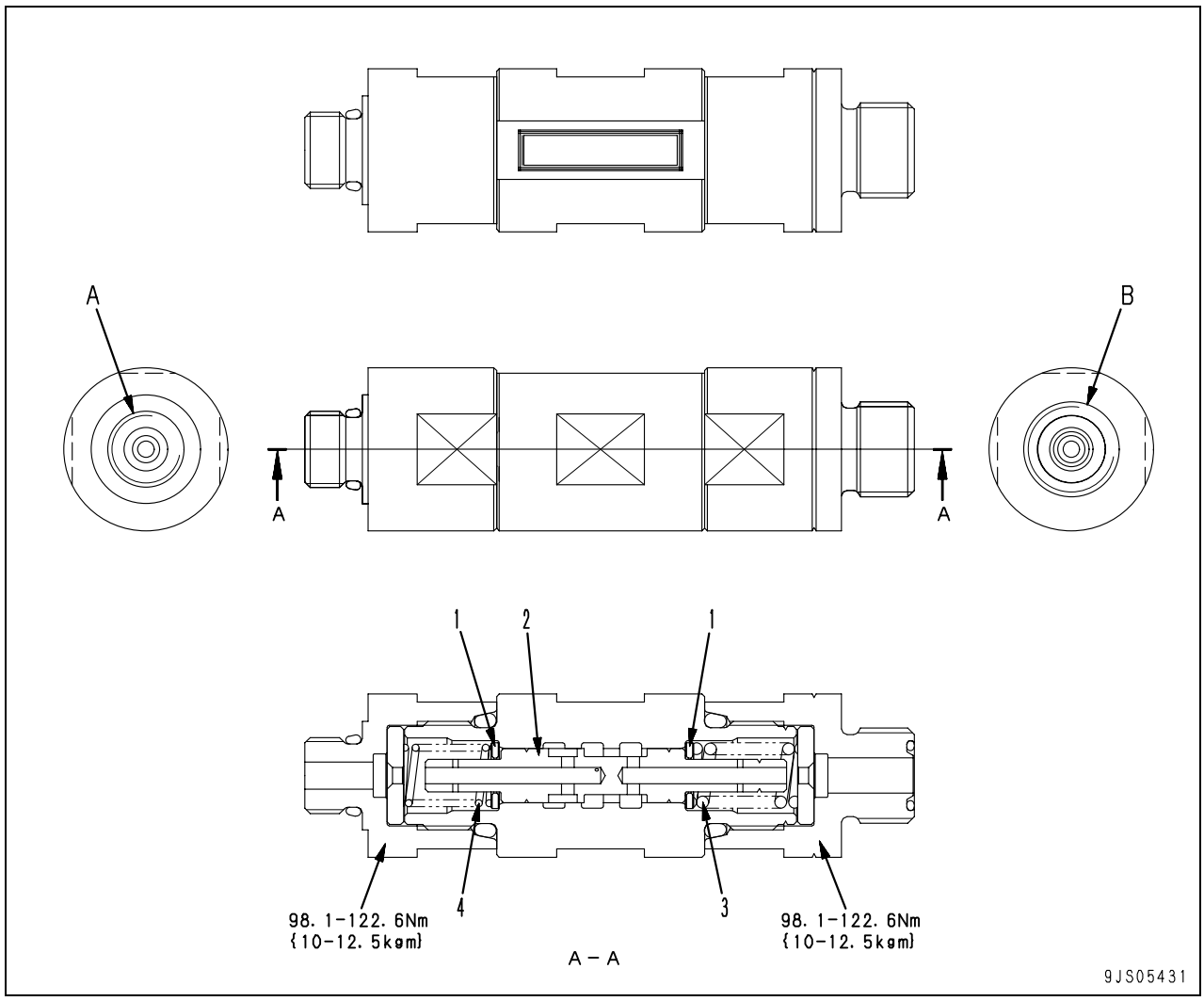
- If rod (4) and piston (8) on the "Lower" side of port (P3) are pushed down with lever (5), the detent starts operation before the stroke end (the operating effort of the lever becomes heavy).
- If rod (4) is pushed down further, the detent operates to keep the lift arm in "float" state even if the lever is released.
- At the same time, the control valve is also moved to the "Float" position to keep the lift arm in float condition.

6. When “float” state of lift arm is reset

- Lever (5) is returned from the “float” position by pushing it down with a force larger than the attractive force of the solenoid.
- The “float” state also can be reset and the lever can be returned to the “neutral” position by turning off the current in the solenoid (de-energizing the solenoid).

- The lift arm raise and bucket tilt operations are carried out similarly to the above.

Stabilizer valve



A: To spring case
B: From PPC valve

1. Retainer
2. Spool

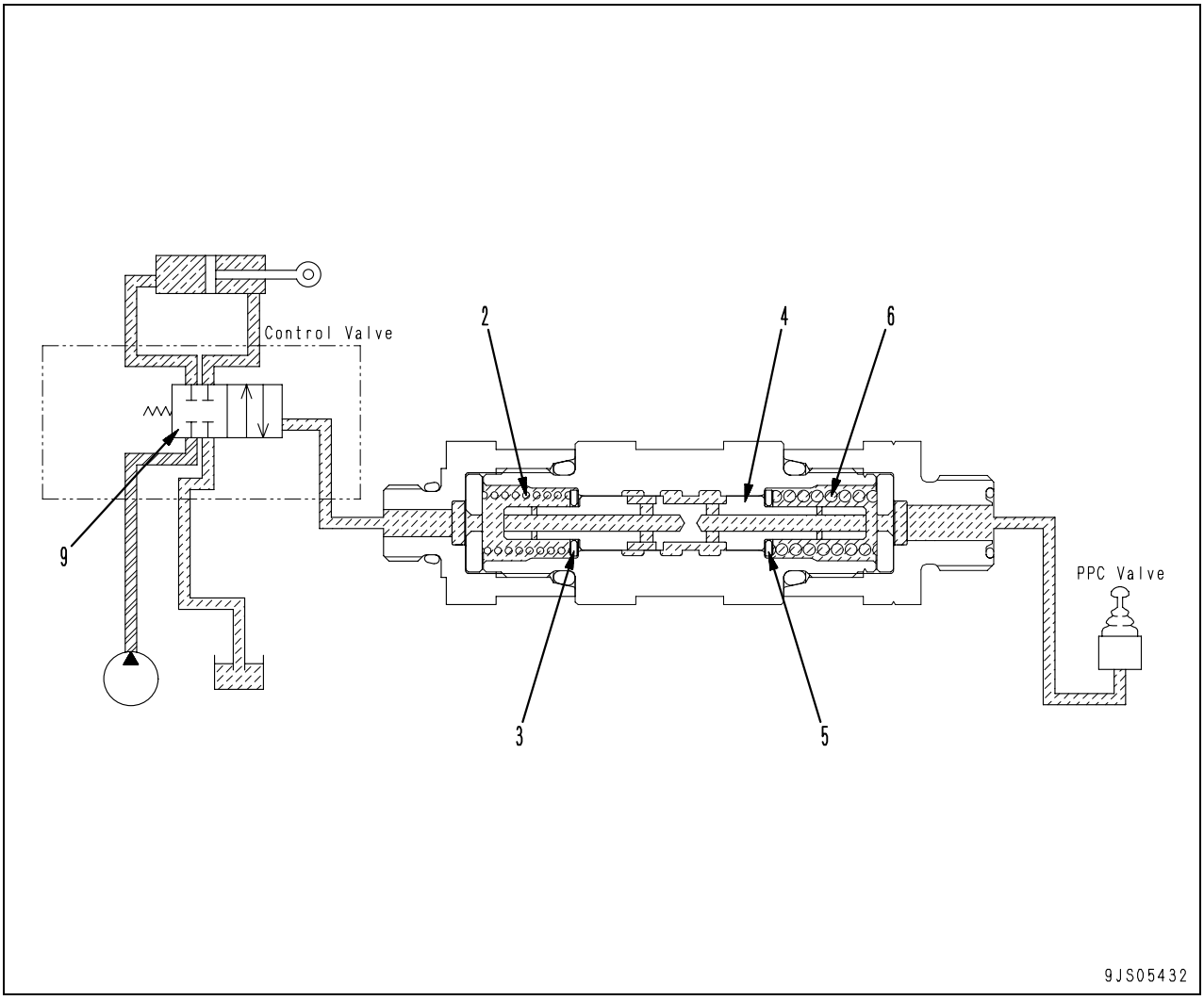
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
3	Spool return spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		20.2 x 12	18.2	88.6 N {8.83 kg}	—	69.2 N {7.06 kg}	
4	Spool return spring	18.4 x 11.5	12.5	28.3 N {2.89 kg}	—	22.7 N {2.31 kg}	

Function

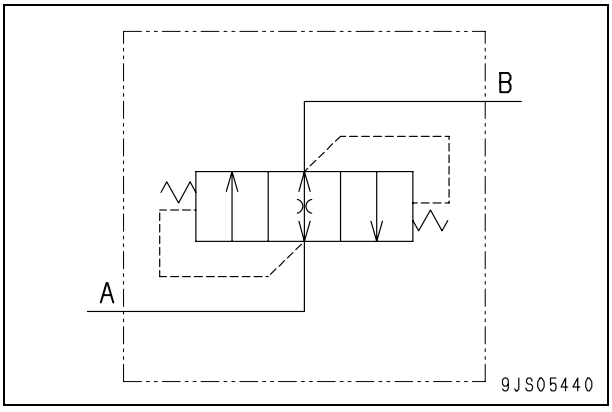
- The stabilizer valve chokes the return circuit of main spool (9) to reduce the shock which is made when the work equipment stops.
- When the temperature is low, the stabilizer valve opens the return circuit of main spool (9) to reduce delay of the work equipment in response.

1. When in neutral

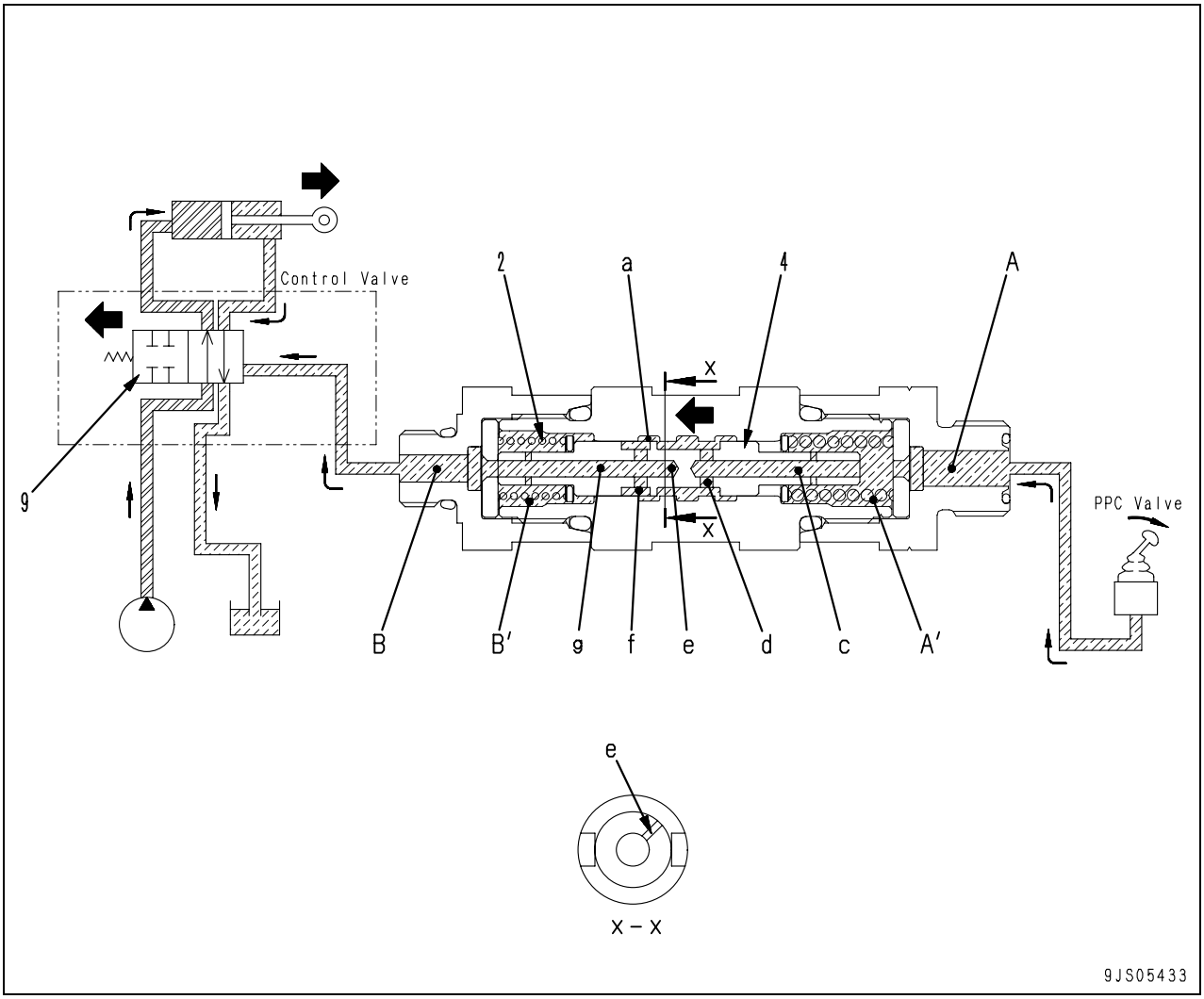


Operation

- Spool (4) is set in neutral by springs (2) and (6) and retainers (3) and (5).



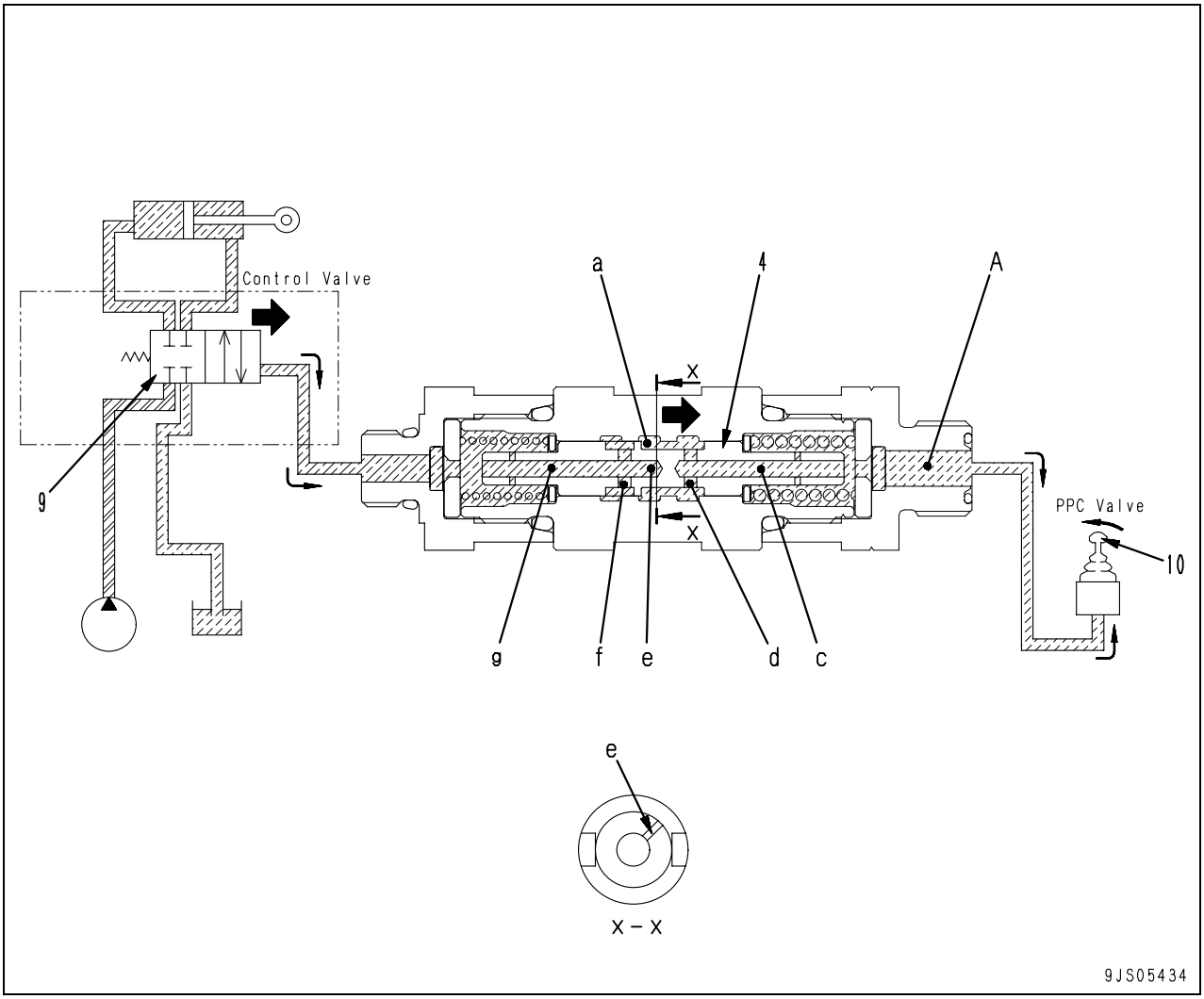
2. When main spool (9) is moved from neutral position to operating position



Operation

- If the PPC pressure is applied to port (A), the pressurized oil flows through passages (c) and (d), and orifice (e) to passage (g).
- At this time, pressure loss is made in orifice (e). If the differential pressure between pressures (A') and (B') exceeds the load on spring (2), spool (4) moves to the left and notch (a) opens.
- If notch (a) opens, the pressurized oil of PPC flows through passages (c) and (d), notch (a), and passages (f) and (g) to the right end of main spool (9).

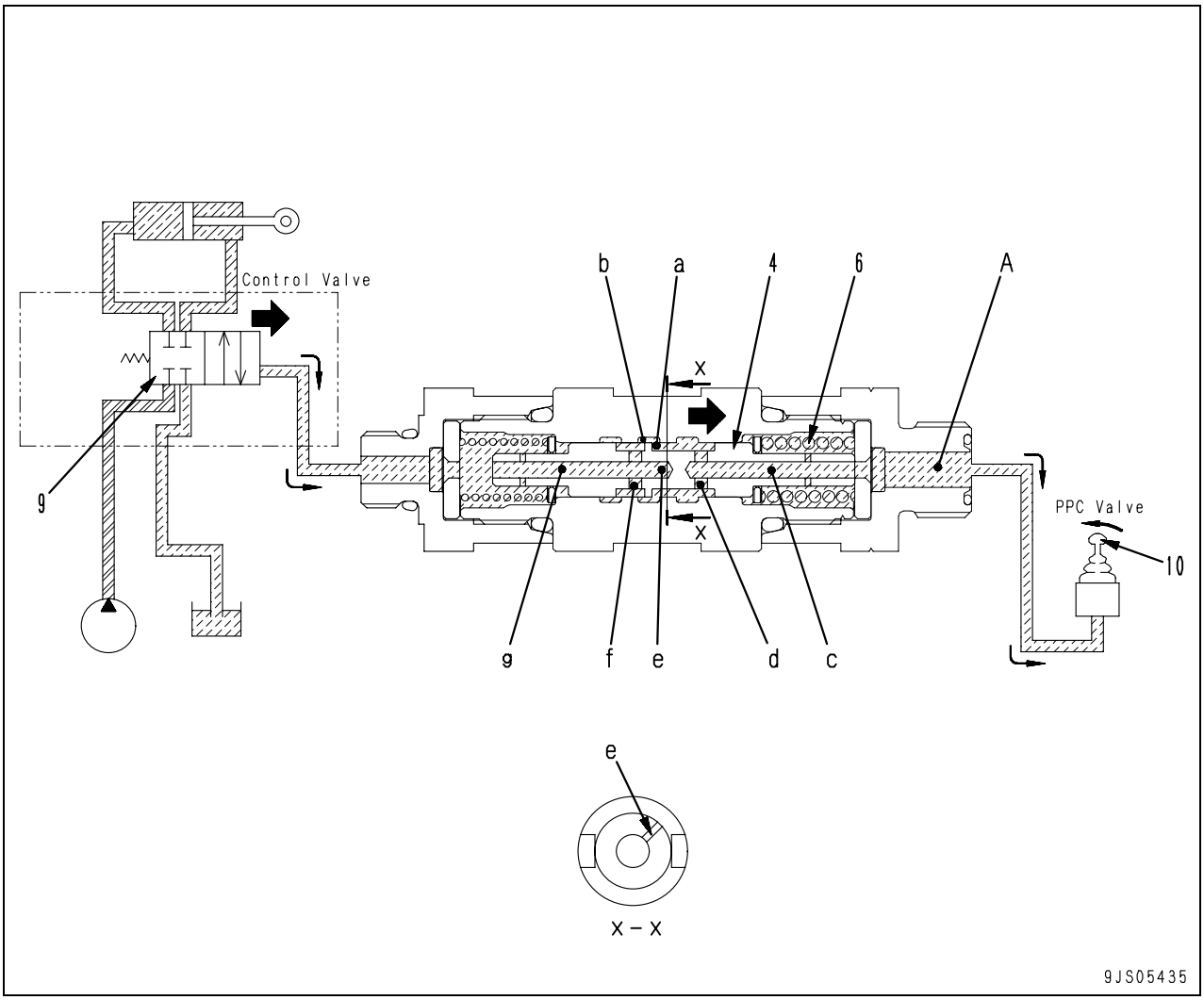
3. When main spool (9) is moved from operating position to neutral position



Operation

- When main spool (9) is operated, spool (4) is pressed to the left by the differential pressure between before and after notch (a).
- If control lever (10) is returned, pressure (A) lowers and spool (4) moves to the right up to the neutral position.
- During this operation, the pressurized oil in the spring case of the control valve flows through passages (g) and (f), notch (a), and passages (d) and (c) to the PPC circuit until notch (a) closes.
- If spool (4) moves to the right and notch (a) closes, the pressurized oil in the spring case flows through passage (g), orifice (e), and passages (d) and (c) to the PPC circuit.
- As a result, the line between the spring case and PPC circuit is choked and the shock made when the work equipment stops is reduced.

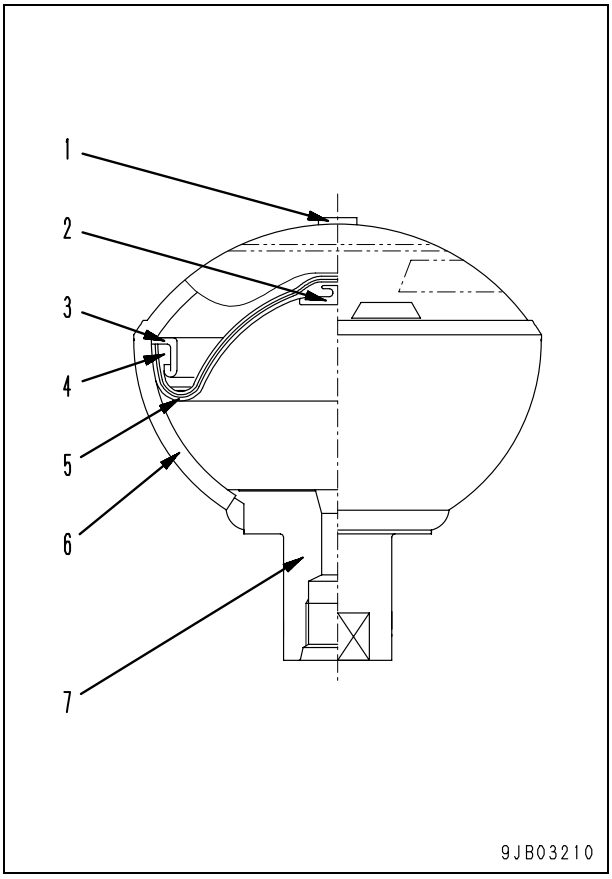
4. When main spool (9) is moved from operating position to neutral position (at low temperature)



Operation

- When main spool (9) is operated, spool (4) is pressed to the left by the differential pressure between before and after notch (a).
- If control lever (10) is returned, pressure (A) lowers and spool (4) moves to the right up to the neutral position.
- During this operation, the pressurized oil in the spring case of the control valve flows through passages (g) and (f), notch (a), and passages (d) and (c) to the PPC circuit until notch (a) closes.
- If spool (4) moves to the right and notch (a) closes, the pressurized oil in the spring case flows through passage (g), orifice (e), and passages (d) and (c) to the PPC circuit.
- When the temperature is low and the viscosity of the hydraulic oil is high, if the differential pressure between before and after orifice (e) exceeds the load of spring (6), spool (4) moves to the right further and notch (b) opens.
- If notch (b) opens, the pressurized oil in the spring case flows through passages (g) and (f), notch (b), and passage (d) to passage (c).
- As a result, the line between the spring case and PPC circuit is not choked and the delay of the work equipment in response is reduced.

Accumulator (for PPC circuit)



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

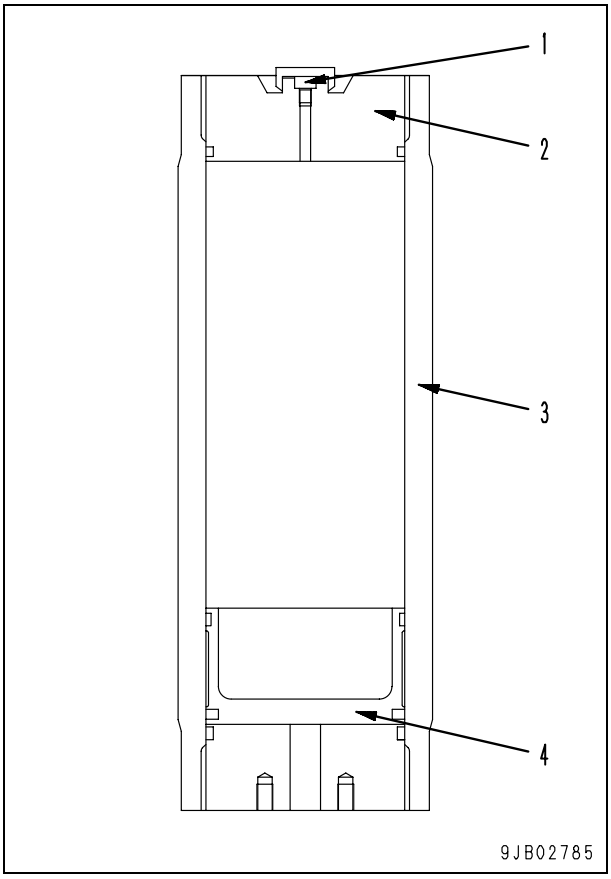
Outline

- The accumulator is installed between the charge valve and work equipment PPC valve. Even if the engine stops with the work equipment raised, the pressure of the compressed nitrogen gas in the accumulator applies the pilot oil pressure to the work equipment control valve so that the work equipment will lower by its weight.

Specifications

Gas used: Nitrogen gas
Amount of gas: 500 cc
Charged gas pressure: 1.18 MPa {12 kg/cm^2}
(at 80°C)
Max. pressure used: 3.92 MPa {40 kg/cm^2}

Accumulator (for ECSS)



1. Valve
2. Top cover
3. Cylinder
4. Free piston

Function

- The accumulator is installed to the lift cylinder bottom circuit. The space between cylinder (3) and free piston (4) is filled with nitrogen gas. The nitrogen gas absorbs the oil pressure pulses generated on the lift cylinder bottom side during travel for higher travel performance and operating performance by utilizing its compressibility.

Specifications

Gas used: Nitrogen gas
Amount of gas: 4,000 cc
Charged gas pressure: 2.94 MPa {30 kg/cm^2}
(at 20°C)
Max. operating pressure: 40 MPa {408 kg/cm^2}

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

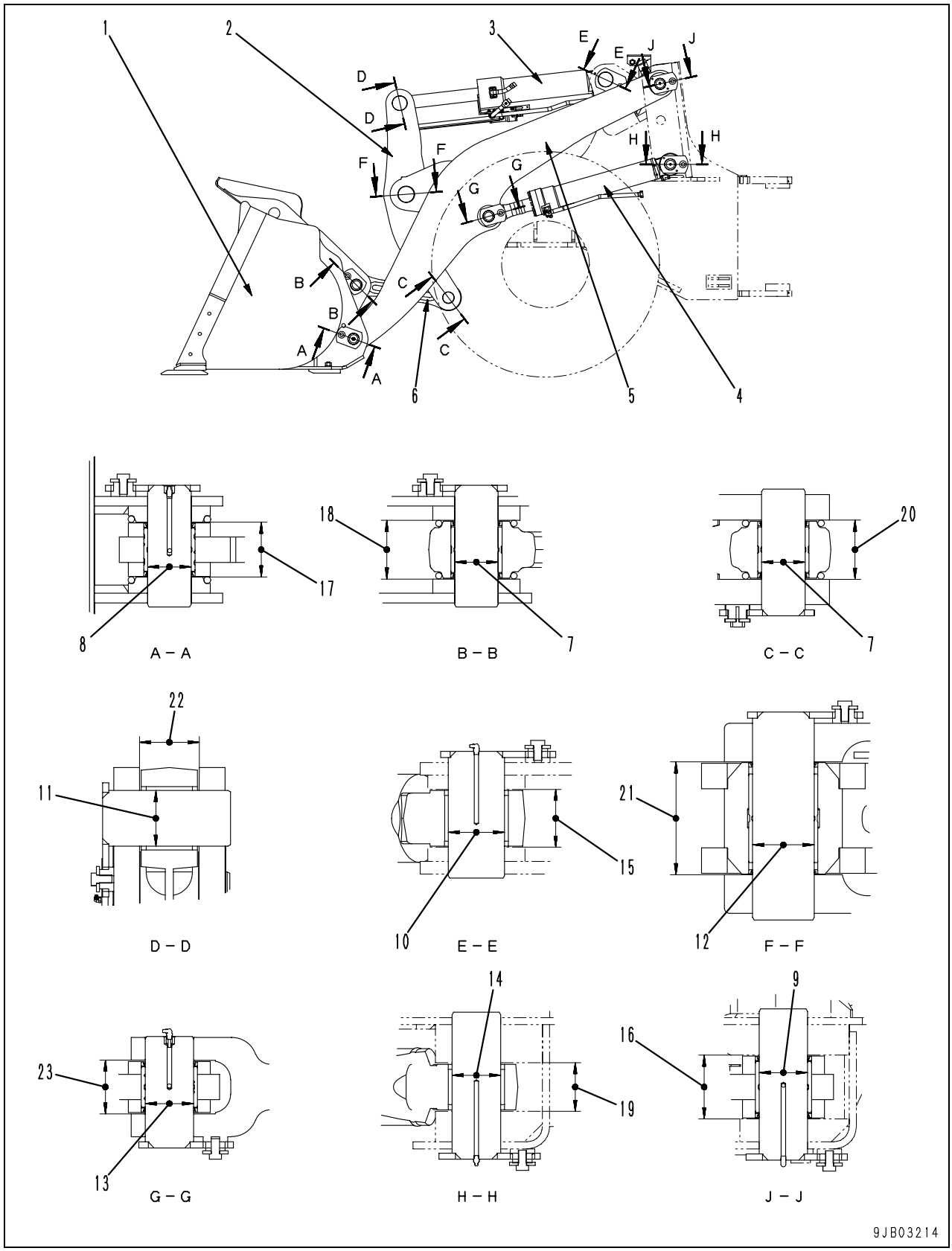
10 Structure, function and maintenance standard

Work equipment

Work equipment 2
Work equipment linkage 2
Bucket 4
Bucket positioner and boom kick-out 5
Work equipment cylinder 11

Work equipment

Work equipment linkage

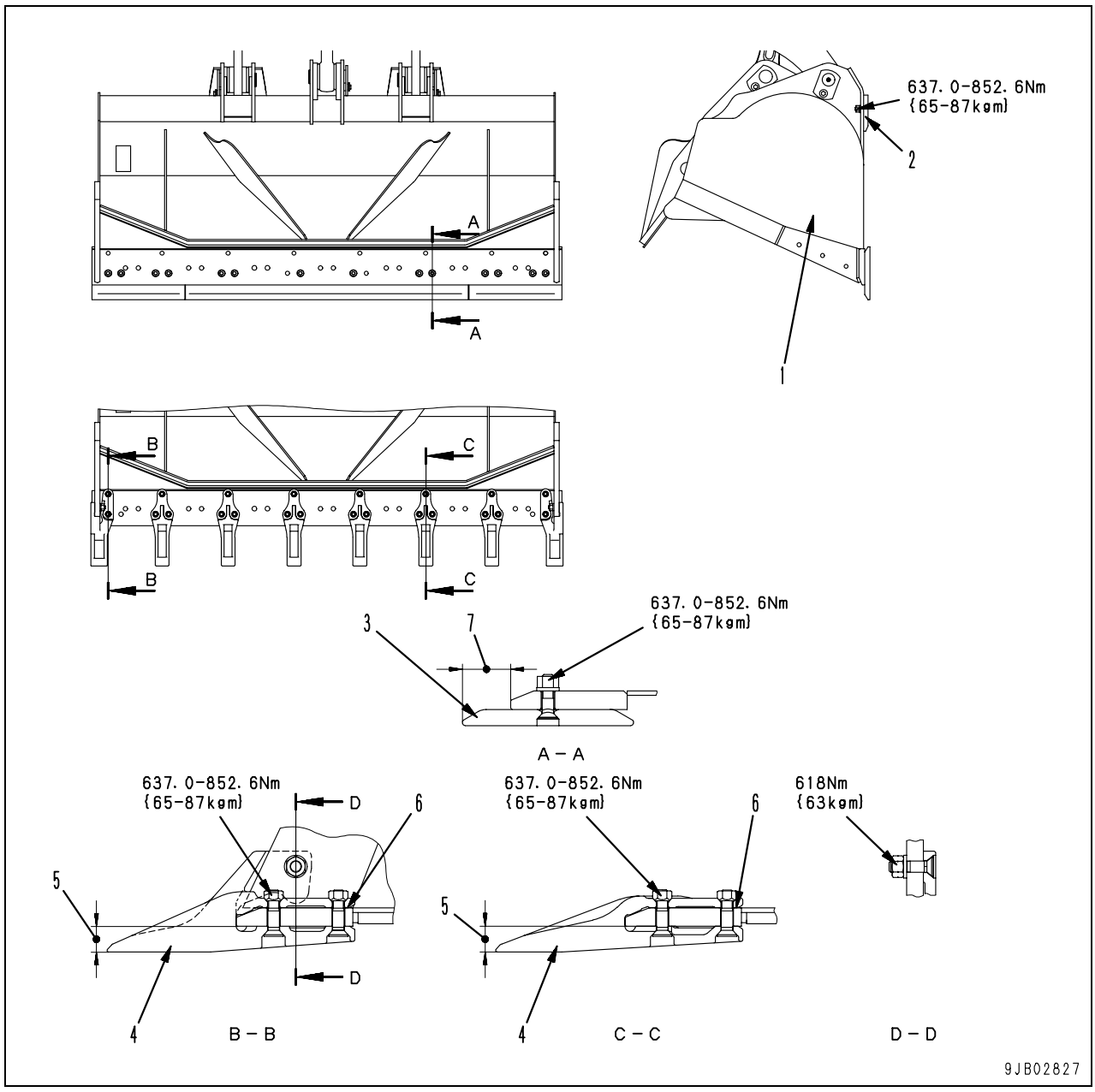


1. Bucket
2. Bell crank
3. Bucket cylinder
4. Lift cylinder
5. Lift arm
6. Bucket link

Unit: mm

No.	Check item	Criteria					Remedy
7	Clearance between bushing and pin at each end of bucket link	Standard size	Tolerance		Standard clearance	Clearance limit	Replace (Replace pin when it has scuff marks, too.)
			Shaft	Hole			
		85	–0.036 –0.090	+0.207 +0.120	0.156 – 0.297	1.0	
8	Clearance between bushing and pin connecting lift arm and bucket	85	–0.036 –0.090	+0.207 +0.120	0.156 – 0.297	1.0	
9	Clearance between bushing and pin connecting lift arm and frame	95	–0.036 –0.090	+0.207 +0.120	0.156 – 0.297	1.0	
10	Clearance between bushing and pin connecting bucket cylinder bottom and frame	110	–0.036 –0.090	+0.207 +0.120	0.156 – 0.297	1.0	
11	Clearance between bushing and pin connecting bucket cylinder rod and bell crank	110	–0.036 –0.090	+0.207 +0.120	0.156 – 0.297	1.0	
12	Clearance between bushing and pin connecting bell crank and lift arm	120	–0.036 –0.090	+0.245 +0.145	0.181 – 0.335	1.0	
13	Clearance between bushing and pin connecting lift cylinder rod and lift arm	95	–0.036 –0.090	+0.207 +0.120	0.156 – 0.297	1.0	
14	Clearance between bushing and pin connecting lift cylinder bottom and frame	95	–0.036 –0.090	+0.207 +0.120	0.156 – 0.297	1.0	
15	Connecting part of bucket cylinder and frame	Boss width		Width of hinge		Standard clearance	Adjust the shim so that clearance may be set to 1.5 mm or smaller on each side
		Standard size	Tolerance	Standard size	Tolerance		
		110	0 –0.5	114	±1.5	2.5 – 6.0	
16	Connecting part of lift arm and frame	122	—	126	+3 0	4.0 – 7.0	
17	Connecting part of lift arm and bucket	106	—	108	+1.5 0	2.0 – 3.5	
18	Connecting part of bucket link and bucket	112.5	+2.8 –0.5	116	+1.5 0	0.7 – 5.5	
19	Connecting part of lift cylinder and frame	90	0 –0.5	96	+3 0	6.0 – 9.5	
20	Connecting part of bell crank and bucket link	112.5	+2.8 –0.5	117	±1.5	0.2 – 6.5	Replace
21	Connecting part of bell crank and lift arm	220	+2 0	223	±0.5	0.5 – 3.5	
22	Connecting part of bucket cylinder and bell crank	110	0 –0.5	117	±1.5	5.5 – 9.0	Adjust the shim so that clearance may be set to 1.5 mm or smaller on each side
23	Connecting part of lift arm and lift cylinder	100	—	106	±1.5	4.5 – 7.5	

Bucket

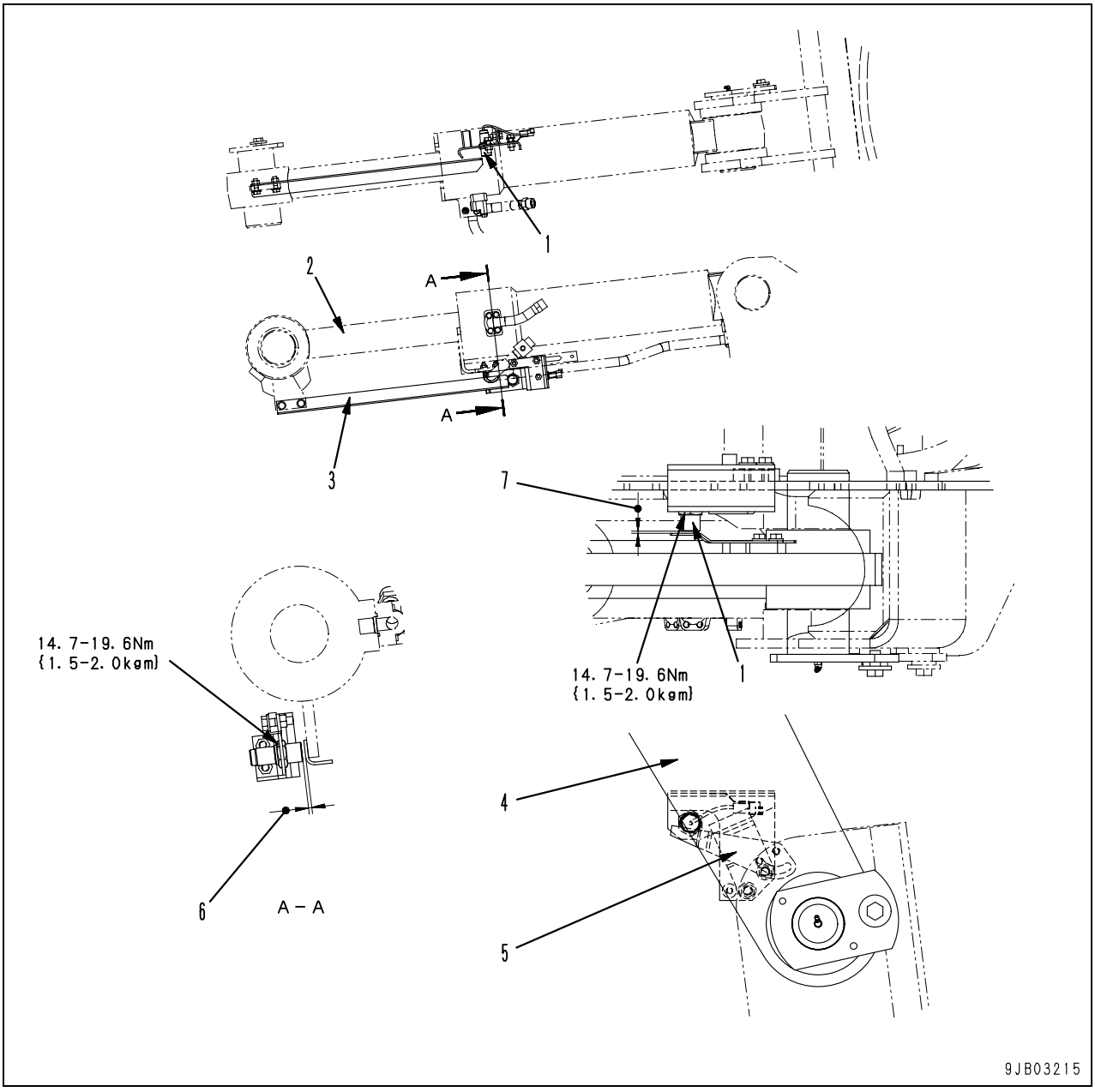


1. Bucket
2. Wear plate
3. Bolt-on cutting edge (BOC)
4. Bucket teeth (if equipped)

Unit: mm

No.	Check item	Criteria		Remedy
5	Wear of bucket tooth	Standard size	Repair limit	Replace
		50	18.5	
6	Clearance in bucket teeth mounting parts	Max. 0.5	—	Adjust or replace
7	Wear of cutting edge	93	—	Reverse or replace

Bucket positioner and boom kick-out

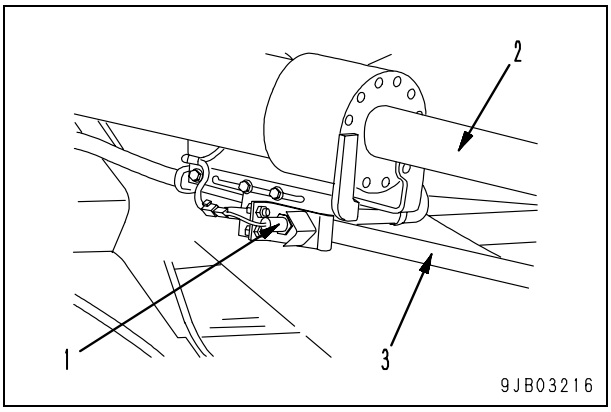


1. Proximity switch
2. Bucket cylinder
3. Angle
4. Lift arm
5. Plate

Unit: mm

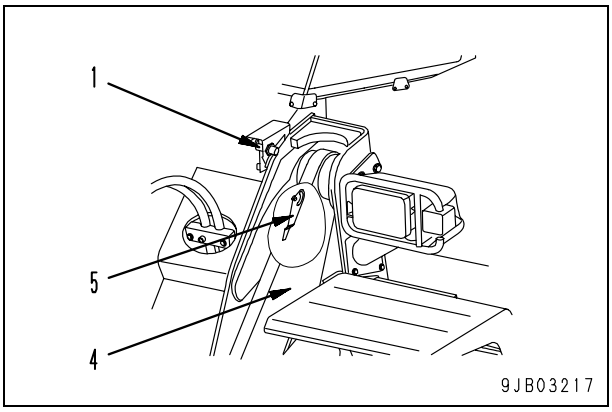
No.	Check item	Criteria	Remedy
6	Clearance between bucket positioner proximity switch and angle	3 – 5	Adjust
7	Clearance between boom kick-out proximity switch and plate	3 – 5	

Bucket positioner



- The bucket positioner is driven electrically. When the bucket is returned to an angle from the dump position toward the tilt position, the bucket positioner returns the bucket control lever from the “tilt” position to the “hold” position to automatically stop the bucket at a proper digging angle.
- Angle (3) is fixed to the rod side of bucket cylinder (2). And proximity switch (1) is fixed to the cylinder side.
- Moving the bucket control lever from “dump” position to “tilt” position moves the rod of bucket cylinder (2) toward the machine front side.
  As angle (3) moves a specific distance, proximity switch (1) detects that it is away from the sensing face, and returns the bucket control lever to “hold” position.

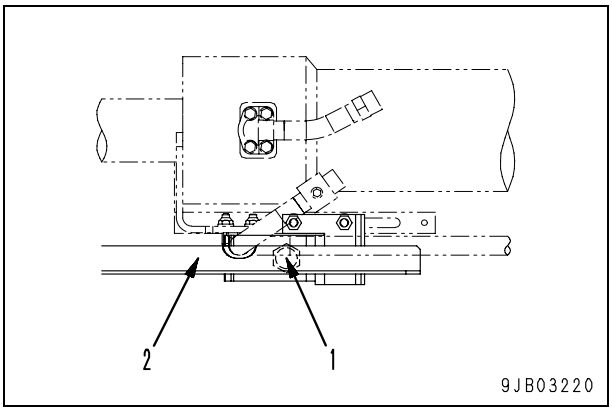
Boom kick-out

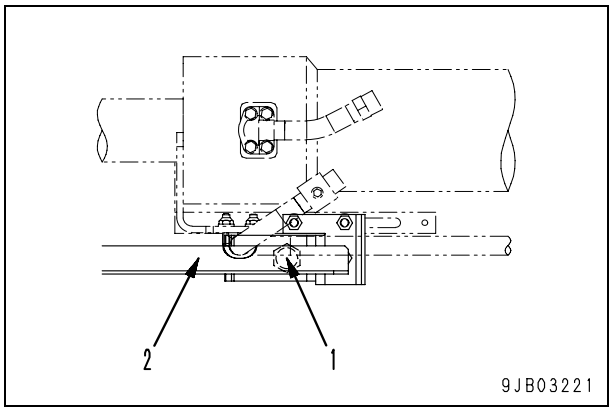


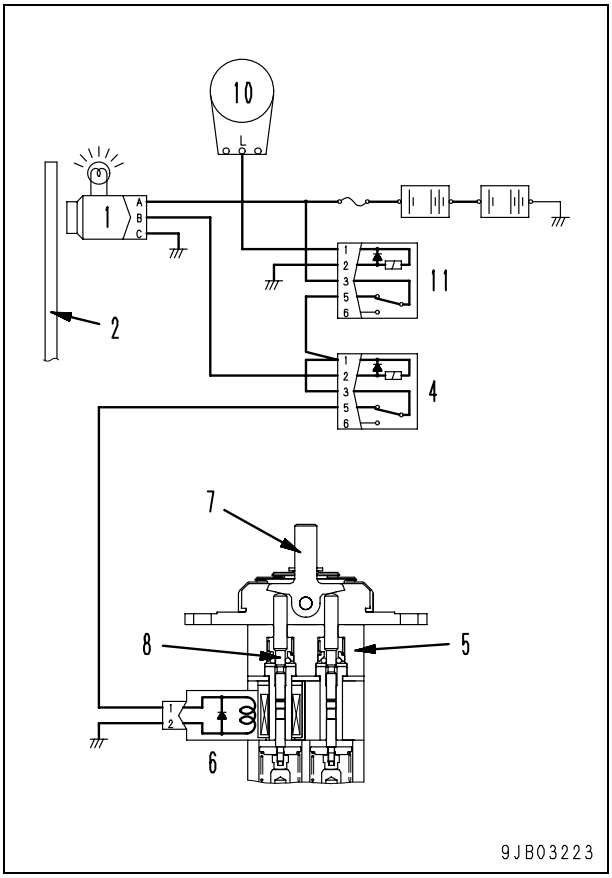
- The boom kick-out is driven electrically. As the lift arm is raised to a specific angle before reaching the maximum height, the boom kick-out returns the lift arm control lever from the “raise” position to the “hold” position to stop the lift arm automatically at a desired height.
- Plate (5) is fixed to lift arm (4). And proximity switch (1) is fixed to the front frame.
- Moving the lift arm control lever from “lower” position to “raise” position moves lift arm (4) upward.
  As plate (5) comes to a specific position, proximity switch (1) detects that it is in the sensing face, and returns the lift arm control lever to “hold” position.

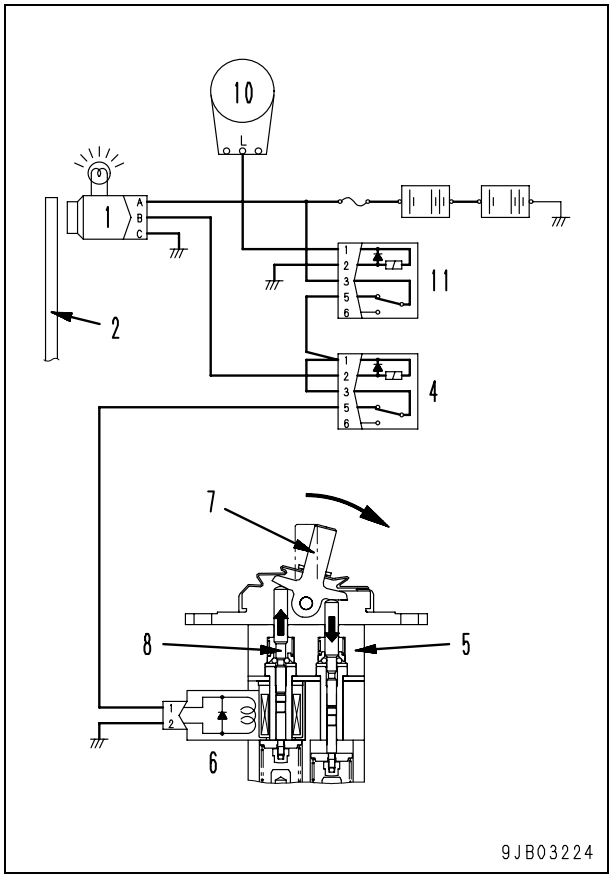
Operation of proximity switch

When bucket is tilted



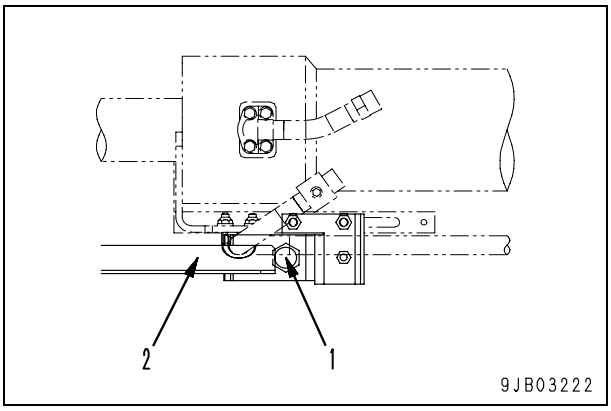


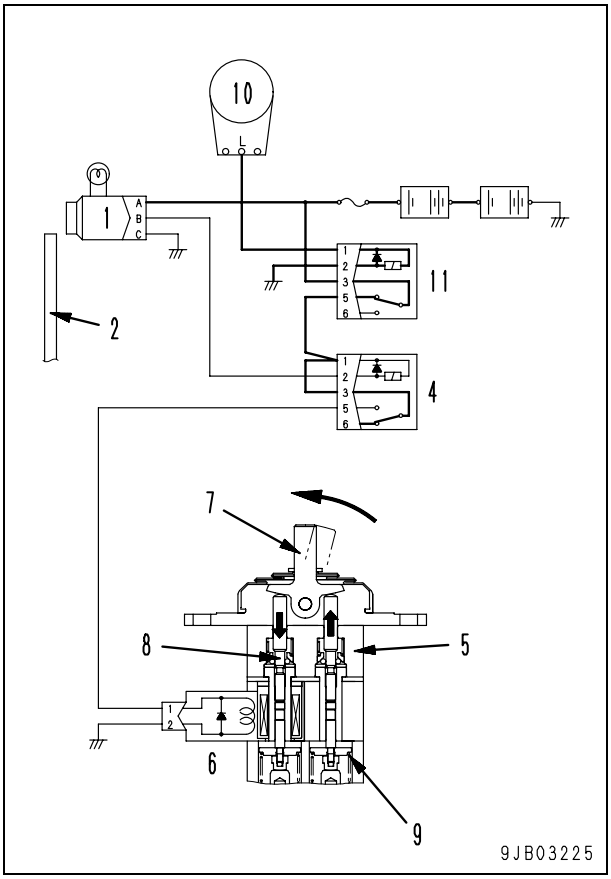




- While the bucket is dumping more than the position being set from the bucket positioner, angle (2) moves on to the sensing face of proximity switch (1), turning on the proximity switch lamp.
  At this point, bucket positioner relay (4) is energized and current flows to detent solenoid (6) of work equipment PPC valve (5) to energize the coil.

- Shifting bucket control lever (7) toward the tilt position moves spool (8) to the position of the arrow. And spool is held there by the energized coil of detent solenoid (6). As a result, bucket control lever (7) is held at the tilt position and the bucket tilts.





- As the bucket is tilted and moved away from the position set by the positioner – in other words, as angle (2) moves away from the sensing face of proximity switch (1), the lamp of proximity switch (1) goes off and bucket positioner relay (4) is turned off.
  Accordingly, the circuit of detent solenoid (6) of work equipment PPC valve (5) is turned OFF to de-energize the coil. Held lift arm spool (8) receives the reaction force of spring (9) and returns bucket control lever (7) to the neutral position.

★ The power supply for detent solenoid (6) operation is turned “ON” or “OFF” by alternator relay (11).
  Detent solenoid (6) circuit is cut off since L signal from alternator (10) is not sent to alternator relay (11) as long as the engine is stopped.
  As the result, bucket control lever (7) cannot be moved and held in the tilt position as long as angle (2) is positioned in sensing face of proximity switch (1).

Function of proximity switch

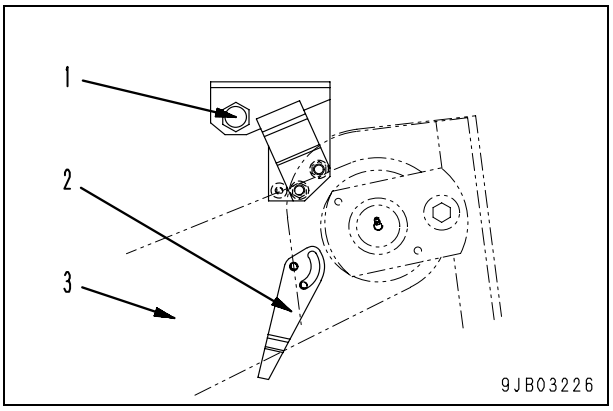
When object of sensing is over sensing face of proximity switch

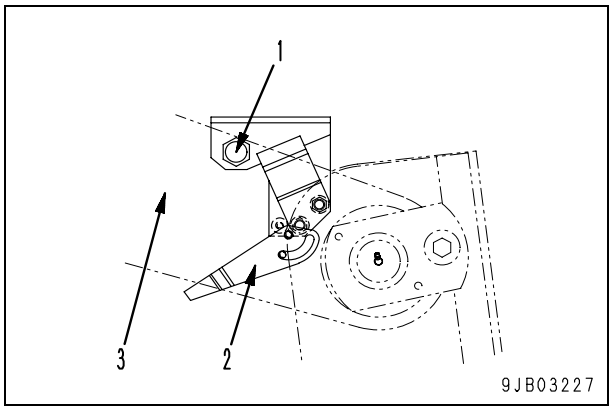
Lamp of proximity switch	ON
Bucket positioner relay switch circuit	ON
Work equipment PPC valve detent solenoid circuit	ON
Work equipment PPC valve detent solenoid	Energized

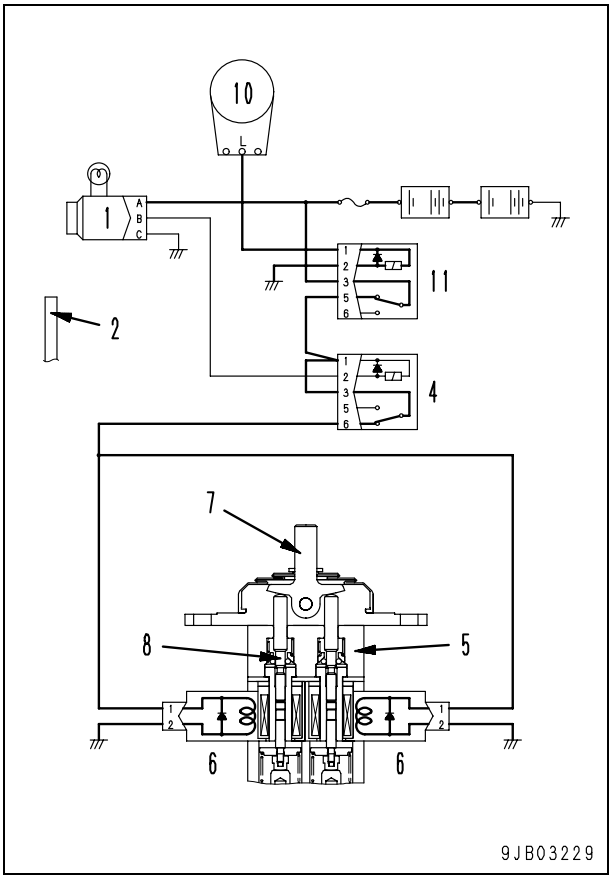
When object of sensing is apart from sensing face of proximity switch

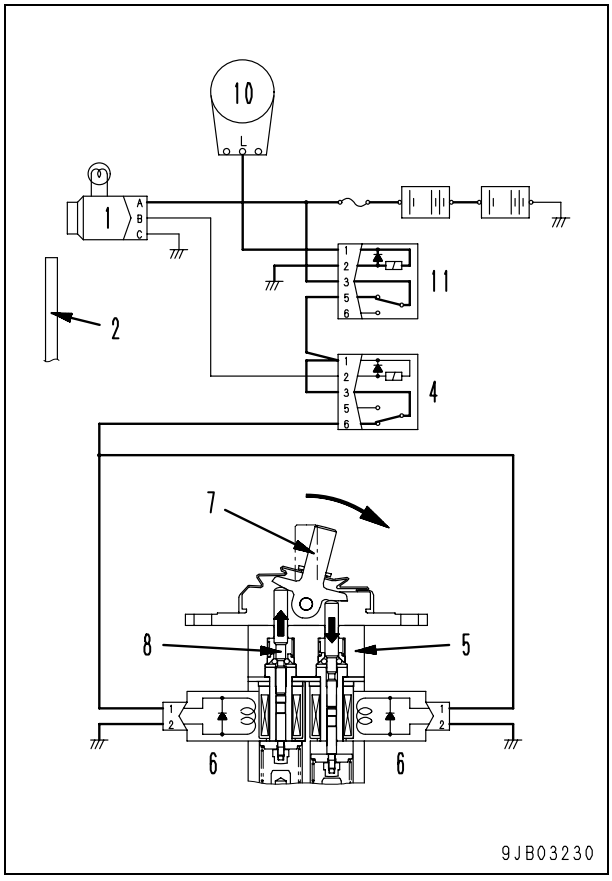
Lamp of proximity switch	OFF
Bucket positioner relay switch circuit	OFF
Work equipment PPC valve detent solenoid circuit	OFF
Work equipment PPC valve detent solenoid	De-energized

When lift arm is raised



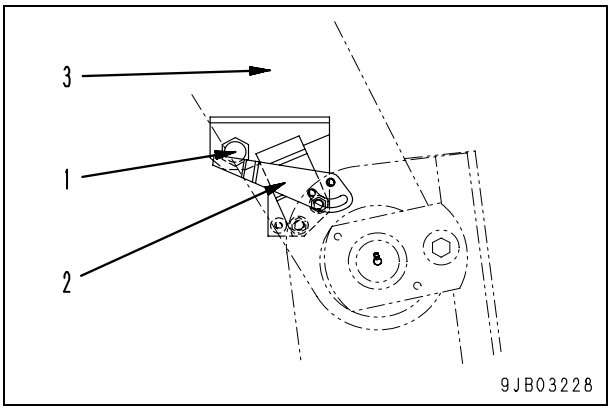


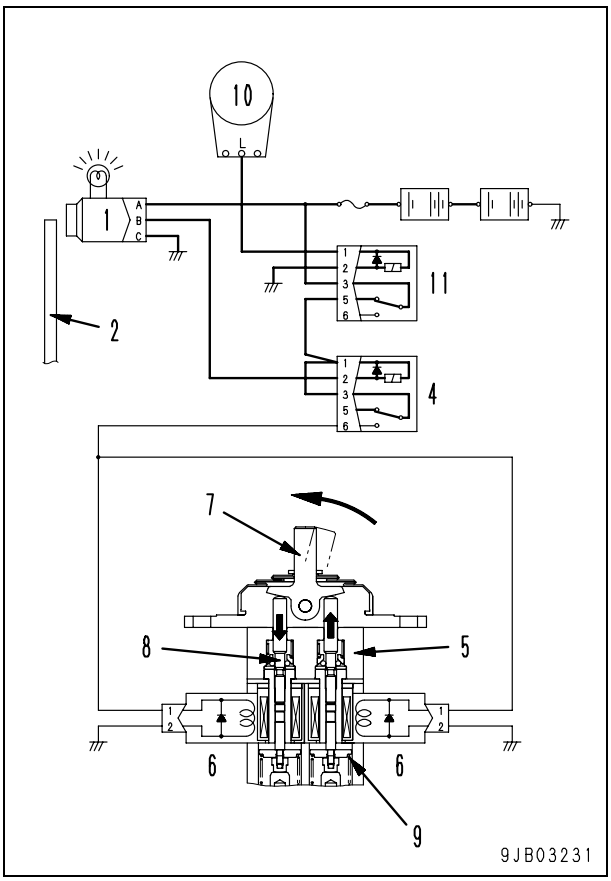




- While lift arm (3) is lower than the position being set from the boom kick-out, plate (2) is not on the sensing face and the lamp of proximity switch (1) goes off.
  At this point, boom kick-out relay (4) is turned off and current is conducted to detent solenoid (6) of work equipment PPC valve (5) to energize the coil.

- Shifting lift arm control lever (7) upward moves spool (8) to the position of the arrow. And spool is held there by the energized coil of detent solenoid (6). As the result, lift arm control lever (7) is held at the raise position and raising of lift arm (3) is continued.





- As raised lift arm (3) comes to the set position of the boom kick-out, or if plate (2) comes in the sensing face of proximity switch (1), the lamp of proximity switch (1) lights up and current is conducted to boom kick-out relay (4).
  Accordingly, the circuit of detent solenoid (6) of work equipment PPC valve (5) is cut off, de-energizing the coil. Held lift arm spool (8) receives the reaction force of spring (9) and returns lift arm control lever (7) to the neutral position.

★ The power supply for detent solenoid (6) operation is turned “ON” or “OFF” by alternator relay (11).
  Detent solenoid (6) circuit is turned off since L signal from alternator (10) is not sent to alternator relay (11) as long as the engine is stopped.
  As the result, lift arm control lever (7) cannot be moved and held in the raise side as long as plate (2) is not positioned in sensing face of proximity switch (1).

Function of proximity switch

When object of sensing is apart from sensing face of proximity switch

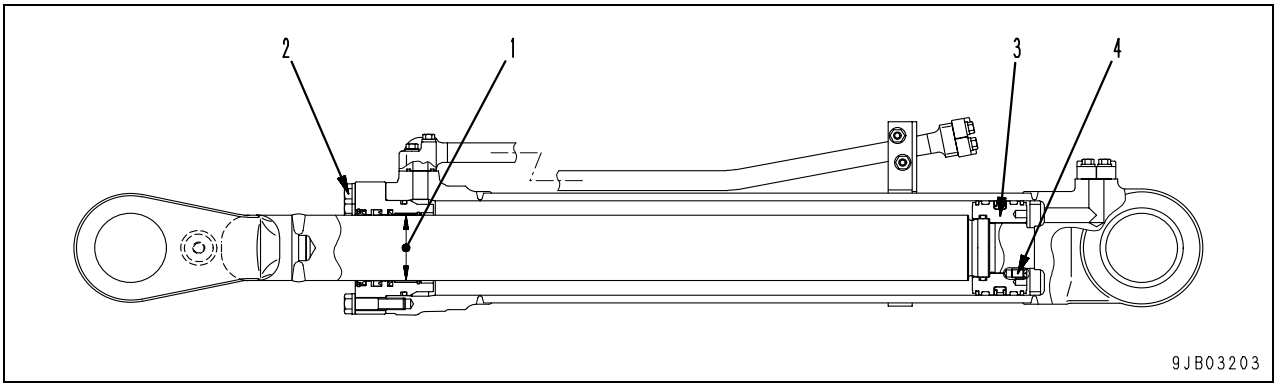
Lamp of proximity switch	OFF
Boom kick-out relay switch circuit	OFF
PPC valve detent solenoid circuit	ON
PPC valve detent solenoid	Energized

When object of sensing is over sensing face of proximity switch

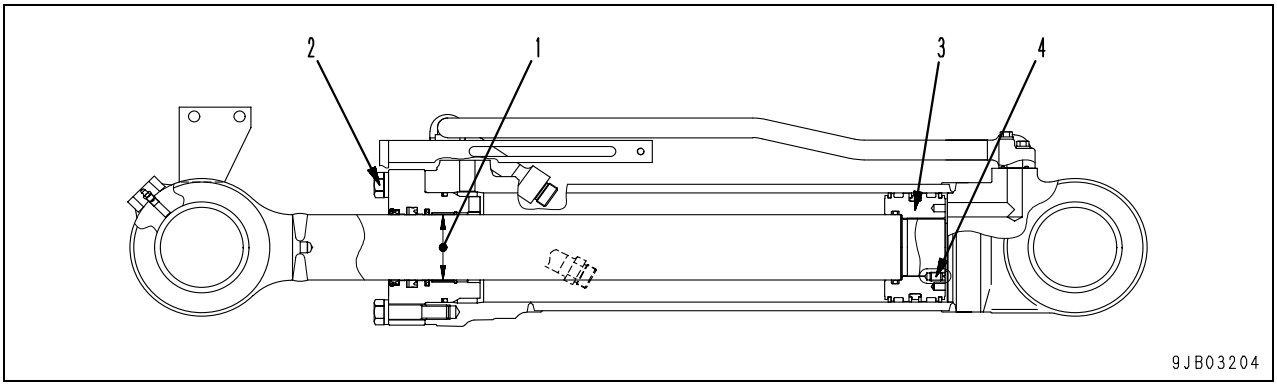
Lamp of proximity switch	ON
Boom kick-out relay switch circuit	ON
PPC valve detent solenoid circuit	OFF
PPC valve detent solenoid	De-energized

Work equipment cylinder

Lift cylinder



Bucket cylinder



Unit: mm

No.	Check item		Criteria					Remedy
		Cylinder name	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and bushing	Lift	90	–0.036 –0.090	+0.257 +0.048	0.084 – 0.347	0.647	Replace bushing
		Bucket	90	–0.036 –0.090	+0.257 +0.048	0.084 – 0.347	0.647	
2	Tightening torque of cylinder head	Lift	270 ± 39.2 Nm {27.5 ± 4.0 kgm}					Retighten
		Bucket	530 ± 78.5 Nm {54.0 ± 8.0 kgm}					
3	Tightening torque of cylinder piston	Lift	294 ± 29.4 Nm {30 ± 3.0 kgm}					
		Bucket	294 ± 29.4 Nm {30 ± 3.0 kgm}					
4	Tightening torque of cylinder piston lock screw	Lift	58.9 – 73.6 Nm {6.0 – 7.5 kgm}					
		Bucket	58.9 – 73.6 Nm {6.0 – 7.5 kgm}					

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

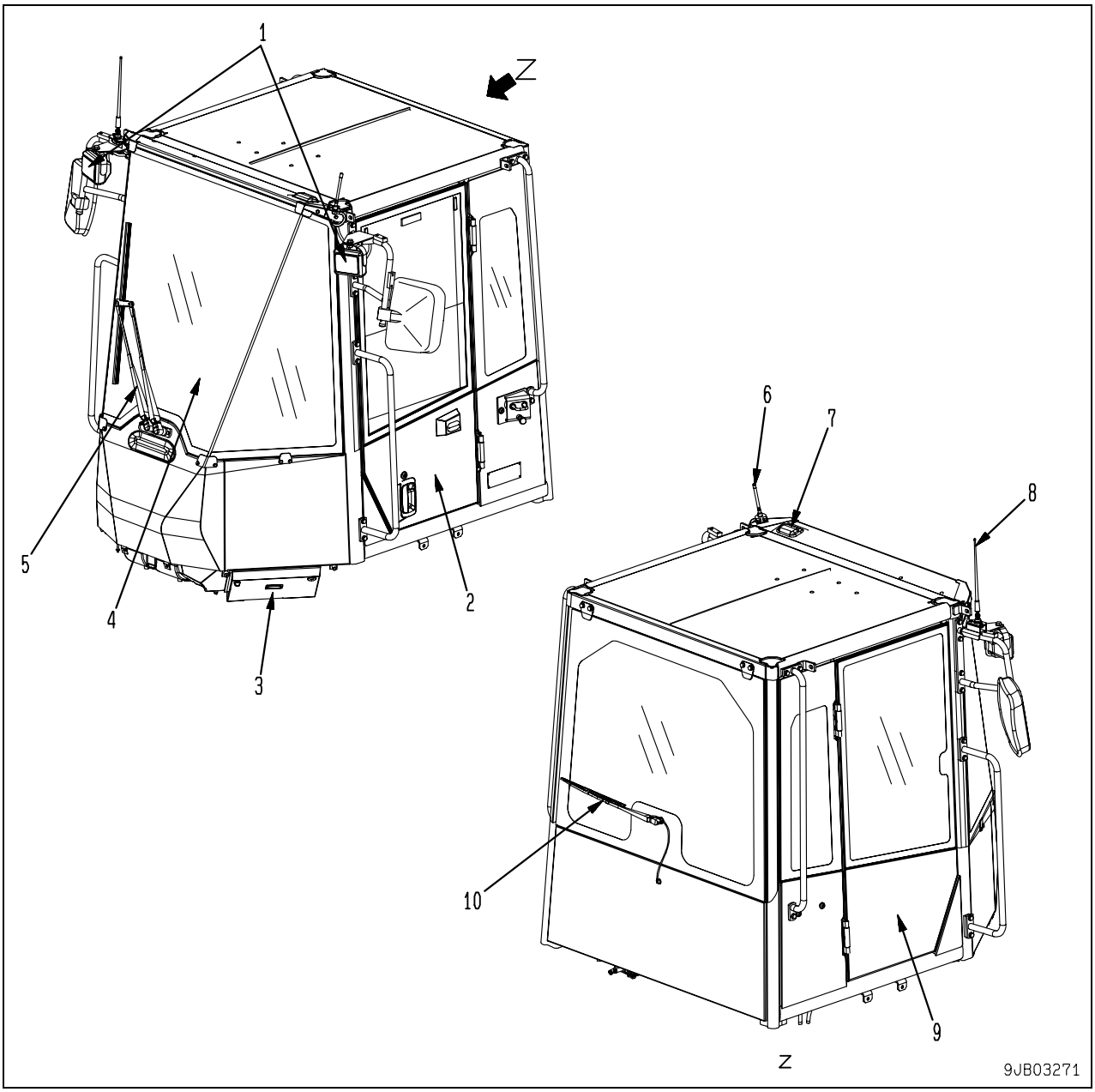
10 Structure, function and maintenance standard

Cab and its attachments

Cab and its attachments 3
Cab 3
Air conditioner 4

Cab and its attachments

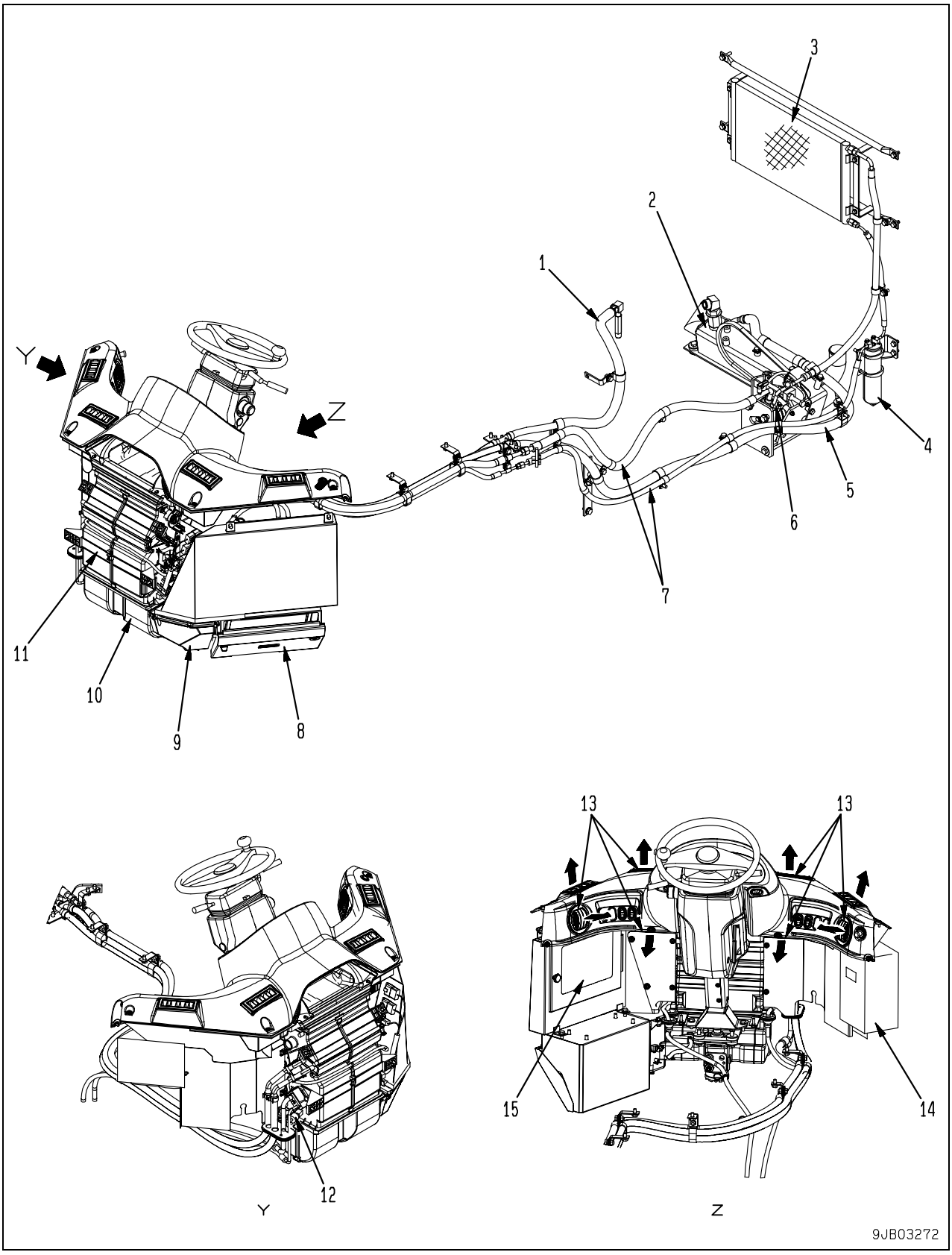
Cab



1. Front working lamp
2. Door (left)
3. Air conditioner external air filter
4. Front glass
5. Front wiper
6. KOMTRAX communication antenna (if equipped)
7. KOMTRAX GPS antenna (if equipped)
8. Radio antenna
9. Door (left)
10. Rear wiper

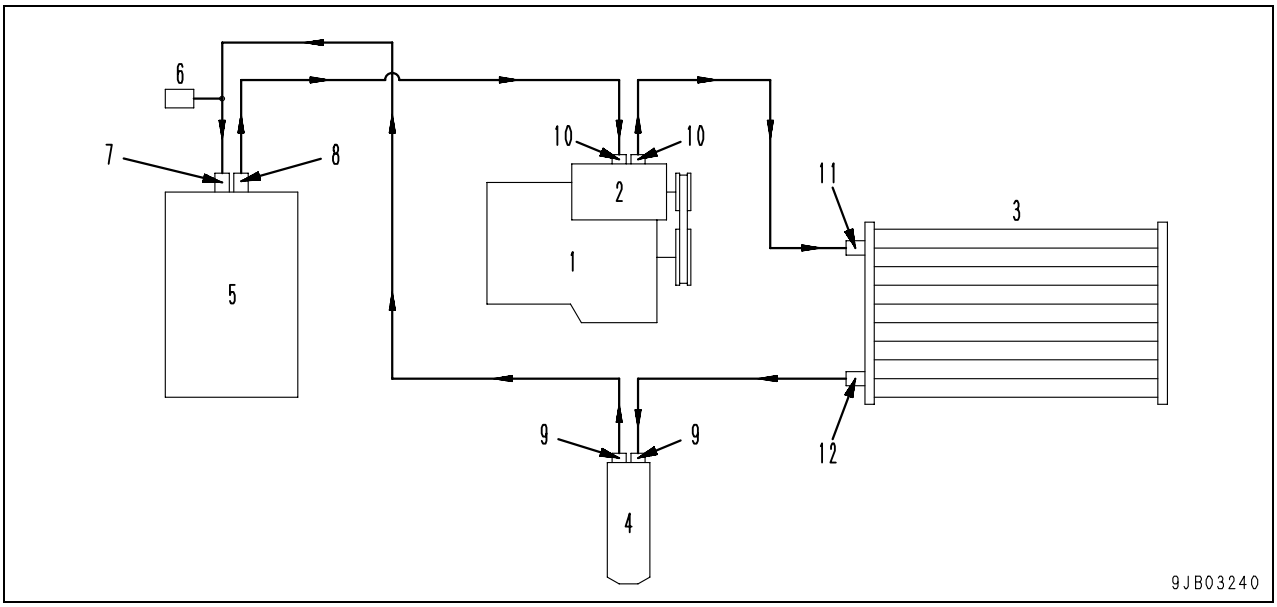
Air conditioner

Air conditioner piping diagram



1. Hot water take-out piping
2. Power train oil cooler
3. Condenser
4. Receiver
5. Hot water return piping
6. Compressor
7. Refrigerant piping
8. External air filter
9. Internal/external air changeover damper
10. Blower unit
11. Air conditioner unit
12. Dual pressure switch
13. Air outlet duct
14. Cool and hot box
15. Internal air filter

Refrigerant circuit diagram



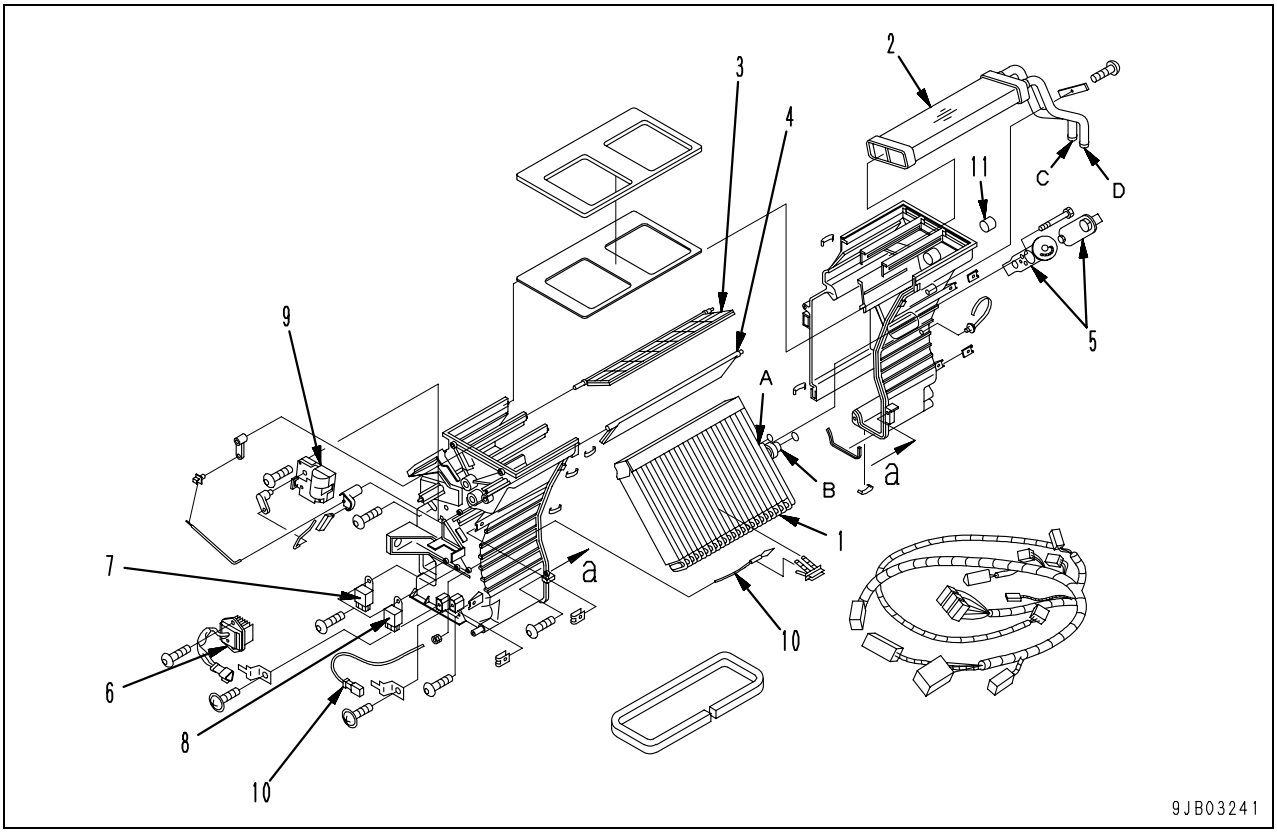
1. Engine
2. Compressor
3. Condenser
4. Receiver
5. Air conditioner unit
6. Dual pressure switch

Table of tightening torque for refrigerant piping adapter

Unit: Nm {kgm}

No.	Check item	Criteria	Remedy
7	Air conditioner unit refrigerant inlet side	12 – 15 {1.2 – 1.5} (Screw size: M16 x 1.5)	Retighten
8	Air conditioner unit refrigerant outlet side	30 – 35 {3.1 – 3.6} (Screw size: M24 x 1.5)	
9	Receiver refrigerant pipe set bolt	8 – 12 {0.8 – 1.2} (Screw size: M16 x 1.0)	
10	Compressor refrigerant piping lock bolt	20 – 25 {2.0 – 2.6} (Screw size: M8 x 1.25)	
11	Condenser refrigerant inlet side	12 – 15 {1.2 – 1.5} (Screw size: M16 x 1.5)	
12	Condenser refrigerant outlet side	20 – 25 {2.1 – 2.6} (Screw size: M22 x 1.5)	

Air conditioner unit



A: From receiver
B: To compressor
C: Hot water inlet
D: Hot water outlet

1. Evaporator
2. Heater core
3. Air mix damper (upper)
4. Air mix damper (lower)
5. Expansion valve
6. Blower controller
7. Blower motor relay
8. Compressor clutch relay
9. Air mix damper actuator
10. Evaporator temperature sensor
11. Dual pressure switch

Outline

- The vertical air conditioner unit on which evaporator (1) and heater core (2) is synchronized with the blower and intake unit to generate cool and hot air.
- The temperature adjusting switch on the air conditioner panel controls air mix dampers (3) and (4) to adjust the spurting out temperature.

Cooler

- The cooler circulates refrigerant through evaporator (1) to cause heat exchange (dehumidification and cooling).
- Air taken in by the blower and intake unit is cooled with evaporator (1) and then blown out from the duct and grill.

Heater

- The heater circulates engine coolant in heater core (2) to cause heat exchange (heating).
- Air taken in by the blower and intake unit is heated with heater core (2) and then blown out through the duct and grill.

Functions of major components

Evaporator

- Evaporator fin is cooled by the low-pressure, low-temperature refrigerant gas being sent from the expansion valve. Air from the blower motor is cooled and dehumidified when passing through the fin.

Heater core

- Fin of the heater core is heated by the hot water (cooling water) being sent from the engine. Air from the blower motor is heated as it passes through the fin.

Expansion valve

- This valve converts high-pressure, high-temperature liquid refrigerant from the receiver to low-pressure, low-temperature misty refrigerant through the throttling function.
  It controls flow rate of refrigerant by changing level of throttling depending on the thermal load in the operator's cab.

Blower controller

- It controls the blower motor speed receiving signal current from the air conditioner panel.

Blower motor relay

- Signal current from the air conditioner panel controls the relay coil. As the relay coil is energized and the switch is turned “ON“, power is supplied to the blow motor.

Compressor clutch relay

- Signal current from the air conditioner panel dual pressure switch is used for controlling the relay coil. As the relay coil is energized and the switch is turned “ON“, the magnet clutch of the compressor is connected.

Air mix damper actuator

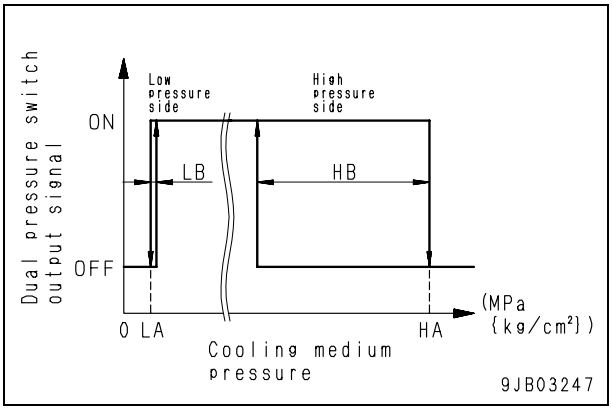
- It starts the built-in motor receiving signal current from the air conditioner panel in order to open or close the air mix damper through the link mechanism.
- The motor rotating direction is determined as the air conditioner panel read the position of the potentiometer being built in the actuator. This reading is done as the target temperature is set from the temperature adjustment switch on the air conditioner panel.
- Rotation of the motor is stopped as the contact, which is to move interlocked with the motor, moves away or signal current from the air conditioner panel is turned “OFF”.

Evaporator temperature sensor

- In order to prevent freezing of the evaporator, it senses the evaporator temperature and sends necessary signals to the air conditioner panel. The signal sent to the air conditioner panel is used to control the compressor. As the result, temperature of the air blown out of the grill is adjusted depending on the volume of refrigerant circulated in the evaporator.

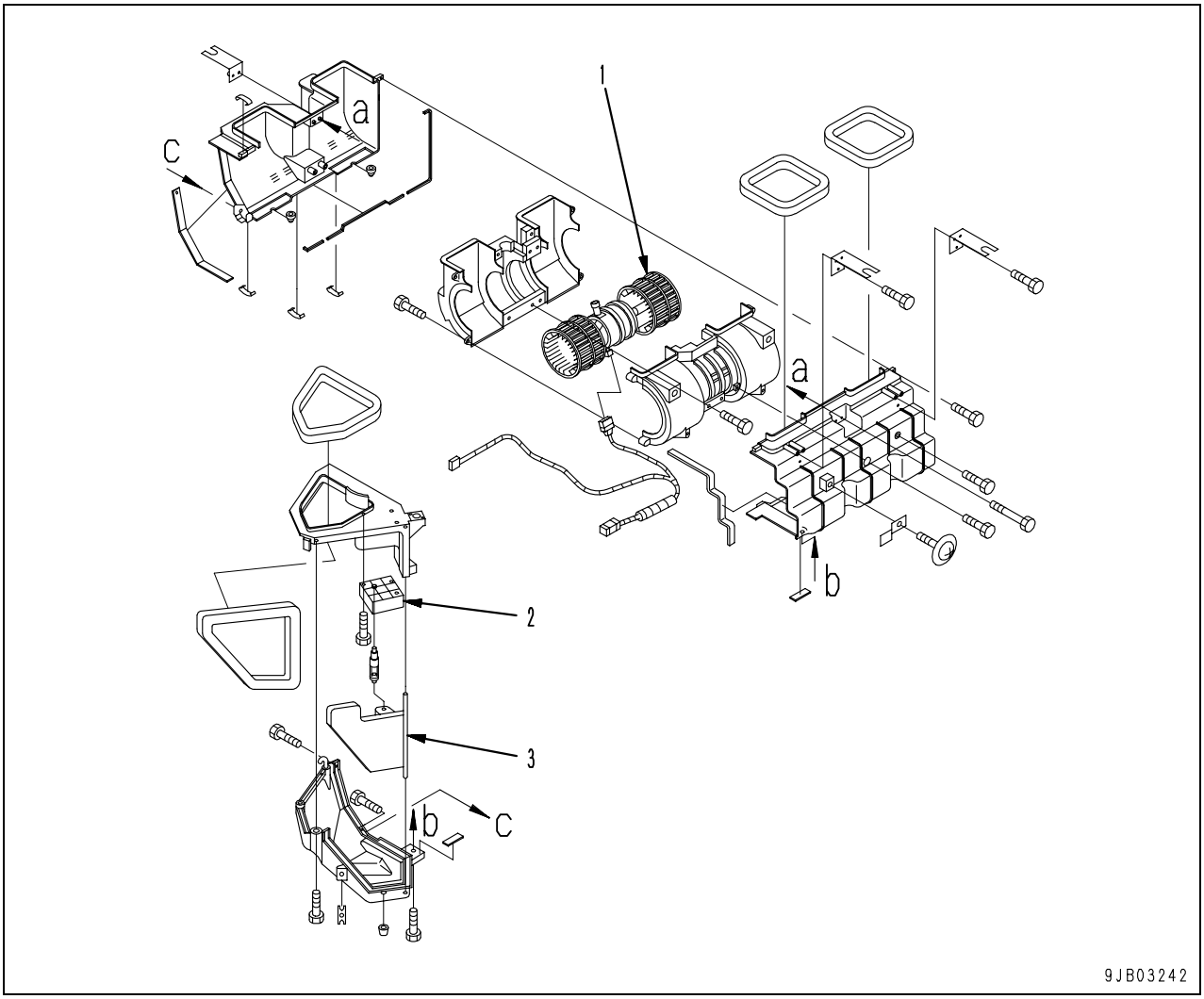
Dual pressure switch

- If abnormally low or high pressure was generated in the refrigerant circulation circuit, this switch releases the magnet clutch of the compressor to protect a series of cooler-related equipment.



LA: 0.20 MPa {2 kg/cm^2}
LB: 0.02 MPa {0.2 kg/cm^2}
HA: 3.14 MPa {32 kg/cm^2}
HB: 0.59 MPa {6 kg/cm^2}

Blower and intake unit



1. Blower motor assembly
2. Internal/external air changeover damper actuator
3. Internal/external air changeover damper

Functions of major components

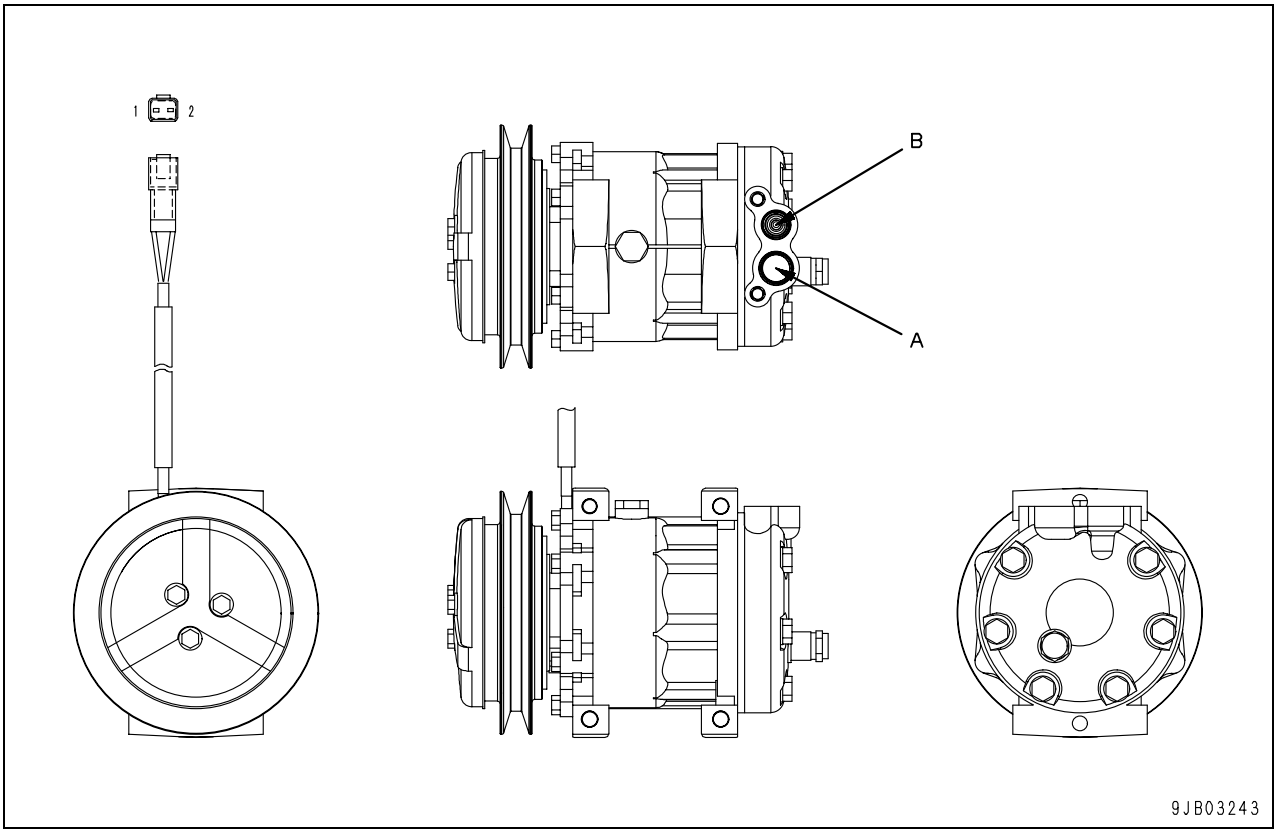
Blower motor assembly

- It suctions air by rotating the fin installed on the blower motor. And it is also used for sending the absorbed air to the evaporator and heater core.

Internal/external air changeover damper actuator

- Receiving signal current from the air conditioner panel, it starts the built-in motor to open or close the internal/external air changeover damper through the link mechanism.
- The motor rotation direction is determined from the internal/external air changeover switch on the air conditioner panel.
- Rotation of the motor is stopped as the contact, which is to move interlocked with the motor, moves away or signal current from the air conditioner panel is turned “OFF”.

Compressor



A: From air conditioner unit
B: To condenser

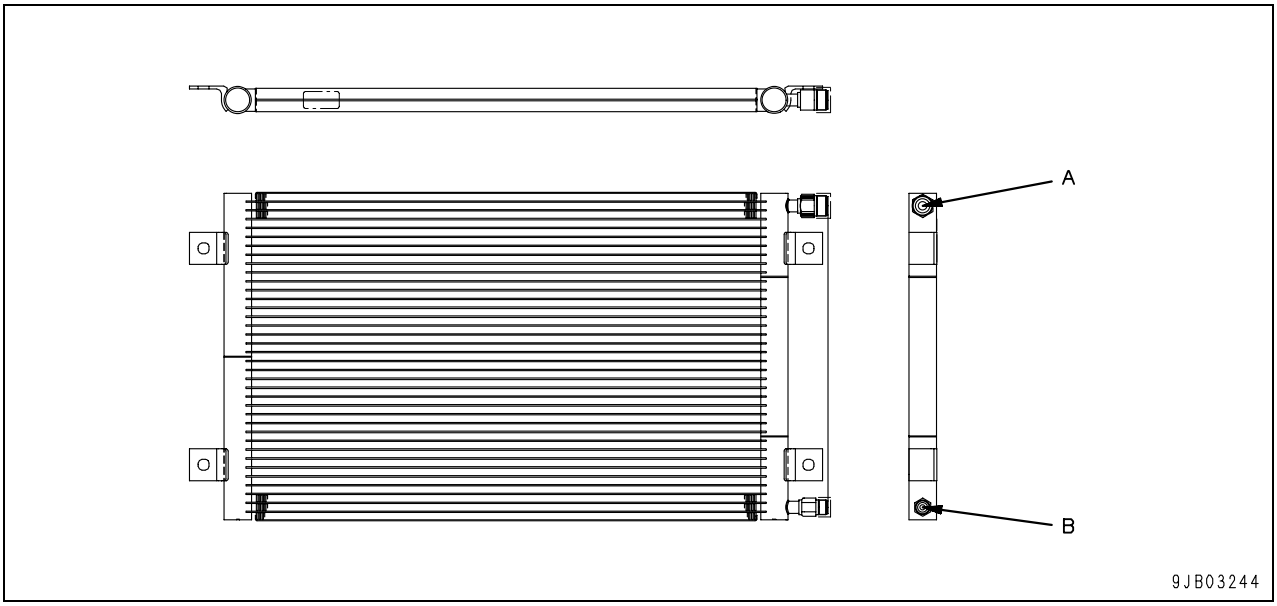
Function

- Other than circulating the refrigerant, it compresses the refrigerant gas from the evaporator to high-pressure, high-temperature misty refrigerant so that it may be easily regenerated (liquefied) at normal temperature.
- Its built-in magnet clutch turns on or off depending on the evaporator temperature and refrigerant pressure.

Specifications

Number of cylinders – Bore x Stroke (mm)	7 – 29.3 x 27.4
Piston capacity (cc/rev)	129.2
Allowable maximum speed (rpm)	4,000

Condenser



A: From compressor
B: To receiver

Function

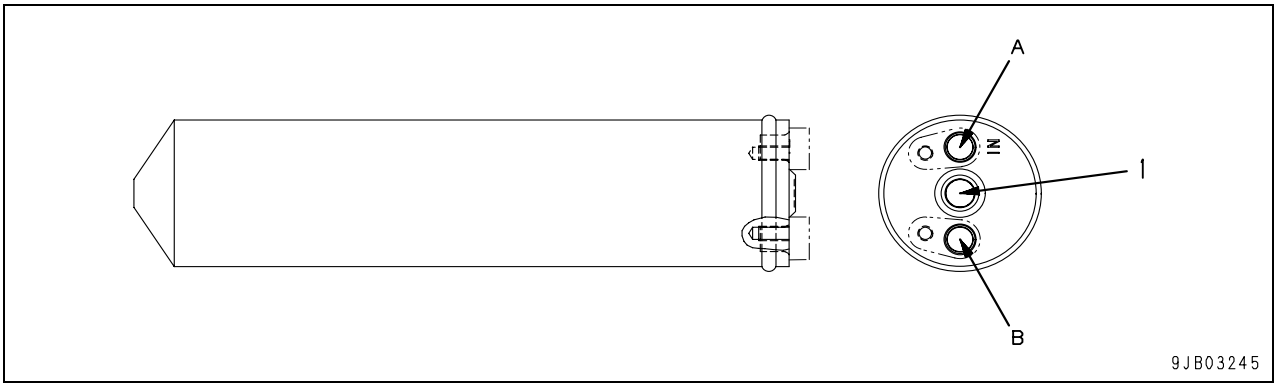
- It cools and liquefies the high-pressure and high-temperature misty refrigerant from the compressor.

★ If the fin crushes or is clogged with dusts, heat exchange efficiency is degraded and complete liquefaction of refrigerant becomes unavailable. As the result, pressure in the refrigerant circulation circuit will be increased, applying extra load to the engine or degrading the cooling effect. Thus, care must be used in its handling and daily inspection.

Specifications

Fin pitch (mm)	1.5
Total heat dissipation surface (m^2)	6.55
Max. pressure used (MPa {kg/cm^2})	3.6 {36}

Receiver



A: From condenser
B: To air conditioner unit

1. Sight glass

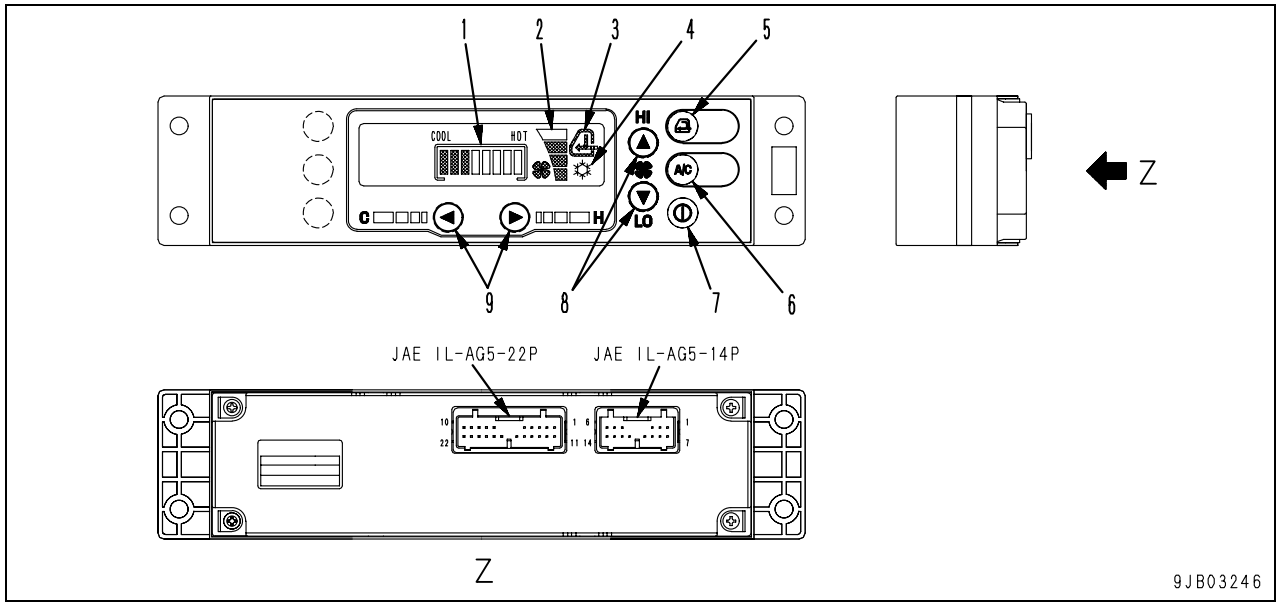
Function

- It is used to store liquefied high-pressure, high-temperature misty refrigerant from the condenser. It is capable of completely liquefying the refrigerant even when bubbles are contained in the refrigerant due to the condenser condition in heat dissipation.
- It eliminates foreign substances in the circulation circuit and water content in the refrigerant by use of the built-in filter and desiccating agent.
- Sight glass (1) allows inspecting flow of the refrigerant.

Specifications

Effective cubic capacity (cm^3)	578
Weight of desiccating agent (g)	300

Air conditioner panel



Display unit

No.	Display category	Displayed items	Display range	Display method	Display color	Remarks
1	Gauges	Spurting out temperature	See above drawing	All segments below applicable level come on (8-step display)	Black	Liquid crystal
2		Air blasting volume	See above drawing	All segments below applicable level come on (4-step display)		
3	Pilot	Circulation of internal air and introduction of external air	When circulating internal air and introducing external air	The display indicates which is currently taking place-internal air circulation or external air introduction-responding to the operation of the internal/external air changeover switch.		
4		Air conditioner	When air conditioner switch is turned “ON”	Turns “ON” air conditioner switch, this lamp lights up.		

Switch block

No.	Type	Function	Operation
5	Internal/external air changeover switch	It is used for selecting the internal air circulation or external air introduction (The pilot indication on the display unit varies depending on the given setting.)	Internal air circulation ↑↓ External air introduction
6	Air conditioner switch	It turns on or off the cooling and the dehumidifying heating function.	OFF ⟷ ON
7	Main power switch	This switch turns on or off the main power of the air conditioner. ON: Display unit indicates the setting being specified when power was turned “OFF”. OFF:Turns off the display unit and stops the fan.	OFF ⟷ ON
8	Fan switch	It controls volume of air sent from the fan. (Adjusted in 4 steps [LO, M1, M2, HI])	LO ⟷ HI
9	Temperature adjusting switch	It is used to control spurting out temperature. (8-step adjustment)	Low temperature ↑↓ High temperature

Outline

- CPU (central processing unit) installed on the panel processes input signals from respective sensors and operation signals of the panel switches to display and output them.
- The self-diagnosis function of CPU makes the troubleshooting easier.

Input and output signals

JAE IL-AG5-14P [CN-C48]

Pin No.	Signal name	Input and output signals
1	GND	—
2	Sensor ground	—
3	Internal/external air changeover damper actuator limiter	Input
4	External air temperature sensor	Input
5	Evaporator temperature sensor	Input
6	Internal air temperature sensor	Input
7	Starting switch (ON)	Input
8	Night lamp signal	Input
9	NC	—
10	NC	—
11	NC	—
12	NC	—
13	Day light sensor 2	Input
14	Day light sensor 1	Output

JAE IL-AG5-22P [CN-C47]

Pin No.	Signal name	Input and output signals
1	NC	—
2	NC	—
3	Blower motor relay	Input
4	Internal/external air changeover damper actuator output 1	Output
5	Internal/external air changeover damper actuator output 2	Output
6	Mode selector actuator output 2	Output
7	Mode selector actuator output 1	Output
8	Air mix damper actuator output 2	Output
9	Air mix damper actuator output 1	Output
10	Actuator potentiometer power supply (5 V)	—
11	NC	—
12	NC	—
13	NC	—
14	NC	—
15	Magnet clutch	Input
16	Air mix damper actuator limiter	Input
17	Mode selector actuator limiter	Input
18	Air mix damper actuator potentiometer	Input
19	Mode selector actuator potentiometer	Input
20	Blower gate	Input
21	Blower feedback	Input
22	Actuator potentiometer ground	—

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

10 Structure, function and maintenance standard

Electrical system, Part 1

Electrical system, Part 1 2
Machine monitor system 2
Machine monitor 7

Electrical system, Part 1

Machine monitor system

Outline

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

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

- The operator mode is used to display the information to the operator normally. The major functions used in the operator 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 items are displayed according to the set state of the optional device selecting function.
   - Travel speed or engine speed indication 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 display, setting and adjustment functions are provided using the character display and the machine monitor mode selector switch, which is the operation switch of the character display.
   1) Display the odometer
   2) Reset the filter or oil replacement time
   3) Input the telephone number
   4) Select the language
   5) Adjust the brightness of the night lighting for the machine monitor
   6) Travel speed/engine speed display selecting function
   7) Function for setting display/no-display of travel speed or engine speed to the character display

- The service mode function is provided 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. Electrical system failure history display function
   The electrical system failures of each controller saved in the machine monitor are displayed. The information of those failures is also deleted with this function.

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

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

4. Engine reduced-cylinder function
   This function is used for the purpose of specifying cylinder having defective combustion by stopping fuel injection to each cylinder from the fuel injector.

5. No injection cranking function
   Before restarting engine after a long-term storing of the machine, this function is used to lubricate the engine internally.

6. Adjustment function
   Functions are provided to correct and adjust the installation errors and manufacturing dispersion of the sensors, solenoid valves, etc. Function for changing control characteristics is provided on user request.

7. Maintenance monitoring function
   Changes the filter or oil replacement time and makes ON-OFF selection of the function.

8. Operating information display function
   Displays fuel consumption per operating hour.

9. Optional device selecting function
   Verifies the installation of optional devices or changes their setting.

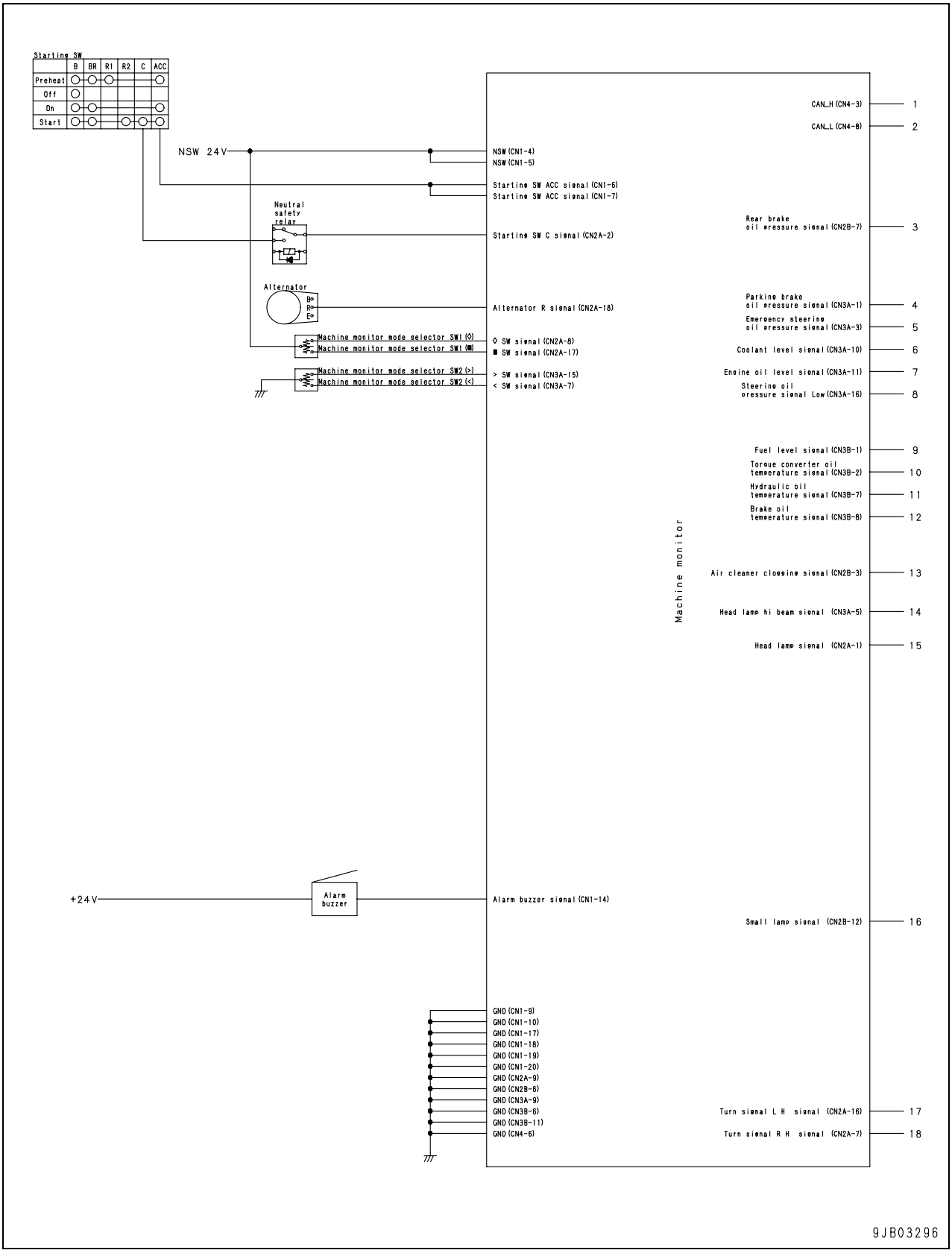
10. Machine serial number input function
    Enters the machine serial number to identify the machine.

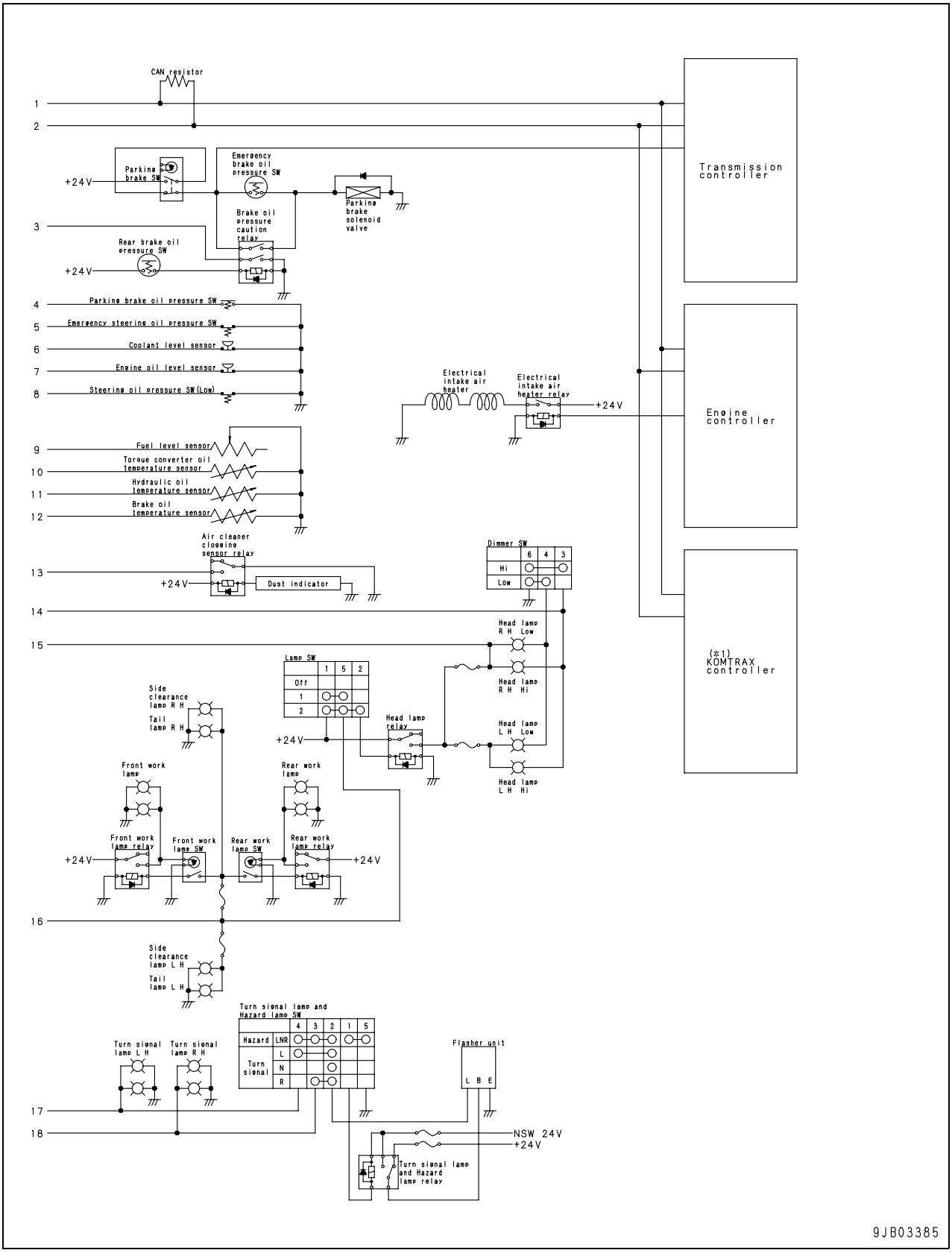
11. Model selection function
    Enter the information of applicable model.

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

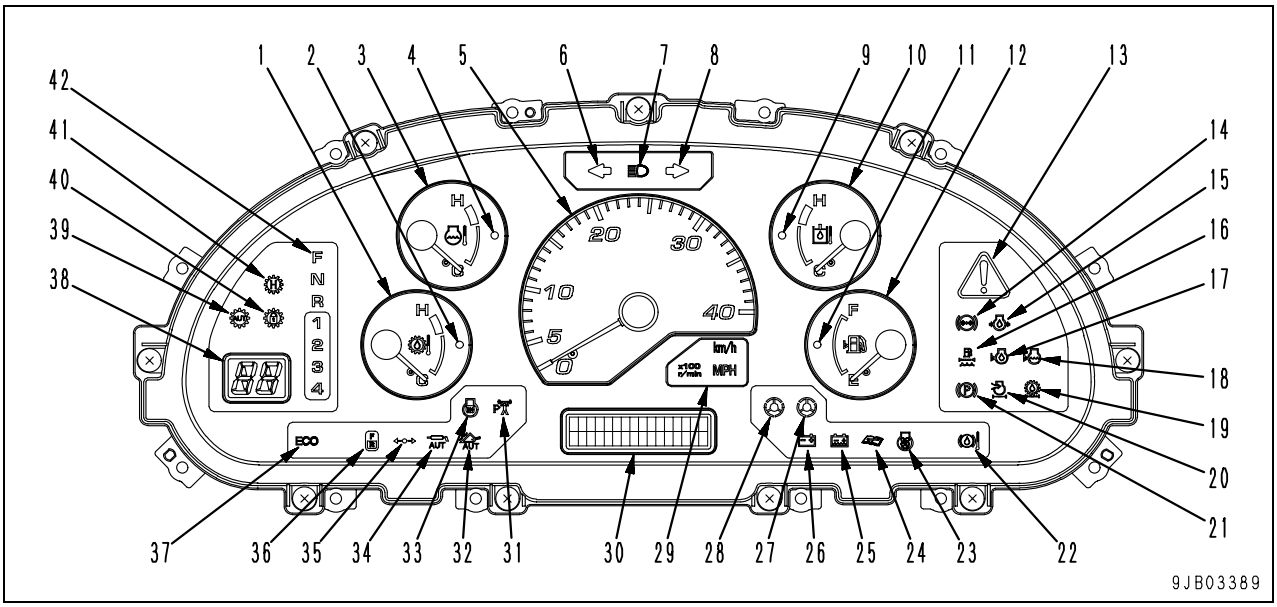
System circuit diagram

★ Items marked with *1 in drawing may or may not installed.




CAN resistor
1
2
Transmission controller
Parking brake SW
+24V
Emergency brake oil pressure SW
Parking brake solenoid valve
Brake oil pressure caution relay
3
Rear brake oil pressure SW
+24V
4 Parking brake oil pressure SW
5 Emergency steering oil pressure SW
6 Coolant level sensor
7 Engine oil level sensor
8 Steering oil pressure SW(Low)
Electrical intake air heater
Electrical intake air heater relay
+24V
Engine controller
9 Fuel level sensor
10 Torque converter oil temperature sensor
11 Hydraulic oil temperature sensor
12 Brake oil temperature sensor
Air cleaner clogging sensor relay
13
+24V
Dust indicator
Dimmer SW
Hi
Low
14
15
Head lamp R H Low
Head lamp R H Hi
Head lamp L H Low
Head lamp L H Hi
Lamp SW
Off
1
2
Head lamp relay
+24V
(*1) KOMTRAX controller
Side clearance lamp R H
Tail lamp R H
Front work lamp
Rear work lamp
Front work lamp relay
Front work lamp SW
Rear work lamp SW
Rear work lamp relay
+24V
+24V
16
Side clearance lamp L H
Tail lamp L H
Turn signal lamp and Hazard lamp SW
Hazard
Turn signal
Turn signal lamp L H
Turn signal lamp R H
Flasher unit
L B E
17
18
NSW 24V
+24V
Turn signal lamp and Hazard lamp relay
9JB03385

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. Turn signal pilot lamp (Left)
7. Head lamp high beam pilot lamp
8. Turn signal pilot lamp (Right)
9. Hydraulic oil temperature caution lamp
10. Hydraulic oil temperature gauge
11. Fuel level caution lamp
12. Fuel gauge
13. Central warning lamp
14. Brake oil pressure caution lamp
15. Engine oil pressure caution lamp
16. Water separator caution lamp
17. Engine oil level caution lamp
18. Radiator coolant level caution lamp
19. Transmission oil filter clogging caution lamp (*1)
20. Air cleaner clogging caution lamp
    (Machines equipped with KOMTRAX)
21. Parking brake pilot lamp
22. Axle oil temperature caution lamp
23. Cooling fan reverse rotation pilot lamp
24. Maintenance caution lamp
25. Battery electrolyte level caution lamp (*1)
26. Battery charge circuit caution lamp
27. Steering oil pressure caution lamp (*2)
28. Emergency steering pilot lamp (*2)
29. Meter display pilot lamp
30. Character display
31. Power mode pilot lamp
32. Semi automatic digging pilot lamp (*2)
33. Preheating pilot lamp
34. Auto-greasing pilot lamp (*2)
35. Joystick pilot lamp (*2)
36. Directional selector pilot lamp
37. Economy operation pilot lamp
38. Shift indicator
39. Auto-shift pilot lamp
40. Torque converter lockup pilot lamp (*2)
41. Shift hold pilot lamp
42. Shift lever position pilot lamp

*1: Not used by this model
*2: If equipped

List of items displayed on monitor

Condition for judging that engine is running:
When either one or both of following items 1 and 2 is or are sensed, the machine monitor judges that the engine is running.
1. The engine speed is above 500 rpm.
2. There is alternator voltage R and there is terminal C input after the starting switch is turned “ON”.

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

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

Category	No.	Check item	Device	Operating condition	Detecting time (sec.)		Operating condition								Display color	Remarks
							Engine stopped				Engine is running					
					Detection	Reset	Alarm buzzer	Individual display	Central warning lamp	Display of message	Alarm buzzer	Individual display	Central warning lamp	Display of message		
Central warning lamp	13	Central warning	LED	When error is made			△	△	△	△	△	△	△	△	Red	Turned ON with errors (E03 and E02) of each controller, simultaneously displaying the message on the character display.
				For other than above, see “Operating condition, central warning lamp” of other items.			—	—	—		—	—	—			
Back light	—	Back light	LED	When lamp switch is other than “OFF”			—	—	—		—	—	—		White	
Gauges and meters	1 2	Torque converter oil temperature	Pointer: Movement Caution lamps: LED	Other than below			—	—	—		—	—	—		Red	White range: 50 – 120°C Red range: 120 – 135°C When the sensor is grounded: Max When the sensor is disconnected or hot short-circuited: Min
				Alarm: Min. 120°C	10	1	—	○	—		—	○	—			
				Alarm: Min. 130°C	10	1	◎	○	○	B@CENS	◎	○	○	B@CENS		
				When abnormality is detected (out of input signal range)	20	5	—	—	—	DGT1KX	—	—	—	DGT1KX		
	3 4	Engine coolant temperature	Pointer: Movement Caution lamps: LED	Other than below			—	—	—		—	—	—		Red	White range: 50 – 102°C Red range: 102 – 135°C When the sensor is grounded: Max When the sensor is disconnected or hot short-circuited: Min
				Alarm: Min. 102°C	3	0	—	○	—		—	○	—			
				Alarm: Min. 105°C			◎	○	○	B@BCNS	◎	○	○	B@BCNS		
				When abnormality is detected (high temperature)			—	—	—	CA144	—	—	—	CA144		
				When abnormality is detected (low temperature)			—	—	—	CA145	—	—	—	CA145		
	5	Engine speed	Pointer: Movement	When engine speed display is selected			—	—	—		—	—	—		—	(Selectable with the machine monitor setting) Displays “0” when error is made in communication.
		Travel speed		When travel speed display is selected			—	—	—		—	—	—			
	9 10	Hydraulic oil temperature	Pointer: Movement Caution lamps: LED	Other than below			—	—	—		—	—	—		Red	White range: 50 – 100°C Red range: 100 – 125°C When the sensor is grounded: Max When the sensor is disconnected or hot short-circuited: Min
				Alarm: Min. 100°C	10	1	◎	○	○	B@HANS	◎	○	○	B@HANS		
				When abnormality is detected (out of input signal range)	20	5	—	—	—	DGH2KX	—	—	—	DGH2KX		
	11 12	Fuel level	Pointer: Movement Caution lamps: LED	Other than below			—	—	—		—	—	—		Red	Max: 10 Ω Min: 85 Ω When the sensor is grounded: Full When the sensor is disconnected or hot short-circuited: Empty
				Min. 80 Ω	10	1	—	○	—		—	○	—			
Character display	30	Service meter	LCD	Operates when charging normally at 1 : 1 to the clock time			—	—	—		—	—	—		Black	Displays various codes and items according to the machine condition and switch operation.
		Odometer		Converts travel speed pulse into travel distance			—	—	—		—	—	—			

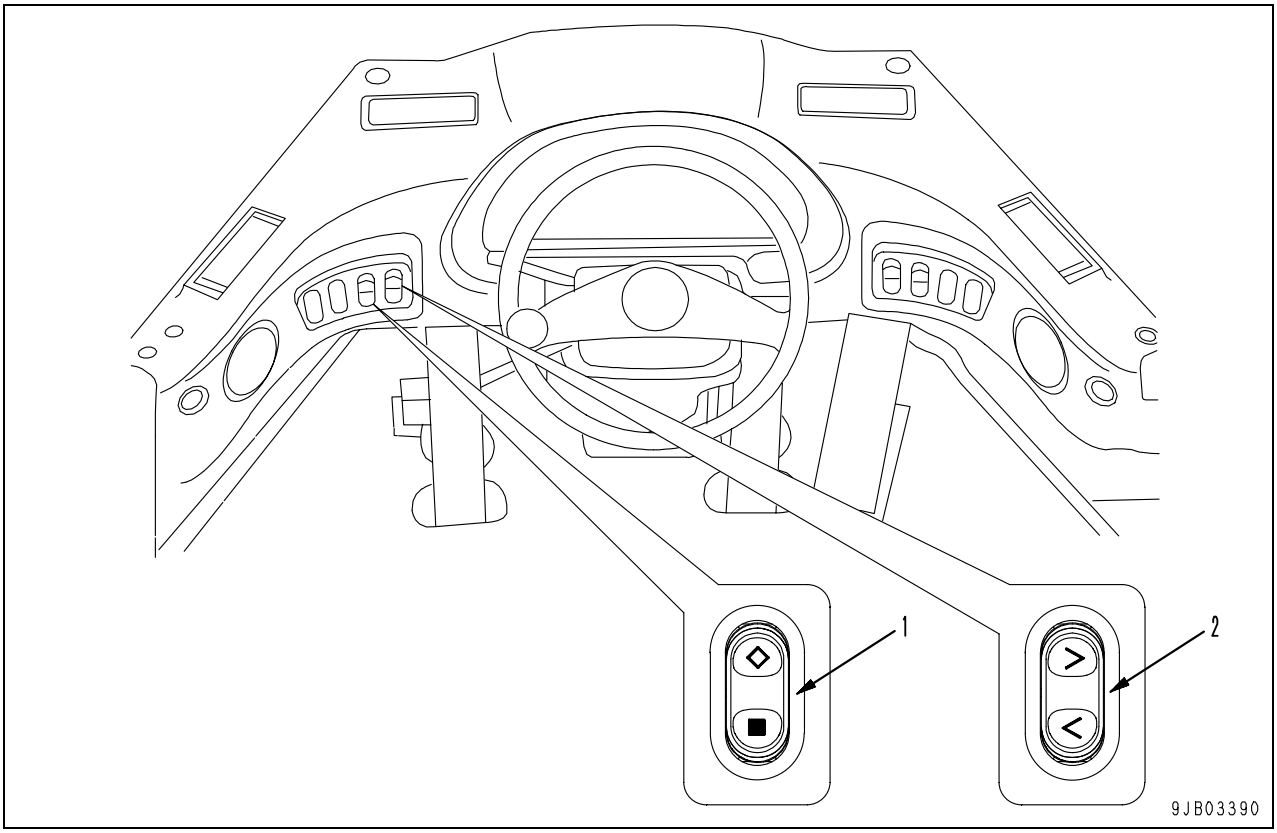
Category	No.	Check item	Device	Operating condition	Detecting time (sec.)		Operating condition								Display color	Remarks
							Engine stopped				Engine is running					
					Detection	Reset	Alarm buzzer	Individual display	Central warning lamp	Display of message	Alarm buzzer	Individual display	Central warning lamp	Display of message		
Unit	29	Engine Speed	LED	When engine speed display is selected	0	0	—	○	—		—	○	—		Green	× 100 r/min (Selectable with the machine monitor setting)
		Travel speed		When travel speed display is selected	0	0	—	○	—		—	○	—		Green	km/h or MPH (Selectable with the machine monitor setting)
Items related to gear shifting	38	Actual gear speed	9-segment LCD	Left side: F, N, R Right side: Gear speed			—	—	—		—	—	—		Black	In neutral, gear speed is not displayed. If error is made in communication, condition is held until starting switch is turned “OFF”.
	39	Auto shift	LED	When auto-shift is selected	0	0	—	○	—		—	○	—		Green	If error is made in communication, condition is held until starting switch is turned “OFF”.
				Other than above			—	—	—		—	—	—			
	40	Torque converter lockup	LED	When lockup operates	0	0	—	—	—		—	○	—		Green	If error is made in communication, condition is held until starting switch is turned “OFF”.
				Other than above			—	—	—		—	—	—			
	41	Shift hold	LED	When auto shift or shift hold is selected	0	0	—	○	—		—	○	—		Green	If error is made in communication, condition is held until starting switch is turned “OFF”.
				Other than above			—	—	—		—	—	—			
	42	Directional lever position F	LED	When F is selected (When engine is stopped, neutral safety is displayed)	1	0	☆	○	○		—	○	—		Green	If error is made in communication, condition is held until starting switch is turned “OFF”.
		Directional lever position N	LED	When N is selected	0	0	—	○	—		—	○	—		Orange	
		Directional lever position R	LED	When R is selected (When engine is stopped, neutral safety is displayed)	1	0	☆	○	○		—	○	—		Green	
		Gear shift lever position 4	LED	When 4th gear speed is selected	0	0	—	○	—		—	○	—		Green	
		Gear shift lever position 3	LED	When 3rd gear speed is selected	0	0	—	○	—		—	○	—		Green	
		Gear shift lever position 2	LED	When 2nd gear speed is selected	0	0	—	○	—		—	○	—		Green	
		Gear shift lever position 1	LED	When 1st gear speed is selected	0	0	—	○	—		—	○	—		Green	
Other symbols	6 8	Turn signal	LED	When turn signal lever and hazard lamp switch signal is input	0	0	—	○	—		—	○	—		Green	Hazard lamp operates when starting switch is turned “OFF”.
	7	High beam of head lamp	LED	When the head lamp is set to high beam (When head lamp and dimmer switch are turned “ON”)	0	0	—	○	—		—	○	—		Blue	
	14	Brake oil pressure	LED	Normal oil pressure (CLOSED)			—	—	—		—	—	—		Red	
				Below set pressure (front) (OPEN) (Detect time continues) and 30 seconds after starting engine (No detection time)	5	1	—	○	—		◎	○	○	2G42ZG		
				Below set pressure (rear) (OPEN) (Detect time continues) and 30 seconds after starting engine (No detection time)	5	1	—	○	—		◎	○	○	2G43ZG		
				Below set pressure (front) (OPEN) (Detect time continues) and 30 seconds after starting engine (No detection time)	1	1	—	○	—		◎	○	○			
				Below set pressure (rear) (OPEN) (Detect time continues) and 30 seconds after starting engine (No detection time)	1	1	—	○	—		◎	○	○			
	15	Engine oil pressure	LED	Normal oil pressure (CLOSED)			—	—	—		—	—	—		Red	
				Low oil pressure (OPEN)			◎	○	○	B@BAZG	◎	○	○	B@BAZG		

Category	No.	Check item	Device	Operating condition	Detecting time (sec.)		Operating condition								Display color	Remarks
							Engine stopped				Engine is running					
					Detection	Reset	Alarm buzzer	Individual display	Central warning lamp	Display of message	Alarm buzzer	Individual display	Central warning lamp	Display of message		
Other symbols	16	Water separator	LED	Normal			—	—	—		—	—	—		Red	
				Water mixing with fuel			—	○	—	CA418	—	○	—	CA418		
	17	Engine oil level	LED	Normal oil level (CLOSED)			—	—	—		—	—	—		Red	If low level is detected when starting switch is turned “ON”, alarm is continued even after engine is started until adequate oil level is reached. Don't check the oil level for 300 sec, after stopping the engine.
				Low oil level (OPEN)	2	1	—	○	—	B@BAZK	—	—	—			
	18	Radiator coolant level	LED	Normal coolant level (CLOSED)			—	—	—		—	—	—		Red	
				Low coolant level (OPEN)	30	1	—	○	—	B@BCZK	—	○	—	B@BCZK		
	20	Air cleaner clogging	LED	Normal (CLOSED)			—	—	—		—	—	—		Red	
				Clogging (OPEN)	2	1	—	—	—		—	○	—	AA1ANX		
	21	Parking brake	LED	Operation (OPEN)			—	○	—		—	○	—		Red	
				Released (CLOSED)			—	—	—		—	—	—			
				Engine is running, parking brake is ON and the directional lever is at other than “N”	0	0	—	—	—		☆	○	○			
	22	Brake oil temperature	LED	Other than below			—	—	—		—	—	—		Red	To be released if the oil temperature is detected consecutively at lower than 125°C for 5 sec.
				Temperature rise (Oil temperature: Min. 120°C) (alarm)	5	5	—	○	—		—	○	—			
				Temperature rise (1 or 2) 1. Oil temperature: Min. 130°C 2. Oil temperature Min.125°C and travel speed min. 35 km/h	5	5	◎	○	○	B@C7NS	◎	○	○	B@C7NS		
				When abnormality is detected (disconnection)			—	—	—	DGR2KA	—	—	—	DGR2KA		
				When abnormality is detected (out of input signal range)			—	—	—	DGR2KX	—	—	—	DGR2KX		
	23	Cooling fan reverse rotation	LED	Normal	0	0	—	—	—		—	—	—		Orange	While fan is reversed, message of “COOLING FAN REVERSE” is displayed on character display.
				Reverse	0	0	—	○	—	Remarks	—	○	—	Remarks		
				Selecting reverse rotation	0	0	—	◎	—		—	◎	—			
	24	Maintenance monitor	LED	Ordinary			—	—	—		—	—	—		Red	Message is simultaneously displayed on the character display.
				30 hours or less before maintenance or maintenance time			—	○	—	△	—	○	—	△		
	25	Battery electrolyte level	LED	Appropriate level			—	—	—		—	—	—		Red	
				Max. 2 V	10	1	—	○	—	B@GAZK	—	○	—	B@GAZK		
				Sensor not installed			—	—	—		—	—	—			
	26	Battery charge circuit	LED	Normal voltage			—	—	—		—	—	—		Red	If abnormality is detected when starting switch is turned “ON”, alarm is continued even after engine is started. <Voltage hysteresis> Abnormal → Normal judgement: Min. 12 V Normal → Abnormal judgment Max. 5 V
				Engine is running, alternator voltage is in short and no starter signal C is input.	30	1	—	—	—		◎	○	○	AB00MA		
				When abnormality is detected (Unmatched engine condition and the signal)	3	1	◎	○	○	AB00L6	—	—	—			
	27	Steering oil pressure	LED	Normal (OPEN)	1	1	—	—	—		—	—	—		Red	The emergency steering function can be enabled only when “ADD” is selected for “13. EMERG S/T” item using the optional device selecting function of the machine monitor.
				Steering oil pressure is low (CLOSED) and engine speed is above 500 rpm	3	1	—	Remarks	—		◎	○	○	DDS5L6		

Category	No.	Check item	Device	Operating condition	Detecting time (sec.)		Operating condition								Display color	Remarks
							Engine stopped				Engine is running					
					Detection	Reset	Alarm buzzer	Individual display	Central warning lamp	Display of message	Alarm buzzer	Individual display	Central warning lamp	Display of message		
Other symbols	28	Emergency steering	LED	Operation (for less than 1 min) (OPEN)	1	1	◎	○	○		◎	○	○		Green	The emergency steering function can be enabled only when “ADD” is selected for “13. EMERG S/T” item using the optional device selecting function of the machine monitor.
				Operation (for less than 1 min) (OPEN)	1	1	—	○	—		—	○	—			
				Stop (CLOSED)			—	—	—		—	—	—			
	31	Power mode	LED	Power mode selector switch “P-mode”	0	0	—	○	—		—	○	—		Green	
				Power mode selector switch “E-mode”			—	—	—		—	—	—			
	32	Semiautomatic digging	LED	Semi auto digging switch “OFF”			—	—	—		—	—	—		Green	Not to be displayed when error is made in communication
				Semi auto digging switch “SOFT” or “HARD”	0	0	—	○	—		—	○	—			
	33	Preheater	LED	Other than below			—	—	—		—	—	—		Red	
				When preheater is turned ON	0	0	—	○	—		—	○	—			
	34	Auto grease	LED	Not in operation			—	—	—		—	—	—		Green	
				Operation	1	1	—	○	—		—	○	—			
				Tank empty	3	1	—	◎ 1 Hz	—		—	◎ 1 Hz	—			
				Abnormal	3	1	—	◎ 2 Hz	—		—	◎ 2 Hz	—			
	35	Joystick	LED	When using steering wheel			—	—	—		—	—	—		Green	The joystick steering function can be enabled only when “J/S” is selected for “14. J/S-FNR SW” item using the optional device selecting function of the machine monitor. Not to be displayed when error is made in communication.
				When the joystick is operating	0	0	—	○	—		—	○	—			
				Selection caution to joystick steering	0	0	☆	◎	○		☆	◎	○			
				FNR switch neutral caution when starting switch is turned to “ON”	0	0	☆	◎	○		☆	◎	○			
				Directional lever priority caution	1	0	☆	◎	○		☆	◎	○			
	36	Directional selector switch	LED	When using the directional lever			—	—	—		—	—	—		Green	The directional selector switch can be enabled only when “FNR SW” is selected for “14. J/S-FNR SW” item using the optional device selecting function of the machine monitor. Not to be displayed when error is made in communication.
				When directional selector switch is operating	0	0	—	○	—		—	○	—			
				Directional lever priority caution	0	0	☆	◎	○		☆	◎	○			
				Directional selector switch neutral caution	0	0	☆	◎	○		☆	◎	○			
	37	Economy mode of operation	LED	Other than below	0	0	—	—	—		—	—	—		Green	
				Economy mode operation	0	0	—	○	—		—	○	—			

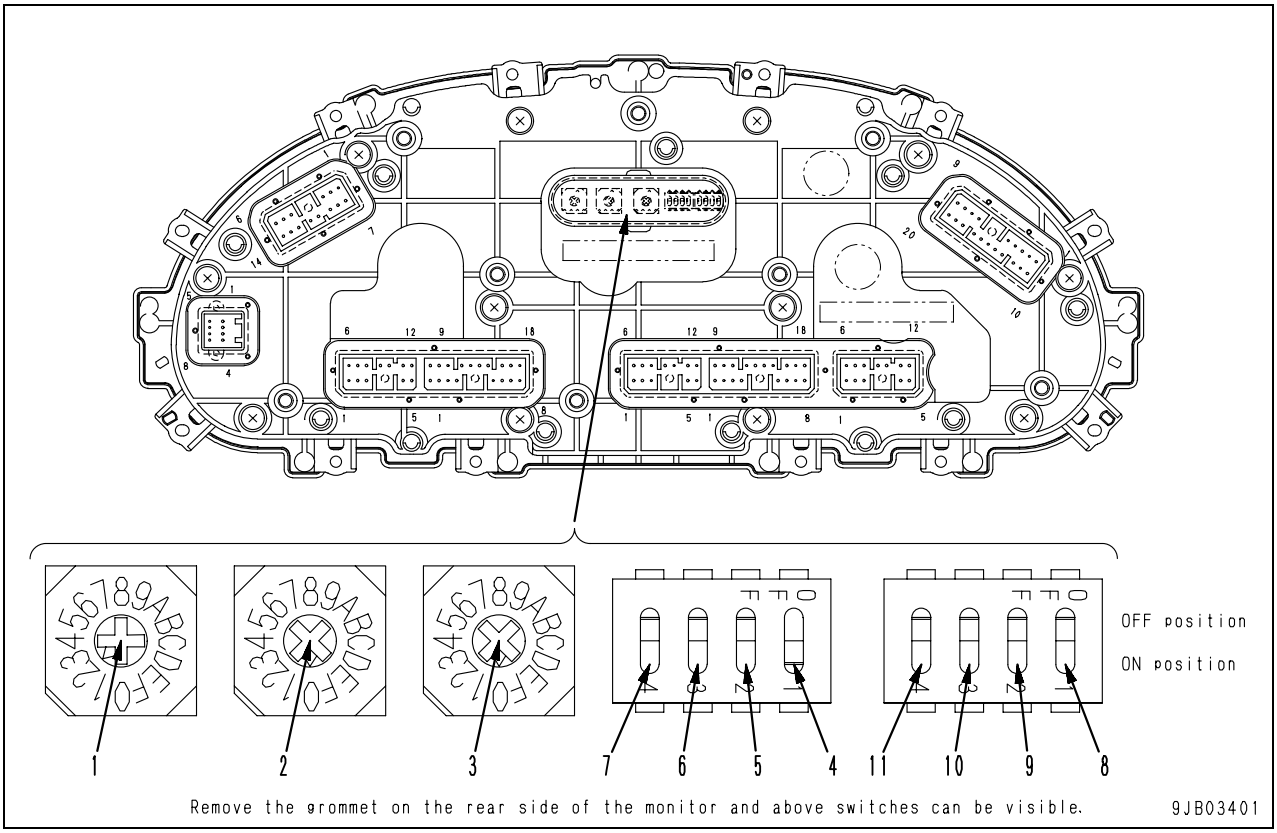
Machine monitor operation switch

Speedometer specification



1. Machine monitor mode selector switch 1
2. Machine monitor mode selector switch 2

Setting of machine monitor



1. Spare rotary switch (SW1)
2. Spare rotary switch (SW2)
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)

★ It is prohibited to change setting of spare rotary switch and DIP switch.

Troubleshooting function

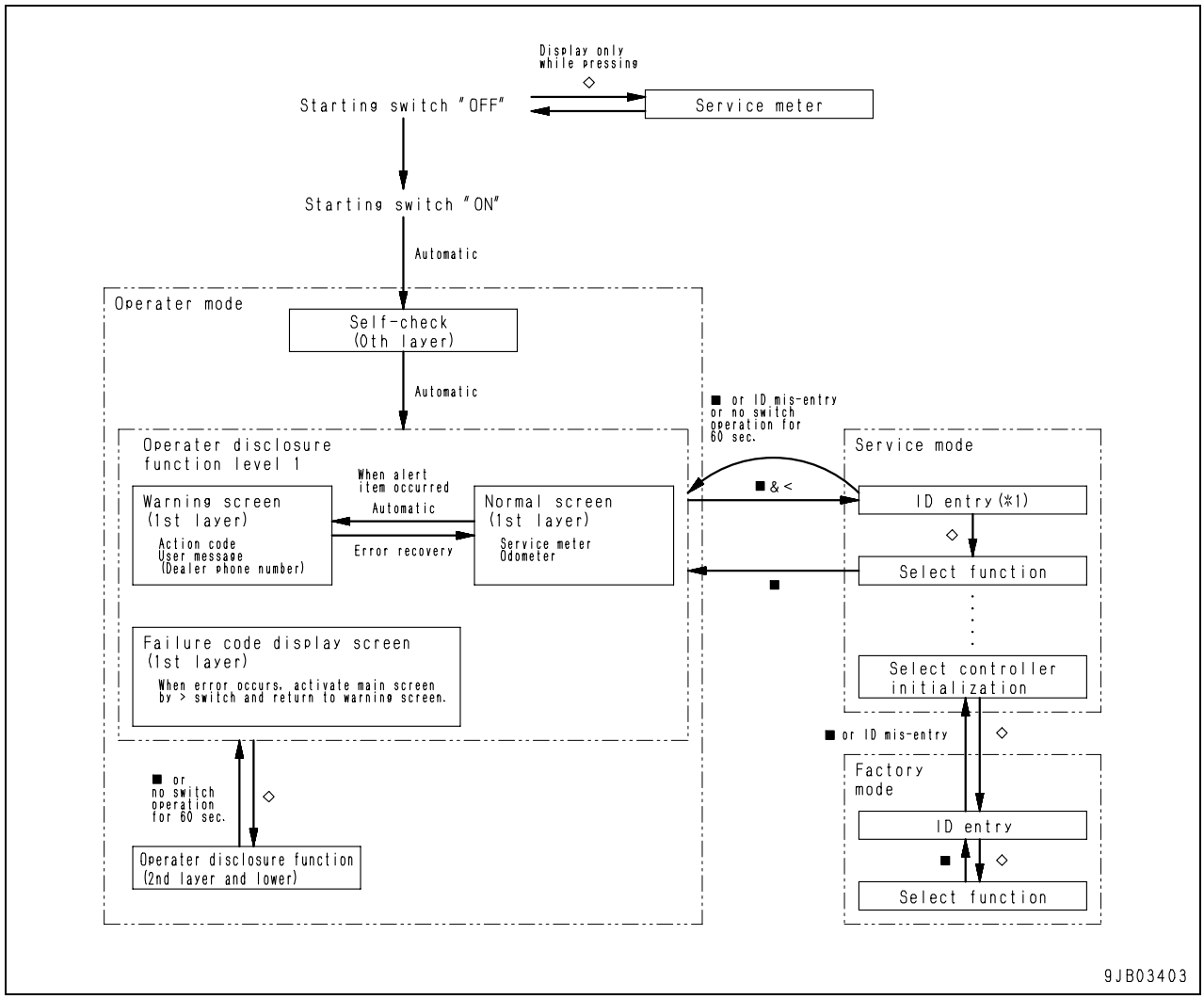
- The machine monitor monitors the input and output signals constantly for troubleshooting for the system.
- If each controller detects abnormality by the self-diagnosis, abnormality information is forwarded to the machine monitor over the network.
- Abnormality information can be checked on the character display using the failure code display mode of the machine monitor.

Character display

Speedometer specification

- Machine monitor display and setting can be changed by using the character display.
- The range operator is enabled to operate in is within the portion of the “Operator mode” in the figure below.

★ For the operating method in the operator mode, see the Operation and maintenance manual.

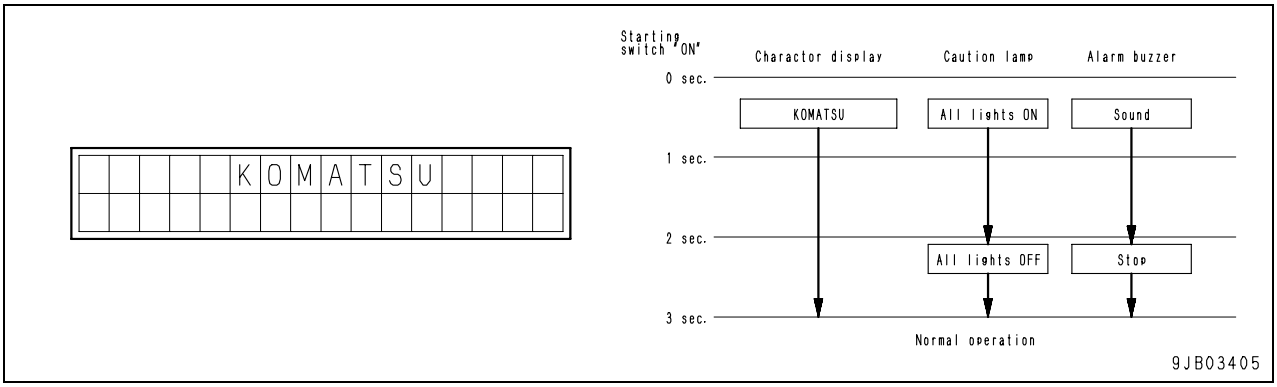


*1: In an ID entered in the “ID entry” screen is once approved, display changes directly to the “Select function” screen without displaying the “ID entry” screen until the starting switch is turned “OFF”.

Operator mode functions

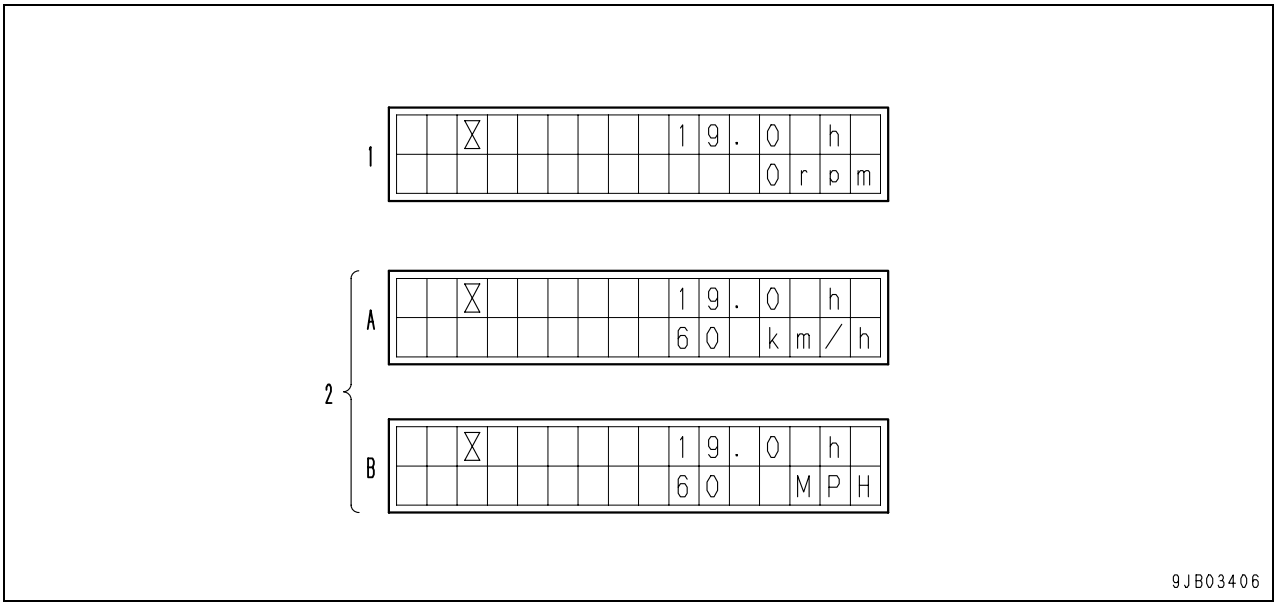
Self-check screen (0th layer)

- Self-check is conducted for 3 seconds automatically when starting switch is turned to “ON”.
- During a self-check, entry through the machine monitor operating switch is not accepted.
- After ending the self-check, the self-check screen automatically moves to 1st layer.



Normal screen (1st layer)

- If the item of “10. RPM/SPEED” is set to “ADD” in the optional device selecting function of machine monitor, engine speed is displayed to the character display when the travel speed is displayed at the center of the monitor.
- When the engine speed is displayed at the center of the monitor, travel speed is displayed to the character display.
- Pressing the “◇” switch changes the screen to the 2nd layer.



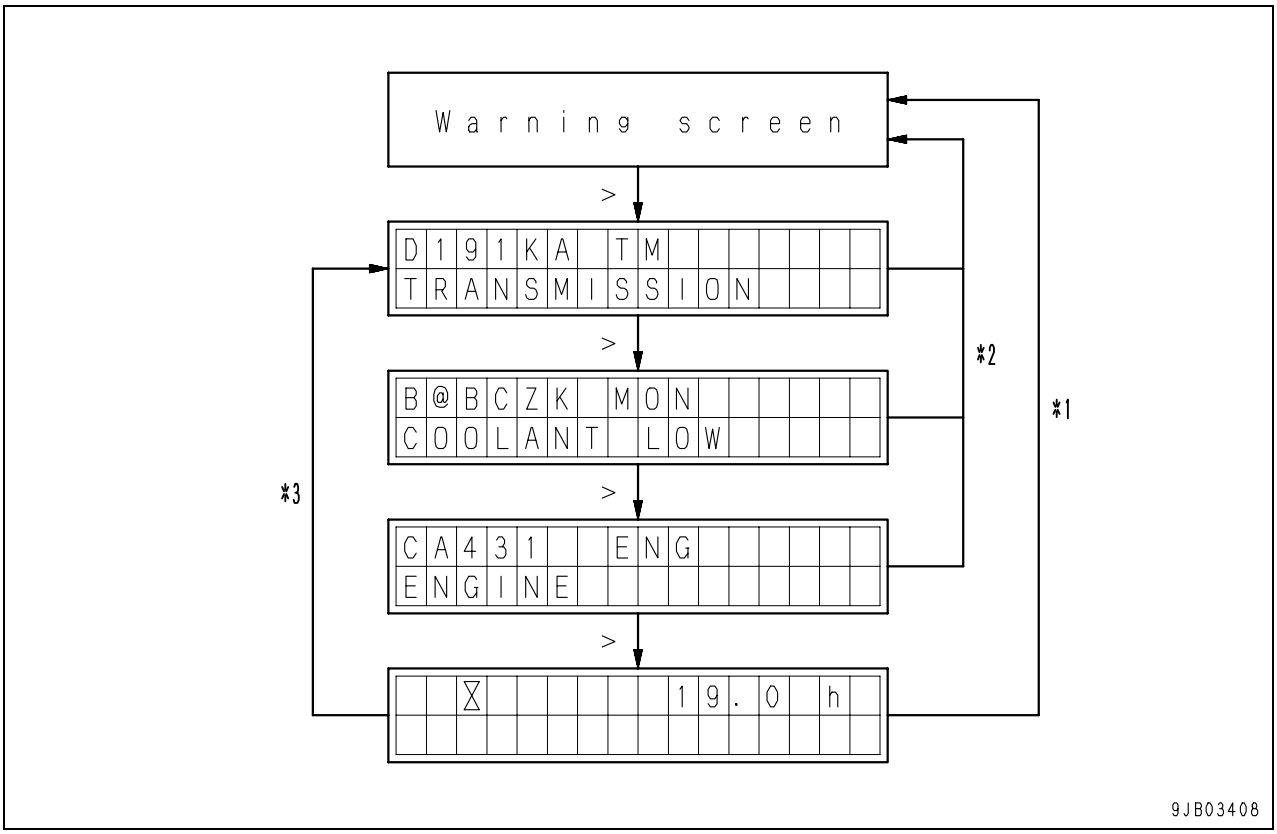
1. Engine speed display
2. Travel speed display
   A. In the case of “km/h” display
   B. In the case of “MPH” display

★ When trying to display travel speed on the character display by “MPH”, display is disabled unless the setting is made to “Non-SI unit specification” in the “Factory mode” of the machine monitor.

Failure code screen (1st layer)

- Pressing the “>” switch when the Warning screen is on display changes display to the Failure code screen.
- If multiple failure codes are present, each pressing of the “>” switch displays them from the item of higher priority downward. If items have the same priority, the item that occurred most recently will be displayed first.

Example of a failure code screen (Simultaneously occurring errors: D191KA, B@BCZK, CA431)

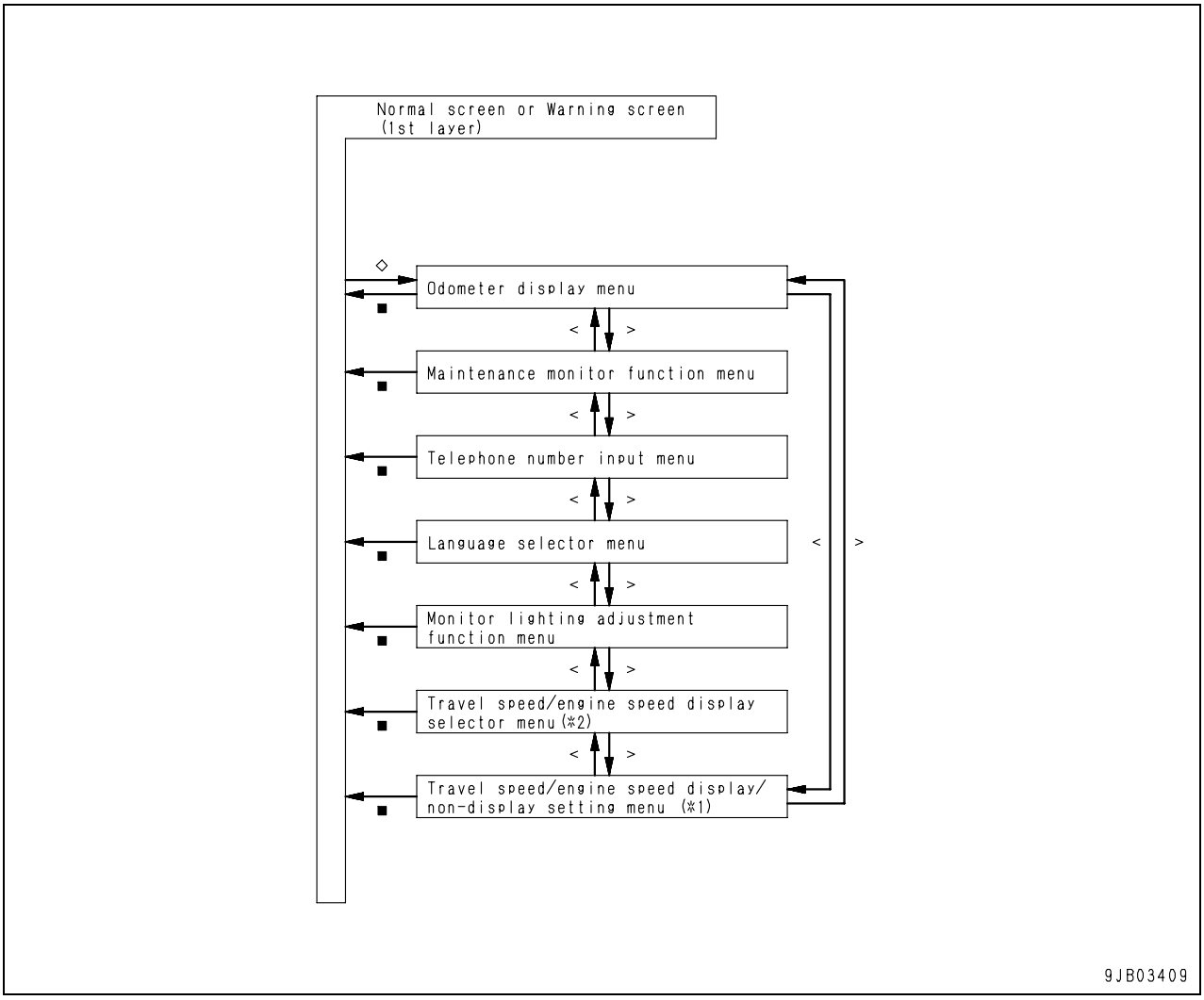


*1: The screen automatically returns to the Warning screen if the switch is not pressed more than 10 seconds in the Normal screen display.
*2: The screen returns to the Warning screen if the switch is not pressed more than 30 seconds in the failure code screen or if a new alarm is turned ON.
*3: Pressing the “>” switch in the Normal screen before 10 seconds lapse changes display to the initial failure code screen.

Functions available to the operator (2nd layer or below)

- Certain menus are not displayed unless the items in the Optional device selection function of the machine monitor are set.
- Pressing "◇" switch enables to select each menu.
- For the 2nd layer down, the screen automatically returns to the screen of the 1st layer if the switch is not pressed more than 60 seconds in the screen display of each menu.
- The language will be displayed as set in the Language selection function. The figure shows a case when "ENGLISH" is selected.

★ See the Operation and maintenance manual for details of each menu.



*1: These menus are displayed when "ADD" is selected for "10. RPM/SPEED" item using the optional device selecting function of the machine monitor.

*2: These menus are displayed when "ADD" is selected for "9. RPM OPT" item using the optional device selecting function of the machine monitor.

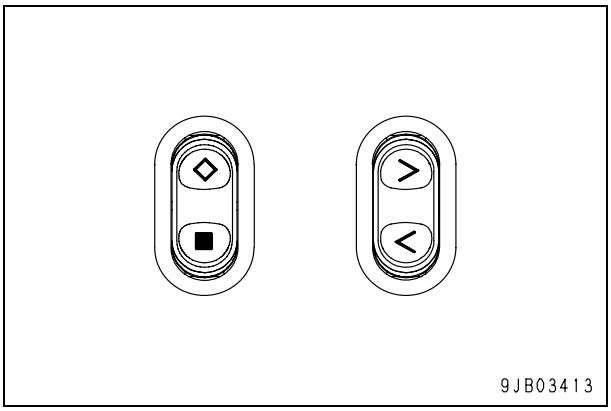
Service mode functions

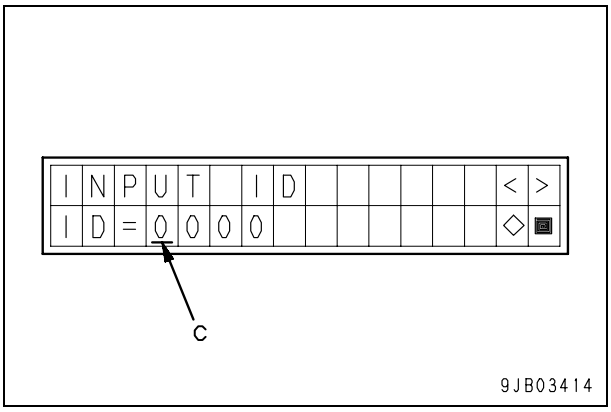
- The machine monitor is provided with service mode function for the ease of troubleshooting for the controllers on the network (including the machine monitor itself).
- Initial setting of the sensors and optional setting can be made in the service mode of the machine monitor.

Procedure for switching to Service Mode

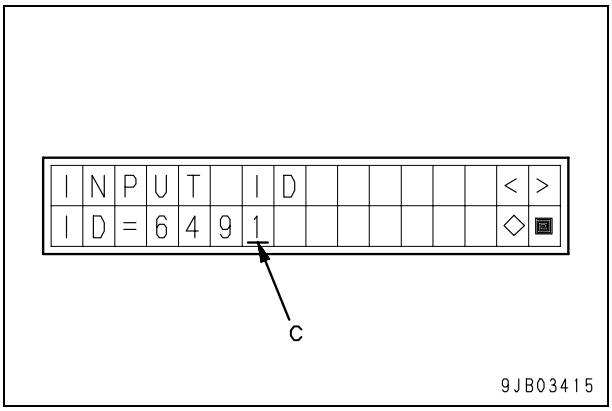
1. Checking of the screen display
   Check that the character display is set to the 1st layer screen in the operator mode.

2. Display of ID input initial screen
   Pressing "◆" switch and "<" switch simultaneously for 5 seconds or more, the ID entry initial screen appears.
   ★ Pressing down the two switches for 5 seconds or more makes the entire screen blank. As this state is recognized, release the switches.



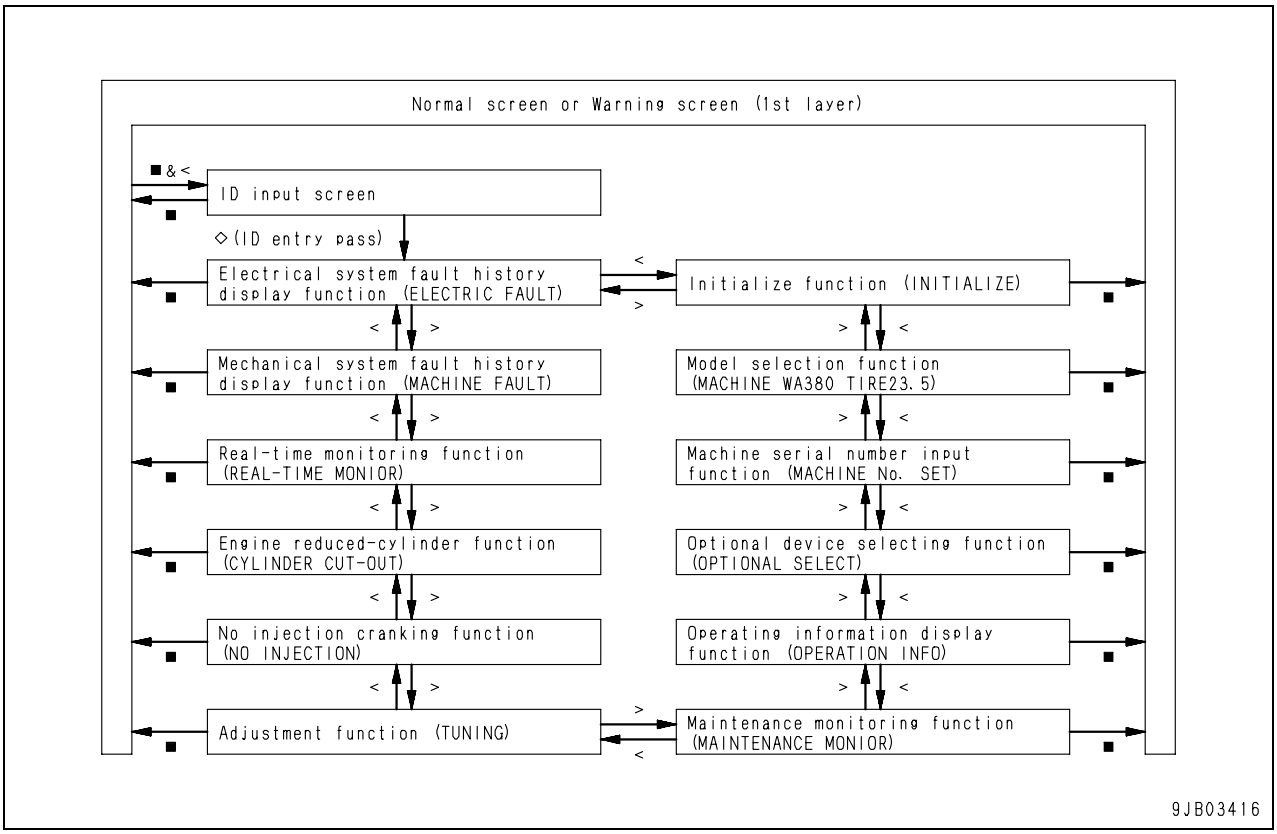


3. ID input and confirmation
   Operate the machine monitor mode selector switches 1 and 2 and enter ID. (ID: 6491)



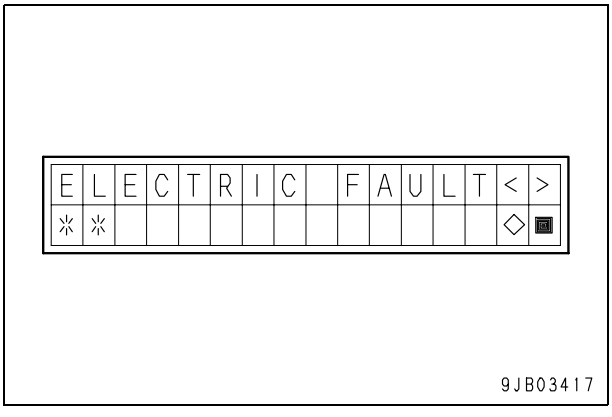
   1) The cursor (C) is located at the highest-order digit. Pressing "<" or ">" switch changes the value of this digit in the range of "0" to "9".
   2) Press "◇" switch to settle the selection with a target value.
      ★ The cursor moves to the 2nd digit position.
   3) Confirm the values for the 2nd digit and onward following the same procedure.
      ★ When you have entered a wrong value to a position, if the cursor is located elsewhere than the highest-order digit, press "■" switch to move the cursor to the highest-order digit to enable to input correct value. In this case, values that had been entered remain as they are until modified.
      ★ Pressing "■" switch when the cursor is located at the highest-order digit, the screen returns to the "1st layer" of the operator mode.
      ★ If switch is not operated more than 60 seconds on the "ID input" screen, it automatically returns to the "1st layer" screen of the operator mode.
   4) If ID is acknowledged upon confirming the 4th digit, the screen changes to the "Electrical system failure history" selector screen.

Service mode menu



★ Pressing “<” or “>” switch on the menu screen switches individual menus of the service mode sequentially and endlessly.
★ Pressing “◇” switch on the target menu screen. The screen changes to the detailed screen of the same menu.
★ Pressing “■” switch on the menu screen returns the screen to the 1st layer of the operator mode.

Electrical system failure history display function (ELECTRIC FAULT)

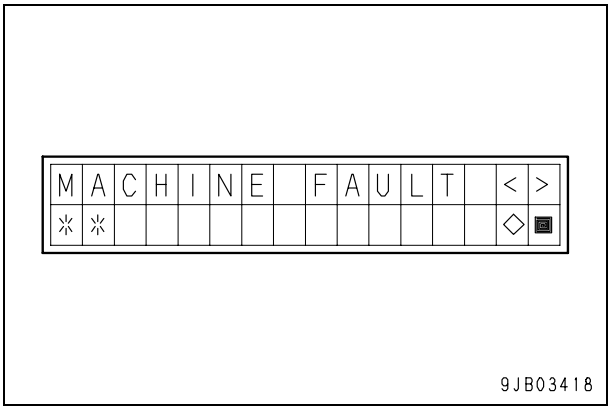


★ “**” field displays total number of the failure history currently recorded. (Max. 20 histories to be stored)

- The history is used to check on the electrical system failures of each controller saved in the machine monitor. After repairing the failure content and verifying normal function, the failure history may be erased.

★ For the operating procedure of this function, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

Mechanical system failure history display function (MACHINE FAULT)

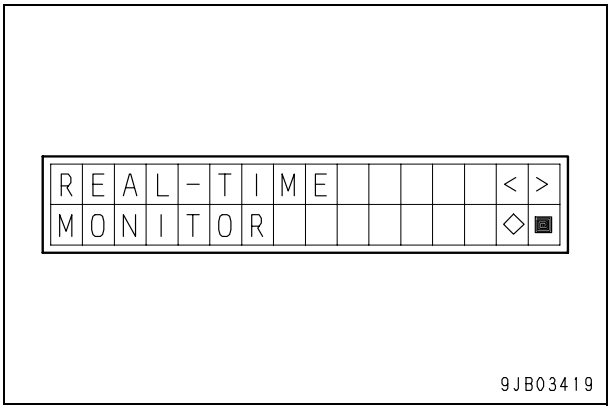


★ "***" field displays total number of the failure history currently recorded. (Max. 20 histories to be stored)

- The history is used to check on the mechanical system failures of each controller saved in the machine monitor.

★ For the operating procedure of this function, see "Special functions of machine monitor (EMMS)" in Testing and adjusting.

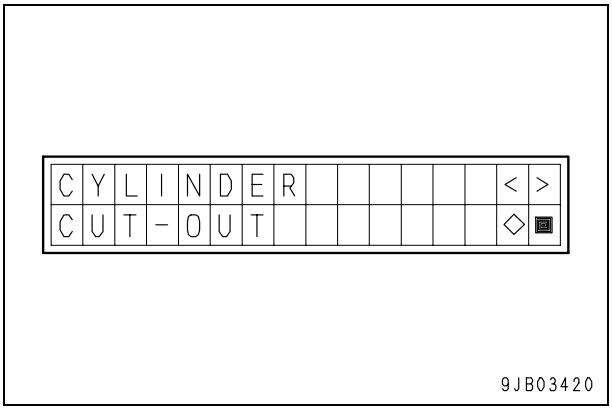
Rear-time monitoring function (REAL-TIME MONITOR)



- The function is used to check on the input/output signals, etc. each controller on the network recognizes.

★ For the operating procedure of this function, see "Special functions of machine monitor (EMMS)" in Testing and adjusting.

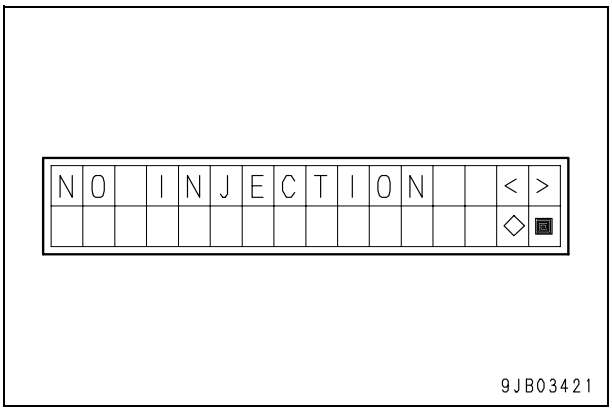
Engine reduced-cylinder function (CYLINDER CUT-OUT)



- This function is used for the purpose of specifying cylinder having defective combustion by stopping fuel injection to each cylinder from the fuel injector.

★ For the operating procedure of this function, see "Special functions of machine monitor (EMMS)" in Testing and adjusting.

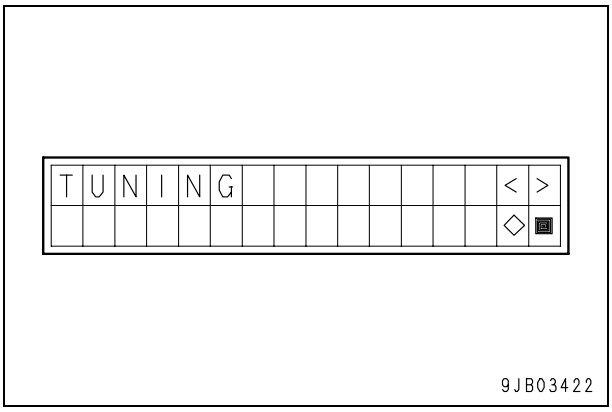
No injection cranking function (NO INJECTION)



- Before restarting engine after a long-term storing of the machine, this function is used to lubricate the engine internally.

★ For the operating procedure of this function, see "Special functions of machine monitor (EMMS)" in Testing and adjusting.

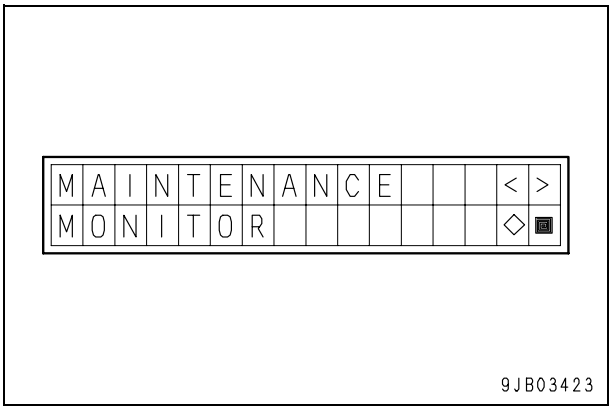
Adjustment function (TUNING)



- This function is used for correcting and adjusting the installation errors and manufacturing dispersion of the sensors, solenoid valves, etc. Function for changing control characteristics is provided on user request.
  These functions are also used when sensors, valves and controllers are replaced or added.

★ For the operating procedure of this function, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

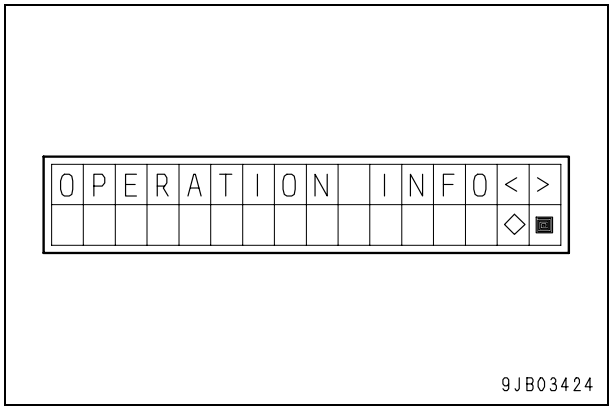
Maintenance monitoring function (MAINTENANCE MONITOR)



- This function is used for changing the filter and oil replacement timing and making ON/OFF selection of this function.

★ For the operating procedure of this function, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

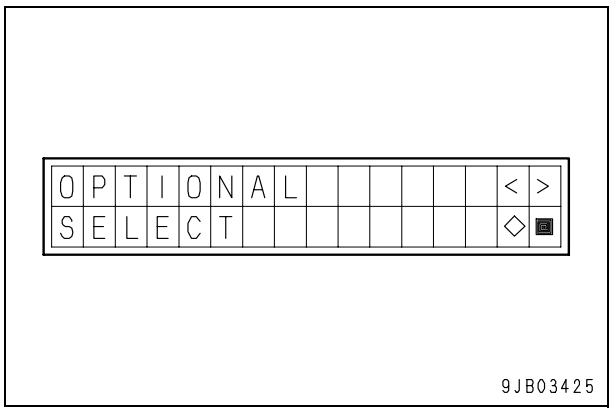
Operating information display function (OPERATION INFO)



- This function is used for displaying fuel consumption per operating hour.

★ For the operating procedure of this function, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

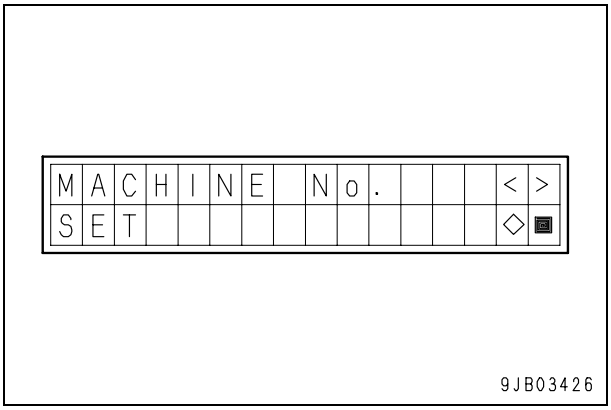
Optional device selecting function (OPTIONAL SELECT)



- This function is used for verifying the installed state of optional devices or when changing their setting.
  This function is also used for installing or removing optional devices.

★ For the operating procedure of this function, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

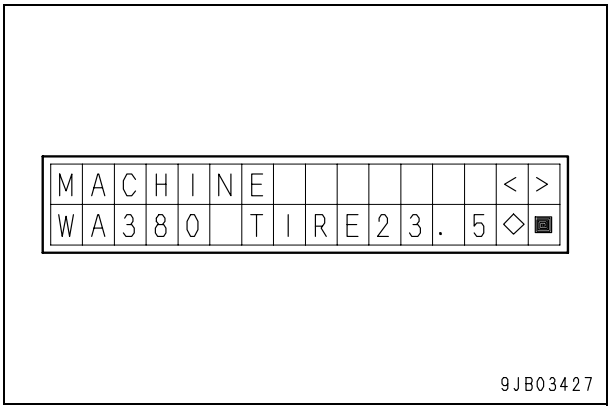
Machine serial number input function (MACHINE No. SET)



- This function is used for displaying or entering the serial numbers of machines.
  Serial numbers of the set machines are used for controlling the machines.

★ For the operating procedure of this function, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

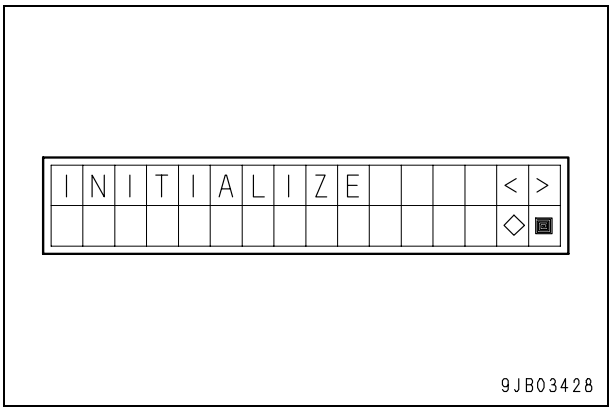
Model selection function (MACHINE WA380 TIRE23.5)



- This function is used for displaying or changing the setting of model information (machine name and tire size).

★ For the operating procedure of this function, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

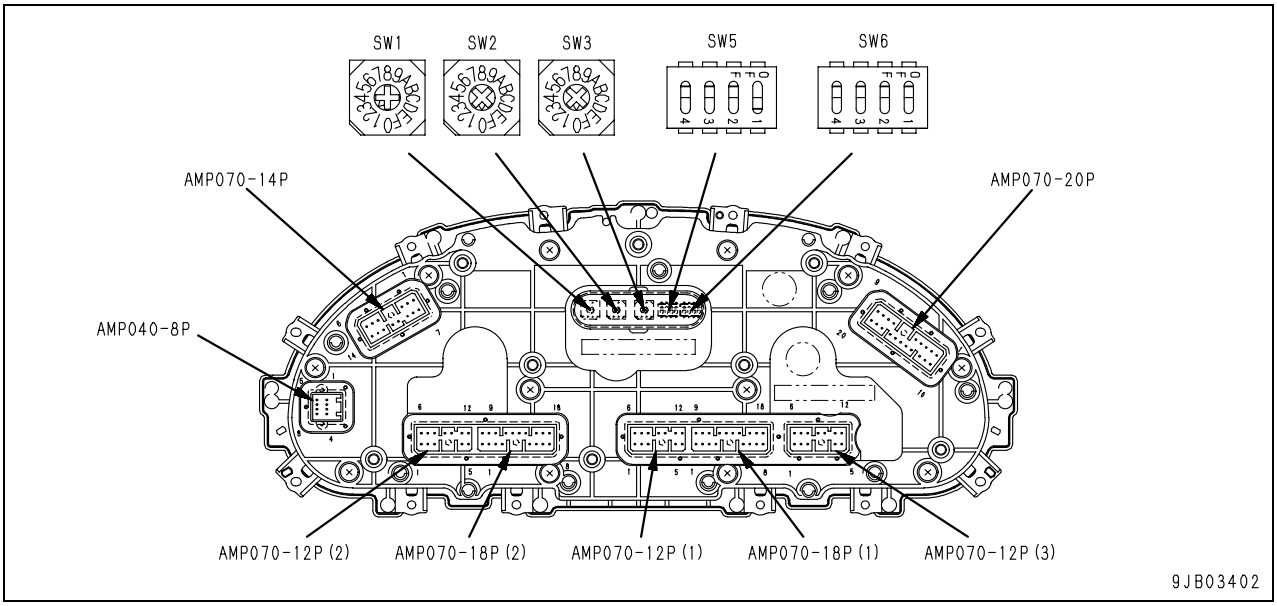
Initialize function (INITIALIZE)



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

★ Since this function is specially handled by the factory, no modification is allowed.

Input and output signals



AMP070-20P [CN-L51]

Pin No.	Specification	I/O	Group	Form of use	Signal name	Remarks
1	(NC)	—	—	—	—	
2	Power supply of small lamp	I	—	Power supply (+24 V)	—	
3	Power supply of small lamp	I	—	Power supply (+24 V)	—	
4	NSW power supply (+24 V)	I	—	Constant power supply (+24 V)	NSW power supply (+24 V)	
5	NSW power supply (+24 V)	I	—	Constant power supply (+24 V)	NSW power supply (+24 V)	
6	SW power supply (+24 V)	I	—	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)	
8	(NC)	—	—	—	—	
9	GND	I	—	GND	GND	
10	GND	I	—	GND	GND	
11	D_OUT_3 (+24 V, sink 200 mA)	O	A	D/O sink	—	
12	D_OUT_2 (+24 V, sink 200 mA)	O	A	D/O sink	—	
13	D_OUT_1 (+24 V, sink 200 mA)	O	A	D/O sink	—	
14	D_OUT_0 (+24 V, sink 200 mA)	O	A	D/O sink	Alarm buzzer 1 (Machine monitor)	
15	Sensor power supply output (+24 V)	O	—	Sensor power supply	—	
16	Sensor power supply output (+5 V)	O	—	Sensor power supply	—	
17	GND	I	—	GND	GND	
18	GND	I	—	GND	GND	
19	GND	I	—	GND	GND	
20	GND	I	—	GND	GND	

AMP070-18P (1) [CN-L52]

Pin No.	Specification	I/O	Group	Form of use	Signal name	Remarks
1	D_IN_0 (24 V, 5 mA)	I	B	D/I(+24 V)	Head lamp	
2	D_IN_2 (24 V, 5 mA)	I	B	D/I(+24 V)	Starting switch C signal	
3	D_IN_4 (24 V, 5 mA)	I	B	D/I(+24 V)	Auto grease A	If equipped
4	D_IN_6 (24 V, 5 mA)	I	B	D/I(+24 V)	—	
5	D_IN_8 (24 V, 5 mA)	I	B	D/I(+24 V)	—	
6	D_IN_10 (24 V, 5 mA)	I	B	D/I(+24 V)	—	
7	D_IN_12 (NSW24 V, 5 mA)	I	C	D/I(+24 V)	Turn signal lamp, right	
8	D_IN_14 (NSW24 V, 5 mA)	I	C	D/I(+24 V)	◇ switch	
9	GND	O	—	GND	Signal GND	
10	D_IN_1 (24 V, 5 mA)	I	B	D/I(+24 V)	—	
11	D_IN_3 (24 V, 5 mA)	I	B	D/I(+24 V)	—	
12	D_IN_5 (24 V, 5 mA)	I	B	D/I(+24 V)	Auto grease B	If equipped
13	D_IN_7 (24 V, 5 mA)	I	B	D/I(+24 V)	—	
14	D_IN_9 (24 V, 5 mA)	I	B	D/I(+24 V)	—	
15	D_IN_11 (24 V, 5 mA)	I	B	D/I(+24 V)	—	
16	D_IN_13 (NSW24 V, 5 mA)	I	C	D/I(+24 V)	Turn signal lamp, left	
17	D_IN_15 (NSW24 V, 5 mA)	I	C	D/I(+24 V)	■ switch	
18	A_IN_0 (0 – 30 V)	I	H	A/I	Alternator R signal	

AMP070-12P (1) [CN-L53]

Pin No.	Specification	I/O	Group	Form of use	Signal name	Remarks
1	D_IN_16 (24 V/GND, 5 mA)	I	D	D/I(GND)	Brake oil pressure (Front)	
2	D_IN_18 (24 V/GND, 5 mA)	I	D	D/I(GND)	—	
3	D_IN_20 (24 V/GND, 5 mA)	I	D	D/I(GND)	Clogging of air cleaner	
4	D_IN_22 (24 V/GND, 5 mA)	I	D	D/I(GND)	—	
5	D_IN_24 (24 V/GND, 5 mA)	I	E	D/I(GND)	—	
6	GND	O	—	GND	Sensor GND	
7	D_IN_17 (24 V/GND, 5 mA)	I	D	D/I(GND)	Brake oil pressure (Rear)	
8	D_IN_19 (24 V/GND, 5 mA)	I	D	D/I(GND)	—	
9	D_IN_21 (24 V/GND, 5 mA)	I	D	D/I(GND)	—	
10	D_IN_23 (24 V/GND, 5 mA)	I	D	D/I(GND)	—	
11	D_IN_25 (24 V/GND, 5 mA)	I	E	D/I(GND)	—	
12	A_IN_1 (0 – 30 V)	I	H	A/I	Small lamp switch	

AMP070-18P (2) [CN-L54]

Pin No.	Specification	I/O	Group	Form of use	Signal name	Remarks
1	D_IN_26 (24 V/GND, 5 mA)	I	E	D/I(GND)	Parking brake	
2	D_IN_28 (24 V/GND, 5 mA)	I	E	D/I(GND)	—	
3	D_IN_30 (24 V/GND, 5 mA)	I	E	D/I(GND)	Normal emergency steering	
4	D_IN_32 (24 V/GND, 5 mA)	I	F	D/I(GND)	Subtotal switch	
5	D_IN_34 (24 V/GND, 5 mA)	I	F	D/I(GND)	Dimmer switch	
6	D_IN_36 (24 V/GND, 5 mA)	I	G	D/I(GND)	—	
7	D_IN_38 (24 V/GND, 5 mA)	I	G	D/I(GND)	< switch	
8	P_IN_0 (0.5 Vp-p)	I	M	P/I	—	
9	GND	O	—	GND	GND	
10	D_IN_27 (24 V/GND, 5 mA)	I	E	D/I(GND)	Coolant level	
11	D_IN_29 (24 V/GND, 5 mA)	I	E	D/I(GND)	Engine oil level	
12	(NC)	—	—	—	—	
13	D_IN_33 (24 V/GND, 5 mA)	I	F	D/I(GND)	Cancel switch	
14	D_IN_35 (24 V/GND, 5 mA)	I	F	D/I(GND)	—	
15	D_IN_37 (24 V/GND, 5 mA)	I	G	D/I(GND)	> switch	
16	D_IN_39 (24 V/GND, 5 mA)	I	G	D/I(GND)	Operation of emergency steering	
17	P_IN_1 (0.5 Vp-p)	I	M	P/I	—	
18	(NC)	—	—	—	—	

AMP070-12P (2) [CN-L55]

Pin No.	Specification	I/O	Group	Form of use	Signal name	Remarks
1	A_IN_2 (High-resistance input)	I	J	A/I	Fuel level sensor	
2	A_IN_4 (High-resistance input)	I	J	A/I	Torque converter oil temperature sensor	
3	A_IN_6 (Low-resistance input)	I	K	A/I	—	
4	A_IN_8 (0 – 5 V)	I	L	A/I	—	
5	A_IN_10 (0 – 14 V)	—	—	—	Battery electrolyte level	If equipped
6	GND	O	—	GND	GND	
7	A_IN_3 (High-resistance input)	I	J	A/I	Hydraulic oil temperature sensor	
8	A_IN_5 (High-resistance input)	I	J	A/I	Brake oil temperature sensor	
9	A_IN_7 (0 – 5 V)	I	L	A/I	—	
10	A_IN_9 (0 – 5 V)	I	L	A/I	—	
11	GND	O	—	GND	GND	
12	A_IN_11 (0 – 14 V)	—	—	—	—	

AMP070-12P (3) [CN-L56]

Pin No.	Specification	I/O	Group	Form of use	Signal name	Remarks
1	S_NET(+)	I/O	N	S-NET	—	
2	S_NET(+)	I/O	N	S-NET	—	
3	CAN(+)	I/O	P	CAN	CAN(+)	
4	S_NET(–)	O	N	S-NET	—	
5	S_NET(–)	O	N	S-NET	—	
6	GND	O	—	GND	GND	
7	GND	O	—	GND	—	
8	CAN(–)	I/O	P	CAN	CAN(–)	
9	(NC)	—	—	—	—	
10	(NC)	—	—	—	—	
11	(NC)	—	—	—	—	
12	(NC)	—	—	—	—	

AMP070-14P [CN-L57]

Pin No.	Specification	I/O	Group	Form of use	Signal name	Remarks
1	(NC)	—	—	—	—	
2	RS232C_1_RTS	I/O	Q	—	—	
3	RS232C_1_RD	I	Q	RD	—	
4	(NC)	—	—	—	—	
5	(NC)	—	—	—	—	
6		I	—	—	—	
7	(NC)	—	—	—	—	
8	RS232C_1_CTS	I/O	Q	—	—	
9	RS232C_1_TX	O	Q	TX	—	
10	RS232C_1_SG	O	Q	—	—	
11	(NC)	—	—	—	—	
12	(NC)	—	—	—	—	
13	(NC)	—	—	—	—	
14	(NC)	—	—	—	—	

AMP040-8P [CN-L58]

Pin No.	Specification	I/O	Group	Form of use	Signal name	Remarks
1	RS232C_0_TXD	O	S	—	—	Do not connect wiring harness on machine
2	FLASH_SW	I	S	—	—	Do not connect wiring harness on machine
3	RS232C_0_TXD	O	S	—	—	Do not connect wiring harness on machine
4	(NC)	—	—	—	—	Do not connect wiring harness on machine
5	RS232C_0_RXD	I	S	—	—	Do not connect wiring harness on machine
6	(NC)	—	—	—	—	Do not connect wiring harness on machine
7	RS232C_0_RXD	I	S	—	—	Do not connect wiring harness on machine
8	GND	O	—	—	—	Do not connect wiring harness on machine

Setting switches (On circuit board)

Switch No.		Specification	I/O	Group	Form of use	Signal name	Remarks
1		16 Posi rotary switch 1	I	—	—	(Spare)	
2		16 Posi rotary switch 2	I	—	—	(Spare)	
3		16 Posi rotary switch 3	I	—	—	(Spare)	
5	1	26 Posi DIP switch 1	I	—	—	(Spare)	
	2	26 Posi DIP switch 2	I	—	—	(Spare)	
	3	26 Posi DIP switch 3	I	—	—	(Spare)	
	4	26 Posi DIP switch 4	I	—	—	(Spare)	
6	1	26 Posi DIP switch 5	I	—	—	(Spare)	
	2	26 Posi DIP switch 6	I	—	—	(Spare)	
	3	26 Posi DIP switch 7	I	—	—	(Spare)	
	4	26 Posi DIP switch 8	I	—	—	(Spare)	

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

10 Structure, function and maintenance standard

Electrical system, Part 2

Electrical system, Part 2 2
Electrical system (Transmission controller system) 2
Transmission controller 36

Electrical system, Part 2

Electrical system (Transmission controller system)

★ Except where otherwise specified, the displayed travel speed in this document represents the one when 23.5-25 tire is worn.

Transmission controller gear shifting control function

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 optimally to suit 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 continued even while the clutch is disengaged in order to reduce lowering of the torque.
  If an abnormal time lag is made in gear shifting, the learning function corrects the modulation automatically.

Gear shifting display function

- The transmission controller displays the state of input signals related to gear shift by sending them to the machine monitor via network.

1. Directional indicators
   The shift lever position pilot lamps of the machine monitor indicate state of the directional lever based on the input data to the transmission controller.
   When the directional lever is at the neutral position and no input signal is sent to the transmission controller, all the shift lever position pilot lamps of the machine monitor go off.
   If two independent signals were sent to the transmission controller by accident, two shift lever position pilot lamps of the machine monitor may turn on.
   As the directional lever is set to “R (Reverse)”, the transmission controller activates the back-up lamp relay to light the reverse lamp and sound the back-up alarm.

2. Gear speed indicators
   The shift lever position pilot lamps of the machine monitor indicates state of the gear shift lever based on the input data to the transmission controller.
   When the gear shift lever is at the neutral position and no input signal is sent to the transmission controller, all the shift lever position pilot lamps of the machine monitor go off.
   If two independent signals were sent to the transmission controller by accident, precedence is given to the higher gear speed. Thus, the shift lever position pilot lamps of the machine monitor may indicate a gearshift lever position not identical with its actual position.

3. Display of actual gear speed
   The shift indicator of the machine monitor indicates state of the directional lever and gear shift lever being based on the output data from the transmission controller.
   When the directional lever is at “N (Neutral)”, the indicator displays “N”. And when the directional lever is at “F (Forward)” or “R (Reverse)”, the indicator displays gear speed along with “F” or “R”.
   When the parking brake is in operation, the gear speed signal is not usually output. Thus, the indicator constantly displays “N”. It also displays “N” if the transmission is set to the neutral while the transmission cut-off is activated.

Automatic gear shifting function

- The transmission gear can be shifted by the automatic gear shifting operation in which the gear speed is selected automatically according to the travel speed or by the manual gear shifting operation in which the gear speed is selected with the gear shift lever.
- Operating the transmission shift mode selector switch allows switching the shift mode. As the auto shift is selected, the auto-shift pilot lamp of the machine monitor comes on.
- In the auto shift mode, either shifting up or shifting down as well as ON or OFF of the lockup clutch (if equipped) is selected depending on the state of the power mode.
- The auto shift comprises two modes “H” and “L”. The shift modes shown in the following table are turned on depending on the state of the transmission shift mode selector switch and the power mode selector switch.

Power mode selector switch	Transmission shift mode selector switch		
	H	L	MANUAL
P-mode	Auto-shift H-mode	Auto-shift L-mode	Manual shift mode
E-mode	Auto-shift L-mode	Auto-shift L-mode	Manual shift mode

- In the auto shift, the transmission controller selects either shifting up or down based on the “Auto-shift points table” stored on it after referencing the directional lever position, gear shift lever position, travel speed, accelerator pedal opening ratio and engine speed.

1. When the gear shift lever position is in “1st” to “4th”
   The maximum gear speed (gear shifting range) used in the automatic gear shifting operation is limited.
   In the automatic gear shifting operation, the machine usually starts in the 2nd gear speed. Accordingly, if the gear shift lever is in “4th”, the gear is shifted up or down between the 2nd gear speed and 4th gear speed. When the kickdown function is turned on, however, shifting down to the 1st also becomes available.

2. When the directional lever is in “N (Neutral)” position
   When the directional lever is set to “N (Neutral)”, actual transmission gear speed is fixed to the one that had been selected prior to setting the lever to “N (Neutral)”.
   When the directional lever is set to “N (Neutral)”, operating the gear shift lever does not change the gear seed. Namely, the gear speed prior to the lever operation remains unchanged. Change of the gear speed becomes available only when the directional lever is set to “F (Forward)” or “R (Reverse)”.

Auto-shift points table

Forward shifting up

		Accelerator pedal opening ratio [%]	Transmission output shaft speed [rpm] (Reference: Travel speed [km/h])			No-shift time [sec.]
			Limit	In acceleration	Hunting prevention	
Engine speed is above 1,000 rpm	From F1 to F2 (H-mode)	0	457 (5.7)	425 (5.3)		2
		20	457 (5.7)	425 (5.3)		
		90	457 (5.7)	425 (5.3)		
		100	457 (5.7)	425 (5.3)		
	From F1 to F2 (L-mode)	0	385 (4.8)	361 (4.5)		
		20	385 (4.8)	361 (4.5)		
		90	385 (4.8)	361 (4.5)		
		100	385 (4.8)	361 (4.5)		
	From F2 to F3 (H-mode)	0	744 (9.3)	704 (8.8)	780 (9.7)	1
		20	744 (9.3)	704 (8.8)	780 (9.7)	
		90	864 (10.8)	824 (10.3)	880 (11.0)	
		100	864 (10.8)	824 (10.3)	880 (11.0)	
	From F2 to F3 (L-mode)	0	321 (4.0)	280 (3.5)	641 (8.0)	
		20	321 (4.0)	280 (3.5)	641 (8.0)	
		90	721 (9.0)	681 (8.5)	744 (9.3)	
		100	721 (9.0)	681 (8.5)	744 (9.3)	
	From F3 to F4 (H-mode)	0	1,106 (13.8)			1
		20	1,106 (13.8)			
		90	1,507 (18.8)			
		100	1,507 (18.8)			
	From F3 to F4 (L-mode)	0	721 (9.0)			
		20	721 (9.0)			
		90	1,288 (16.0)			
		100	1,288 (16.0)			

Forward shifting down

		Accelerator pedal opening ratio [%]	Transmission output shaft speed [rpm] (Reference: Travel speed [km/h])			No-shift time [sec.]
			Limit	In deceleration	Hunting prevention	
Accelerator pedal "ON"	From F4 to F3 (H-mode)	20	946 (11.8)			1
		90	1,346 (16.8)			
		100	1,346 (16.8)			
	From F4 to F3 (L-mode)	20	561 (7.0)			
		90	1,122 (14.0)			
		100	1,122 (14.0)			
	From F3 to F2 (H-mode)	20	423 (5.3)	463 (5.8)	423 (5.3)	2
		90	704 (8.8)	744 (9.3)	672 (8.4)	
		100	704 (8.8)	744 (9.3)	672 (8.4)	
	From F3 to F2 (L-mode)	20	240 (3.0)	280 (3.5)	240 (3.0)	
		90	641 (8.0)	641 (8.0)	401 (5.0)	
		100	641 (8.0)	641 (8.0)	401 (5.0)	
Accelerator pedal "OFF"	From F4, F3 to F2 (H-mode) (L-mode)	0	80 (1.0)			From F4 to F2 0 From F3 to F2 2
		20	80 (1.0)			
Accelerator pedal from "OFF" to "ON"	From F4 to F2 (H-mode)	20	704 (8.8)			0
		90	704 (8.8)			
		100	704 (8.8)			
	From F3 to F2 (H-mode)	20	423 (5.3)			2
		90	423 (5.3)			
		100	423 (5.3)			
	From F4, F3 to F2 (L-mode)	20	240 (3.0)			From F4 to F2 0 From F3 to F2 2
		90	240 (3.0)			
		100	240 (3.0)			

Reverse shifting up

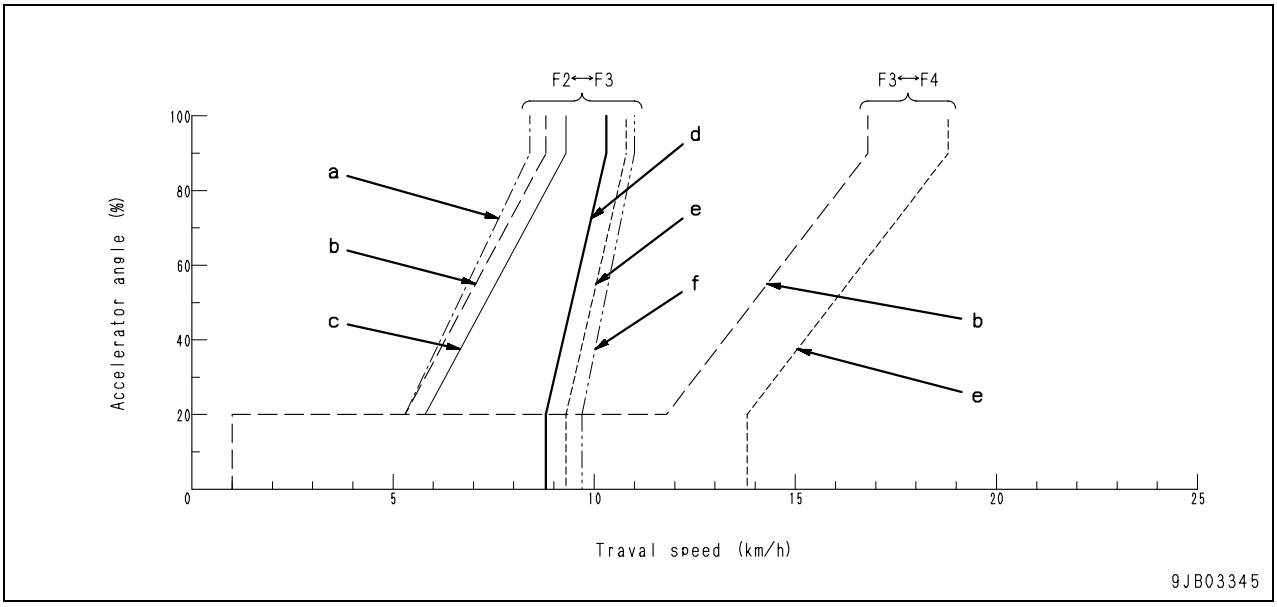
		Accelerator pedal opening ratio [%]	Transmission output shaft speed [rpm] (Reference: Travel speed [km/h])			No-shift time [sec.]
			Limit	In acceleration	Hunting prevention	
Engine speed is above 1,000 rpm	From F1 to F2 (H-mode)	0	491 (6.1)	456 (5.7)		2
		20	491 (6.1)	456 (5.7)		
		90	491 (6.1)	456 (5.7)		
		100	491 (6.1)	456 (5.7)		
	From F1 to F2 (L-mode)	0	413 (5.2)	388 (4.8)		
		20	413 (5.2)	388 (4.8)		
		90	413 (5.2)	388 (4.8)		
		100	413 (5.2)	388 (4.8)		
	From F2 to F3 (H-mode)	0	799 (10.0)	756 (9.4)	838 (10.5)	1
		20	799 (10.0)	756 (9.4)	838 (10.5)	
		90	928 (11.6)	885 (11.0)	962 (12.0)	
		100	928 (11.6)	885 (11.0)	962 (12.0)	
	From F2 to F3 (L-mode)	0	344 (4.3)	301 (3.8)	689 (8.6)	
		20	344 (4.3)	301 (3.8)	689 (8.6)	
		90	775 (9.4)	732 (9.1)	799 (10.0)	
		100	775 (9.4)	732 (9.1)	799 (10.0)	
	From F3 to F4 (H-mode)	0	1,188 (14.8)			1
		20	1,188 (14.8)			
		90	1,618 (20.2)			
		100	1,618 (20.2)			
	From F3 to F4 (L-mode)	0	744 (9.7)			
		20	744 (9.7)			
		90	1,377 (17.2)			
		100	1,377 (17.2)			

Reverse shifting down

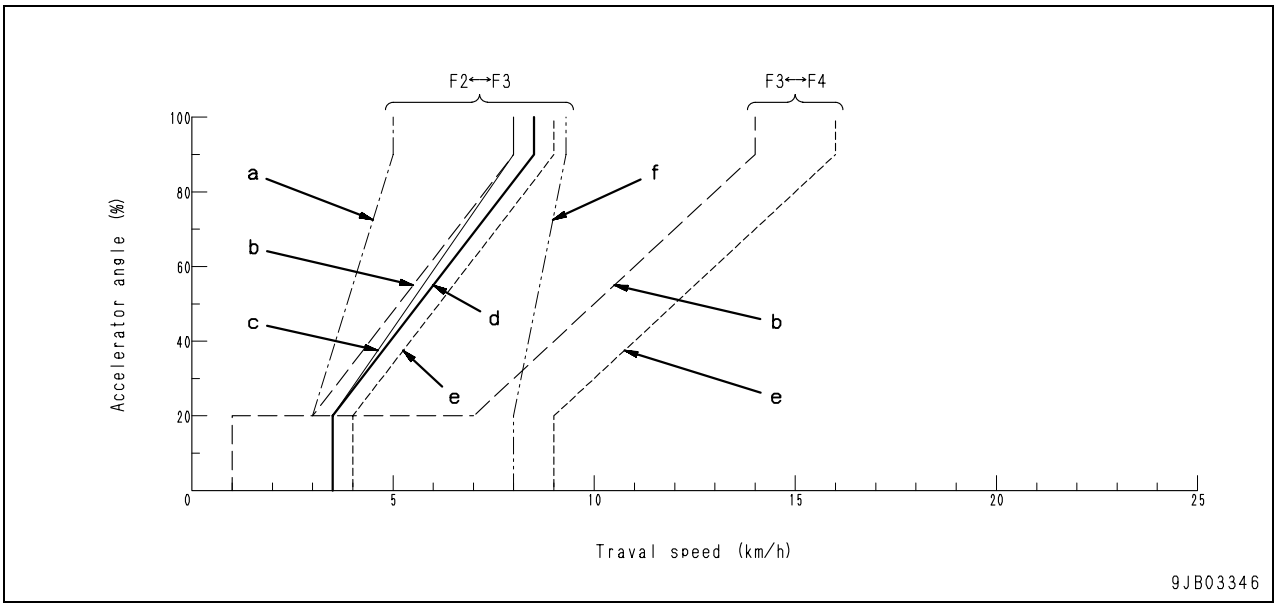
		Accelerator pedal opening ratio [%]	Transmission output shaft speed [rpm] (Reference: Travel speed [km/h])			No-shift time [sec.]
			Limit	In deceleration	Hunting prevention	
Accelerator pedal "ON"	From F4 to F3 (H-mode)	20	1,017 (12.7)			1
		90	1,448 (18.1)			
		100	1,448 (18.1)			
	From F4 to F3 (L-mode)	20	603 (7.5)			
		90	1,207 (15.1)			
		100	1,207 (15.1)			
	From F3 to F2 (H-mode)	20	454 (5.7)	497 (6.2)	445 (5.5)	2
		90	756 (9.4)	799 (10.0)	721 (9.0)	
		100	756 (9.4)	799 (10.0)	721 (9.0)	
	From F3 to F2 (L-mode)	20	258 (3.2)	301 (3.8)	258 (3.2)	
		90	688 (8.6)	688 (8.6)	430 (5.4)	
		100	688 (8.6)	688 (8.6)	430 (5.4)	
Accelerator pedal "OFF"	From F4, F3 to F2 (H-mode) (L-mode)	0	86 (1.1)			From F4 to F2 0 From F3 to F2 2
		20	86 (1.1)			
Accelerator pedal from "OFF" to "ON"	From F4 to F2 (H-mode)	20	757 (9.4)			0
		90	757 (9.4)			
		100	757 (9.4)			
	From F3 to F2 (H-mode)	20	445 (5.5)			2
		90	445 (5.5)			
		100	445 (5.5)			
	From F4, F3 to F2 (L-mode)	20	256 (3.2)			From F4 to F2 0 From F3 to F2 2
		90	256 (3.2)			
		100	256 (3.2)			

Auto-shift points

Forward, H-mode

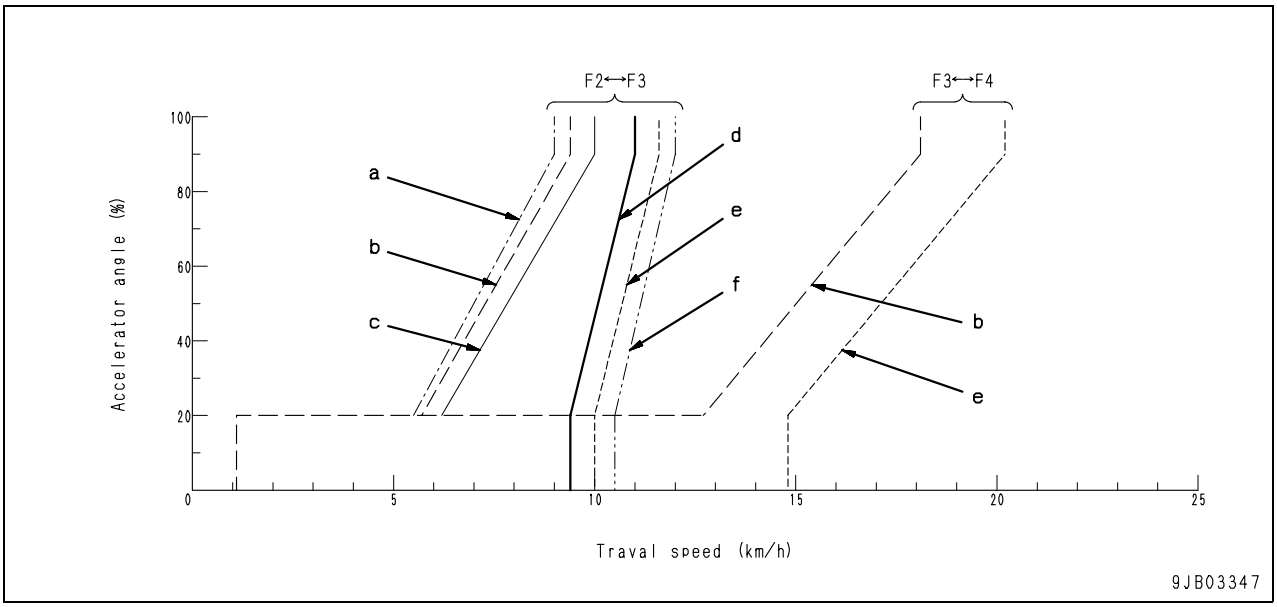


Forward, L-mode

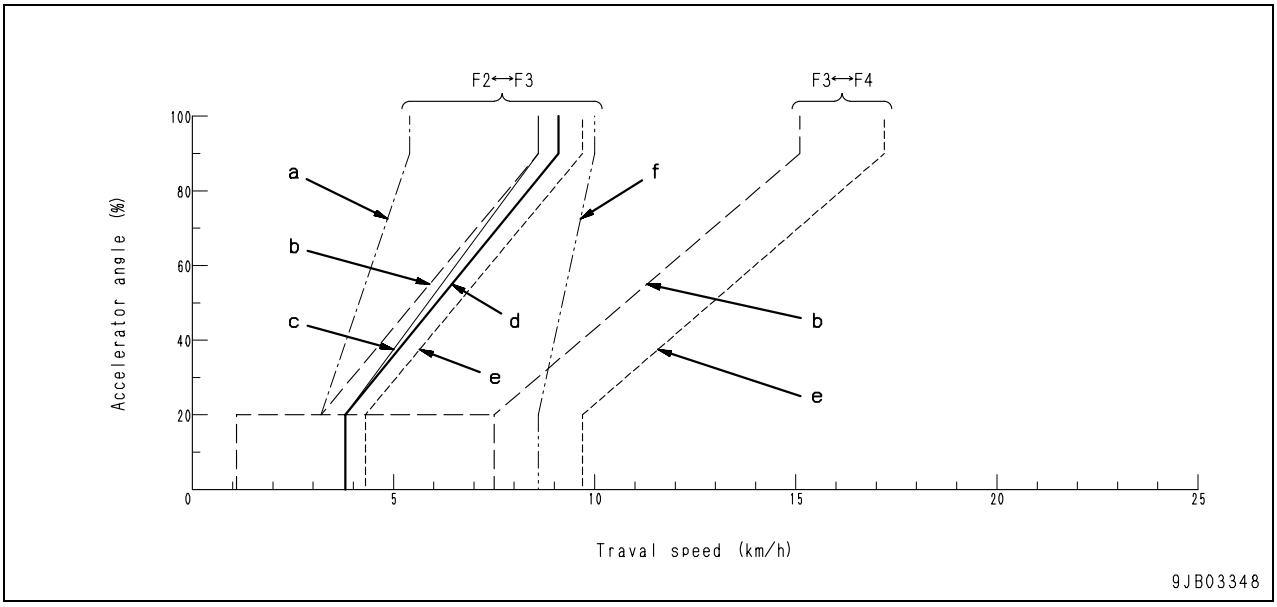


a: Shifting down (Hunting prevention)
b: Shifting down (Limit)
c: Shifting down (In deceleration)
d: Shifting up (In acceleration)
e: Shifting up (Limit)
f: Shifting up (Hunting prevention)

Reverse, H-mode



Reverse, L-mode



a: Shifting down (Hunting prevention)
b: Shifting down (Limit)
c: Shifting down (In deceleration)
d: Shifting up (In acceleration)
e: Shifting up (Limit)
f: Shifting up (Hunting prevention)

Shift hold function

- The shift hold function maintains the gear speed chosen from the hold switch when the auto shift mode was selected. It does not allow shifting up as the travel speed is increased. And it also does not allow shifting down as the travel speed is decreased.
- The shift hold pilot lamp of the machine monitor remains turned on as long as the shift hold function is turned on. Pressing the hold switch again resets the shift hold function and turns off the pilot lamp.
- The shift hold function is automatically reset as the directional lever, gear shift lever or kickdown switch is operated. In such case, the torque converter lockup is turned off.

Kickdown function

1. In manual-shift mode
   When the directional lever is set to “F (Forward)” and the gear shift lever to “2nd”, pressing the kickdown switch changes the gear speed to 1st.
   Operation of the kickdown switch is ignored if the directional lever is set to a position other than “F (Forward)” or if the gear shift lever is set to a position other than the “2nd” position.
   The kickdown function is reset if the directional lever is operated after the actual gear speed has been changed to “1st” or the gear shift lever is set to any position other than “2nd”. After the function is reset, the gear speed is changed to the one being selected from the gear shift lever.

2. In auto-shift mode
   The kickdown function is enabled when the directional lever is set to a position other than “N (Neutral)” and the gear shift lever is set to a position other than the “1st” position.
   The kickdown switch allows changing the gear speed as shown in the following table.
   The kickdown function is reset if the directional lever is operated after the actual gear speed is changed or the no-shift time for hunting prevention elapses. After the reset, the auto shift based on “Auto-shift points table” is turned on.

Gear speed prior to kickdown	Transmission output shaft speed [rpm] as kickdown switch is pressed (Reference: Travel speed [km/h])	Gear speed after kickdown	No-shift time [sec.]
2nd T/C	All range	1st T/C	5
3rd T/C	Below 842 (10.5)	1st T/C	5
	842 (10.5) or above	2nd T/C	4
4th T/C	Below 842 (10.5)	1st T/C	5
	842 (10.5) or above	3rd T/C	4
3rd L/U	Below 842 (10.5)	1st T/C	5
	842 (10.5) or above	3rd T/C	(*1)
4th L/U	Below 842 (10.5)	1st T/C	5
	842 (10.5) or above	4th T/C	(*1)

T/C: Stands for torque converter travel.
L/U: Stands for direct travel (lockup operation).

*1: When the lockup function was reset from the kickdown switch, following operations alone turn it on again.
- Torque converter lockup switch is turned “OFF” once and then turned “ON” again.
- Current travel speed is increased to or beyond a specific level. Here the specific level denotes the speed that starts activating the lockup corresponding to the “Lockup operating points table”

3. When forward 1st is selected
   When “E-mode” is selected for the power mode and the gear speed is set to forward 1st, pressing the kickdown switch changes the power mode to “P-mode”.
   The power mode switching function is enabled, independent of the auto or manual shift, only when forward 1st is selected and it is reset as any actual gear speed other than 1st is selected.

Function of torque converter lockup

(If equipped)

- Turning ON the torque converter lockup switch turns on, independent of the shift mode, the torque converter lockup function prepared for automatic control of the lockup operation.
- The torque converter lockup pilot lamp of the machine monitor remains turned on as long as the lockup operation is continued.
- The operation gear speed of lockup is as follows.

Transmission shift mode selector switch	Lockup operation gear speed (Lockup operates: ○)							
	F1	F2	F3	F4	R1	R2	R3	R4
H			(*1)	○			(*1)	○
L			(*1)	○			(*1)	○
MANUAL			○	○			○	○

*1: When the gear shift lever is set to “4th” in the auto-shift mode, the lockup function is not activated at 3rd speed. The lockup function is turned on at 3rd speed if the gear shift lever is set to “3rd”.

1. Lockup operation travel speed
   “Lockup operating points table” lists the lockup operation travel speeds. When the manual shift is selected, the same travel speeds as that of the auto-shift H-mode turn on the lockup.

2. Function of lockup protection
   The lockup function is operated only when the machine travel direction coincided with the direction lever position.
   <Judging the machine travel direction>
   1) The machine is judged as stopped prior at start of the transmission controller (starting switch “ON”), or the transmission output shaft speed is below 260 rpm.
   2) From above state, if the transmission output shaft speed reached 260 rpm level or above and the directional lever was set to “F (Forward)”, the machine should be judged as traveling forward. If the lever was set to “R (Reverse)”, the machine is traveling reverse.

   ★ When the transmission output shaft speed is 260 rpm, the travel speed is approximately 3.2 km/h.

Lockup operating points table

Forward

		Accelerator pedal opening ratio [%]	Shifting up			Shifting down		
			Transmission output shaft speed [rpm] (Reference: Travel speed [km/h])		No-shift time [sec.]	Transmission output shaft speed [rpm] (Reference: Travel speed [km/h])		No-shift time [sec.]
			Ordinary	Hunting prevention		Ordinary	Hunting prevention	
Power mode "P-mode"	From 3rd T/C to 3rd L/U (H-mode)	0	1,162 (14.5)	1,362 (17.0)	0	1,082 (13.5)		0
		50	1,162 (14.5)	1,362 (17.0)		1,082 (13.5)		
		90	1,202 (15.0)	1,362 (17.0)		1,122 (14.0)		
		100	1,202 (15.0)	1,362 (17.0)		1,122 (14.0)		
	From 3rd T/C to 3rd L/U (L-mode)	0	1,082 (13.5)	1,362 (17.0)		1,042 (13.0)		
		50	1,082 (13.5)	1,362 (17.0)		1,042 (13.0)		
		90	1,122 (14.0)	1,362 (17.0)		1,042 (13.0)		
		100	1,122 (14.0)	1,362 (17.0)		1,042 (13.0)		
	From 4th T/C to 4th L/U (H-mode)	0	1,723 (21.5)		0	1,683 (21.0)		0
		50	1,723 (21.5)			1,683 (21.0)		
		90	2,003 (25.0)			1,683 (21.0)		
		100	2,003 (25.0)			1,683 (21.0)		
	From 4th T/C to 4th L/U (L-mode)	0	1,763 (22.0)			1,683 (21.0)		
		50	1,763 (22.0)			1,683 (21.0)		
		90	1,763 (22.0)			1,683 (21.0)		
		100	1,763 (22.0)			1,683 (21.0)		
Power mode "E-mode"	From 3rd T/C to 3rd L/U (H-mode)	0	1,122 (14.0)	1,258 (15.7)	0	1,082 (13.5)		0
		50	1,122 (14.0)	1,258 (15.7)		1,082 (13.5)		
		90	1,122 (14.0)	1,258 (15.7)		1,082 (13.5)		
		100	1,122 (14.0)	1,258 (15.7)		1,082 (13.5)		
	From 3rd T/C to 3rd L/U (L-mode)	0	1,082 (13.5)	1,258 (15.7)		1,042 (13.0)		
		50	1,082 (13.5)	1,258 (15.7)		1,042 (13.0)		
		90	1,082 (13.5)	1,258 (15.7)		1,042 (13.0)		
		100	1,082 (13.5)	1,258 (15.7)		1,042 (13.0)		
	From 4th T/C to 4th L/U (H-mode)	0	1,763 (22.0)		0	1,683 (21.0)		0
		50	1,763 (22.0)			1,683 (21.0)		
		90	2,003 (25.0)			1,683 (21.0)		
		100	2,003 (25.0)			1,683 (21.0)		
	From 4th T/C to 4th L/U (L-mode)	0	1,723 (21.5)			1,683 (21.0)		
		50	1,723 (21.5)			1,683 (21.0)		
		90	1,763 (22.0)			1,683 (21.0)		
		100	1,763 (22.0)			1,683 (21.0)		

T/C: Stands for torque converter travel.
L/U: Stands for direct travel (lockup operation).

Reverse

		Accelerator pedal opening ratio [%]	Shifting up			Shifting down		
			Transmission output shaft speed [rpm] (Reference: Travel speed [km/h])		No-shift time [sec.]	Transmission output shaft speed [rpm] (Reference: Travel speed [km/h])		No-shift time [sec.]
			Ordinary	Hunting prevention		Ordinary	Hunting prevention	
Power mode "P-mode"	From 3rd T/C to 3rd L/U (H-mode)	0	1,248 (15.6)	1,463 (18.3)	0	1,162 (14.5)		0
		50	1,248 (15.6)	1,463 (18.3)		1,162 (14.5)		
		90	1,291 (16.1)	1,463 (18.3)		1,205 (15.0)		
		100	1,291 (16.1)	1,463 (18.3)		1,205 (15.0)		
	From 3rd T/C to 3rd L/U (L-mode)	0	1,162 (14.5)	1,463 (18.3)		1,119 (14.0)		
		50	1,162 (14.5)	1,463 (18.3)		1,119 (14.0)		
		90	1,205 (15.0)	1,463 (18.3)		1,119 (14.0)		
		100	1,205 (15.0)	1,463 (18.3)		1,119 (14.0)		
	From 4th T/C to 4th L/U (H-mode)	0	1,853 (23.1)		0	1,810 (22.6)		0
		50	1,853 (23.1)			1,810 (22.6)		
		90	2,155 (26.9)			1,810 (22.6)		
		100	2,155 (26.9)			1,810 (22.6)		
	From 4th T/C to 4th L/U (L-mode)	0	1,896 (23.7)			1,810 (22.6)		
		50	1,896 (23.7)			1,810 (22.6)		
		90	1,896 (23.7)			1,810 (22.6)		
		100	1,896 (23.7)			1,810 (22.6)		
Power mode "E-mode"	From 3rd T/C to 3rd L/U (H-mode)	0	1,205 (15.0)	1,351 (16.9)	0	1,162 (14.5)		0
		50	1,205 (15.0)	1,351 (16.9)		1,162 (14.5)		
		90	1,205 (15.0)	1,351 (16.9)		1,162 (14.5)		
		100	1,205 (15.0)	1,351 (16.9)		1,162 (14.5)		
	From 3rd T/C to 3rd L/U (L-mode)	0	1,162 (14.5)	1,351 (16.9)		1,119 (14.0)		
		50	1,162 (14.5)	1,351 (16.9)		1,119 (14.0)		
		90	1,162 (14.5)	1,351 (16.9)		1,119 (14.0)		
		100	1,162 (14.5)	1,351 (16.9)		1,119 (14.0)		
	From 4th T/C to 4th L/U (H-mode)	0	1,896 (23.7)		0	1,810 (22.6)		0
		50	1,896 (23.7)			1,810 (22.6)		
		90	2,155 (26.9)			1,810 (22.6)		
		100	2,155 (26.9)			1,810 (22.6)		
	From 4th T/C to 4th L/U (L-mode)	0	1,853 (23.1)			1,810 (22.6)		
		50	1,853 (23.1)			1,810 (22.6)		
		90	1,896 (23.7)			1,810 (22.6)		
		100	1,896 (23.7)			1,810 (22.6)		

T/C: Stands for torque converter travel.
L/U: Stands for direct travel (lockup operation).

Function of hunting prevention

- The transmission controller detects and prevents hunting that can result from shifting the gear from 2nd to 3rd and 3rd to 2nd in the auto shift mode.
- If gearshifts of 2nd to 3rd to 2nd to 3rd are performed within 5 seconds from the previous gear shift, hunting is thought to have occurred, and the gear speed is selected from 2nd or 3rd, whose operation time is longer.
- As the hunting prevention function is turned on, the shift point in the hunting prevention section in “Auto-shift points table” is applied to the next automatic gear shifting.
- Currently turned on hunting prevention function is reset as the next gear shifting (including the direction switching operation and kickdown operation) is done. As the hunting prevention function is reset, the ordinary auto shift point is restored.
- The transmission controller resets the lockup if ON/OFF of the 3rd lockup occurred consecutively within 5 seconds. For the next lockup, the transmission controller applies the lockup operating point in the hunting prevention section of “Lockup operating points table”.
- The hunting prevention function related to the lockup is turned on in the manual shift mode, too, if the controller judges hunting is present.

Transmission initial learning and ECMV current adjustment

- Adjusting the “Transmission initial learning setting” and “Transmission ECMV current adjustment” items by use of the adjustment function of the machine monitor allows correcting variations of the transmission itself as well as ECMV.
- Ignoring above adjustment can lead to generation of gear shifting shocks or time lag.

★ For the adjustment procedure, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

Changing shift points

- The transmission controller has the function of adjusting the gear shift points of “L-mode” in auto-shift.
- When hunting is induced by some conditions unique to a worksite, adjust the shift up and down travel speeds by adjusting the “Adjustment of transmission L-mode shift point” item by use of the adjustment function of the machine monitor.

★ For the adjustment procedure, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

4th gear speed derating function

- Restriction of operation at 4th gear speed becomes available by selecting “ADD” for “23. FORBID 4TH” item using the optional device selecting function of the machine monitor.

★ For the setting procedure, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

Function of transmission controller protection

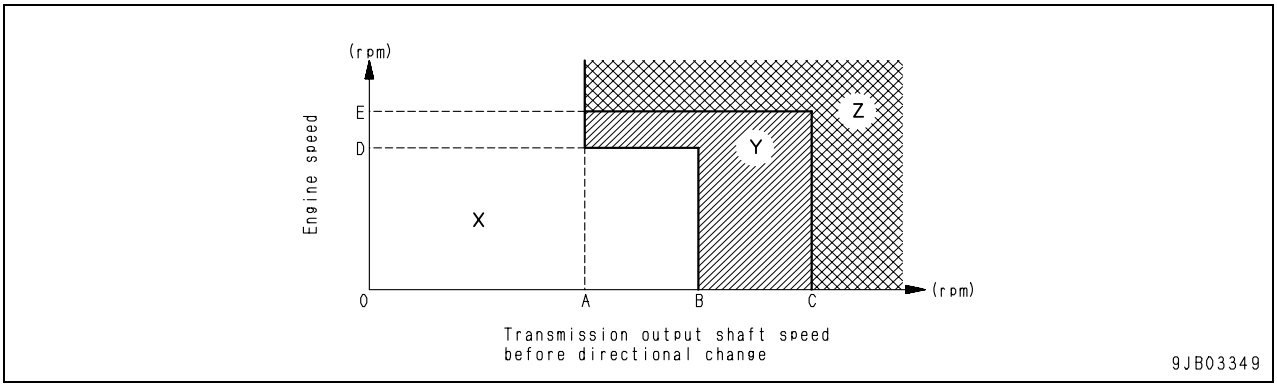
Protection function prepared for directional selection

- When the directional lever is operated during high-speed travel (3rd/4th), engagement of the speed clutch is controlled to protect the transmission.

1. In manual-shift mode
   Range X: Travel direction is changed. (Ordinary range)
   Range Y: Travel direction is changed and alarm buzzer sounds.
   Range Z: Travel direction is changed and alarm buzzer sounds.

2. In auto-shift mode
   Range X: Travel direction is changed and transmission is set to 2nd gear speed. (Ordinary range)
   Range Y: Travel direction is changed, transmission is set to 2nd gear speed and alarm buzzer sounds.
   Range Z: Travel direction is changed and alarm buzzer sounds. Gear speed is switched to 3rd or 4th depending on the given travel speed. If the travel speed continues to slow down, gear speed is shifted down to 2nd gear speed.

★ Shifting up and down as well as kickdown operation is not accepted for 2 seconds succeeding to operation of the directional selector switch. When shifting up or down is done from the gear shift lever, wait for 2 seconds before starting gear shifting.
In the auto-shift mode, it is prohibited to turn on shifting up until the speed is once decelerated to 2nd.



Transmission output shaft speed [rpm]
(Reference: Travel speed [km/h])

A	1,042 (13)
B	1,122 (14)
C	1,282 (16)

Engine speed [rpm]

D	1,700
E	1,900

Function of shift down protection

- In order to protect the engine and pump, this function rejects the shifting down operation as long as the machine is traveling at a speed higher than the set one.
- The alarm buzzer is sounded as long as the shift down protection function is turned on.
- The buzzer sounds are continued until the gear speed position of the gear shift lever coincides with the actual gear speed. Thus, shifting up operation can stop the alarm buzzer sounds even if the travel speed is not slowed down.
- The shift down protection is enabled also for the kickdown operation in the auto-shift mode. If the kickdown switch is pressed while the machine is traveling at a higher speed than that specified in the protecting conditions, this function rejects the kickdown switch and sounds the alarm buzzer for 3 seconds.
- The operating condition of shift down protection function is as follows.

Targeted gear speed of shift down	Transmission output shaft speed [rpm] (Reference: Travel speed [km/h])	
	Condition for applying protection	Condition for resetting protection
To 3rd gear speed	2,227 (27.8) or above	Below 2,005 (25.0)
To 2nd gear speed	1,470 (18.3) or above	Below 1,322 (16.5)
To 1st gear speed	1,061 (13.2) or above	Below 951 (11.9)

Function of engine overrun prevention

- As the transmission output shaft speed reached a level corresponding to the engine speed of 2,500 rpm or above, this function resets the lockup automatically in order to prevent the engine overrun.
- The alarm buzzer is sounded as long as the engine overrun prevention function is turned on.
- The lockup reset state is maintained for 5 seconds after it has been reset. After 5 seconds from the reset, the transmission output shaft speed reached a level corresponding to the engine speed of below 2,500 rpm, this function applies the lockup again.
- The operating condition of the engine overrun prevention function is as follows.

Actual gear speed	Transmission output shaft speed [rpm] (Reference: Travel speed [km/h])
F3	1,976 (24.6)
F4	3,516 (43.9)
R3	2,106 (26.3)
R4	3,782 (47.2)

Maximum travel speed derating function

- As the transmission output shaft speed reached a level corresponding to the travel speed of 40 km/h or above, this function resets the lockup in order for the safety.
- The alarm buzzer is sounded as long as the maximum travel speed derating function is turned on.
- The lockup reset state is maintained for 5 seconds after it has been reset. After 5 seconds from the reset, as the transmission output shaft speed reached a level corresponding to the travel sped of below 38 km/h, this function stops the alarm buzzer but maintains the lockup in the reset state.
- When the lockup clutch is not installed on the machine, alarm buzzer alone will be sounded.
- The operating condition of the maximum travel speed derating function is as follows.

Threshold value	Transmission output shaft speed [rpm] (Reference: Travel speed [km/h])
Lockup resetting operation	3,205 (40.0)
Completion of lockup resetting operation	3,045 (38.0)
Operation of alarm buzzer	3,205 (40.0)
Resetting of alarm buzzer	3,165 (39.5)

Function of neutralizer

- When the parking brake switch is turned “ON”, this function holds the transmission at neutral position, independent of the directional lever and gear shift lever positions, in order to prevent dragging of the parking brake.
- The safety mechanism employed on the parking brake circuit maintains the parking brake operative when the currently turned “OFF” starting switch is turned “ON”. Thus, when the starting switch is turned “ON”, the transmission is always set to the neutral independent of the directional lever and gear shift lever positions.

Engine control function

Power mode selecting function

- Setting the power mode selector switch to “P-mode” sends the P-mode torque curve information to the engine controller. At the same time, above operation sends information of the power mode to the machine monitor, lighting up the power mode pilot lamp.

Engine stall prevention control

- When the engine speed is low, switching the travel direction during high-speed travel results in applying counter torque from tires to the engine, potentially inducing the risk of the engine stall.
- In order to prevent the engine stop, this function sends the specified throttle (accelerator pedal) lower limit position value to the engine controller as the travel direction is switched.
- When the direction was changed from “reverse” to “forward”, this function sends as much as approximately 25% of the specified throttle lower limit position values to the engine controller. In the case of “forward” to “reverse”, as much as approximately 15% of the values are sent. This communication lasts for 2 seconds after the directional selection is completed.

Economy operation pilot lamp function

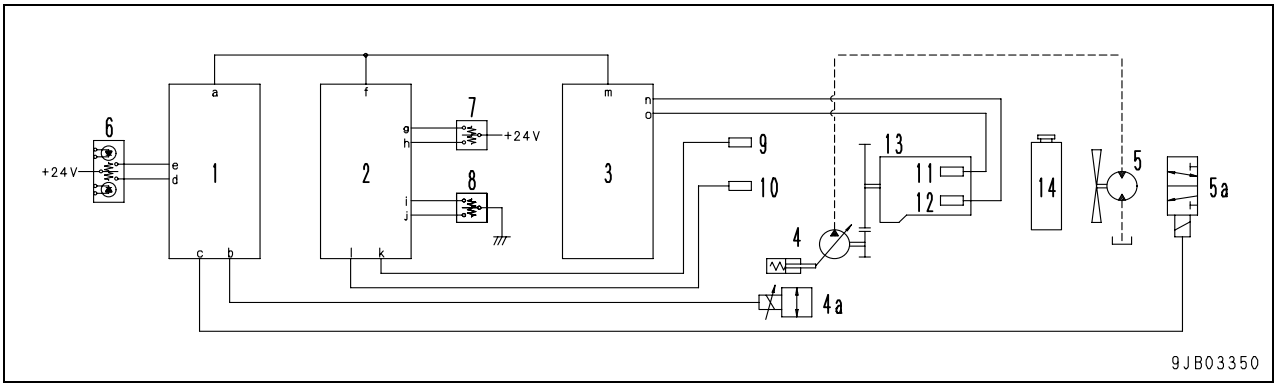
- In order to prompt the operator for the low fuel consumption operation, this function lights up the economy operation pilot lamp as long as the low fuel consumption operation is continued.
- The conditions for lighting up the economy operation pilot lamp is as follows.

Power mode	Economy operation pilot lamp lighting condition
E-mode	The low fuel consumption operation is turned on in this mode independent of the running or operating state. Thus, the lamp is constantly lighted.
P-mode	The lamp is lighted when the accelerator pedal opening ratio is maintained below 75% for more than 0.5 seconds.

- The economy operation pilot lamp can be constantly turned off by selecting “NO ADD” for “19. ECO LAMP” item using the optional device selecting function of the machine monitor.

★ For the setting procedure, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

Cooling fan control function



1. Transmission controller
2. Machine monitor
3. Engine controller
4. Cooling fan pump
   4a. Swash plate angle control EPC valve
5. Cooling fan motor
   5a. Cooling fan reverse rotation solenoid valve
6. Cooling fan reverse rotation switch
7. Machine monitor mode selector switch 1
8. Machine monitor mode selector switch 2
9. Hydraulic oil temperature sensor
10. Torque converter oil temperature sensor
11. Coolant temperature sensor
12. Engine speed sensor
13. Engine
14. Radiator

Input and output signals

Transmission controller
- a. CAN signal
- b. Cooling fan pump swash plate angle control signal
- c. Cooling fan reverse rotation signal
- d. Cooling fan automatic reverse rotation signal
- e. Cooling fan manual reverse rotation signal

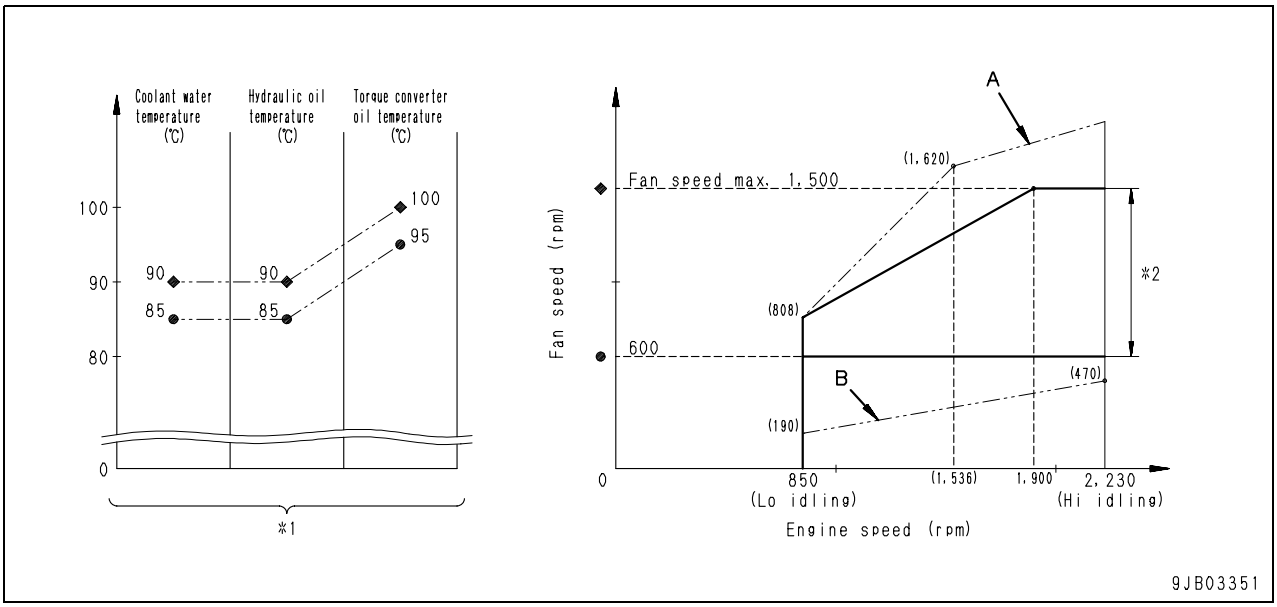
Machine monitor
- f. CAN signal
- g. “◇” switch signal
- h. “■” switch signal
- i. “>” switch signal
- j. “<” switch signal
- k. Hydraulic oil temperature signal
- l. Torque converter oil temperature signal

Engine controller
- m. CAN signal
- n. Engine speed signal
- o. Coolant temperature signal

Fan control

- Employment of the hydraulically driven cooling fan as well as controlling its speed through control of the hydraulic pump swash plate allows reducing the horsepower loss and noises in low temperature environment.
- Engine speed and coolant temperature received by the engine controller and hydraulic oil temperature and torque converter oil temperature received by the machine monitor are sent to the transmission controller via the network.
- Based on the received information, the transmission controller sends the signal current to the swash plate angle control EPC valve on the cooling fan pump, so that the valve may control the swash plate angle in order to set the fan speed to a level suitable for the given temperature level and the engine speed.

Fan speed in accordance with temperature



*1: The target fan speed is determined based on the coolant temperature, hydraulic oil temperature or torque converter oil temperature data, whichever is higher.

★ The torque converter oil temperature data is used for the fan speed control only when the coolant temperature was maintained 82°C or above for more than 30 seconds.
(As the coolant temperature went below 82°C, the cumulative time is reset.)

*2: Within this range, the fan speed is set according to the coolant temperature, hydraulic oil temperature or torque converter oil temperature.

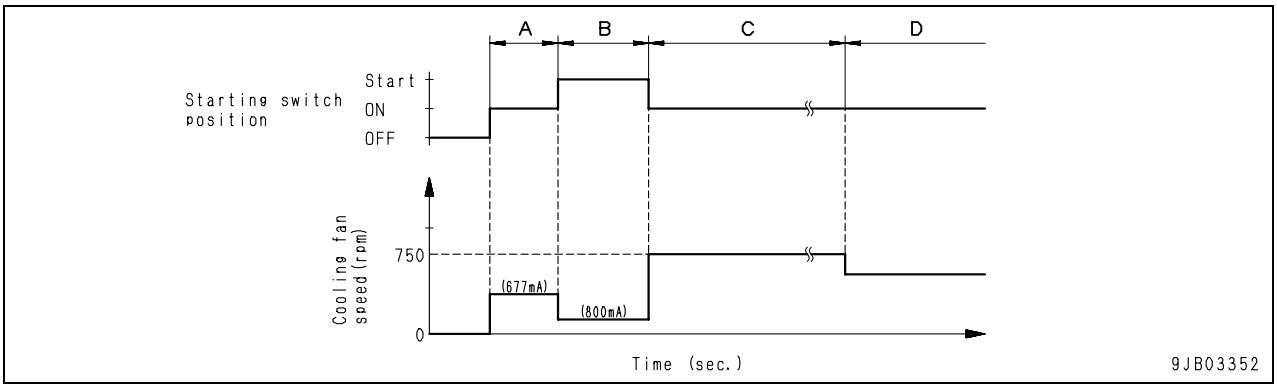
A: When the pump swash plate angle is maximum
B: When pump swash plate angle is minimum

Pump protection function

- In order to prevent overrun of the cooling fan motor, this function minimizes the swash plate angle of the cooling fan pump as the engine speed reached 2,300 rpm or above.
- If the transmission controller fails to recognize the engine speed and respective temperature data due to a failure on the network communication, this function sends a specific command current (677 mA) to the swash plate angle control EPC valve on the pump so that the pump may work functionally – equivalent to a fixed pump.

Control at start of engine

- At start of the engine, a fan control approach different from the usual temperature-based one is employed.



Range A: When engine is stopped [When starting switch 1-stage “ON”]

- Engine speed is not recognizable as long as it is stopped. Thus, this function sends the command current of 677 mA to the swash plate angle control EPC valve on the pump.

Range B: While cranking is taking place

- While cranking is taking place to start the engine, this function sends the command current of 800 mA to the swash plate angle control EPC valve on the pump in order to reduce the torque needed for starting the engine.

Range C: For 30 seconds from start of engine.

- This function controls the pump swash plate angle in such that the fan minimum speed may be set to 750 rpm or equivalent. Setting the fan speed at this level allows the cooling fan pump to feed enough refilling oil to the brake accumulator.

★ When the fan speed exceeded 750 rpm because of the temperature condition, precedence is given to the basic control.

Range D: Basic control

- Denotes the ordinary fan control as described in the section of “Fan speed in accordance with temperature”.

Fan reverse rotation function

- As the fan reverse rotation switch is pressed for cleaning of the radiator core, the cooling fan reverse rotation solenoid valve of the cooling fan motor is activated, reverse rotating the fan.

1. Fan manual reverse rotation function
   The operator can select the fan rotation direction as he chooses by setting the fan reverse rotation switch to “MANUAL”.
   As long as switching of the fan rotation direction is taking place, the pilot lamps of the fan reverser rotation switch and the machine monitor keep blinking to inform the operator that the switching is underway. And when the fan rotation is reversed responding to the high engine speed, high coolant or oil temperature, this lamp also keeps on blinking until the preparation for switching is completed.
   As the fan rotation switching condition is met, this function sends the accelerator opening ratio-restricting signal to the engine controller so that the engine speed may not reach 1,200 rpm or above while the switching is underway.
   As long as the reverse fan rotation is continued, the pilot lamp of the fan reverse rotation switch and the machine monitor remains turned on.

   The fan rotation is switched from “forward” to “reverse” as every condition in the following table is met.

Condition 1	The fan reverse rotation switch is set “MANUAL”.
Condition 2	Engine speed is over 500 rpm and below 1,200 rpm. [In order to prevent generation of peak pressure at switching of the rotation direction.]
Condition 3	Coolant temperature is below 90°C. [In order to prevent overheat.]
Condition 4	Hydraulic oil temperature is below 90°C. [In order to prevent overheat.]
Condition 5	Torque converter oil temperature is below 90°C. [In order to prevent overheat.]
Condition 6	30 seconds have passed after the engine is started (after engine speed reached 500 rpm or above). [In order to secure enough oil to be fed to the brake accumulator.]

   The fan rotation is switched from “reverse” to “forward” as any of the following conditions is met.

Condition 1	While the fan reverse rotation was taking place, the fan reverse rotation switch was set to MANUAL again and the engine speed went below 1,200 rpm.
Condition 2	The engine speed went below 1,200 rpm after 10 minutes from start of the fan reverse rotation.
Condition 3	Engine has stopped.

2. Overheat prevention function
   If overheat occurs is recognized of the coolant temperature, hydraulic oil temperature or torque converter oil temperature during the fan reverse rotation (thermometer caution lamp of the machine monitor comes on), this function forcibly stops the reverse rotation and turns on the forward rotation in order to increase air flow to the radiator.

3. Fan speed during reverse rotation
   While the fan reverse rotation is continued, this function sets the fan speed to the maximum by cutting off the command current to the swash plate angle control EPC valve of the fan pump (the command current is forced to 0 mA).
   Setting the fan speed to the maximum increases air flow to the radiator core maximum, making the cleaning work easier.

4. Fan automatic reverse rotation function
(If equipped)
Setting the fan reverse rotation switch to “AUTO” allows changing the fan rotation direction switching cycle and the reverse rotation duration at a specific interval.
As long as switching of the fan rotation direction is taking place, the pilot lamps of the fan reverser rotation switch and the machine monitor keep blinking to inform the operator that the switching is underway. And when the fan rotation is reversed responding to the high engine speed, high coolant or oil temperature, this lamp also keeps on blinking until the preparation for switching is completed.
As the fan rotation switching condition is met, this function sends the accelerator opening ratio-restricting signal to the engine controller so that the engine speed may not reach 1,200 rpm or above while the switching is underway.
As long as the fan reverse rotation is continued, the pilot lamp of the fan reverse rotation switch and the machine monitor remains turned on.

The fan rotation is switched from “forward” to “reverse” as every condition in the following table is met.

Condition 1	The fan reverse rotation switch is set “AUTO”.
Condition 2	Coolant temperature is below 90°C. [In order to prevent overheat.]
Condition 3	Hydraulic oil temperature is over 50°C and below 90°C. [90°C of the upper limit is set in order to prevent overheat.]
Condition 4	Torque converter oil temperature is below 90°C. [In order to prevent overheat.]
Condition 5	30 seconds have passed after the engine is started (after engine speed reached 500 rpm or above). [In order to secure enough oil to be fed to the brake accumulator.]
Condition 6	The fan rotation direction switching cycle or the reverse rotation duration has elapsed.

The fan rotation is switched from “reverse” to “forward” as any of the following conditions is met.

Condition 1	While the fan reverse rotation was taking place, the fan reverse rotation switch was set to “AUTO”. And then the hydraulic oil temperature went to 50°C or above.
Condition 2	After the fan rotation direction switching cycle or the reverse rotation duration has elapsed, the hydraulic oil temperature went to 50°C or above.
Condition 3	Engine has stopped.

5. Adjustment of the automatic fan switching cycle to reverse rotation and duration
(If equipped)
Any cycle is settable for the switching cycle of fan rotation direction and also any duration is settable for the reverse rotation duration by adjusting the items “Automatic fan switching cycle to reverse rotation” and “Reverse rotation duration” with the adjusting function of the machine monitor.
★ For the adjustment procedure, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

Work equipment pump swash plate control function

- The work equipment pump swash plate control function comprises the functions named “Engine stall prevention control at low idle” and “Pickup auxiliary function when engine speed is low”. Comparing results of calculations done on respective functions, this function selects the data that makes the work equipment pump delivery smaller (the data that sets a larger value for the command current to the swash plate angle control EPC valve).
- A balance between the work capability and drawbar pull in respective modes is achieved by switching from the pump delivery-reducing pressure to another. This change is done by switching the power mode using the power mode selector switch.

Engine stall prevention control at low idle

- Engine stall can result from radical increase in load at low idle. In order to prevent this trouble, this function restricts the pump delivery at high pressure by controlling the pump swash plate angle through EPC.

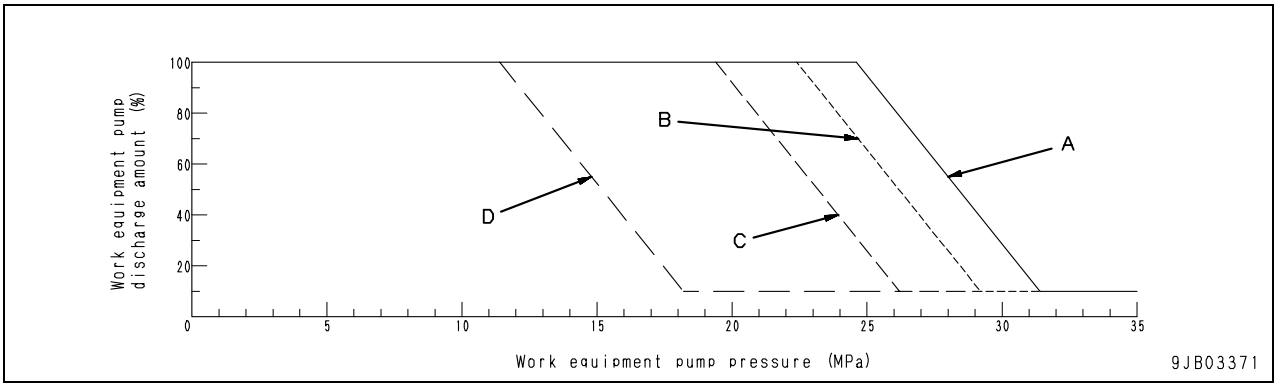
  In P-mode

Engine speed (rpm)	780	830	850	880
EPC valve command current (mA)	800	330	200	0

  In E-mode

Engine speed (rpm)	780	830	850	880
EPC valve command current (mA)	800	500	350	350

Oil pressure – flow rate characteristics when control is done with command current to swash plate angle control EPC valve of work equipment pump



A: When EPC valve command current is 0 mA
B: When EPC valve command current is 300 mA
C: When EPC valve command current is 500 mA
D: When EPC valve command current is 800 mA

Pickup auxiliary function when engine speed is low

- Compound operation of the work equipment and steering at a low engine speed can make the engine pickup poor because the work equipment pump suction torque becomes larger compared with the torque generated with the engine.
- It is an auxiliary function prepared to help improving the engine pickup. As the accelerator pedal is pressed from a low engine speed, this function sends the command current corresponding to the steering oil pressure to the swash plate angle control EPC valve of the work equipment pump in order to alleviate the load by controlling the pump swash plate.

1. Command current to swash plate angle control EPC valve of work equipment pump
   This function stores the EPC valve command current value data corresponding to the data of engine speed, accelerator opening ratio and steering oil pressure. It selects an optimum pump delivery by choosing the data with the lowest current value.
   When the pump delivery increased (when the command current is decreased), this function prevents sudden operation of the work equipment due to radical increase in flow rate by restraining 120 mA or greater fluctuations within 0.1 second.
   When the pump delivery decreased (when the command current is increased), this function prevents sudden stop of the work equipment due to radical decrease in flow rate by restraining 60 mA or greater fluctuations within 0.1 second.

   In P-mode

Engine speed (rpm)	750	1,500	1,700	2,400
EPC valve command current (mA)	800	800	0	0

Accelerator pedal opening ratio (%)	0	20	50	100
EPC valve command current (mA)	330	330	800	800

Steering oil pressure (MPa {kg/cm^2})	0 {0}	50 {4.9}	80 {7.9}	350 {34.3}
EPC valve command current (mA)	200	600	800	800

   In E-mode

Engine speed (rpm)	750	1,500	1,700	2,400
EPC valve command current (mA)	800	800	350	350

Accelerator pedal opening ratio (%)	0	20	50	100
EPC valve command current (mA)	350	350	800	800

Steering oil pressure (MPa {kg/cm^2})	0 {0}	100 {9.8}	120 {11.8}	350 {34.3}
EPC valve command current (mA)	486	486	800	800

Transmission cut-off function

- The transmission cut-off oil pressure sensor detects the brake pilot pressure as the brake pedals of both sides are pressed and sets the transmission to the neutral.
- The transmission can be cut-off at any position by saving the pressure at the brake pressing position as the brake pilot oil pressure at which the transmission is set to the neutral.

1. Contents of control

Transmission cut-off control	Outline	• As the transmission cut-off operating conditions are met, the transmission is set to the neutral. • As the transmission cut-off reset conditions are met, the transmission is released and the transmission gear speed is controlled by the modulation.
	Operating condition	<Operating conditions at 1st and 2nd gear speeds> • When the transmission cut-off switch is turned “ON” and the brake pilot oil pressure became larger than the cut-off IN pressure. < Operating conditions at 3rd and 4th gear speeds> • When the transmission cut-off switch is turned “ON” and the brake pilot oil pressure became larger than the cut-off IN pressure while the accelerator pedal opening ratio is maintained at less than 30%.
	Reset condition	If any of the following conditions is met, the cut-off is reset. • The transmission cut-off switch is turned “OFF”. • The brake pilot oil pressure is below the cut-off OUT pressure.
Setting of the transmission cut-off point	Settable conditions	• When the transmission cut-off switch is turned “ON”.
	Setting method	1) Press the brake pedal up to a desired setting position. (Setting is available without pressing the brake pedal) 2) Press the transmission cut-off set switch. 3) This function recognizes the brake pilot pressure at which the switch was pressed. <When the position is within the settable range> The brake pilot pressure at which the switch was pressed is temporarily stored. <When the position is out of the settable range> The upper limit or lower limit brake pilot pressure within the settable range is temporarily stored. This function sends the information to the machine monitor via the network needed by it to sound the set completion buzzer (blip blip). 4) The pilot lamp contained in the transmission cut-off switch blinks for 2 seconds. 5) Set value is saved. (The setup mode ends) ★ The setting is held after the starting switch is turned “OFF”.
	Resetting method	1) From step 4 of the setting method (the pilot lamp contained in the transmission cut-off set switch blinks for 2 seconds), press the transmission cut-off set switch again. 2) As the blinking ends, the cutoff point is set as the default brake pilot oil pressure. This function sends the information to the machine monitor via the network needed by it to sound the setting cancel buzzer (beep). 3) Set (Default) value is saved. (The setup mode ends) ★ The setting is held after the starting switch is turned “OFF”.

2. Outputting conditions

Outputting conditions	Pilot lamp contained in transmission cut-off switch	Buzzer command (Communication output)	Cut-off point
When transmission cut-off switch is “ON”	ON	Not issued	Controlled with the value saved last
When transmission cut-off switch is “ON” and transmission cut-off set switch is “ON” For 2.5 seconds or until reset (sensor normal) Up to setting methods 2) – 5)	Blinks (For 2 seconds or until reset)	As the set switch is pressed, set completion buzzer sounds (blip blip)	Brake pilot oil pressure is saved as the set switch is pressed
When transmission cut-off switch is “ON” and transmission cut-off pressure sensor is abnormal	Remains turned off	Not issued (Error buzzer is sounded)	No control is turned on Saved value is not modified
When transmission cut-off switch is “ON” and transmission cut-off set switch is abnormal	ON	Not issued (Machine monitor displays an error indication)	Controlled with value saved last Saved value is not modified
When transmission cut-off switch is “ON” and transmission cut-off off set switch is “ON” Reset is done within 2.5 seconds	ON	As the set switch is pressed, setting cancel buzzer sounds (beep)	Default value of brake pilot oil pressure is saved
When transmission cut-off switch is “OFF”	OFF	Not issued	Not controlled

★ Shift indicator of machine monitor displays “N” as long as cut-off is continued. (Directional output signal “N”)
★ As long as cut-off is continued, gear speed change from the gear shift lever is unavailable. (Gear speed change is prohibited when transmission is at neutral)
After the cut-off is reset, connecting F or R clutch enables the gear speed change.
★ When the cut-off had been turned on after selecting 1st speed with the kickdown switch, 1st speed is selected after the reset regardless of the shift mode being selected.
★ When the lockup is turned on, the cut-off is activated only after the lockup is reset.

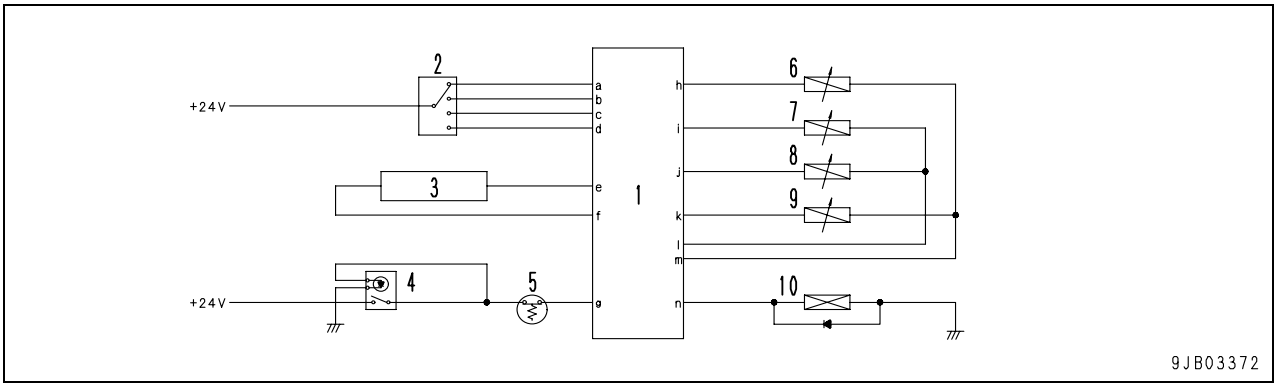
3. Settable range of transmission cut-off point

Settable range
0.49 – 4.41 MPa {5 – 45 kg/cm^2}

Note 1: When the specified cut-off point is below 0.49 MPa {5 kg/cm^2}, it is assumed as 0.49 MPa {5 kg/cm^2}.
Note 2: When the specified cut-off point is 4.41 MPa {45 kg/cm^2} or above, it is assumed as 4.41 MPa {45 kg/cm^2}. The default value is 1.47 MPa {15 kg/cm^2}.

Hysteresis of 0.20 MPa {2 kg/cm^2} is set for the cut-off IN (for neutral) pressure and OUT (reset) pressure.
Example) When the pressure sensor is set at a position where the pressure is 0.98 MPa {10 kg/cm^2},
Cut-off IN pressure = 0.98 MPa {10 kg/cm^2}
Cut-off OUT pressure = 0.78 MPa {8 kg/cm^2}

ECSS function



1. Transmission controller
2. Gear shift lever
3. Speed sensor
4. ECSS switch
5. ECSS cut-off oil pressure switch
6. 1st clutch ECMV
7. 2nd clutch ECMV
8. 3rd clutch ECMV
9. 4th clutch ECMV
10. ECSS solenoid valve

Input and output signals

a. Gear shift lever “1st” signal
b. Gear shift lever “2nd” signal
c. Gear shift lever “3rd” signal
d. Gear shift lever “4th” signal
e. Travel speed signal
f. Pulse GND
g. ECSS switch “ON” signal
h. 1st clutch ECMV operation signal
i. 2nd clutch ECMV operation signal
j. 3rd clutch ECMV operation signal
k. 4th clutch ECMV operation signal
l. ECMV GND
m. ECMV GND
n. ECSS operation signal

Outline

- When the machine travels at high speed, the damping effect of the accumulator charged with high-pressure gas and the automatic control of the lift cylinder circuit relief pressure under each travel condition damp the vertical movement of the work equipment and reduce rocking of the chassis. As a result, the operator comfort is improved, spillage of material is prevented, and the working efficiency is improved.

Setting method

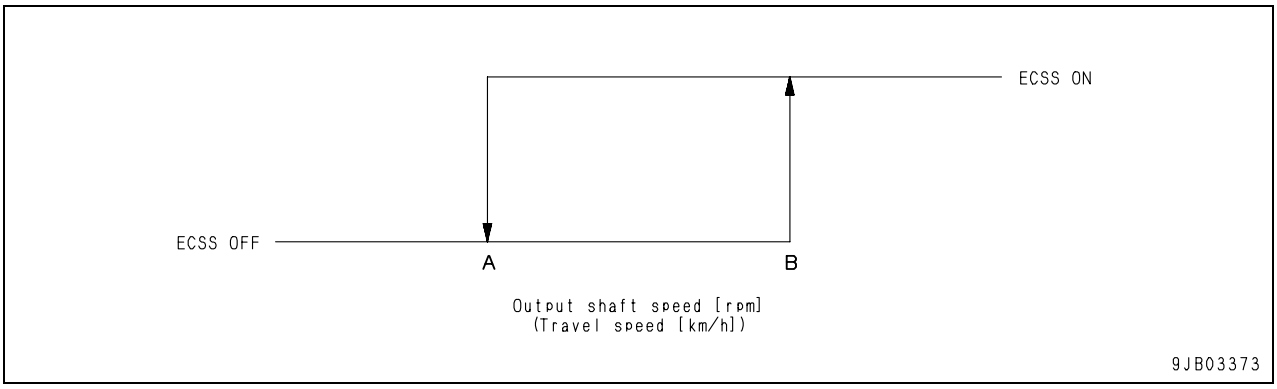
- The ECSS can be enabled only when “ADD” is selected for “20. E.C.S.S.” item using the optional device selecting function of the machine monitor.

★ For the setting procedure, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

Operation

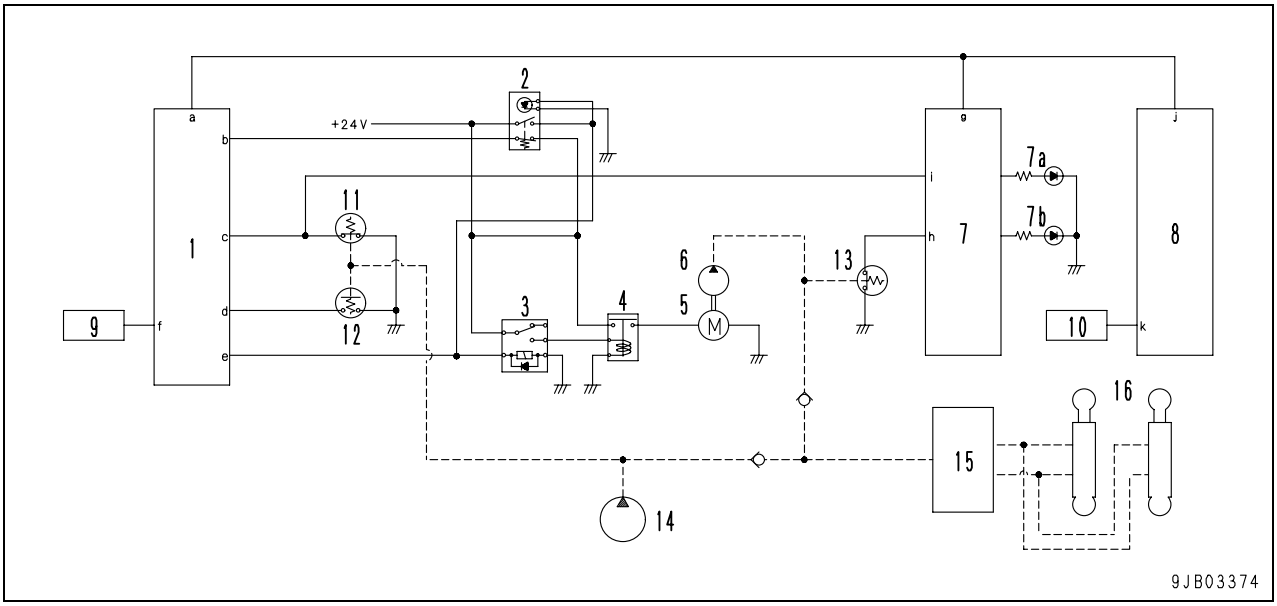
- The operating condition of ECSS is as follows.

ECSS switch	Gear speed	Output shaft speed [rpm] (Reference: Travel speed [km/h])	ECSS cut-off oil pressure switch	ECSS operation signal
OFF	Full speed	0 – Max.	ON/OFF	OFF
ON	Full speed		ON (Lift arm in operation)	
	1st		OFF (Lift arm stopped)	
	2nd – 4th	Max. 240 (3)		
		Min. 401 (5)		ON



ECSS switching point	A	B
Output shaft speed [rpm] (Reference: Travel speed [km/h])	240 (3)	401 (5)

Electric emergency steering function



1. Transmission controller
2. Emergency steering switch
3. Emergency steering switch relay
4. Emergency steering relay
5. Emergency steering electric motor
6. Emergency steering pump
7. Machine monitor
   7a. Steering oil pressure caution lamp
   7b. Emergency steering pilot lamp
8. Engine controller
9. Speed sensor
10. Engine speed sensor
11. Steering pump oil pressure switch (Low)
12. Steering pump oil pressure switch (Hi)
13. Emergency steering oil pressure switch
14. Steering pump
15. Steering valve
16. Steering cylinder

Input and output signals

Transmission controller
- a. CAN signal
- b. Emergency steering switch signal
- c. Steering oil pressure signal (Low)
- d. Steering oil pressure signal (Hi)
- e. Emergency steering operation signal
- f. Travel speed signal

Machine monitor
- g. CAN signal
- h. Emergency steering operation signal
- i. Steering oil pressure signal (Low)

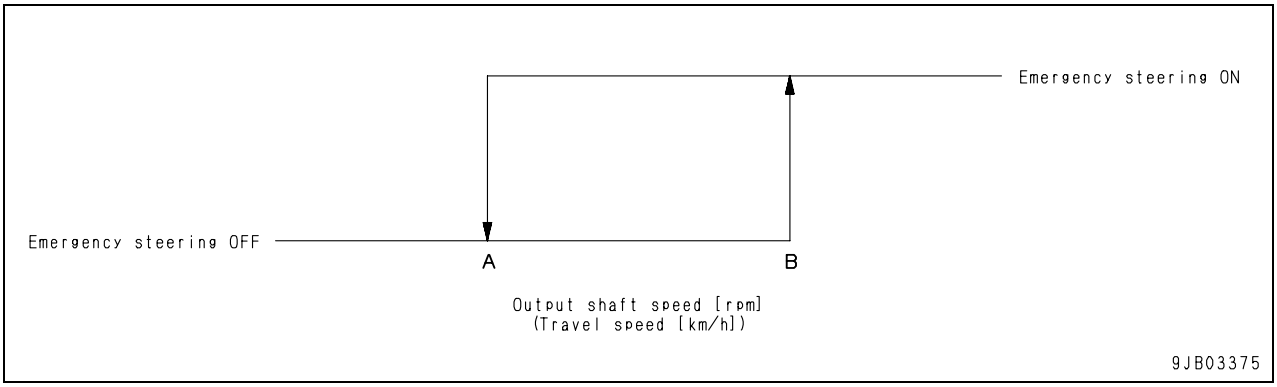
Engine controller
- j. CAN signal
- k. Engine speed signal

Outline

- This function constantly monitors state of the oil pressure switch of the steering circuit. If the steering oil pressure goes low and the transmission output shaft speed (travel speed) goes to or above the emergency steering “ON” value shown in the figure, it outputs the emergency steering operation signal to the emergency steering switch relay to activate the emergency steering.
- The emergency steering switch allows operating the emergency steering motor regardless of the steering oil pressure or the transmission output shaft speed (travel speed).

★ Continuous operation by use of the emergency steering switch shall be no longer than 60 seconds.

★ Travel speed when the emergency steering is operated shall be 5 km/h maximum.



Emergency steering switching point	A	B
Output shaft speed [rpm] (Reference: Travel speed [km/h])	152 (1.9)	160 (2.0)

Setting method

- The emergency steering function can be enabled only when “ADD” is selected for “13. EMERG S/T” item using the optional device selecting function of the machine monitor.

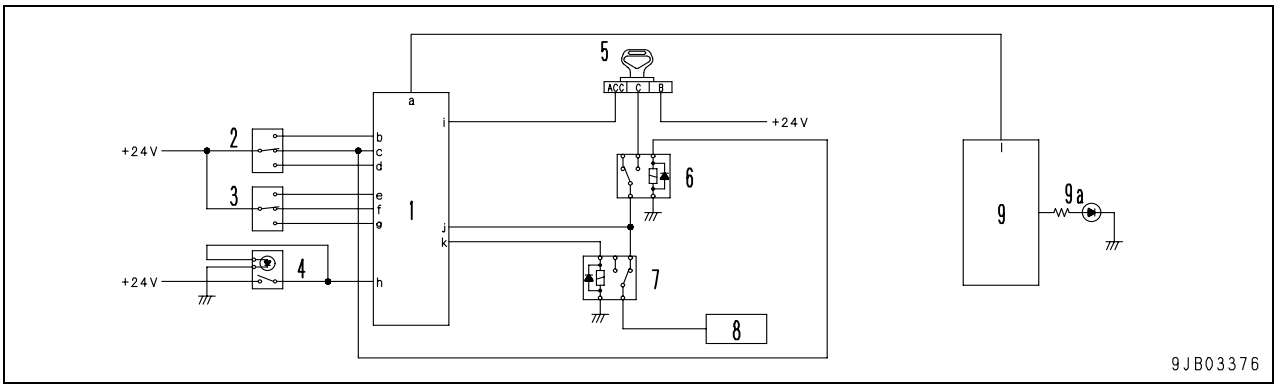
★ For the setting procedure, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

Self-check operation of emergency steering

- The emergency steering system checks its operation automatically 3 seconds after the starting switch is turned “ON” (after self-check of the machine monitor finished).
  The self-check, however, is not performed in the following cases.
  1) When the starting switch is set in the “START” position and the starting motor starts.
  2) When the engine is already run.
     (When the detected engine speed was above 500 rpm.)
  3) While the steering oil pressure is being sensed.
  4) When the automatic preheater operates.
  5) When an error related to the emergency steering was detected in the process of self-check by the machine monitor.
  6) When the engine was not started for 10 seconds or longer after the preceding self-check.
     (When the detected engine speed did not reach 500 rpm for 10 seconds or longer.)
- As self-check of the emergency steering is started, the emergency steering operation signal is output for up to 3 seconds.
- When the machine monitor detected the emergency steering operation pressure within 3 seconds, the machine monitor transmits the emergency steering operation sensing signal to the transmission controller through network. Receiving the signal, it ends self-check of the emergency steering.
- If the machine monitor fails to detect the emergency steering operation pressure within 3 seconds, the transmission controller becomes unable to recognize the emergency steering operation sensing signal from the machine monitor and thus generates an error message.

Directional selector switch control function

- Turning “ON” the directional selector switch actuation switch enables the directional selection of the machine from the work equipment directional selector switch in addition to the same operation from the directional lever of the steering column.



1. Transmission controller
2. Directional lever
3. Directional selector switch
4. Directional selector switch actuation switch
5. Starting switch
6. Neutral safety relay
7. Transmission controller neutral safety relay
8. Starting motor
9. Machine monitor

9a. Directional selector pilot lamp

Input and output signals

Transmission controller

a. CAN signal
b. Directional lever “F” signal
c. Directional lever “N” signal
d. Directional lever “R” signal
e. Directional selector switch “F” signal
f. Directional selector switch “N” signal
g. Directional selector switch “R” signal
h. Directional selector switch actuation switch “ON” signal
i. Starting switch ACC signal
j. Starting switch C signal
k. Transmission controller neutral signal

Machine monitor

l. CAN signal

Operation of directional selector switch functions

- Turning the directional selector actuation switch “ON” sends the command current to the transmission controller, requesting it to enable the directional selection signal from the directional selector switch.
- Whenever operating the directional selector switch actuation switch, be sure to set the directional lever and the directional selector switch to “N (Neutral)”. It is an indispensable safety measure. If the directional selector switch actuation switch was operated when any of above lever or switch is not set to “N (Neutral)”, the directional selector pilot lamp of the machine monitor starts flashing, triggering the alarm buzzer.
- When the directional selection from the directional selector switch is available, the machine monitor's directional selector pilot lamp and the pilot lamp contained in the directional selector switch actuation switch come on.
- When the directional selection from the directional selector switch is enabled, setting the directional lever to “F (Forward)” or “R (Reverse)” gives precedence to the directional selection by use of the directional lever. In this case, the system judges an abnormal directional selection is performed, flashing the machine monitor's directional selector pilot lamp and activating the alarm buzzer.
- Flashing of the machine monitor's directional selector pilot lamp and the alarm buzzer sounds can be reset only by setting both the directional lever and the directional selector switch to “N (Neutral)”. Until then, operation from the directional selector switch remains unacceptable.
- The following table shows the directional selection available from the lever and switches under respective operating conditions.

	Operating conditions			Directional selection operation	Function of directional selector switch	Machine monitor output	
	Directional lever	Directional selector switch	Directional selector switch actuation switch			Directional selector pilot lamp	Alarm buzzer
Directional lever operation	All range (F/N/R)	N	OFF	Precedence is given to directional lever	Disabled	OFF	Stopped
Directional selector switch operation	N	All range (F/N/R)	ON	Precedence is given to directional selector switch	Enabled	ON	Stopped
Precedence is given to directional lever	Other than N (F/R)	All range (F/N/R)	ON	Precedence is given to directional lever	Disabled	Blinks	Sounded
Directional lever operation error (Operational error)	All range (F/N/R)	Other than N (F/R)	OFF	Precedence is given to directional lever	Disabled	Blinks	Sounded
Actuation switch operation error (Operational error)	Other than N (F/R)	Other than N (F/R)	Alternate ON/OFF operation	Precedence is given to directional lever	Disabled	Blinks	Sounded

Safety function at start of engine

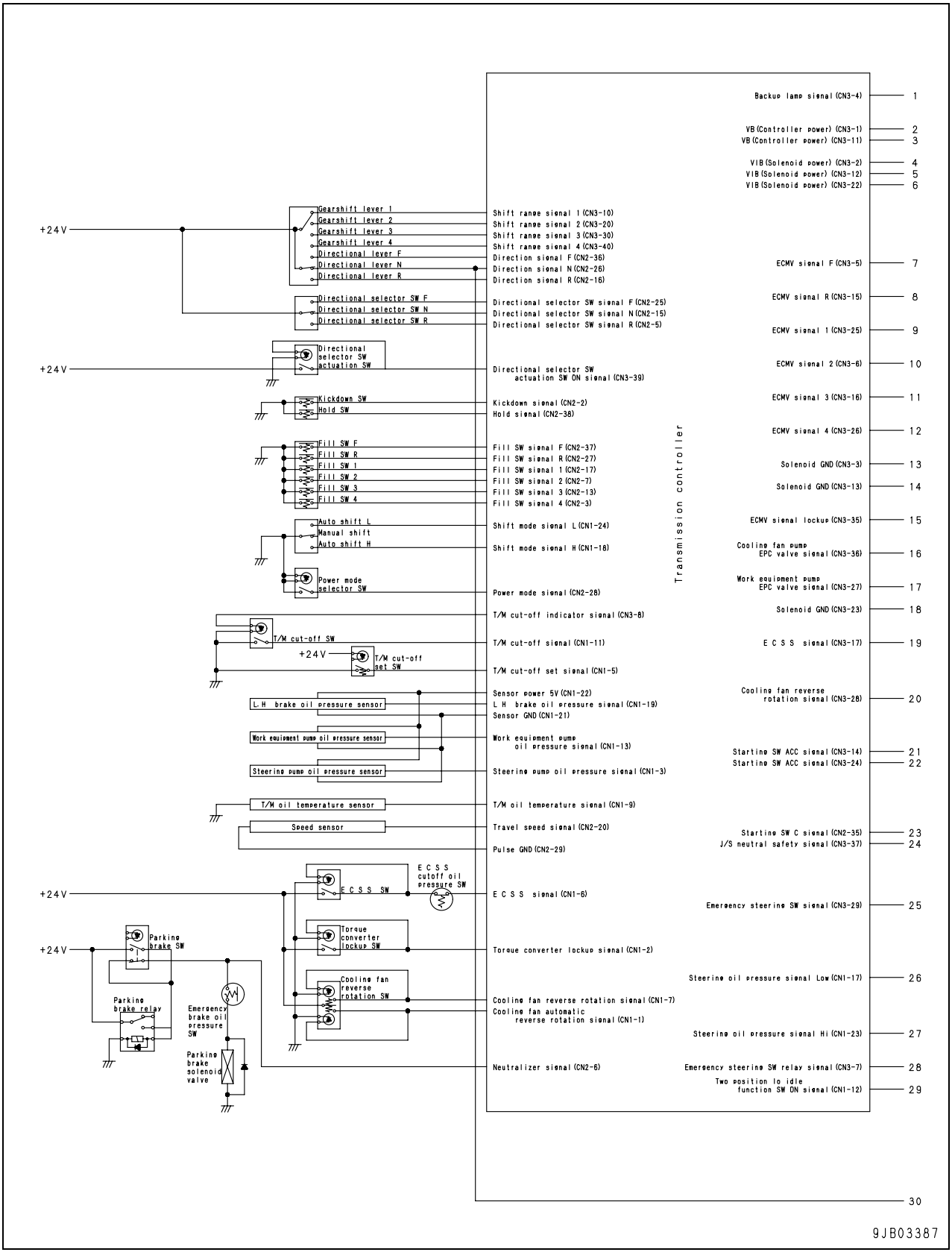
- When the directional selector switch actuation switch is set to “ON” when starting of the engine, be sure to set the directional selector switch to “N (Neutral)”. Otherwise, the signal sent to the transmission controller neutral safety relay will cut off the starting motor circuit, disabling starting of the engine.

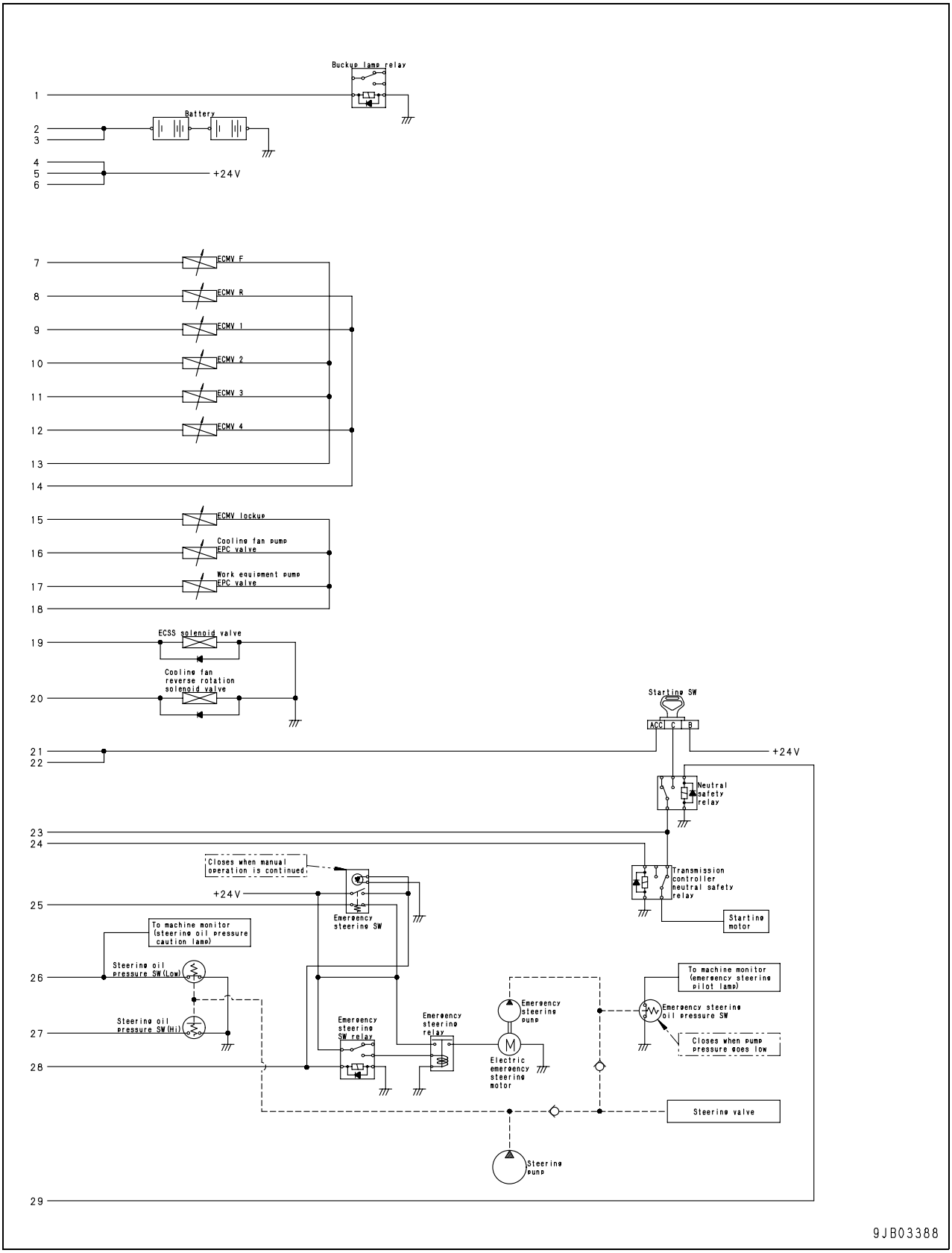
Setting method

- The directional selector switch can be enabled only when “FNR SW” is selected for “14. J/S-FNR SW” item using the optional device selecting function of the machine monitor.

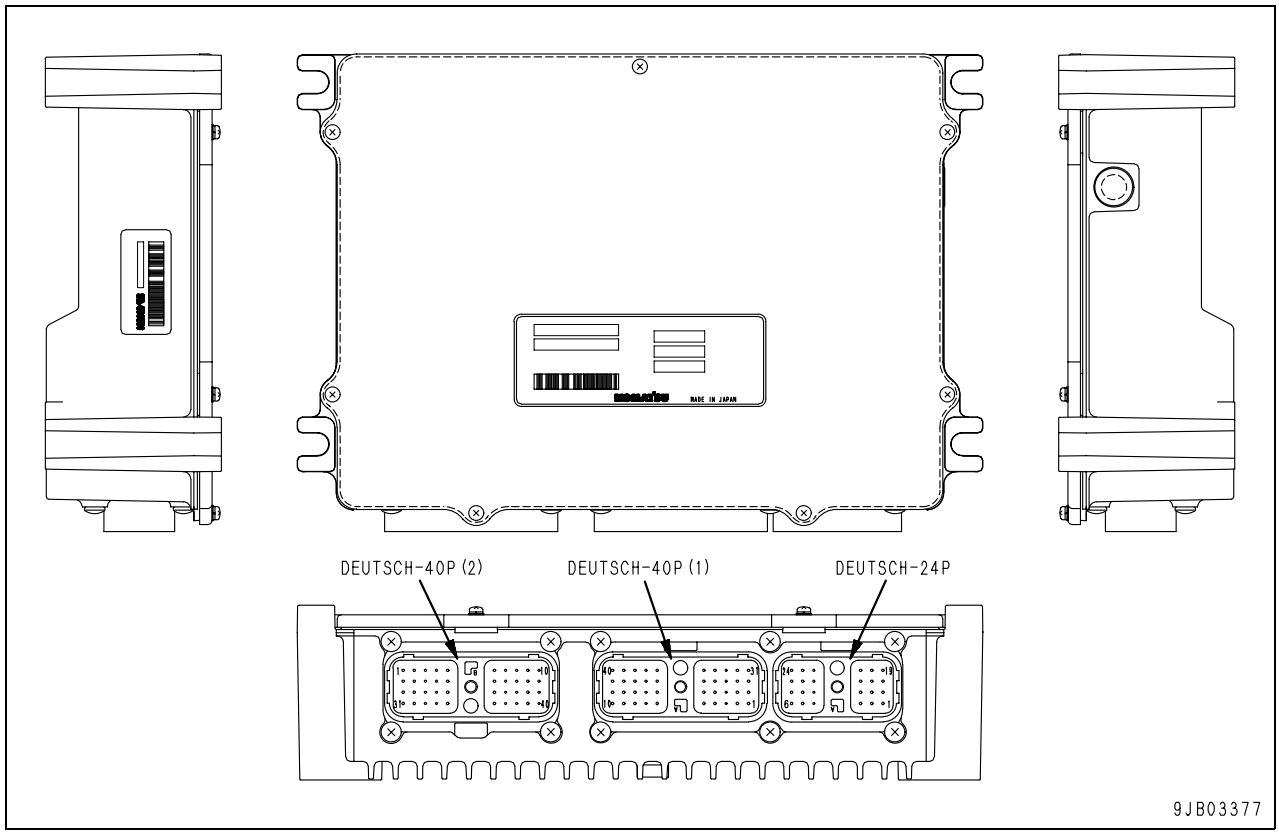
★ For the setting procedure, see “Special functions of machine monitor (EMMS)” in Testing and adjusting.

System circuit diagram




Buckup lamp relay
1
Battery
2
3
4
5
6
+24V
7
ECMV F
8
ECMV R
9
ECMV 1
10
ECMV 2
11
ECMV 3
12
ECMV 4
13
14
15
ECMV lockup
16
Cooling fan pump EPC valve
17
Work equipment pump EPC valve
18
19
ECSS solenoid valve
Cooling fan reverse rotation solenoid valve
20
Starting SW
ACC C B
21
22
+24V
Neutral safety relay
23
24
Closes when manual operation is continued.
+24V
25
Emergency steering SW
Transmission controller neutral safety relay
Starting motor
To machine monitor (steering oil pressure caution lamp)
Steering oil pressure SW(Low)
26
To machine monitor (emergency steering pilot lamp)
Steering oil pressure SW(Hi)
27
Emergency steering SW relay
Emergency steering relay
Emergency steering pump
Emergency steering oil pressure SW
Closes when pump pressure goes low
28
Electric emergency steering motor
Steering valve
Steering pump
29
9JB03388

Transmission controller



Input and output signals

DEUTSCH-24P [CN-L61]

Pin No.	Signal name	Input/Output signal
1	Cooling fan automatic reverse rotation switch	Input
2	Torque converter lockup switch	Input
3	Steering pump oil pressure sensor	Input
4	Signal GND	—
5	Transmission cut-off set switch	Input
6	ECSS switch	Input
7	Cooling fan reverse rotation switch	Input
8	NC	Input
9	Transmission oil temperature sensor	Input
10	Signal GND	—
11	Transmission cut-off switch	Input
12	2-stage low idle switch	Input

Pin No.	Signal name	Input/Output signal
13	Work equipment pump oil pressure sensor	Input
14	NC	—
15	NC	—
16	Sensor power supply output (+24 V)	Output
17	Steering pressure switch (Low)	Input
18	Shift mode H	Input
19	Brake pressure sensor	Input
20	Memory reset	Input
21	Analog GND	—
22	Potentiometer power supply (+5 V)	Output
23	Steering pressure switch (Hi)	Input
24	Shift mode L	Input

DEUTSCH-40P(1) [CN-L62]

Pin No.	Signal name	Input/Output signal
1	NC	—
2	Kickdown switch	Input
3	ECMV fill switch 4th	Input
4	NC	—
5	Directional selector switch (J/S FNR SW) R	Input
6	Neutralizer (parking brake) signal	Input
7	ECMV fill switch 2nd	Input
8	NC	—
9	NC	—
10	NC	—
11	NC	—
12	NC	—
13	ECMV fill switch 3rd	Input
14	NC	—
15	Directional selector switch (J/S FNR SW) N	Input
16	Directional lever R	Input
17	ECMV fill switch 1st	Input
18	NC	—
19	NC	—
20	Speed sensor	Input

Pin No.	Signal name	Input/Output signal
21	NC	—
22	CAN0-L	Input and output
23	NC	—
24	NC	—
25	Directional selector switch (J/S FNR SW) F	Input
26	Directional lever N	Input
27	ECMV fill switch R	Input
28	Power mode switch	Input
29	Pulse GND	—
30	NC	—
31	NC	—
32	CAN0-H	Input and output
33	NC	—
34	NC	—
35	Starting switch C signal	Input
36	Directional lever F	Input
37	ECMV fill switch F	Input
38	Hold switch	Input
39	NC	—
40	NC	—

DEUTSCH-40P(2) [CN-L63]

Pin No.	Signal name	Input/Output signal
1	VB (Controller power)	Input
2	VIS (Solenoid power)	Input
3	SOL_COM (Solenoid common GND)	Input
4	Back-up lamp relay	Output
5	ECMV F	Output
6	ECMV 2nd	Output
7	Emergency steering switch relay	Output
8	Pilot lamp contained in transmission cut-off switch	Output
9	Joystick shift-up switch	Input
10	Gear shift lever 1st	Input
11	VB (Controller power)	Input
12	VIS (Solenoid power)	Input
13	SOL_COM (Solenoid common GND)	Input
14	Starting switch ACC signal	Input
15	ECMV R	Output
16	ECMV 3rd	Output
17	ECSS solenoid	Output
18	Power train pump bypass solenoid relay	Output
19	Joystick shift-down switch	Input
20	Gear shift lever 2nd	Input

Pin No.	Signal name	Input/Output signal
21	GND (Controller GND)	Input
22	VIS (Solenoid power)	Input
23	SOL_COM (Solenoid common GND)	Input
24	Starting switch ACC signal	Input
25	ECMV 1st	Output
26	ECMV 4th	Output
27	Work equipment pump EPC	Output
28	Cooling fan pump reverse rotation solenoid	Output
29	Emergency steering switch	Input
30	gear shift lever 3rd	Input
31	GND (Controller GND)	Input
32	GND (Controller GND)	Input
33	GND (Controller GND)	Input
34	NC	—
35	ECMV lockup	Output
36	Cooling fan pump EPC	Output
37	Neutral output	Output
38	NC	—
39	Directional selector switch actuation switch	Input
40	Gear shift lever 4th	Input

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

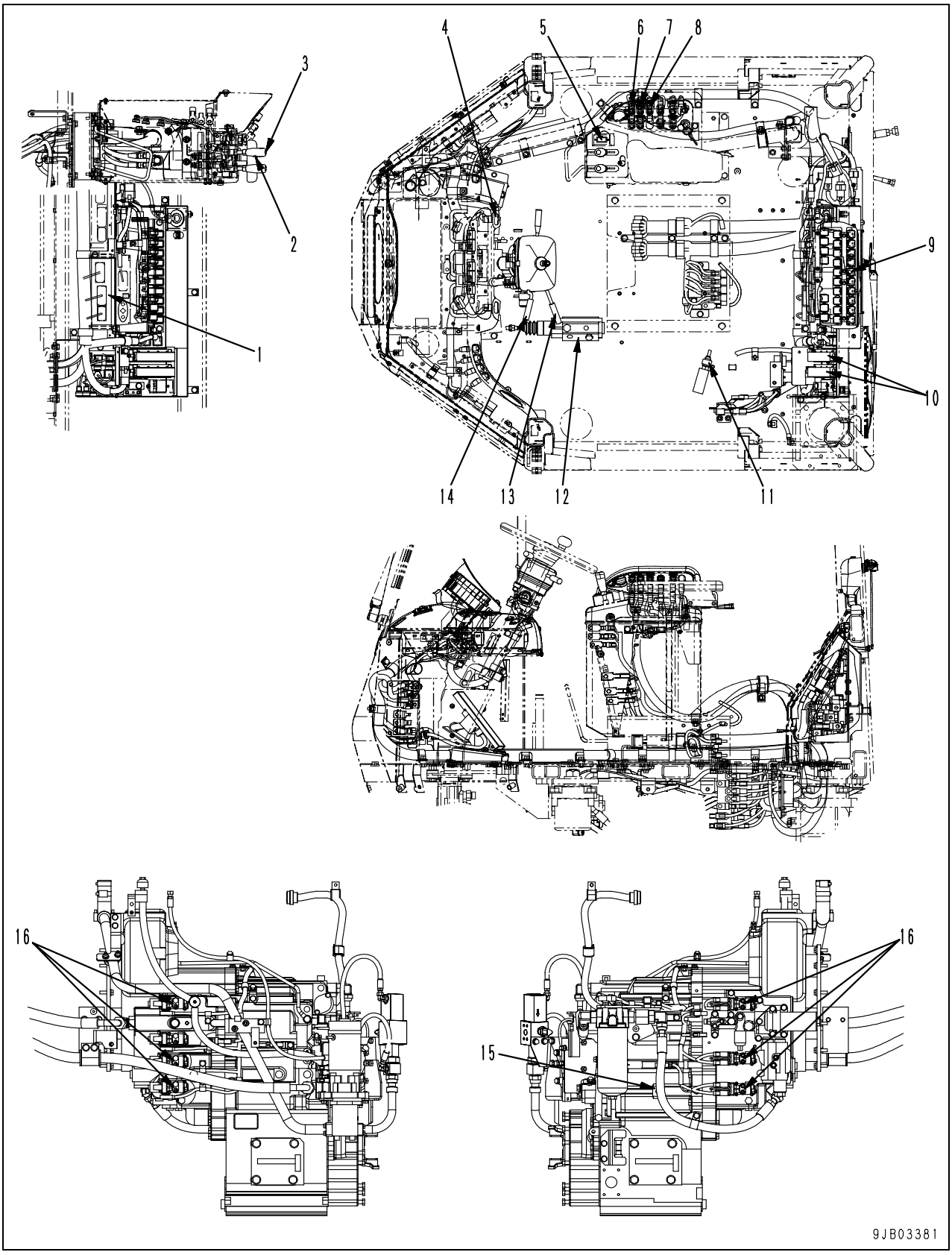
10 Structure, function and maintenance standard

Electrical system, Part 3

Electrical system, Part 3 2
Electric transmission control 2
Kickdown switch and hold switch 6
KOMTRAX terminal system 8
Engine starting circuit 10
Engine stopping circuit 12
Preheating circuit 13
Engine power mode selector circuit 14
Engine output derating function 15
Automatic warm-up function 15
Parking brake circuit 16
Sensor 18

Electrical system, Part 3

Electric transmission control

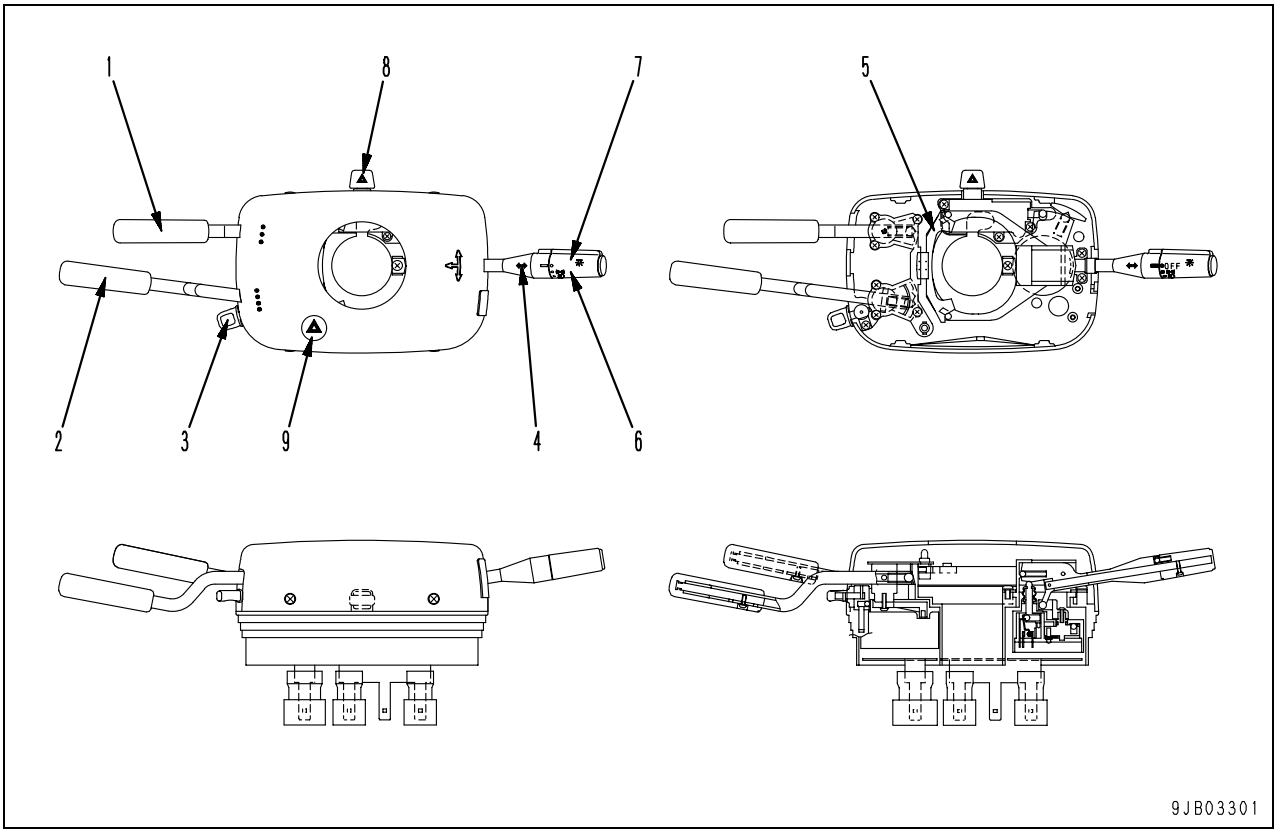


1. Transmission controller
2. Hold switch
3. Kickdown switch
4. Parking brake switch
5. Directional selector switch
6. Transmission cut-off switch
7. Transmission cut-off set switch
8. Directional selector switch actuation switch
9. Relay
10. Fuse box
11. Transmission cut-off oil pressure sensor
12. Brake valve
13. Gear shift lever
14. Directional lever
15. Speed sensor
16. Transmission ECMV

Function

No.	Function	Operation
1	Selection of travel direction and neutral	The travel direction can be changed by operating the directional lever. When the directional selector switch actuation switch is turned “ON” and the directional lever is set to “N (Neutral)”, directional selection becomes available from the directional selector switch.
2	Selection of gear speed	The gear speed can be changed by operating the gear shift lever.
3	Kickdown	The kickdown switch allows shifting down the gear without resorting to the gear shift lever. In the manual gear shift mode, the gear can be shifted down to the 1st only while the transmission is in the forward 2nd. In the auto-shift mode, the gear can be shifted down according to the gear speed and travel speed being selected before the switch was pressed.
4	Hold	If the hold switch is pressed in the auto-shift mode, the current gear speed is held and is not shifted up even if the travel speed is increased. Even if the travel speed is slowed down, the gear is not shifted down.
5	Transmission cut-off	When the transmission cut-off switch is turned “ON”, the transmission is set to the neutral at the adjusted pressing distance of the brake pedal.
6	Transmission cut-off set	The transmission cut-off function allows adjusting the brake pedal pressing distance at which the transmission is set to the neutral.
7	Transmission cut-off selection	The transmission cut-off function can be turned ON and OFF. While this function is “OFF”, the left brake pedal works as the ordinary brake (similarly to the right brake pedal).
8	Neutralizer	While the parking brake is applied, it sets the transmission to the neutral. This function prevents seizure of the parking brake by disabling the machine to travel while the parking brake is applied.
9	Neutral safety	This function disables starting the engine if the directional lever is not set to “N (Neutral)”. In this way, it prevents accidents caused by sudden start.
10	Alarm	In the reverse travel, this function alerts nearby people by activating the backup lamp and backup buzzer.

Combination switch



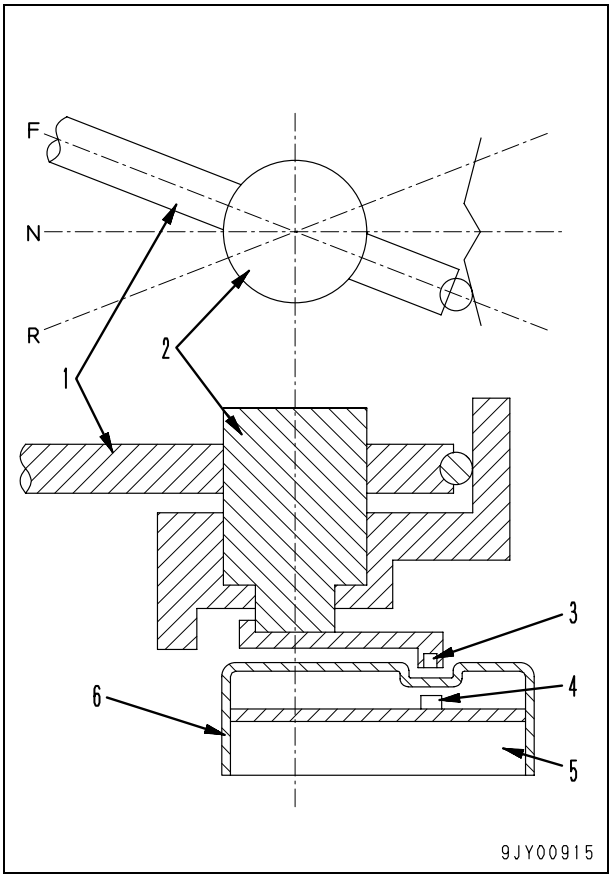
Outline

- The directional lever has 3 positions and the gear shift lever has 4 positions. The detent mechanism is not provided 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. As a lever is shifted to any position, the switch connected with the shaft operates to conduct the current only to that circuit.

Function

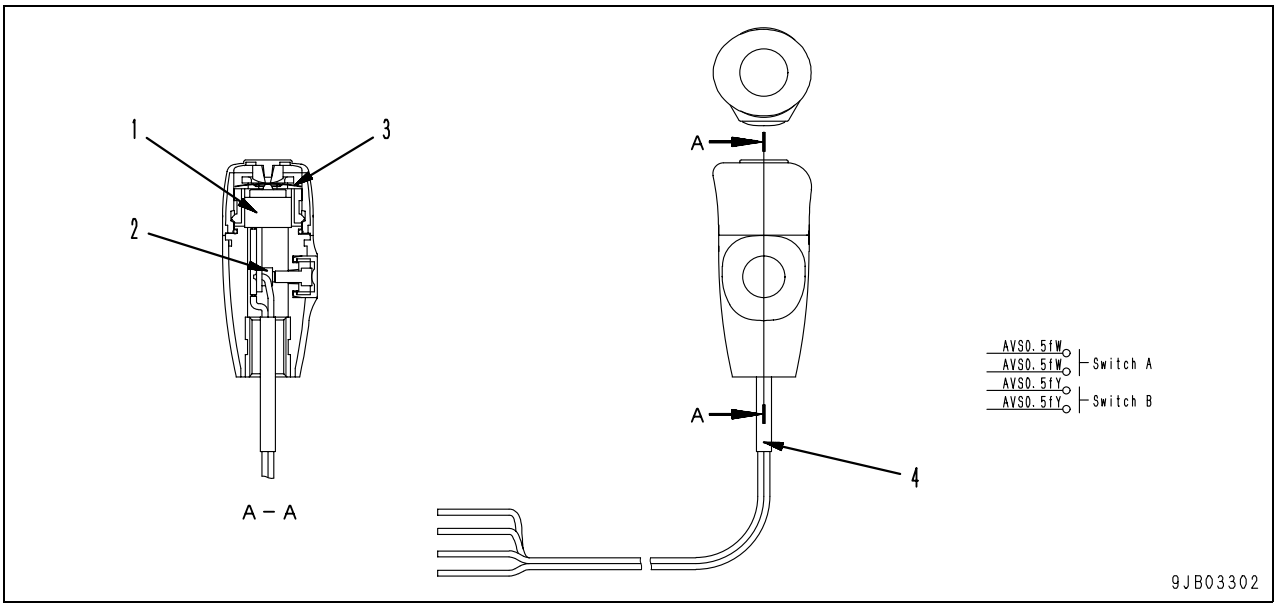
No.	Name	Operation
1	Directional lever	Selects the travel direction and neutral.
2	Gear shift lever	Selects a gear speed.
3	Gear shift lever stopper	Makes the gear shift lever not movable to the 3rd or 4th during work.
4	Turn signal lever	Turns the turn signal lamps ON and OFF.
5	Self-cancel	After turning to the right or left, setting the steering wheel back returns the turn signal lever automatically to the neutral.
6	Lamp switch	Turns the headlamp, clearance lamp, tail lamp, and instrument panel lamp ON.
7	Dimmer switch	Selects the high or low beam of the headlamp.
8	Hazard lamp switch	Flashes the right and left turn signal lamps, turn signal pilot lamps, and indicator lamps.
9	Hazard lamp pilot lamp	Starts flashing as the hazard lamp switch is turned “ON”.

Operation



- Shaft (2) of directional and gear shift 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.
- As the directional lever is set to “F (Forward)”, magnet (3) comes right above Hall IC (4) of “F” position of the control switch. Magnet (3) provides magnetism to Hall IC (4) moving through the space between the clearance and case (6).
- Hall IC (4) is set in the magnetism sensor circuit. Upon detecting the magnetism of magnet (3), it sends the “F (Forward)” position signal of the directional lever to the current amplifier circuit. The current amplifier circuit outputs the signal to operate the transmission ECMV.

Kickdown switch and hold switch



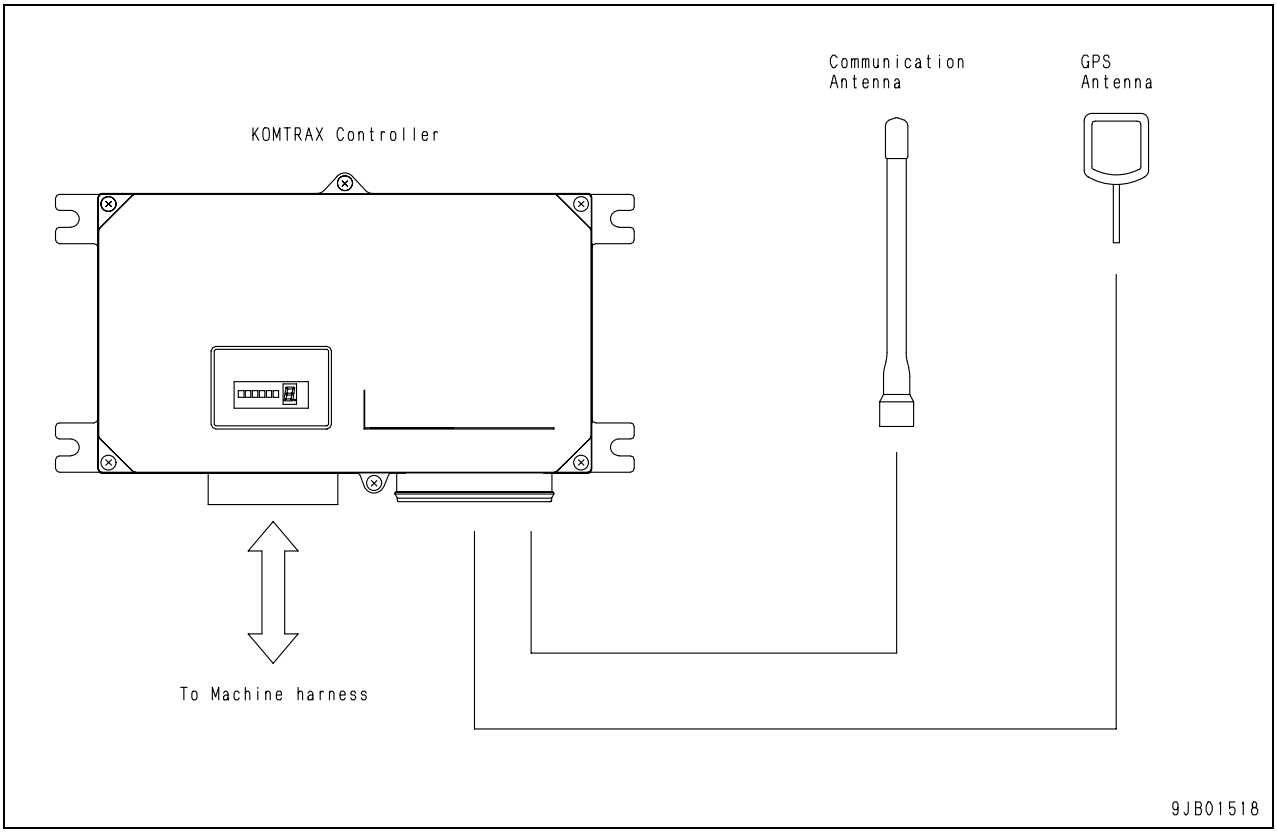
1. Switch A (White wiring harness)
2. Switch B (Yellow wiring harness)
3. Spring
4. Harness

Function

- These switches are installed to the knob of the lift arm control lever. Switch A (1) works as the kickdown switch and switch B (2) works as the hold switch.
- Both of switch A (1) and switch B (2) are of momentary type, that is, their contacts are closed only while they are pressed.

KOMTRAX terminal system

(if equipped)

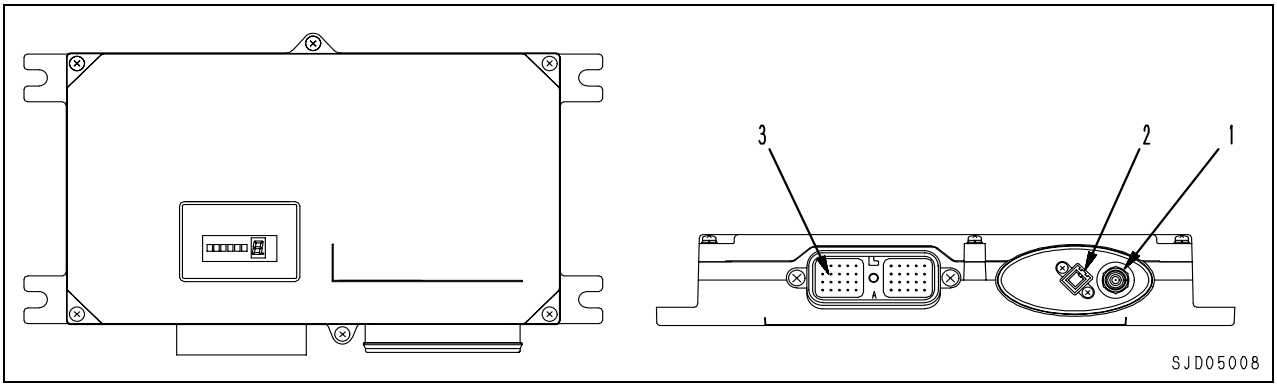


- The KOMTRAX terminal sends various information on the machine by a wireless communication. The KOMTRAX operator refers to this information in the office, and various services can be provided for the customer.

  ★ To be provided with the KOMTRAX terminal service, it is necessary to sign up separately.

  Information that can be sent from the KOMTRAX terminal is as follows:
  1. Traveling map
  2. Service meter
  3. Location information
  4. Error history

KOMTRAX terminal



1. Communication antenna connector
2. GPS antenna connector
3. Machine harness connector (DEUTSCH-40P)

Input and output signals

DEUTSCH-40P [CN-L80]

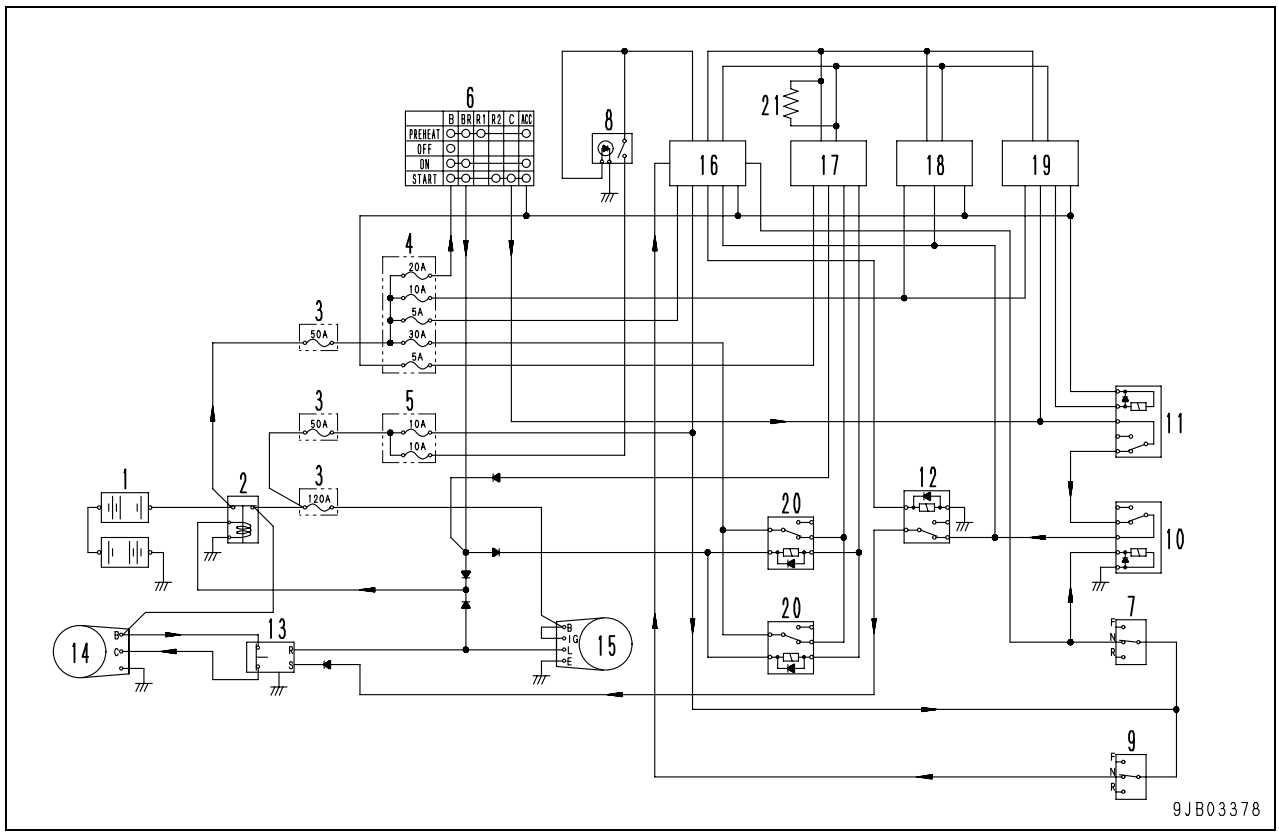
Pin No.	Signal name	Input/Output signal
1	NC	—
2	NC	—
3	NC	—
4	NC	—
5	NC	—
6	NC	—
7	CAN0_L	Input/Output
8	CAN0_H	Input/Output
9	NC	—
10	NC	—
11	NC	—
12	NC	—
13	NC	—
14	NC	—
15	NC	—
16	NC	—
17	NC	—
18	NC	—
19	NC	—
20	Immobilize signal	Output

Pin No.	Signal name	Input/Output signal
21	Operation mode selection 1	Input
22	Operation mode selection 2	Input
23	NC	—
24	NC	—
25	NC	—
26	NC	—
27	Starting switch C signal	Input
28	Alternator R signal	Input
29	NC	—
30	NC	—
31	NC	—
32	NC	—
33	NC	—
34	NC	—
35	NC	—
36	Starting switch ACC signal	Input
37	Power supply GND	—
38	Power supply GND	—
39	Constant power supply (24 V)	Input
40	Constant power supply (24 V)	Input

Outline

- The KOMTRAX controller can send information via wireless communication antenna, acquiring various information of the machine from the network signal in the machine and the input signal. Also, the controller incorporates CPU (Central Processing Unit) and provides the wireless communication function and the GPS function.
- There are the LED lamp and the 7-segment indicator lamp in the display area, and these lamps are used for the testing and the troubleshooting.

Engine starting circuit



1. Battery
2. Battery relay
3. Slow-blow fuse
4. Fuse box 1
5. Fuse box 2
6. Starting switch
7. Directional lever
8. Directional selector switch actuation switch
9. Directional selector switch
10. Neutral safety relay
11. KOMTRAX engine cut-out relay (if equipped)
12. Transmission controller neutral safety relay
13. Starting motor safety relay
14. Starting motor
15. Alternator
16. Transmission controller
17. Engine controller
18. Machine monitor
19. KOMTRAX controller (if equipped)
20. Engine controller cut-out relay
21. CAN resistor

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 directional selector switch actuation switch is turned “ON”, the directional selector switch must be set to “N (Neutral)” to enable starting up the engine.

2. If KOMTRAX controller receives the externally applied engine cut-out command, the newly employed KOMTRAX engine cut-out circuit disables startup of the engine.
   (if equipped)

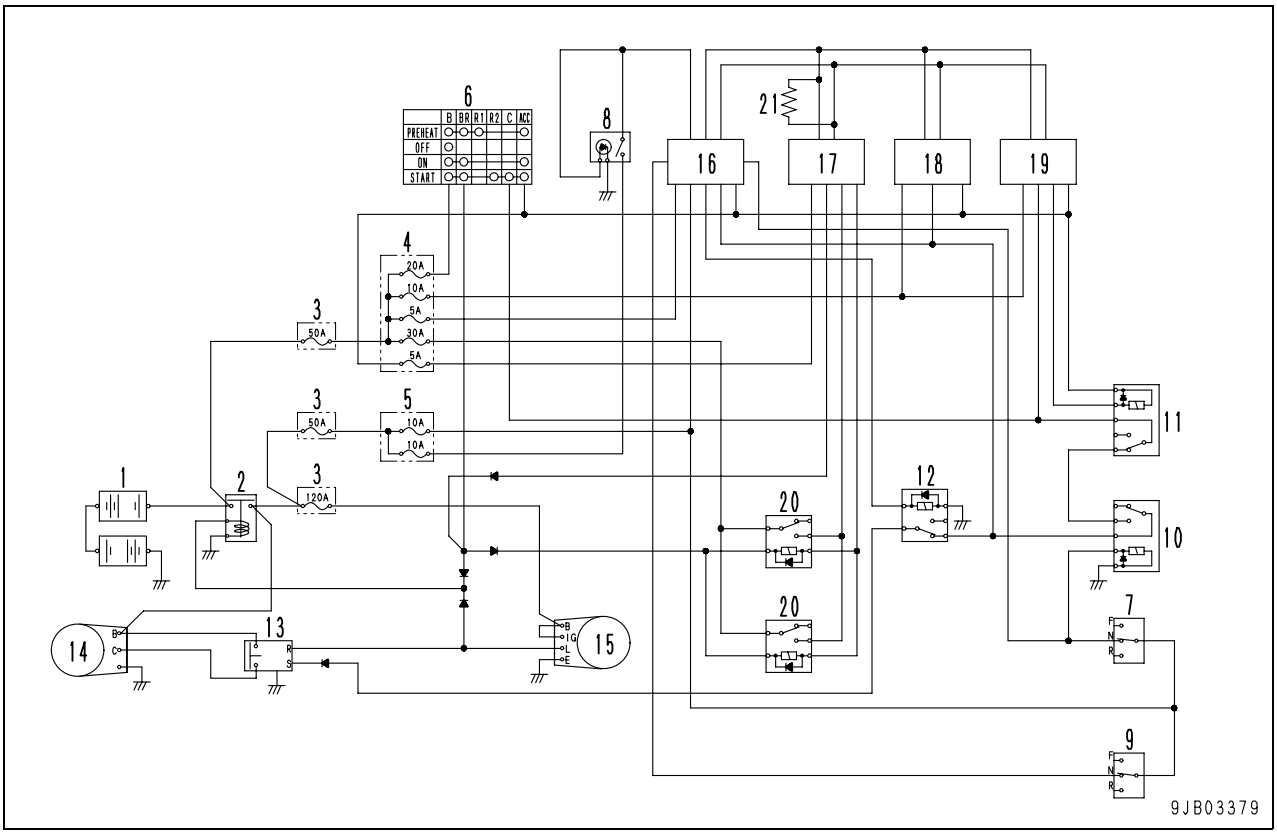
Operation

1. When starting switch is turned “ON”
   - As the starting switch is turned “ON”, 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, thereby closing the contact of the battery relay. As a result, the power is supplied to each circuit of the machine.
     At this time, the ACC signal is sent from terminal ACC of the starting switch to the engine controller, readying the engine for startup.

2. Neutral safety circuit
   - Setting the directional lever to “N (Neutral)” conducts the current from contact N of the directional lever to the coil of the neutral safety relay.
   - While the directional selector switch is used (while the directional selector switch actuation switch is “ON”), the current flows from the directional selector switch actuation switch to the transmission controller. If the directional selector switch is set to “N (Neutral)” at this point, the transmission controller stops the current flow to the coil of the transmission controller neutral safety relay.

3. When starting switch is set to “START”
   - As the starting switch is set to “START”, the current flows through the starting switch terminal C, KOMTRAX engine cut-out relay, neutral safety relay and transmission controller neutral safety relay to the starting motor safety relay to start the engine.
   - When the directional lever is set to any position other than “N (Neutral)”, the neutral safety relay is not activated and interrupts the engine startup.
   - When the directional selector switch is set to any position other than “N (Neutral)”, the transmission controller neutral safety relay is activated and interrupts the engine startup.
   - As KOMTRAX controller receives the externally applied engine cut-out command, KOMTRAX engine cut-out relay is activated and shuts down the circuit from the starting switch terminal C to the starting motor safety relay. Thus, engine startup becomes unavailable.
     (if equipped)

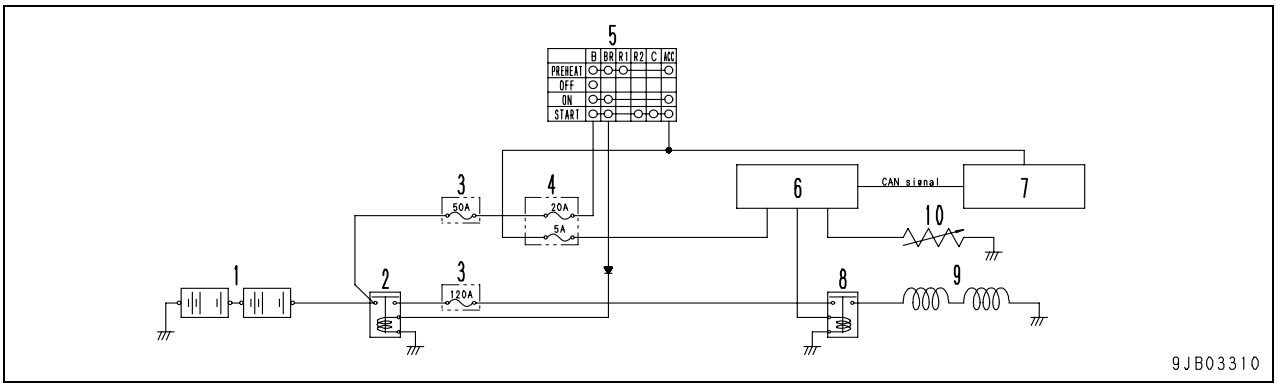
Engine stopping circuit



Operation

- Setting the starting switch to “OFF” cuts off ACC signal from the starting switch terminal ACC to the engine controller.
- Although ACC is cut off, the engine controller keeps the engine controller cut-out relay working to maintain the current flow to the engine controller until its internal processing is complete.
- As ACC signal is cut off, the engine lowers its speed and stops. At the same time, the alternator stops power generation. Thus, supply of voltage from the alternator terminal L is aborted.
  And the current from the starting switch terminal BR is also stopped and the contacts of the battery relay are opened. Consequently, the power supplied to each circuit of the machine is stopped.

Preheating circuit



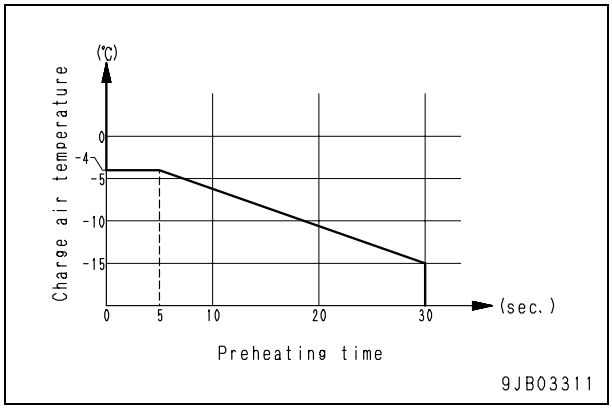
1. Battery
2. Battery relay
3. Slow-blow fuse
4. Fuse box 1
5. Starting switch
6. Engine controller
7. Machine monitor
8. Electrical intake air heater relay
9. Electrical intake air heater
10. Boost pressure and temperature sensor

Outline

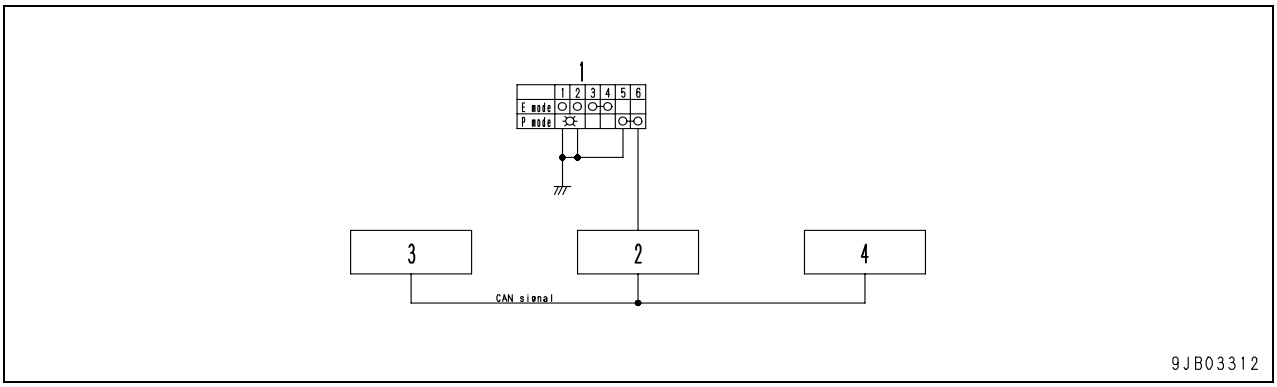
- The automatic preheating system is installed so that the engine will start easily in a cold district.
- The automatic preheating system is capable of cutting the preheating time short as the starting switch is set to “ON”. This system is also capable of automatically setting the preheating duration referencing temperature of intake air.
- Setting the starting switch to “ON” lights the preheater pilot lamp of the machine monitor and starts preheating of intake air with the electrical intake air heater.
  The engine controller sets the preheating duration referencing the intake air temperature being sent from the boost pressure sensor and temperature sensor.
- The pilot lamp remains turned on as long as preheating is continued. Keep the starting switch in the “ON” position during this time. Setting the starting switch to “START” from this state resets preheating.

Operation

- Set the starting switch to “ON” to start the engine controller. At this time, if intake air temperature is –4°C or below, the engine controller starts up the electrical intake air heater immediately after the starting switch is turned “ON” to initiate preheating by the electrical intake air heater.
- The preheating time is set as shown below.



Engine power mode selector circuit



1. Power mode selector switch
2. Transmission controller
3. Machine monitor
4. Engine controller

Function

- Setting the power mode selector switch to “P-mode” increases the engine output to the maximum. And setting the switch to “E-mode” reduces the working fuel consumption.
- Receiving the switch signal, the transmission controller selects a gear speed and travel speed matched to the power mode in the auto-shift mode.

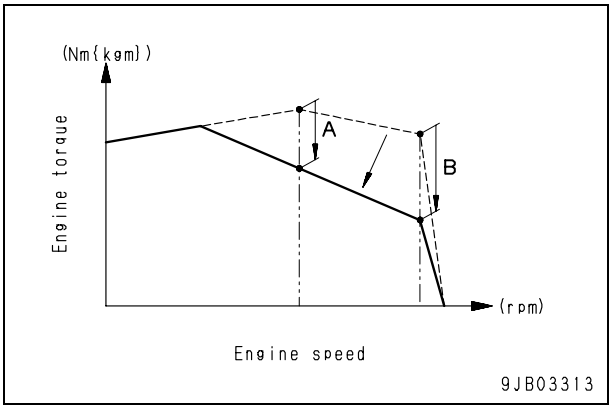
Operation

- Setting the power mode selector switch to “P-mode” sends the switch signal to the transmission controller and CAN signal to the engine controller, changing the engine torque performance curve into “P-mode”. At the same time, the transmission controller sends the power mode pilot lamp lighting signal to the machine monitor using the CAN signal format.

Engine output derating function

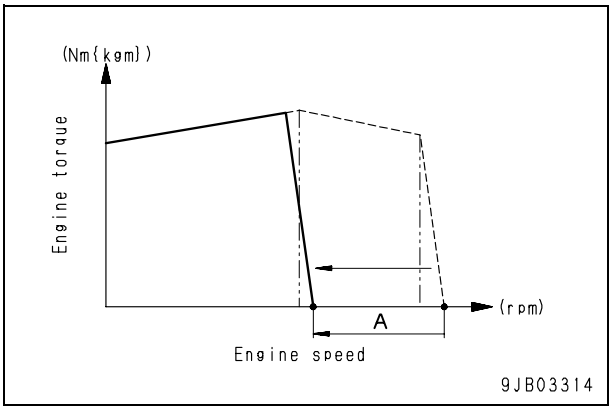
- If the engine controller detects a failure, it protects the engine by derating the engine torque or speed.

- Following figure shows the engine torque performance when the torque was derated.



A: Maximum torque point is derated by approx. 30%
B: Rated output point is derated by approx. 50%

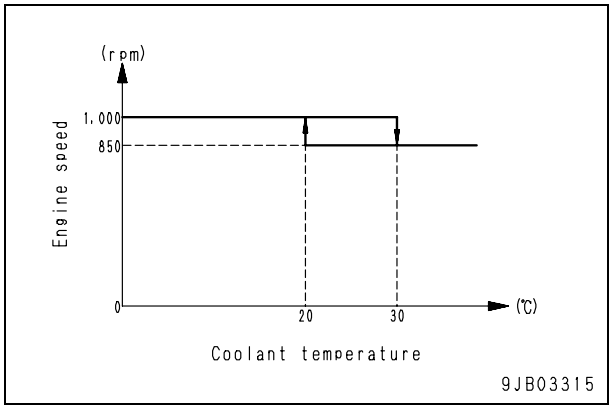
- Following figure shows the engine torque performance when the engine speed was derated.



A: Derated near to the engine speed at maximum torque point

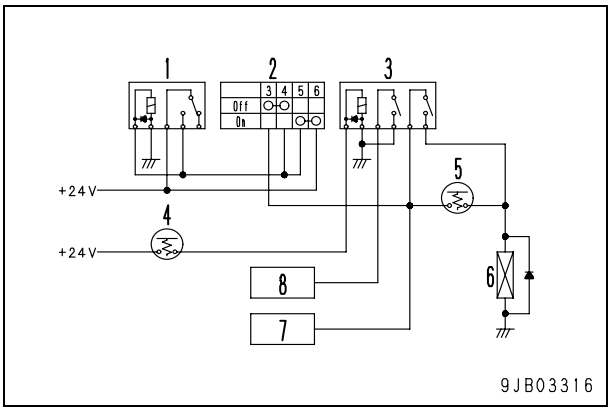
Automatic warm-up function

- When starting the engine in a cold district, this function warms it up by increasing the engine low idle speed.
- If the coolant temperature is below 20°C at starting of the engine, this function increases the low idle speed to 1,000 rpm. The time required for increasing the low idle speed depends on the coolant temperature as shown in the figure below.
- If the coolant temperature reaches 30°C or above or the accelerator pedal opening ratio remains at 70% or above for 3 seconds minimum during this process, the automatic warm-up function is automatically reset and the engine speed returns to 850 rpm.



Parking brake circuit

Operation



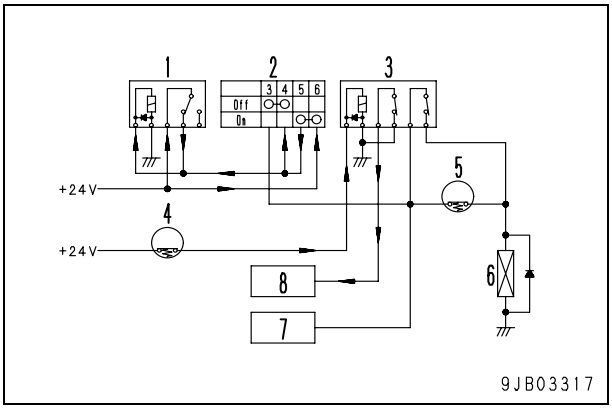
1. Parking brake relay
2. Parking brake switch
3. Brake oil pressure caution relay
4. Rear brake oil pressure switch
5. Emergency brake oil pressure switch
6. Parking brake solenoid valve
7. Transmission controller
8. Machine monitor

When starting switch is turned “OFF”

- Turning the starting switch “OFF” opens contact of parking brake relay (1). Thus, current to the parking brake circuit is stopped and operation of the parking brake is started. Accordingly, when the starting switch is turned “OFF”, current is not conducted to parking brake solenoid valve (6) regardless of the position of parking brake switch (2). And the parking brake remains being applied.

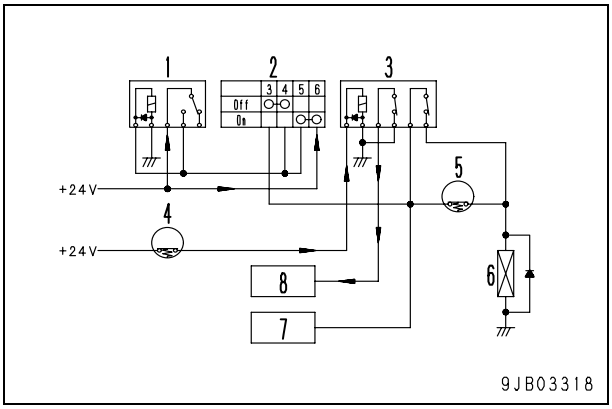
When starting switch is turned “ON”

1. When parking brake switch was turned “ON (applied)” prior to turning “ON” of starting switch



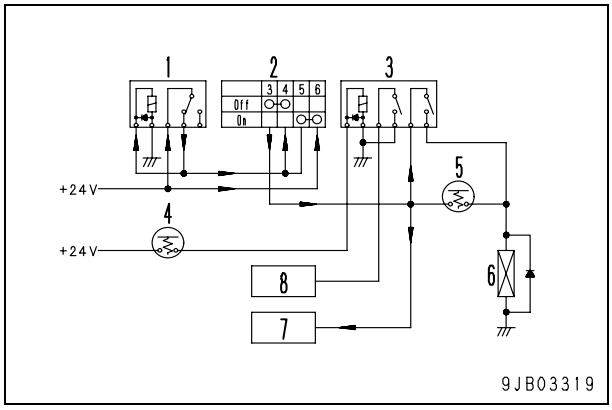
- While parking brake switch (2) is turned “ON (applied)”, current from the battery relay flows through parking brake switch (2) to the coil of parking brake relay (1) and closes the contact.
- As parking brake relay (1) contact is closed, current from the battery relay keeps on flowing to the coil, holding the relay contact, until current from the battery relay is cut off.
- At this time, current does not flow to parking brake solenoid valve (6). Thus, the parking brake remains being applied.
- Recognizing the operation signal from parking brake switch (2), transmission controller (7) sets the transmission to the neutral as long as the parking brake is applied so that its dragging may not result.
- Turning “OFF (released)” the parking brake switch then conducts current from the battery relay through parking brake relay (1), parking brake switch (2), emergency brake oil pressure switch (5) to parking brake solenoid valve (6) to release the parking brake.

2. When parking brake switch was turned “OFF (released)” prior to turning “ON” of starting switch



- While the parking brake switch is “OFF (released)”, the current does not flow to parking brake relay (1) and its contacts remain open.
- Turning “ON” the starting switch from this state does not conduct current to parking brake solenoid valve (6). Accordingly, the parking brake is not released automatically.

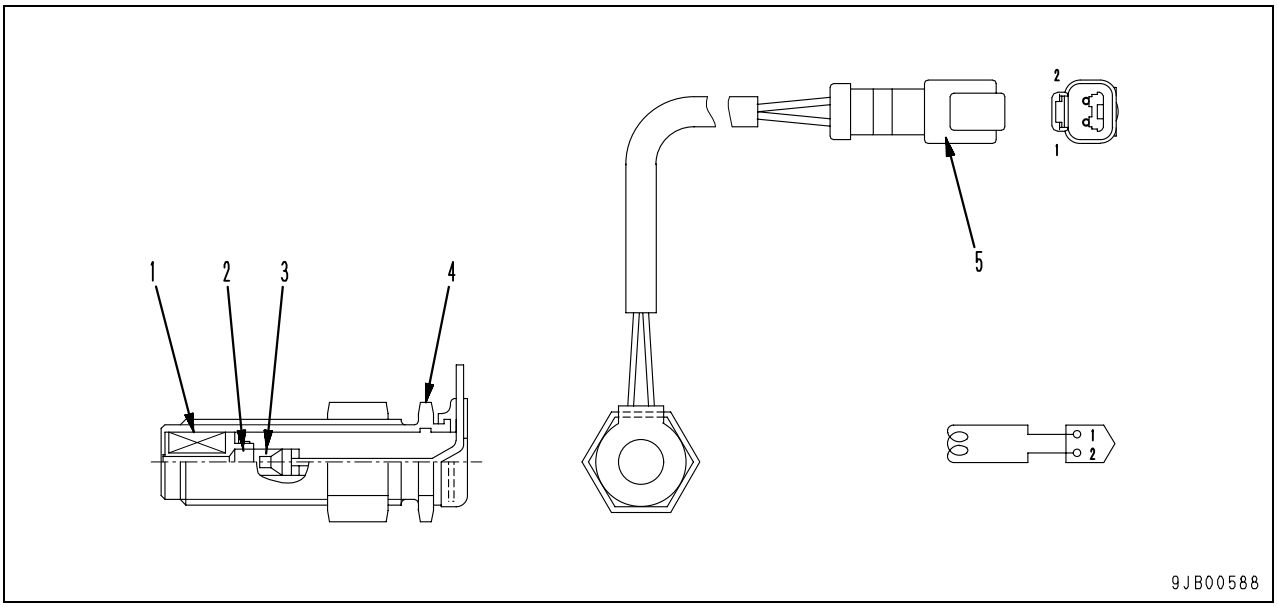
When low oil pressure occurred on main brake (when emergency brake is applied)



- If oil pressure of the main brake goes low, contact of rear brake oil pressure switch (4) with the high operating pressure setting opens first, cutting off current to coil of brake oil pressure caution relay (3).
- Then contact of brake oil pressure caution relay (3) opens, cutting off current to machine monitor (8). As the result, machine monitor generates the alarm.
- Then contact of emergency brake oil pressure switch (5), the operating pressure setting of which is lower than that of rear brake oil pressure switch (4), opens cutting off current to parking brake solenoid valve (6). As the result, the parking brake is applied.
- In this case, unlike when the parking brake switch was turned “ON (applied)”, flow of the operation signal from parking brake switch (2) to the transmission controller (7) is maintained. Thus, transmission is not set to the neutral.
- Therefore, when the emergency brake is applied, using the engine brake in parallel allows not only reducing the braking distance but also moving the machine should the emergency brake is applied.

Sensor

Speed sensor

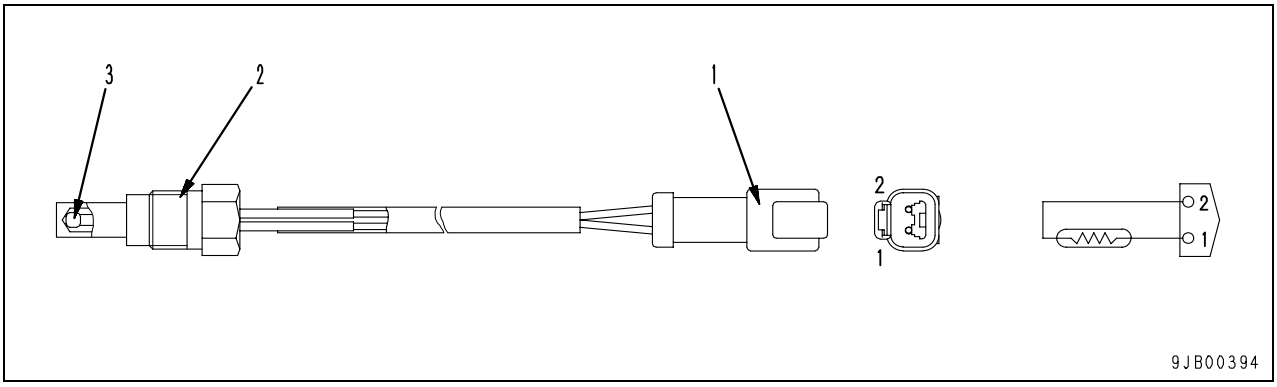


1. Wire
2. Magnet
3. Terminal
4. Housing
5. Connector

Function

- Being set in the output gear of the transmission case, this sensor outputs pulsed voltage sensing the gear speed.

Torque converter oil temperature sensor
Hydraulic oil temperature sensor
Transmission oil temperature sensor
Brake oil temperature sensor

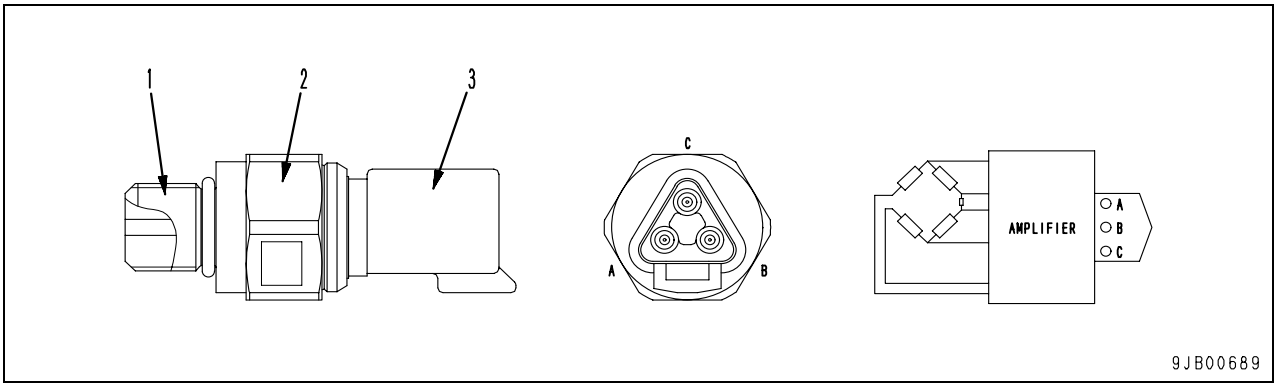


1. Connector
2. Plug
3. Thermistor

Function

- The torque converter oil temperature sensor is installed on the transmission case (rear). The hydraulic oil temperature sensor is installed on the return line of the hydraulic tank. The transmission oil temperature sensor is installed on the transmission case (front). And the brake oil temperature sensor is installed on the rear axle. They convert changes in temperature to changes in resistance of the thermistors to output the results in signals.

Work equipment pump oil pressure sensor
Steering pump oil pressure sensor

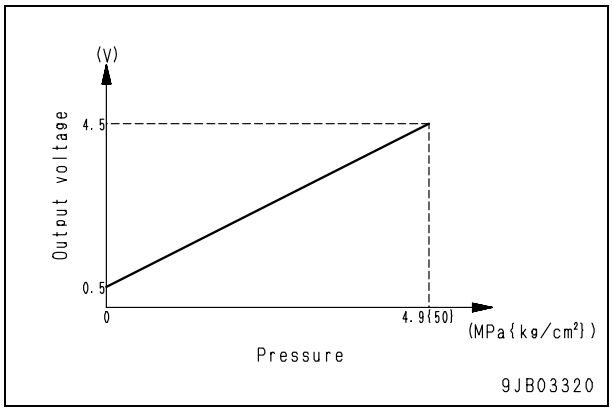


1. Plug
2. Sensor
3. Connector

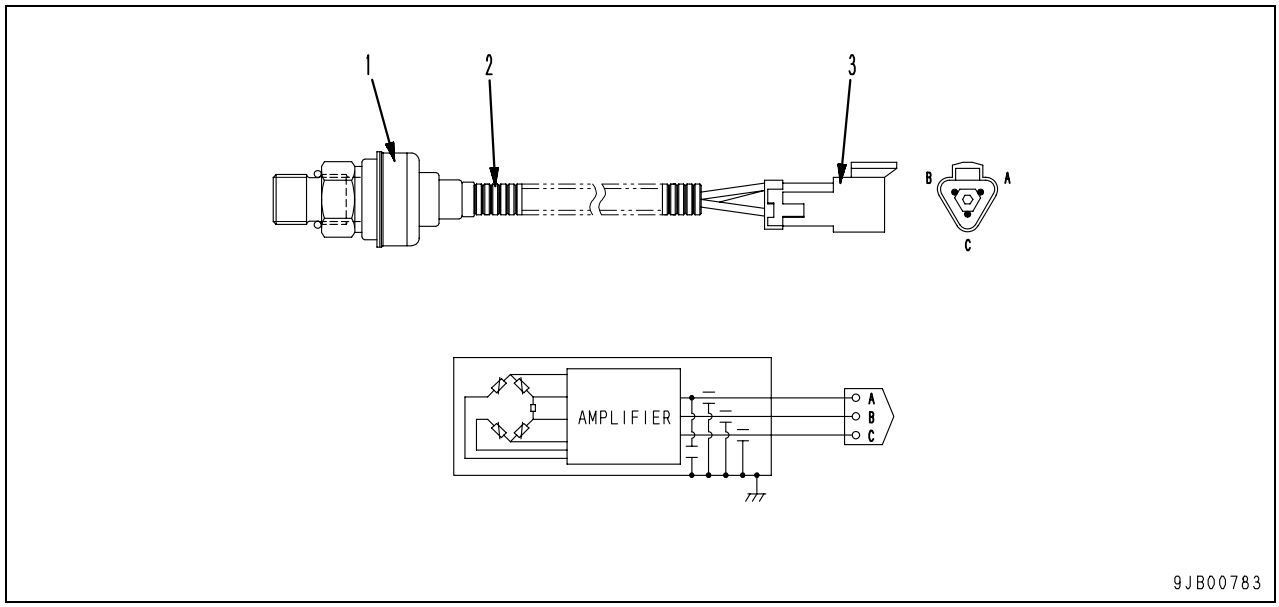
Function

- The work equipment pump oil pressure sensor is installed on the work equipment control valve and the steering pump oil pressure sensor is installed on the block of the steering pump discharge line. They are used for detecting the pump discharge pressure and output it in variable voltages.

Output characteristics



Transmission cut-off oil pressure sensor

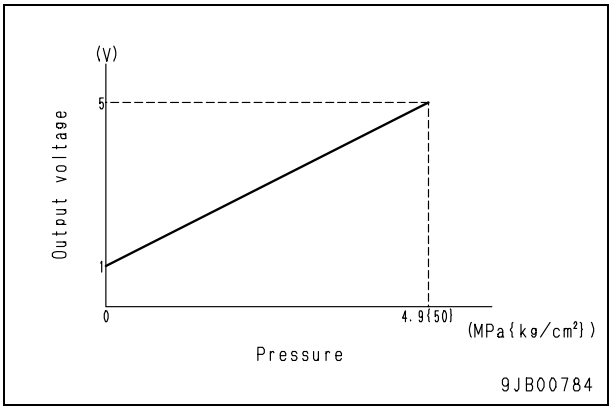


1. Sensor
2. Lead wire
3. Connector

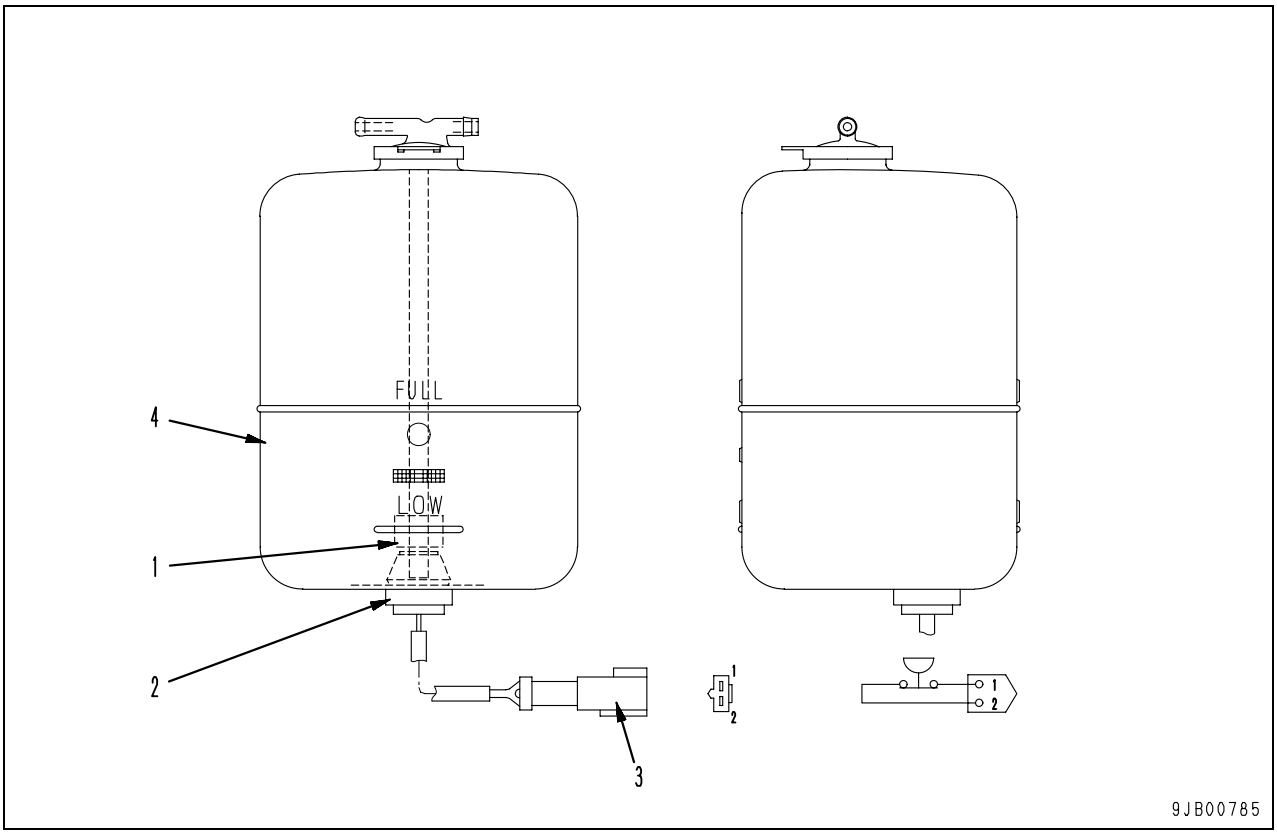
Function

- Being installed on the tube of the front brake line situated under the floor, this sensor outputs the brake operating pressure in variable voltage.

Output characteristics



Coolant level sensor

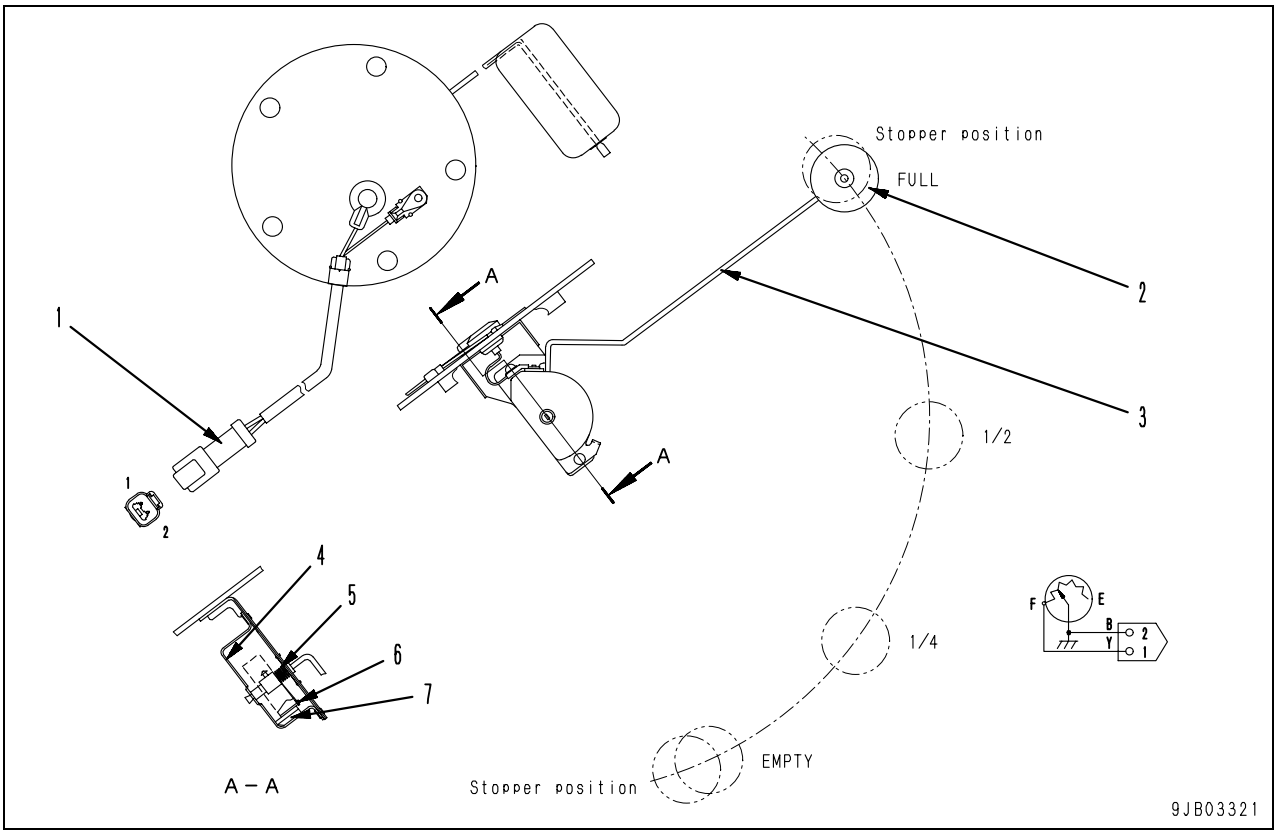


1. Float
2. Sensor
3. Connector
4. Sub-tank

Function

- This sensor is installed in the engine room to the right side of the machine body. As the coolant level goes lower than the specified level, the float lowers and the switch is turned “OFF”.

Fuel level sensor

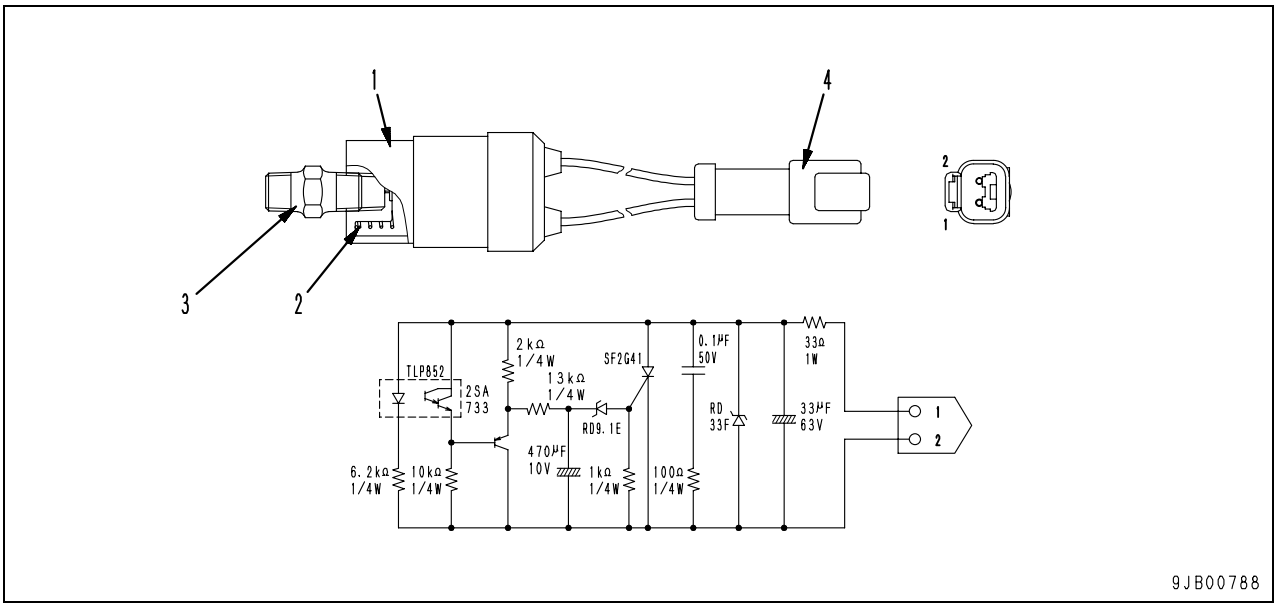


1. Connector
2. Float
3. Arm
4. Body
5. Spring
6. Contact
7. Spacer

Function

- This sensor is installed on the side face 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 resistance changes according to the operating angle and signal voltage is generated from the source voltage according to the change of the resistance.

Air cleaner clogging sensor

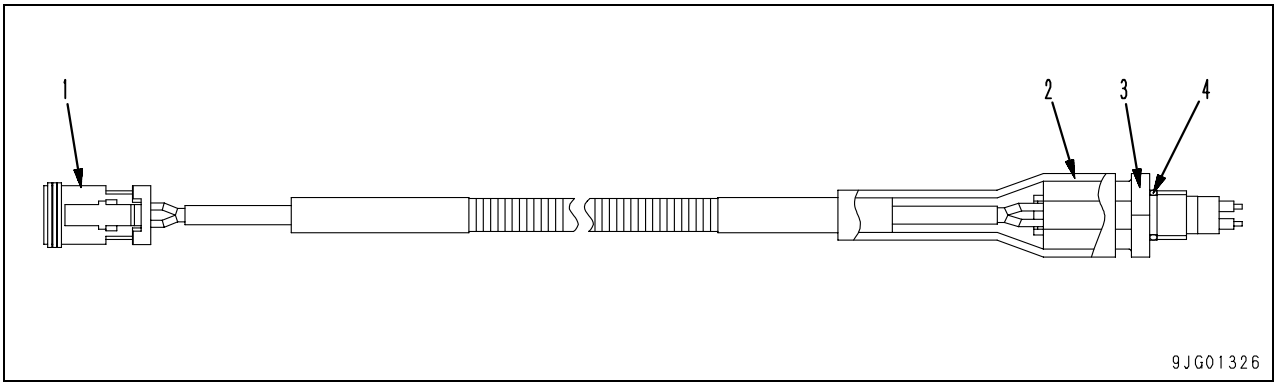


1. Indicator
2. Spring
3. Adapter
4. Connector

Function

- The air cleaner clogging sensor is installed in the air cleaner outlet. It outputs the signal as the air cleaner is clogged and the pressure is decreased to the specified level (negative pressure).

Water-in-fuel sensor

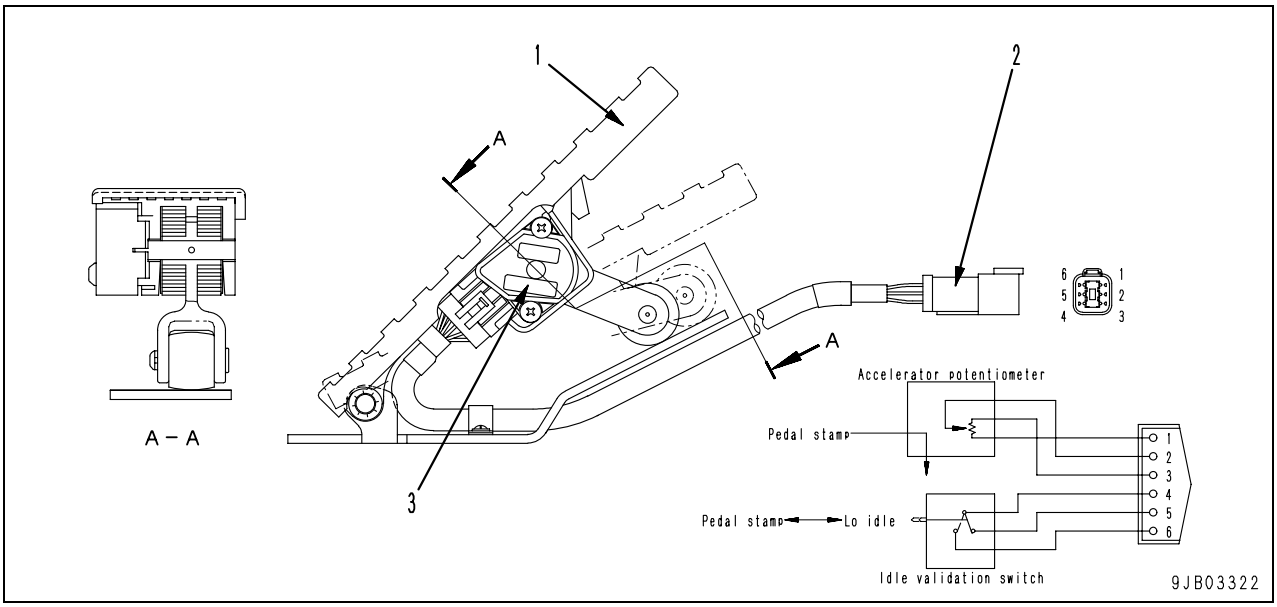


1. Connector
2. Tube
3. Sensor
4. O-ring

Function

- This sensor is installed in the cup of the fuel prefilter. It outputs the signal as entrainment of water in fuel is sensed.

Accelerator pedal sensor



1. Pedal
2. Connector
3. Sensor

Function

- This sensor is installed on the surface of the floor. It outputs the accelerator signal or idle validation signal depending on the accelerator pressing angle.

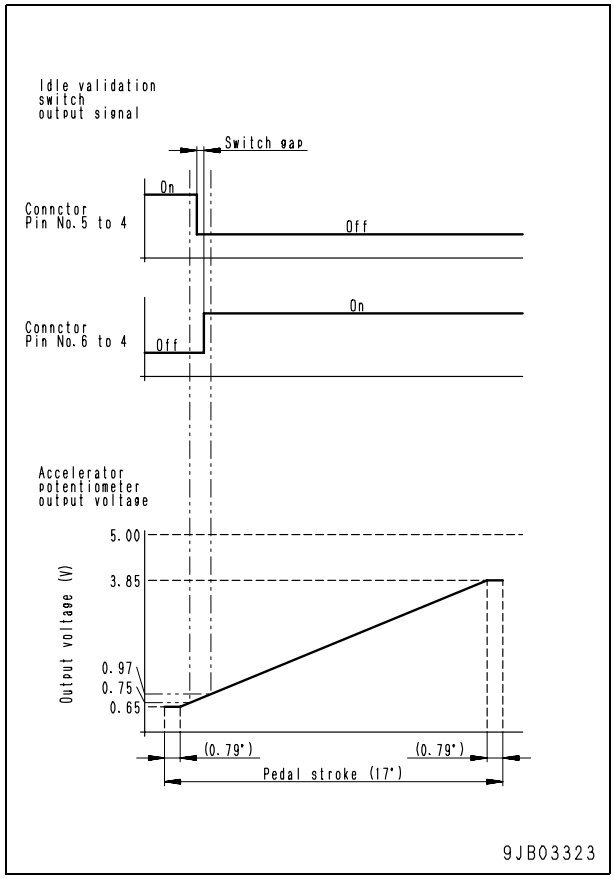
Accelerator signal

- Magnitude of the accelerator pedal displacement being detected by the potentiometer inside the sensor is output in variable voltage from No. 2 pin.

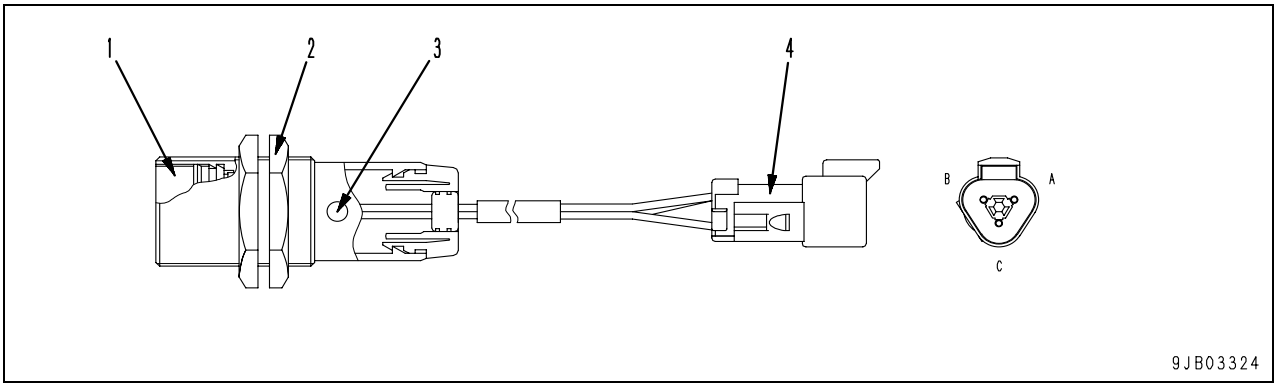
Idle validation signal

- The switch inside the sensor detects the accelerator pedal operation. As the accelerator pedal is released, it outputs the signal being entered to No. 5 pin from No. 4 pin. And as the accelerator pedal is pressed, it outputs the signal being entered to No. 6 pin from No. 4 pin.

Output characteristics



Boom kick-out proximity switch
Bucket positioner proximity switch



1. Switch
2. Locknut
3. Operation indication lamp
4. Connector

Function

- The boom kick-out proximity switch is installed in the lift arm left side connecting part of the front frame. And the bucket positioner proximity switch is installed on the bucket cylinder. As long as the plate is positioned on the detector plane, the switch lights up the operation indication lamp and turns itself “ON”.

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 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				WA380-6	
Engine				SAA6D107E-1	
Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Engine speed	High idle (E-mode)		rpm	1,880 ± 50	1,880 ± 50
	High idle (P-mode)			2,230 ± 50	2,230 ± 50
	Low idle (E-mode)			850 ± 25	850 ± 25
	Low idle (P-mode)			850 ± 25	850 ± 25
Exhaust temperature (Turbocharger outlet temperature)	All revolution ranges (Atmospheric temperature: 20°C)		°C	Max. 550	Max. 600
Intake air pressure (Boost pressure)	At rated output		kPa {mmHg}	Min. 140 {Min. 1,050}	113 {850}
Exhaust gas color	Engine coolant temperature: Within operating range	At sudden acceleration	Pollution level %	Max. 25	Max. 35
		At high idle		—	—
Valve clearance	Normal temperature	Intake valve	mm	0.25 ± 0.05	0.152 – 0.381
		Exhaust valve		0.51 ± 0.05	0.381 – 0.762
Blow-by pressure	• At rated output • Engine coolant temperature: Within operating range		kPa {mmH2O}	Max. 0.98 {Max. 100}	1.96 {200}
Oil pressure	At high idle Engine coolant temperature: Within operating range	SAE0W30E0S SAE0W40E0S SAE10W30DH SAE15W40DH SAE30DH	MPa {kg/cm^2}	Min. 0.29 {Min. 3.0}	0.25 {2.5}
	At low idle Engine coolant temperature: Within operating range			Min. 0.10 {Min. 1.0}	0.07 {0.7}
Oil temperature	All engine speed ranges (Inside oil pan)		°C	80 – 110	Min. 120
Belt tension	Deflection under finger pressure of approx. 58.8 N {approx. 6 kg}	Idler pulley – crankshaft pulley	mm	Auto-tensioner	Auto-tensioner
	Deflection under finger pressure of approx. 98 N {approx. 10 kg}	Air conditioner compressor – crankshaft pulley		11 – 15	11 – 15

Standard service value table for chassis

*: The value shows the value before the detent.

Machine model						WA380-6	
Category	Item			Measurement conditions	Unit	Standard value for new machine	Service limit value
Directional lever	Operating effort		N → FORWARD, REVERSE	• Engine stopped • Measure at center of lever knob	N {kg}	5.9 (+4.9/–3.0) {0.6 (+0.5/–0.3)}	Max. 16.7 {Max. 1.7}
	Stroke		N → FORWARD, REVERSE		mm	35 ± 10	35 ± 20
Gearshift lever	Operating effort		1st → 2nd	• Engine stopped • Measure at center of lever knob	N {kg}	5.9 (+4.9/–3.0) {0.6 (+0.5/–0.3)}	Max. 16.7 {Max. 1.7}
			2nd → 3rd			5.9 (+4.9/–3.0) {0.6 (+0.5/–0.3)}	Max. 16.7 {Max. 1.7}
			3rd → 4th			5.9 (+4.9/–3.0) {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: Within operating range	N {kg}	Max. 12.8 {Max. 1.3} (*)	Max. 19.6 {Max. 2.0} (*)
			RAISE → HOLD			Max. 14.7 {Max. 1.5}	Max. 22.6 {Max. 2.3}
			HOLD → LOWER			Max. 12.8 {Max. 1.3} (*)	Max. 19.6 {Max. 2.0} (*)
			LOWER → HOLD			—	—
			LOWER → FLOAT			Max. 15.7 {Max. 1.6}	Max. 23.5 {Max. 2.4}
			FLOAT → HOLD			Max. 14.7 {Max. 1.5}	Max. 22.6 {Max. 2.3}
		Bucket	HOLD → DUMP			Max. 17.7 {Max. 1.8}	Max. 26.5 {Max. 2.7}
			HOLD → TILT			Max. 12.8 {Max. 1.3} (*)	Max. 19.6 {Max. 2.0} (*)
			TILT → HOLD			Max. 14.7 {Max. 1.5}	Max. 22.6 {Max. 2.3}
	Stroke	Lift arm	HOLD ⟷ RAISE	• Engine speed: Low idle • Hydraulic oil temperature: Within operating range	mm	43 ± 9 (*)	43 ± 18 (*)
			HOLD ⟷ LOWER			43 ± 9 (*)	43 ± 18 (*)
			HOLD ⟷ FLOAT			50 ± 9	50 ± 18
		Bucket	HOLD → DUMP			50 ± 9	50 ± 18
			HOLD → TILT			43 ± 9 (*)	43 ± 18 (*)

Machine model						WA380-6	
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	Max. 100
	Operating effort			• Flat, level, straight, dry, and paved road • Engine speed: Low idle (Bucket empty)	N {kg}	6.9 – 12.6 {0.7 – 1.3}	Max.19.6 {Max. 2.0}
	Turns (Not including play)			• Engine speed: High idle • Left lock – right lock	Turns	3.7 ± 0.4	3.7 ± 0.8
	Operating time	Low idle		• Engine started • Hydraulic oil temperature: Within operating range • Left lock – right lock	sec.	4.4 ± 0.4	Max. 6.9
		High idle				3.7 ± 0.4	Max. 4.5
Frame	Clearance between front frame and rear frame			• Engine speed: 1,200 rpm • Hydraulic oil temperature: Within operating range • Flat, level, straight, and dry road • Max. steering angle	mm	40 ± 5	—
Accelerator pedal	Operating effort			• Engine started • Measure at 150 mm from fulcrum of pedal.	N {kg}	29.4 – 58.6 {3.0 – 6.0}	—
	Operating angle	Neutral (a1)		★ For measuring posture, see Fig. A at end of this section • Engine started • a2 = a1 – a3	deg.	45 ± 2	—
		Max. (a2)				17 ± 2	—
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}	323 ± 30 {32.9 ± 3.0}	Min. 264 {Min. 26.9}
	Operating angle	Neutral (a1)			deg.	53	—
		Max. (a2)				15 (+1/0)	—
	Play					5 ± 1	—
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 – 10	—
Engine speed	Torque converter stall			• Engine coolant temperature: Within operating range • Torque converter oil temperature: Within operating range • Hydraulic oil temperature: Within operating range	E-mode	rpm	1,815 ± 50	1,815 ± 100
					P-mode		2,130 ± 50	2,130 ± 100
	Hydraulic stall				E-mode		1,870 ± 100	1,870 ± 200
					P-mode		2,220 ± 100	2,220 ± 200
	Torque converter stall + hydraulic stall				E-mode		1,810 ± 100	1,810 ± 200
					P-mode		2,095 ± 100	2,095 ± 200

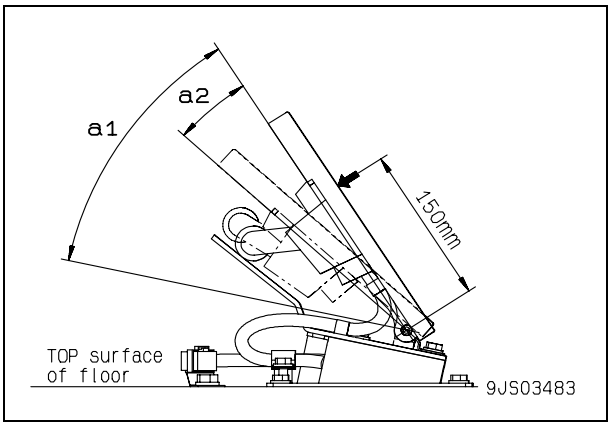
Machine model						WA380-6	
Category	Item		Measurement conditions		Unit	Standard value for new machine	Service limit value
Transmission, torque converter	Main relief pressure	Low idle	• Torque converter oil temperature: Within operating range (60 – 80°C) • Engine speed: 2,000 rpm		MPa {kg/cm^2}	2.73 ± 0.2 {27.9 ± 2}	2.73 ± 0.2 {27.9 ± 2}
		Engine speed 2,000 rpm				2.89 ± 0.2 {29.5 ± 2.0}	2.89 ± 0.2 {29.5 ± 2.0}
	Torque converter relief (inlet) oil pressure					Max. 0.88 {Max. 9.0}	Max. 0.88 {Max. 9.0}
	Torque converter outlet port oil pressure					0.34 – 0.59 {3.5 – 6.0}	0.34 – 0.59 {3.5 – 6.0}
	ECMV output (clutch) oil pressure	1st, 2nd, 3rd, 4th Forward Reverse	• Torque converter oil temperature: Within operating range • Engine speed: 2,000 rpm • Manual switch: ON			2.3 ± 0.15 {23.5 ± 1.5}	2.3 ± 0.15 {23.5 ± 1.5}
		Lockup (If equipped)				1.72 ± 0.5 {17.5 ± 1.5}	1.72 ± 0.5 {17.5 ± 1.5}
Steering	Steering relief pressure		• Hydraulic oil temperature: Within operating range • Engine speed: High idle		MPa {kg/cm^2}	24.5 ± 1.23 {250 ± 12.5}	24.5 (+1.23/–2.45) {250 (+12.5/–25)}
	Steering control pressure		• Hydraulic oil temperature: Within operating range • Engine speed: Low idle • Steering wheel: Neutral			1.1 – 1.4 {11 – 14}	0.9 – 1.6 {9 – 16}
Accumulator	Charge cut-in pressure		• Engine speed: Low idle • Hydraulic oil temperature: Within operating range	• Point where brake oil pressure warning lamp goes out	MPa {kg/cm^2}	5.9 (+0.5/0) {60 (+5/0)}	5.9 (+0.98/–0.5) {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 (+1.5/–0.5) {100 (+15/–5)}
Power train	Travel speed (Bucket empty)	FORWARD	P-mode	1st	km/h	6.6 ± 0.3	6.6 ± 0.5
				2nd		11.5 ± 0.6	11.5 ± 0.8
				3rd		20.2 ± 1.0	20.2 ± 1.4
				4th		34.0 ± 1.7	34.0 ± 2.4
			E-mode	1st		5.5 ± 0.3	5.5 ± 0.4
				2nd		9.6 ± 0.5	9.6 ± 0.7
				3rd		16.5 ± 0.8	16.5 ± 1.2
				4th		26.6 ± 1.3	26.6 ± 1.8

Machine model						WA380-6	
Category	Item		Measurement conditions		Unit	Standard value for new machine	Service limit value
Power train	Travel speed (Bucket empty)		REVERSE	P-mode 1st	km/h	7.1 ± 0.4	7.1 ± 0.5
				P-mode 2nd		12.3 ± 0.6	12.3 ± 0.9
				P-mode 3rd		21.5 ± 1.1	21.5 ± 1.5
				P-mode 4th		35.5 ± 1.8	35.5 ± 2.5
				E-mode 1st		5.9 ± 0.3	5.9 ± 0.4
				E-mode 2nd		10.2 ± 0.5	10.2 ± 0.7
				E-mode 3rd		17.5 ± 0.9	17.5 ± 1.2
				E-mode 4th		27.8 ± 1.4	27.8 ± 1.9
Wheel brake	Brake oil pressure		• Hydraulic oil temperature: Within operating range		MPa {kg/cm^2}	4.6 ± 0.4 {46.9 ± 4.1}	Min. 3.99 {Min. 40.7}
	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. 0.1 {Max. 1.0}	Max. 0.1 {Max. 1.0}
	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 323 ± 30 N {32.9 ± 3 kg} • Measure braking distance		m	Max. 5	Max. 5
	Disc wear		• Oil pressure: 4.9 MPa {50 kg/cm^2} • Pedal stroke end		mm	Projection of shaft 0	Projection of shaft to wear limit [Max. 2.4]
Parking brake	Parking brake oil pressure		• Torque converter oil temperature: Within operating range • Engine speed: Low idle • Parking brake: OFF		MPa {kg/cm^2}	Min. 2.4 {Min. 24.5}	Min. 2.4 {Min. 24.5}
	Parking brake solenoid basic pressure					Min. 2.4 {Min. 24.5}	Min. 2.4 {Min. 24.5}
	Performance		• Tire inflation pressure: Specified pressure • Flat paved road with 1/5 (11° 20') grade. Dry, paved road surface • Machine at operating condition ★ For measuring posture, see Figs. D and E at end of this section		—	Holds in position	Holds in position
	Disc thickness				mm	3.2 ± 0.08	2.97
Work equipment PPC	PPC valve basic pressure		• Hydraulic oil temperature: Within operating range • Engine speed: High idle		MPa {kg/cm^2}	3.72 (+0.2/0) {38 (+2/0)}	3.72 (+0.2/–0.2) {38 (+2/–2)}
	PPC valve output pressure	Lift arm RAISE, FLOAT; Bucket DUMP, TILT	• Hydraulic oil temperature: Within operating range • Engine speed: High idle • Control lever operated fully			3.72 (+0.1/–0.1) {38 (+1/–1)}	3.72 (+0.1/–0.2) {38 (+1/–2)}
		Lift arm LOWER				2.2 ± 0.25 {22.5 ± 2.5}	2.2 ± 0.39 {22.5 ± 4}

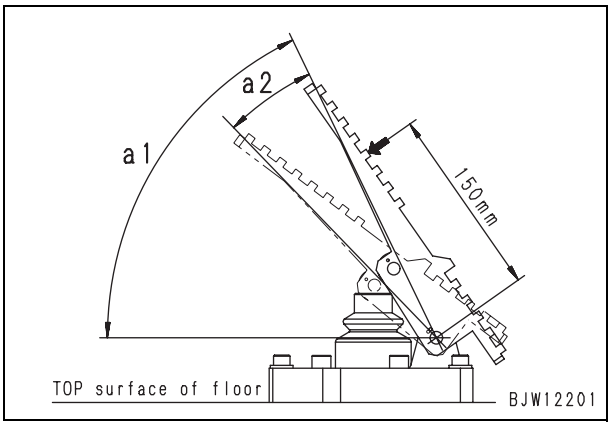
Machine model						WA380-6	
Category	Item			Measurement conditions	Unit	Standard value for new machine	Service limit value
Work equipment	Work equipment relief pressure			• Hydraulic oil temperature: Within operating range • Engine speed: High idle	MPa {kg/cm^2}	31.4 ± 1.57 {320 ± 16}	31.4 (+1.57/–3.92) {320 (+16/–40)}
	Unload pressure			• Hydraulic oil temperature: Within operating range • Engine speed: High idle • Work equipment control lever: Neutral		2.35 ± 0.29 {24 ± 3}	2.35 ± 0.59 {24 ± 6}
	LS differential pressure			• Hydraulic oil temperature: Within operating range • Engine speed: High idle • Lift arm lever: at half stroke		1.47 ± 0.2 {15 ± 2}	1.47 ± 0.39 {15 ± 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	E-mode	6.9 ± 0.5	Max. 8.7
					P-mode	5.9 ± 0.5	Max. 7.6
		Lift arm LOWER			E-mode	3.3 ± 0.5	Max. 4.4
					P-mode	3.3 ± 0.5	Max. 4.4
		Bucket full stroke	Tilt-out	• 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	E-mode	1.8 ± 0.3	Max. 2.4
					P-mode	1.8 ± 0.3	Max. 2.4
			Tilt-in		E-mode	2.6 ± 0.3	Max. 3.4
					P-mode	2.3 ± 0.3	Max. 3.0
		Moving bucket from level position	Tilt-in		E-mode	1.8 ± 0.3	Max. 2.4
					P-mode	1.6 ± 0.3	Max. 2.2
	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. 20	Max. 24
		Retraction of bucket cylinder rod				Max. 17	Max. 20
Hydraulic drive fan	Max. fan speed			• Engine speed: High idle • Engine coolant temperature: Min. 95°C • Hydraulic oil temperature: Min. 95°C • Torque converter oil temperature: Min. 105°C	rpm	1,500 ± 100	1,500 ± 200
	Min. fan speed			• Engine speed: Low idle • Engine coolant temperature: Max. 75°C • Hydraulic oil temperature: Max. 75°C • Torque converter oil temperature: Max. 85°C		600 ± 50	600 ± 100
	Fan drive pressure			• Engine speed: High idle • Engine coolant temperature: Min. 95°C • Hydraulic oil temperature: Min. 95°C • Torque converter oil temperature: Min. 105°C	MPa {kg/cm^2}	11.7 ± 1.2 {119 ± 12}	11.7 ± 1.8 {119 ± 18}
	Fan reverse solenoid output pressure			• Engine speed: High idle • Engine coolant temperature: Min. 95°C • Hydraulic oil temperature: Min. 95°C • Torque converter oil temperature: Min. 105°C		11.7 ± 1.2 {119 ± 12}	11.7 ± 1.8 {119 ± 18}

Machine posture and procedure for performance measurement

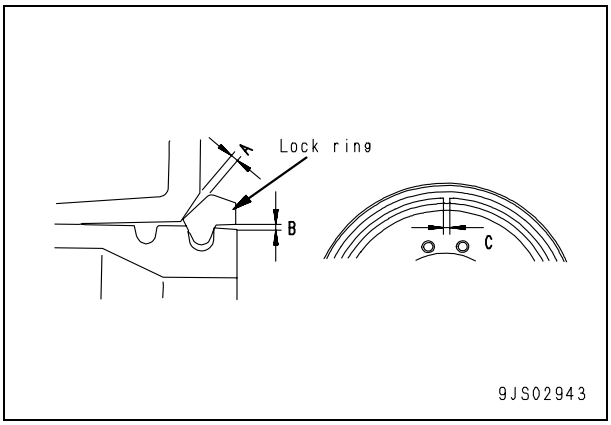
★ **Fig. A**



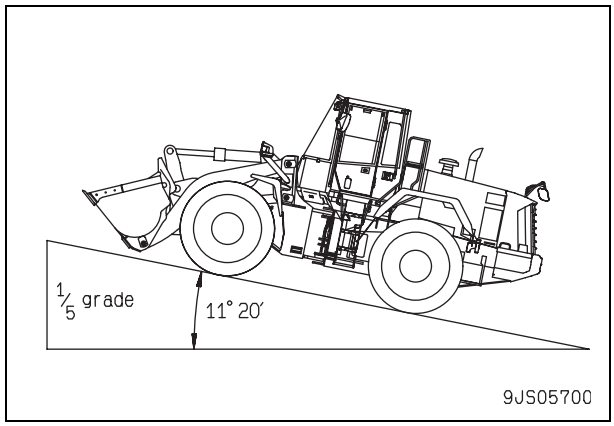
★ **Fig. B**



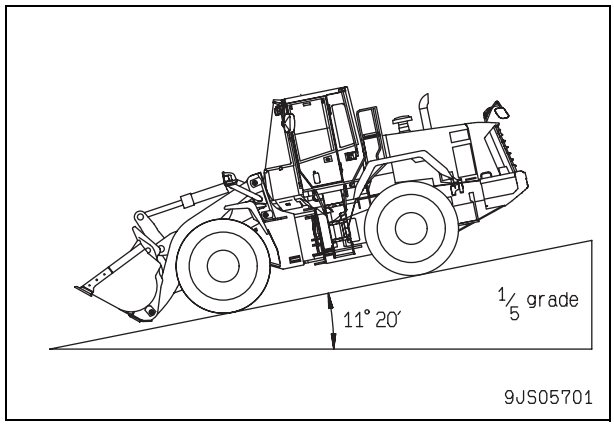
★ **Fig. C**



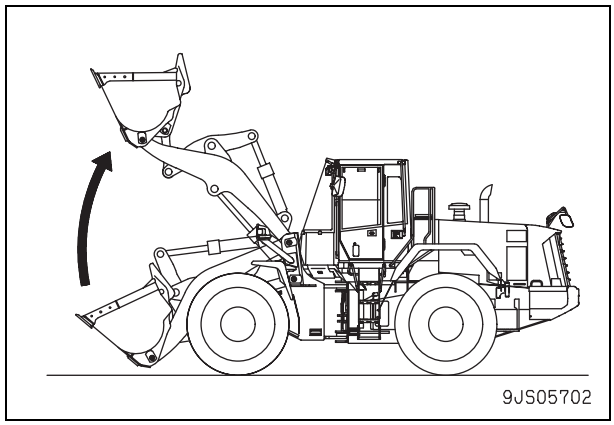
★ **Fig. D**



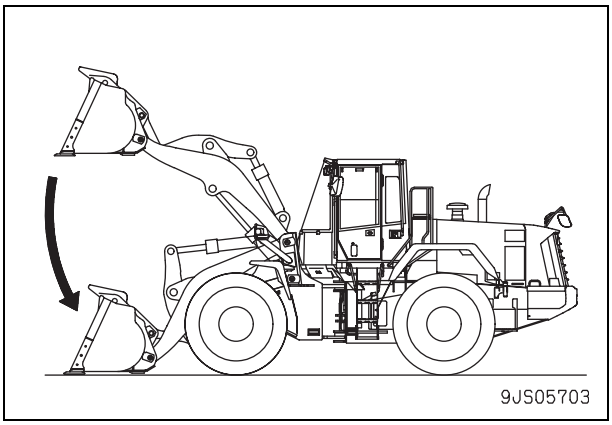
★ **Fig. E**



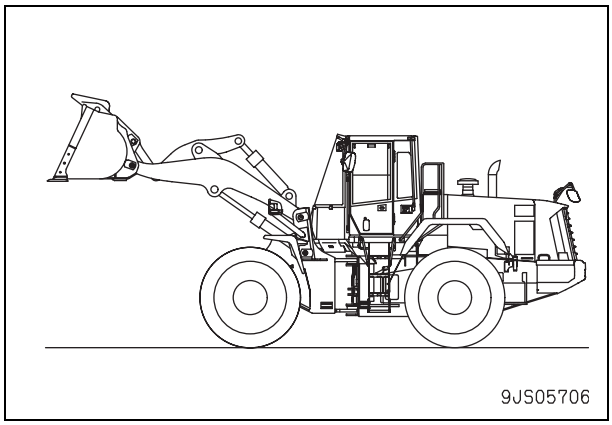
★ **Fig. F**



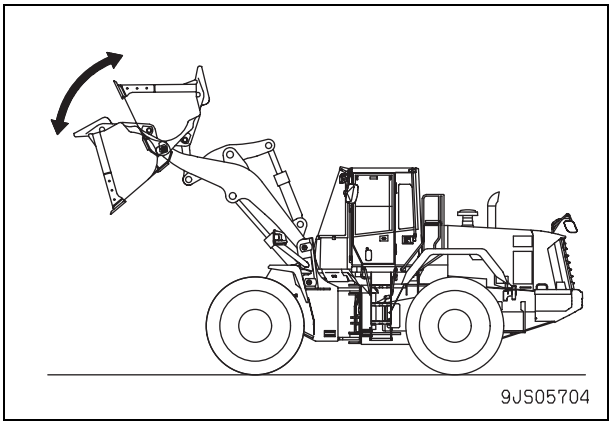
★ **Fig. G**



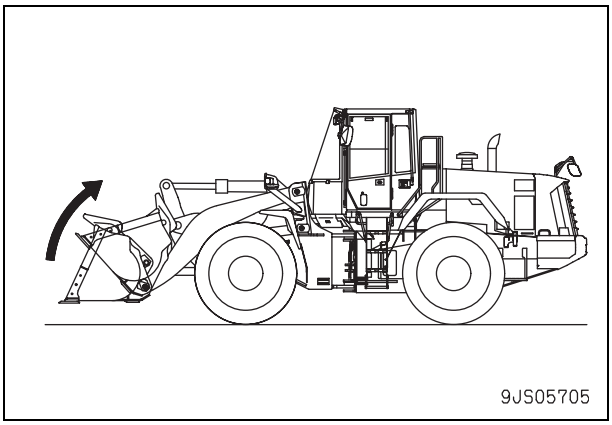
★ **Fig. K**



★ **Fig. H**



★ **Fig. J**



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

30 Testing and adjusting

Testing and adjusting, Part 1

Testing and adjusting, Part 1 3
Tools for testing, adjusting, and troubleshooting 3
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Measuring compression pressure 12
Measuring blow-by pressure 15
Measuring engine oil pressure 16
Measuring intake air (boost) pressure 17
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Releasing residual pressure in fuel system 18
Measuring fuel pressure 19
Measuring fuel return rate and leakage 21
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Testing leakage in fuel system 26
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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	
Adjusting valve clearance	B	1	795-799-1131	Gear	1	
		2	Commercially available	Clearance gauge	1	
Measuring compression pressure	C	1	795-799-6700	Puller	1	For 107E-1 engine
		2	795-502-1590	Gauge assembly	1	0 – 6.9 MPa {0 – 70 kg/cm^2}
		3	795-790-4410	Adapter	1	For 107E-1 engine
		4	6754-11-3130	Gasket	1	For 107E-1 engine
Measuring blow-by pressure	D		799-201-1504	Blow-by checker	1	0 – 5 kPa {0 – 500 mmH_2O}
Measuring engine oil pressure	E	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	F		799-201-2202	Boost gauge kit	1	–101 – 200 kPa {–760 – 1,500 mmHg}
Measuring fuel compression	G	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	6732-81-3170	Adapter	1	10 × 1.0 mm → R1/8
			6215-81-9710	O-ring	1	
		3	799-401-2320	Hydraulic tester	1	Pressure gauge: 0.98 MPa {10 kg/cm^2}
Measuring fuel return rate and leakage	H	1	795-790-4700	Tester kit	1	
		2	795-790-6700	Adapter	1	
		3	6754-71-5340	Connector	1	
		4	6754-71-5350	Washer	1	
		5	Commercially available	Measuring cylinder	1	
		6	Commercially available	Stopwatch	1	
Measuring directional lever	J		79A-264-0021	Push-pull scale	1	0 – 294 N {0 – 30 kg}
Testing power train oil pressure	K	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	L		794-423-1190	Plug	1	20 × 1.5 mm

Testing and adjusting item	Symbol		Part No.	Part Name	Q'ty	Remarks
Testing and adjusting steering wheel	M		79A-264-0021	Push-pull scale	1	0 – 294 N {0 – 30 kg}
Testing and adjusting steering oil pressure	N	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	
		3	799-401-2701	Differential pressure gauge	1	
		4	799-401-3200	Adapter	1	Size 03
Testing hydraulic drive fan	P	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}
Bleeding air from hydraulic drive fan circuit	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}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	790-261-1130	Coupling	1	
Testing and adjusting accumulator charge pressure	R		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}
Testing wheel brake oil pressure	S	1	793-605-1001	Brake test kit	1	
		2	790-101-1430	Coupler	1	
		3	790-101-1102	Pump	1	
		4	790-301-1720	Adapter	1	20 × 1.5 mm → R1/8
		5	799-101-5160	Nipple	1	
		6	799-401-2220	Hose	1	Length: 5 m
		7	790-261-1130	Coupling	1	
Measuring wear of wheel brake disc	T		Commercially available	Slide calipers	1	
Testing parking brake oil pressure	U	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	
Testing wear of parking brake disc	V		Commercially available	Slide calipers	1	
Measuring and adjusting work equipment control lever	W	1	79A-264-0021	Push-pull scale	1	
		2	Commercially available	Scale	1	
Testing and adjusting work equipment PPC oil pressure	X	1	799-101-5002	Analog 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	

Testing and adjusting item	Symbol		Part No.	Part Name	Q'ty	Remarks
Testing and adjusting work equipment oil pressure	Y	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	
		3	799-401-2701	Differential pressure gauge	1	
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	
Removal and installation of boost pressure and temperature sensor	—		Commercially available	Torque wrench	1	3.26 mm torque wrench (KTC Q4T15 or equivalent)
Removal and installation of engine oil pressure sensor	—		(Under setting)	Deep socket	1	27 mm deep socket
Removal and installation of engine coolant temperature sensor	—		Commercially available	Deep socket	1	21 mm deep socket (MITOLOY 4ML-21 or equivalent)

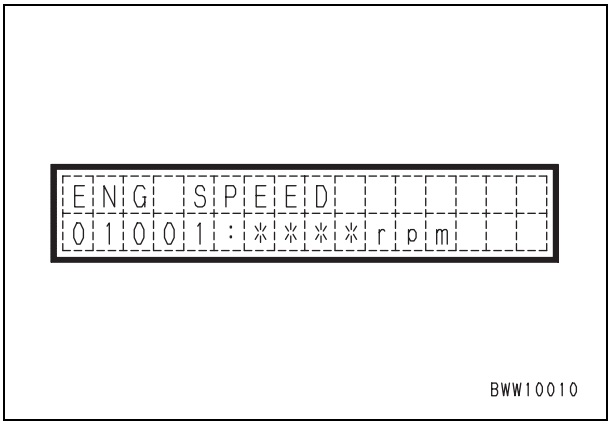
★ For the model names and part Nos. of the T-adapters and boxes used for troubleshooting of the controllers, sensors, actuators, and wiring harnesses, see Troubleshooting, “T-branch box and T-branch table”.

Measuring engine speed

⚠ **Put chocks under the tires.**
⚠ **When measuring, check that there are no persons around the machine.**

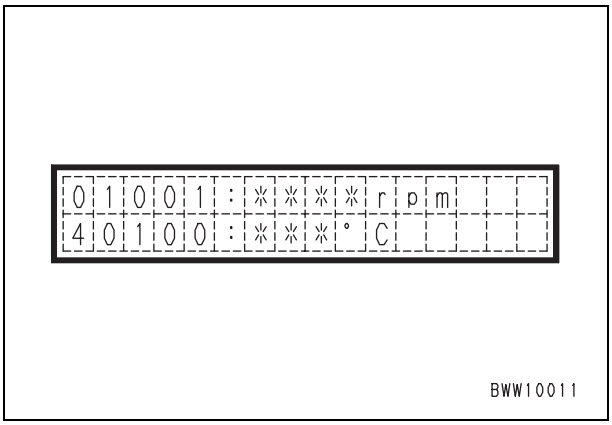
★ Measure the engine speed under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range
- Torque converter oil temperature: Within operating range

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) Display “ENG SPEED” from the monitoring items of the machine monitor.
   ★ 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.

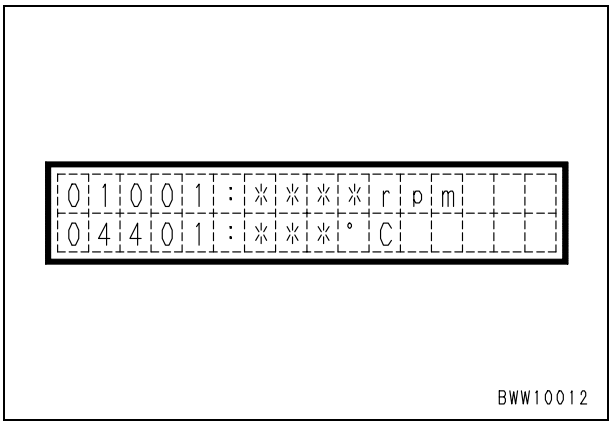
2. Measuring torque converter stall speed
1) Referring to “Special function of machine monitor”, select the real time monitoring function of the service mode.
2) Select the two-item simultaneous monitoring (2 ITEMS) and then enter the following code numbers directly.
   ★ Monitoring items
   [1] Code No.01001: ENG SPEED (Engine speed)
   [2] Code No.40100: TC OIL TEMP (Torque converter oil temperature)



3) Start the engine.
4) Turn the transmission cut-off selector switch OFF and press the left brake pedal securely.
5) Turn the torque converter lockup switch (if equipped) OFF.
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 or switch to the F (forward) or R (reverse) position.
   ⚠ **Keep pressing the brake pedal securely.**
10) 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) Turn the transmission cut-off selector switch OFF and press the left brake pedal securely.
4) Turn the torque converter lockup switch (if equipped) OFF.
5) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
6) While keeping the directional lever at N (Neutral) position, set the gearshift lever in the 4th position.
7) Release the parking brake.
8) While pressing the brake pedal, set the directional lever to the F (forward) or R (reverse) position.
   ⚠ **Keep pressing the brake pedal securely.**
9) 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

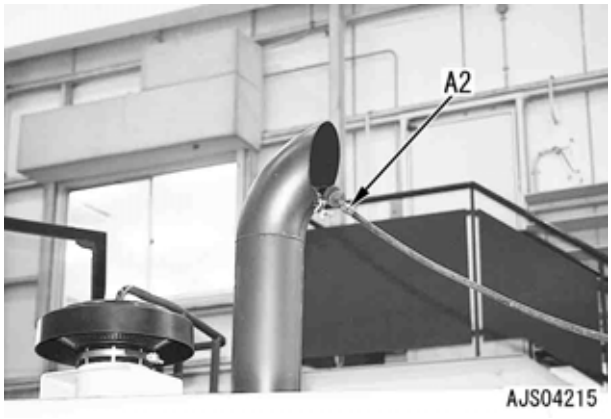
1) Stick a sheet of filter paper to smoke checker **A1**.
2) Insert the exhaust gas intake pipe in the muffler (exhaust pipe).
3) Start the engine and heighten the engine coolant temperature to the operating range.
4) Accelerate the engine suddenly or run it at high idle and operate the handle of smoke checker **A1** so that the filter paper will absorb the exhaust gas.



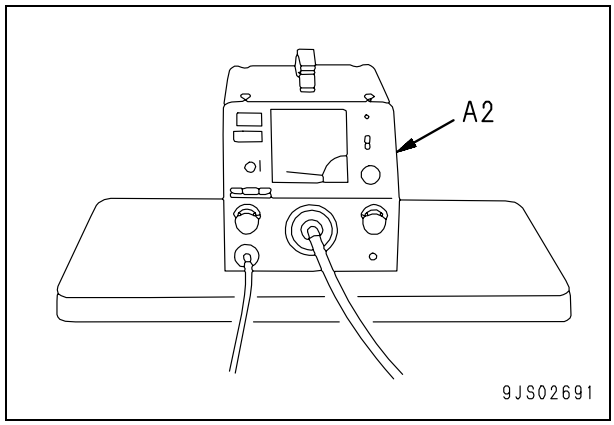
5) Take out the filtering paper and compare it with the attached scale for judgement.
6) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

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.

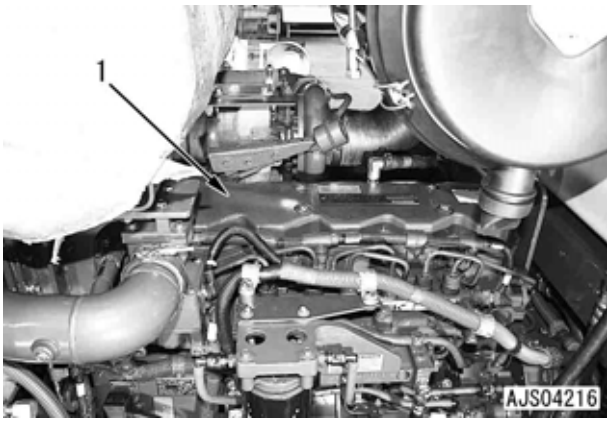
Adjusting valve clearance

★ Adjusting tool for valve clearance

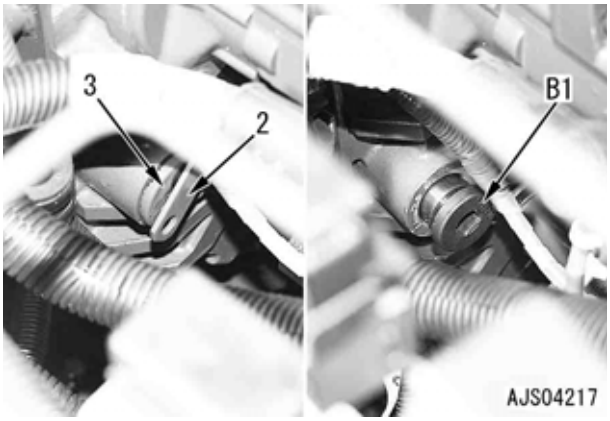
Symbol		Part No.	Part Name
B	1	795-799-1131	Gear
	2	Commercially available	Clearance gauge

★ Adjust the valve clearance under the following condition.
- Engine coolant temperature: Normal temperature

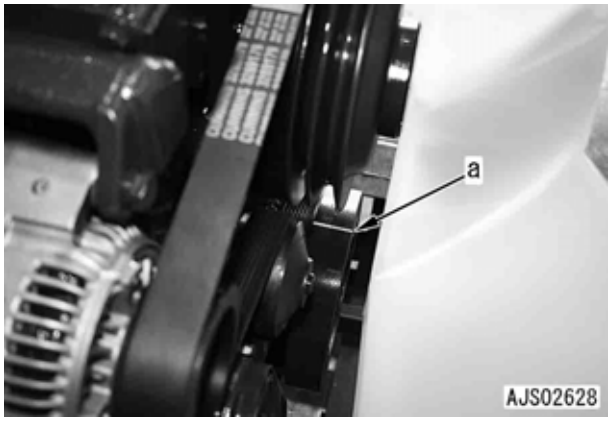
1. Remove cylinder head cover (1). For details, see Disassembly and assembly, “Removal and installation of cylinder head assembly”.



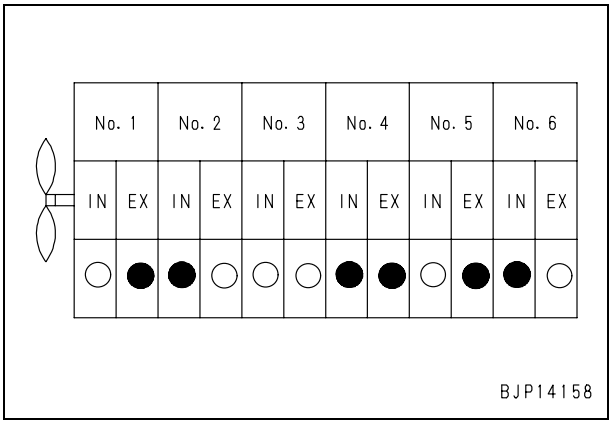
2. Remove plate (2) and cap (3) from the flywheel housing and install gear **B1**.



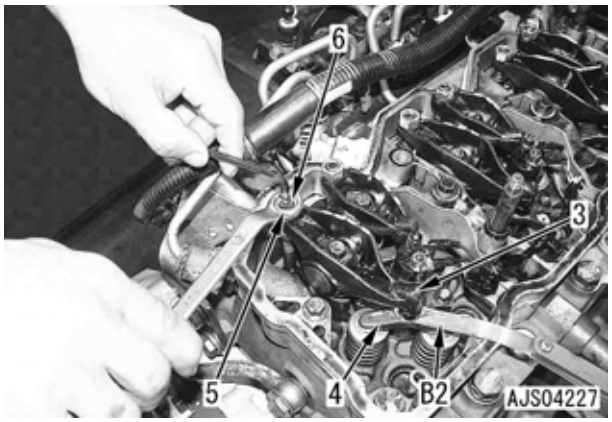
3. Rotate the crankshaft forward with gear **B1** to set the stamped “1.6TOP” line (a) of the crankshaft pulley to the top and set the No. 1 cylinder to the compression top dead center.
   ★ When the No. 1 cylinder is at the compression top dead center, the rocker arm of the No. 1 cylinder can be moved by the valve clearance with the hand. If the rocker arm cannot be moved, the No. 1 cylinder is not at the compression top dead center. In this case, rotate the crankshaft one more turn. (You may adjust the valve clearances of the valves marked with ○ in the following valve arrangement drawing without rotating the crankshaft.)



4. Check the movement of the rocker arm of the No. 1 cylinder to judge the valve to be adjusted.
   ★ If you can move the rocker arms of air intake valves (IN) with the hand by the valve clearance, adjust the valves marked with ○ in the valve arrangement drawing.
   ★ If you can move the rocker arms of exhaust valves (EX) with the hand by the valve clearance, adjust the valves marked with ● in the valve arrangement drawing.
   ★ Valve arrangement drawing



1) Insert clearance gauge **B2** in the clearance between rocker arm (3) and crosshead (4).
2) Loosen locknut (5) and adjust the valve clearance with adjustment screw (6).
   ★ With the clearance gauge inserted, turn the adjustment screw to a degree that you can move the clearance gauge lightly.
3) While fixing adjustment screw (6), tighten locknut (5).
   ⇦ Locknut
   24 ± 4 Nm {2.45 ± 0.41 kgm}
   ★ After tightening the locknut, check the valve clearance again.



5. Similarly to step 3, rotate the crankshaft forward with gear **B1** to set the stamped “1.6TOP” line (a) of the crankshaft pulley to the top.
6. Adjust the valve clearance of the No. 6 cylinder.
   ★ Adjust according to step 4.
   ★ While the No. 6 cylinder is at the compression top dead center, you can adjust the valve clearances of the valves marked with ○ in the valve arrangement drawing.
7. After finishing adjustment, remove the adjusting tools and return the removed parts.
   ⇦ Cylinder head cover mounting bolt:
   24 ± 4 Nm {2.45 ± 0.41 kgm}

Measuring compression pressure

★ Measuring tools for compression pressure

Symbol		Part No.	Part Name
C	1	795-799-6700	Puller
	2	795-502-1590	Gauge assembly
	3	795-790-4410	Adapter
	4	6754-11-3130	Gasket

⚠ **When measuring the compression pressure, take care not to burn yourself on the exhaust manifold or muffler or get caught in a rotating part.**

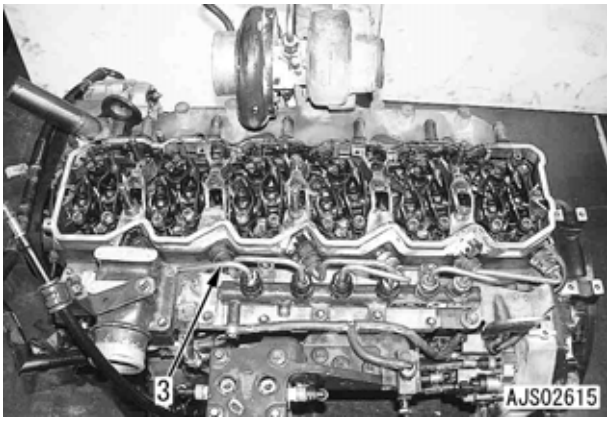
★ Measure the compression pressure after the engine is warmed up.
(Engine oil temperature: 40 – 60°C)

1. Remove cylinder head cover (1). For details, see Disassembly and assembly, “Removal and installation of cylinder head assembly”.

2. Disconnect 6 injector wiring harness connectors (2) and move the wiring harnesses.



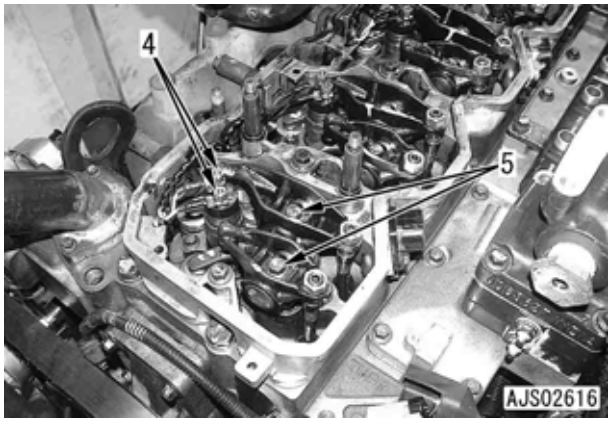
3. Disconnect fuel high-pressure tube (3).



4. Loosen injector terminal nut (4) and remove the terminal from the injector.

5. Set the cylinder to be checked to the compression top dead center.
★ See “Adjusting valve clearance”.

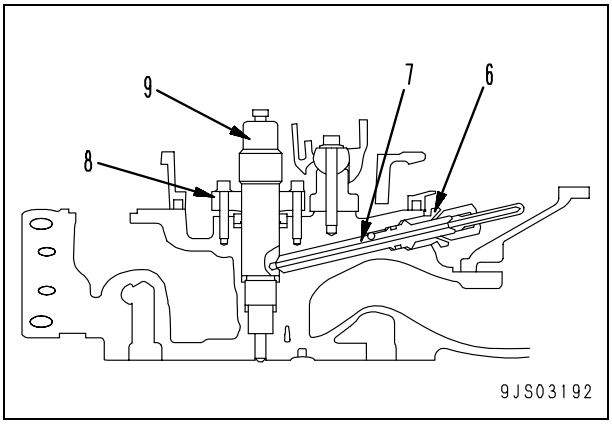
6. Remove rocker arm assembly (5).

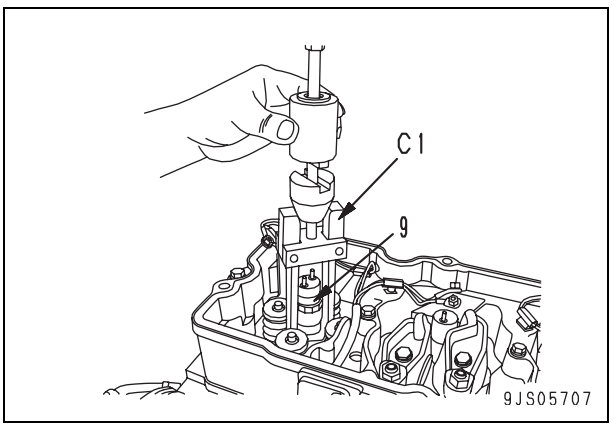


7. Remove retainer (6) and fuel inlet connector (7).

8. Remove holder (8).

9. Remove injector (9).
★ Using tool **C1**, remove the injector with impacts of a slide hammer.
★ Do not remove the injector by prying its top up.





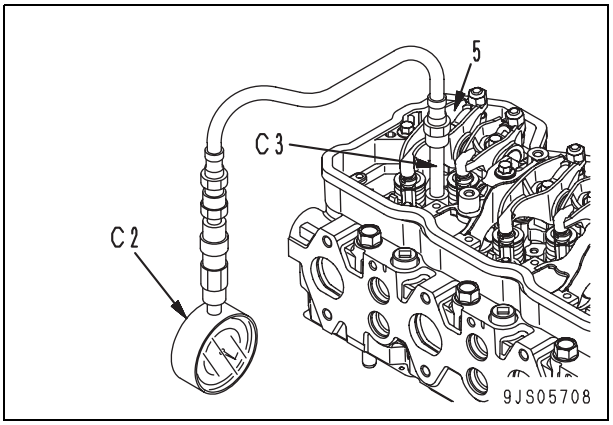
10. Fit gasket **C4** to the end of adapter **C3** and insert them in the injector mounting portion.

11. Fix adapter **C3** with injector holder.
    ★ Tighten the holder mounting bolts alternately.
    Holder mounting bolt:
    8 ± 0.8 Nm {0.8 ± 0.08 kgm}

12. Connect gauge assembly **C2** to adapter **C3**.
    ★ If engine oil is applied thinly to the connecting parts of the adapter and gauge, air does not leak easily.

13. Install rocker arm assembly (5).
    Rocker arm assembly mounting bolt:
    36 ± 5 Nm {3.67 ± 0.51 kgm}

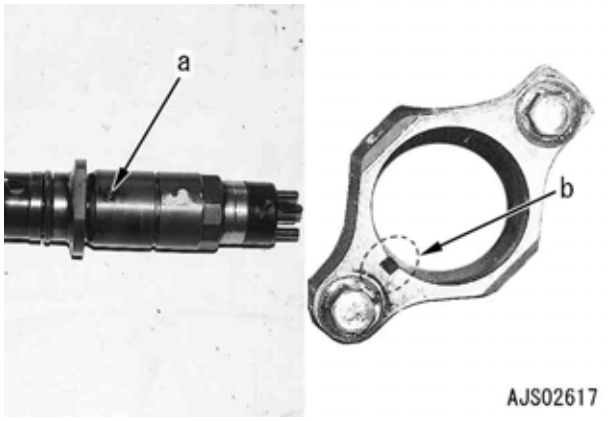
14. Adjust the valve clearance.
    ★ See “Adjusting valve clearance”.



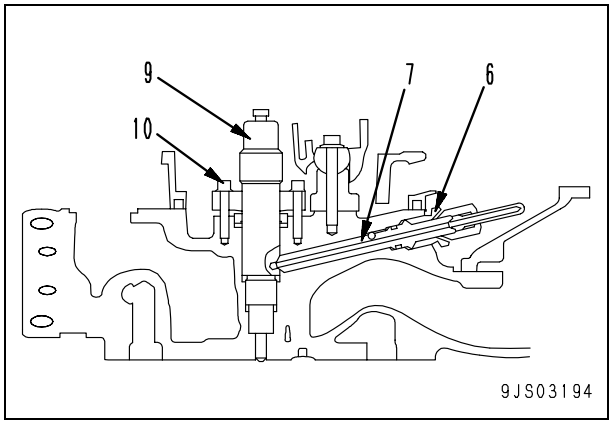
15. Referring to “Special functions of machine monitor (EMMS)”, set the engine in the no-injection cranking mode.
    ⚠ **If the engine is not set in the no-injection cranking mode, it starts during measurement and that is dangerous. Accordingly, be sure to set the engine in the no-injection cranking mode.**

16. Rotate the engine with the starting motor and measure the compression pressure.
    ★ Read the gauge when its pointer is stabilized.

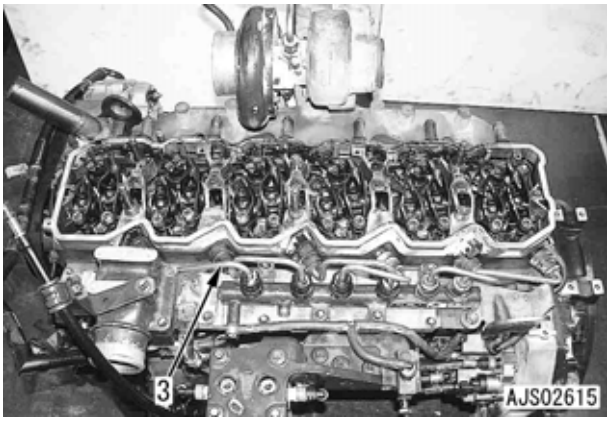
17. After finishing measurement, remove the measuring tools and return the removed parts.
    ★ Install the injector and fuel high-pressure tube according to the following procedure.
    1) While matching projection (a) of the injector to notch (b) of the holder, set the injector to the cylinder head.
       ★ When setting the injector, direct the above matching position toward the fuel inlet connector insertion side.



    2) Tighten injector holder mounting bolts (10) by 3 – 4 turns.
    3) Set fuel inlet connector (7).
       ★ Push in the fuel inlet connector until the O-ring is fitted and the connector clicks.
    4) Tighten injector holder mounting bolts (10) alternately.
       Holder mounting bolt:
       8 ± 0.8 Nm {0.8 ± 0.08 kgm}
    5) Tighten retainer (6) of the fuel inlet connector.
       Retainer:
       50 ± 5 Nm {5.1 ± 0.5 kgm}



6) Tighten the sleeve nut of the fuel high-pressure tube on the head side and then tighten that on the common rail side.
   ⇦ Sleeve nut:
   35 ± 3.5 Nm {3.6 ± 0.4 kgm}



★ After installing the rocker arm assembly, adjust the valve clearance. For details, see “Adjusting valve clearance”.
⇦ Rocker arm assembly mounting bolt:
36 ± 5 Nm {3.67 ± 0.51 kgm}

★ Tighten the injector terminal nut to the following torque.
⇦ Terminal nut:
1.5 ± 0.25 Nm {0.15 ± 0.025 kgm}

★ Tighten the head cover to the following torque.
⇦ Head cover mounting nut:
24 ± 4 Nm {2.45 ± 0.41 kgm}

Measuring blow-by pressure

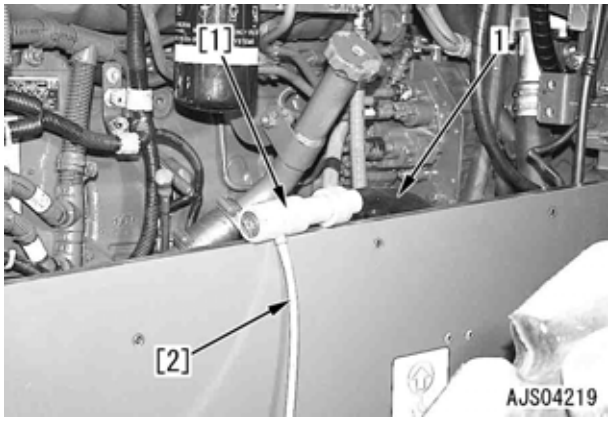
★ Blow-by pressure measurement tools

Symbol	Part No.	Part Name
D	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. Open the engine right side cover.

2. Stop the engine. Install nozzle [1] and hose [2] of blow-by checker **D** to blow-by hose (1) and connect them to gauge [3].



3. Start the engine and increase the engine coolant temperature to the operating range.

4. Turn the transmission cut-off selector switch OFF and press the left brake pedal securely.

5. Turn the torque converter lockup switch (if equipped) OFF.

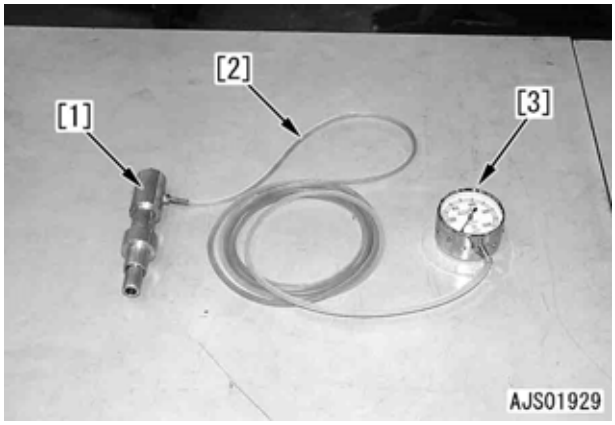
6. Set the transmission auto shift and manual shift selector switch in the MANUAL position.

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 or switch 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 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.



11. Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

Measuring engine oil pressure

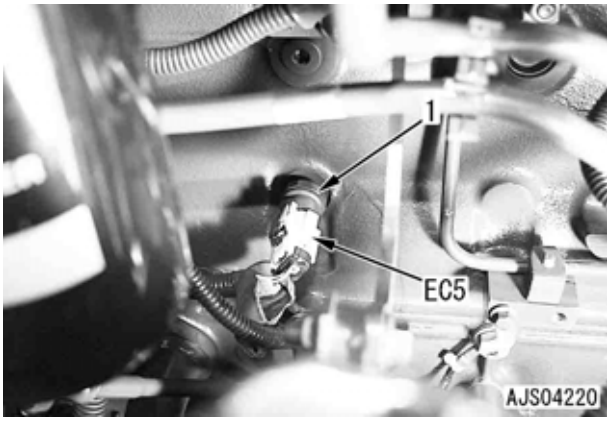
★ Engine oil pressure measurement tools

Symbol		Part No.	Part Name
E	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

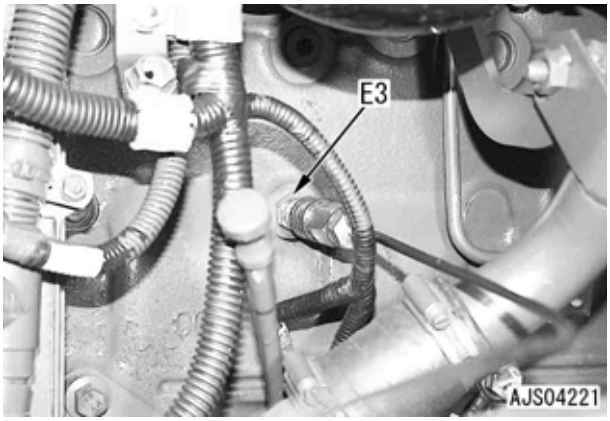
★ Measure the engine oil pressure under the following condition.
- Engine coolant temperature: Within operating range

1. Open the engine right side cover.

2. Disconnect wiring connector **EC5** and remove switch (1) (14 × 1.5 mm).



3. Install nipple **E3** (14 × 1.5 mm) and then connect hydraulic tester **E2** (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.

Measuring intake air (boost) pressure

★ Measuring instruments for intake air (boost) pressure

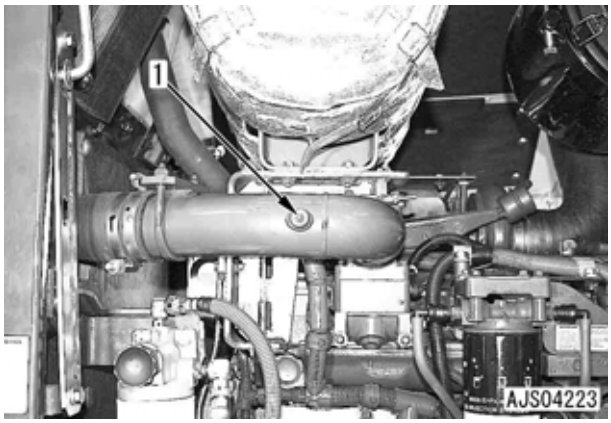
Symbol	Part No.	Part Name
F	799-201-2202	Boost gauge kit

⚠ **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

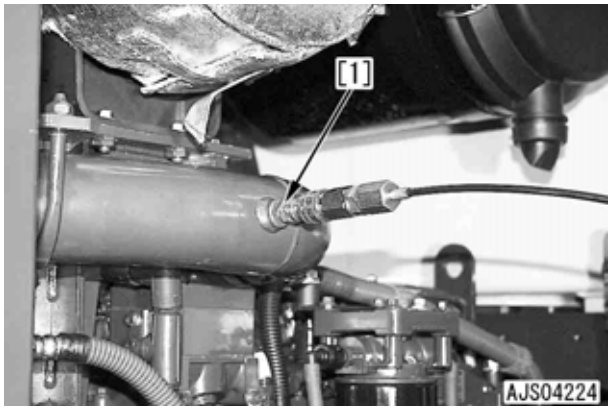
1. Open the engine right side cover.

2. Remove air boost pressure pickup plug (1) (R1/8).



3. Install nipple [1] in boost gauge kit **F** and connect pressure gauge [2].

4. Start the engine and increase the coolant temperature to the operating range.



5. Run the engine at medium or higher speed to drain the oil from the hose.
   ★ Insert the connecting parts of the gauge and hose about a half and open the self-seal on the hose side repeatedly, and the oil will be drained.
   ★ If Pm kit (A) is available, you may drain the oil by using the oil draining coupling (790-261-1130) in that kit.
   ★ If the oil is left in the hose, the gauge does not work. Accordingly, be sure to drain the oil.

6. Turn the transmission cut-off selector switch OFF and press the left brake pedal securely.

7. Turn the torque converter lockup switch (if equipped) OFF.

8. Set the transmission auto shift and manual shift selector switch in the MANUAL position.

9. 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.

10. Release the parking brake.

11. While pressing the brake pedal, set the directional lever to the F (forward) or R (reverse) position.
    ⚠ **Keep pressing the brake pedal securely.**

12. 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.



13. 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.)**

Measuring fuel pressure

★ Measuring tools for fuel pressure

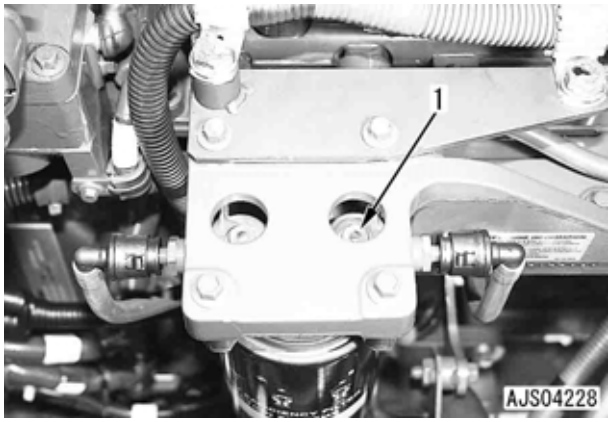
Symbol		Part No.	Part name
G	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	6732-81-3170	Adapter (10 × 1.0 mm → PT1/8)
		6215-81-9710	O-ring
	3	799-401-2320	Hydraulic tester

★ Test only the fuel pressure in the low-pressure circuit from the feed pump through the fuel main filter to the supply pump and in the return circuit between the supply pump/common rail/ injector and fuel tank.

⚠ **Since the pressure in the high-pressure circuit from the supply pump through the common rail to the fuel injector is very high, it cannot be measured.**

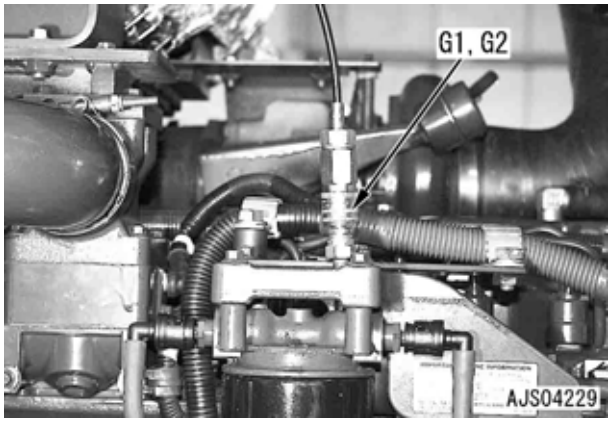
1. Measuring pressure in fuel low-pressure circuit

1) Remove fuel pressure pickup plug (1) from the fuel main filter.



2) Install adapter **G2** and nipple [1] of hydraulic tester **G1** and connect them to oil pressure gauge [2].

★ Use the oil pressure gauge of 2.5 MPa {25 kg/cm^2}.



3) Run the engine at low idle and measure the pressure in the fuel low-pressure circuit.

★ If the pressure in the fuel low-pressure circuit is in the following range, it is normal.

At low idle	0.5 – 1.3 MPa {5.1 – 13.3 kg/cm^2}
During cranking	0.3 – 1.1 MPa {3.1 – 11.3 kg/cm^2}

⚠ **If the engine cannot be started, you may measure the fuel pressure while rotating the engine with the starting motor. Do not rotate for more than 20 seconds continuously, however, for protection of the starting motor.**

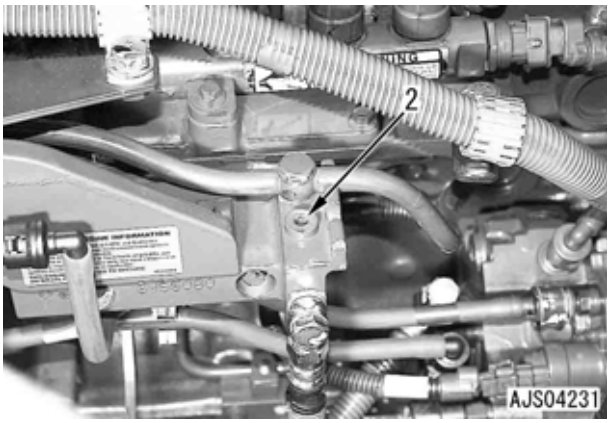


4) After finishing measurement, remove the measuring tools and return the removed parts.

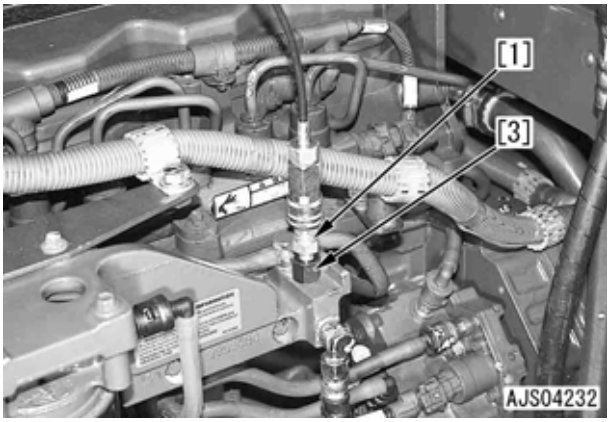
Fuel pressure pickup plug:
10 ± 2 Nm {1 ± 0.2 kgm}

2. Measuring pressure in fuel return circuit

1) Remove fuel pressure pickup plug (2) from the fuel return block.



2) Install nipple [3] of hydraulic tester **G1** and nipple [1] and connect them to hydraulic tester **G3**.
   ★ Nipple [3]:
   790-301-1181, 07002-11223



3) Run the engine at low idle and measure the pressure in the fuel return circuit.
   ★ If the pressure in the fuel return circuit is in the following range, it is normal.

At low idle	Max. 0.02 MPa {Max. 0.19 kg/cm^2}
During cranking	

⚠ If the engine cannot be started, you may measure the fuel pressure while rotating the engine with the starting motor. Do not rotate for more than 20 seconds continuously, however, for protection of the starting motor.

4) After finishing measurement, remove the measuring tools and return the removed parts.
   Fuel pressure pickup plug:
   24 ± 4 Nm {2.4 ± 0.4 kgm}

Measuring fuel return rate and leakage

★ Measuring tools for fuel return rate and leakage

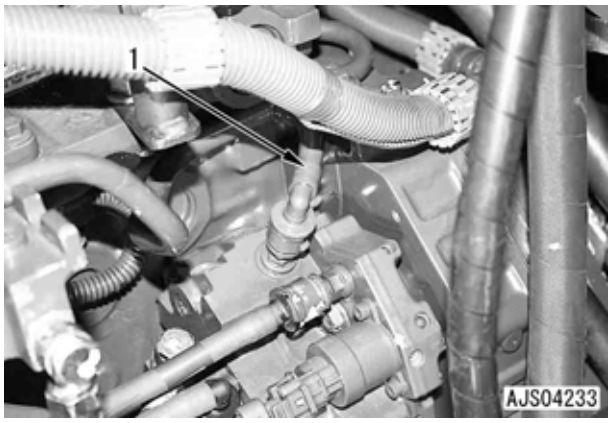
Symbol		Part No.	Part name
H	1	795-790-4700	Tester kit
	2	795-790-6700	Adapter
	3	6754-71-5340	Connector
	4	6754-71-5350	Washer
	5	Commercially available	Measuring cylinder
	6	Commercially available	Stopwatch

★ Prepare an oil (receiving) pan of about 20 liters to receive the fuel flowing out during measurement.

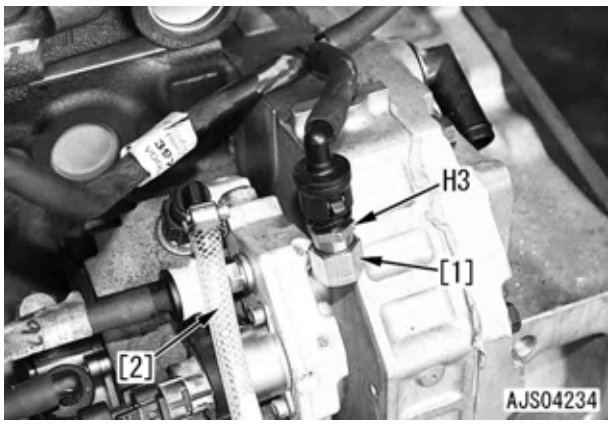
⚠ **Stop the machine on a flat ground and lower the work equipment to the ground.**

1. Measuring return rate from supply pump

1) Open the engine hood and disconnect return hose (1) of the supply pump.
   ★ The return hose is connected by a quick coupler.



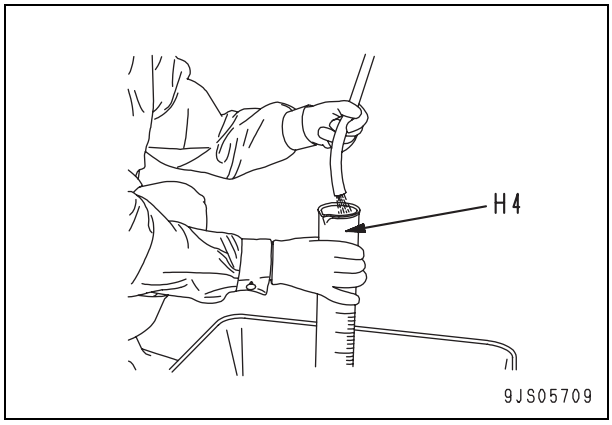
2) Install connector **H3** and cap nut [1] of tester kit **H1** to the return hose to stop the fuel from flowing out.
3) Connect test hose [2] of tester kit **H1** to the supply pump.
   ★ Lay the test hose so that it will not slacken and put its end in the oil (receiving) pan.
   ★ The shape in the figure is different from SAA6D107E-1 for WA380-6.



4) Run the engine at low idle and measure the return rate in 1 minute with measuring cylinder **H4**.
   ★ If the return rate from the supply pump is in the following range, it is normal.

At low idle	1,000 cc/min.
During cranking	140 cc/min.

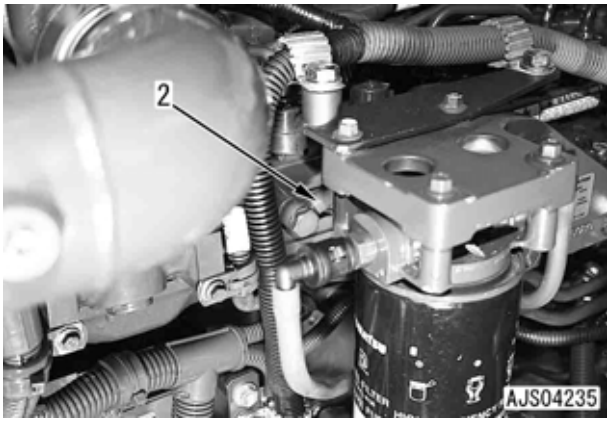
⚠ **If the engine cannot be started, you may measure the return rate while rotating the engine with the starting motor. Do not rotate for more than 20 seconds continuously, however, for protection of the starting motor.**



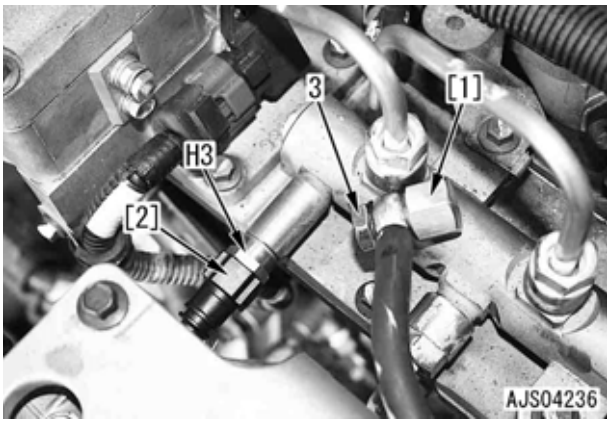
5) After finishing measurement, remove the measuring tools and return the removed parts.
   ★ When measuring the leakage from the pressure limiter or finishing the measurement: Return the removed parts to their original positions.
   ★ When measuring the leakage from the injector: Leave the removed parts as they are and keep the test hose end in the oil (receiving) pan.

2. Measuring leakage from pressure limiter

1) Open the engine hood and disconnect return hose (2) from the pressure limiter.
   ★ Install the seal washer to the connector bolt.

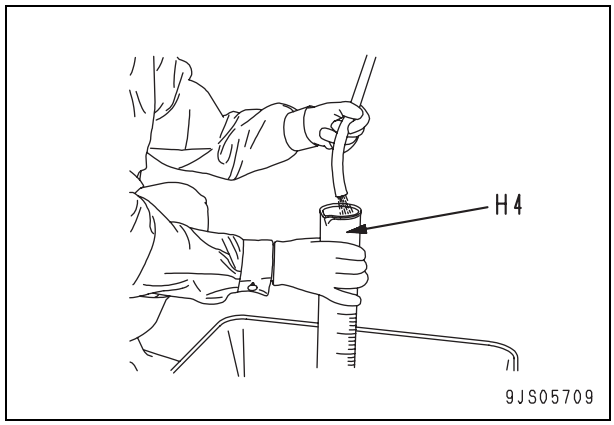


2) Install removed connector bolt (3) and cap nut [1] of tester kit **H1** to the return hose to stop the fuel from flowing out.
3) Install connector **H3** to the common rail and connect test hose [2] of tester kit **H1**.
   ★ Lay the test hose so that it will not slacken and put its end in the oil (receiving) pan.
   ★ The shape in the figure is different from SAA6D107E-1 for WA380-6.



4) Run the engine at low idle and measure the leakage in 1 minute with measuring cylinder **H4**.
   ★ If the leakage from the pressure limiter is in the following range, it is normal.

At low idle	0 cc (No leakage)

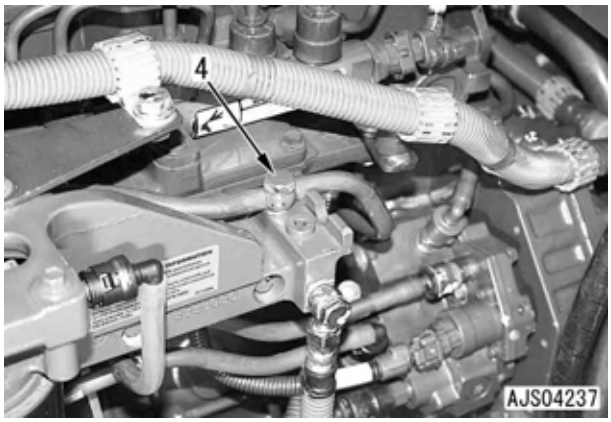


5) After finishing measurement, remove the measuring tools and return the removed parts.
   Joint bolt:
   24 ± 4 Nm {2.4 ± 0.4 kgm}

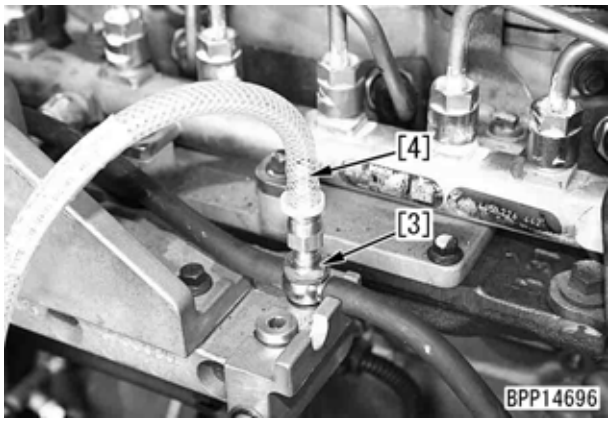
3. Measuring return rate from injector

★ The leakage from the injector is measured while the return hose of the pressure limiter is connected. Accordingly, before measuring the leakage from the injector, check that the leakage from the pressure limiter is normal.

1) Referring to “Measuring return rate from supply pump”, set the supply pump for measurement.
   ⚠ **The fuel returning from the supply pump flows out during measurement of the return rate from the injector. Accordingly, keep the test hose end in the oil (receiving) pan.**
2) Remove connector bolt (4) of the return block.



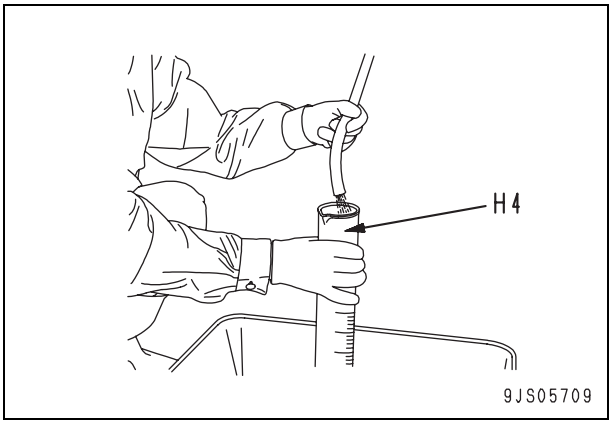
3) Install connector bolt [3] of adapter **H2** instead of the removed connector bolt and connect test hose [4].
   ★ Lay the test hose so that it will not slacken and put its end in the oil (receiving) pan.
   ★ The shape in the figure is different from SAA6D107E-1 for WA380-6.



4) Run the engine at low idle and measure the return rate in 1 minute with measuring cylinder **H4**.
   ★ If the return rate from the injector is in the following range, it is normal.

At low idle	180 cc/min.
During cranking	90 cc/min.

⚠ If the engine cannot be started, you may measure the return rate while rotating the engine with the starting motor. Do not rotate for more than 20 seconds continuously, however, for protection of the starting motor.



5) After finishing measurement, remove the measuring tools and return the removed parts.
   Joint bolt:
   24 ± 4 Nm {2.4 ± 0.4 kgm}

Bleeding air from fuel circuit

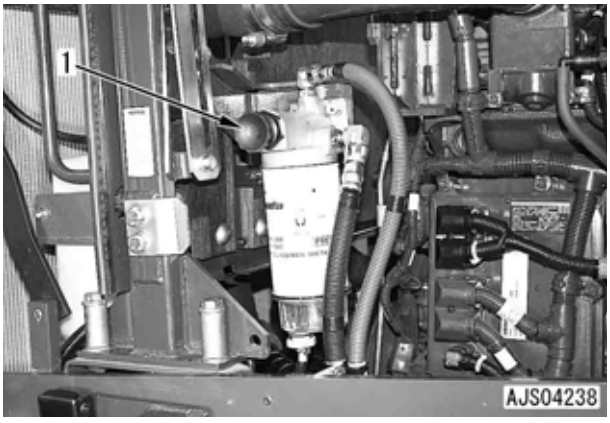
★ If fuel is used up or if a fuel circuit part is removed and installed, bleed air from the fuel circuit according to the following procedure.

⚠ **Stop the machine on a flat ground and lower the work equipment to the ground.**

1. Fill the fuel tank with fuel.
   ★ Add fuel until the float of the sight gauge reaches the maximum position.

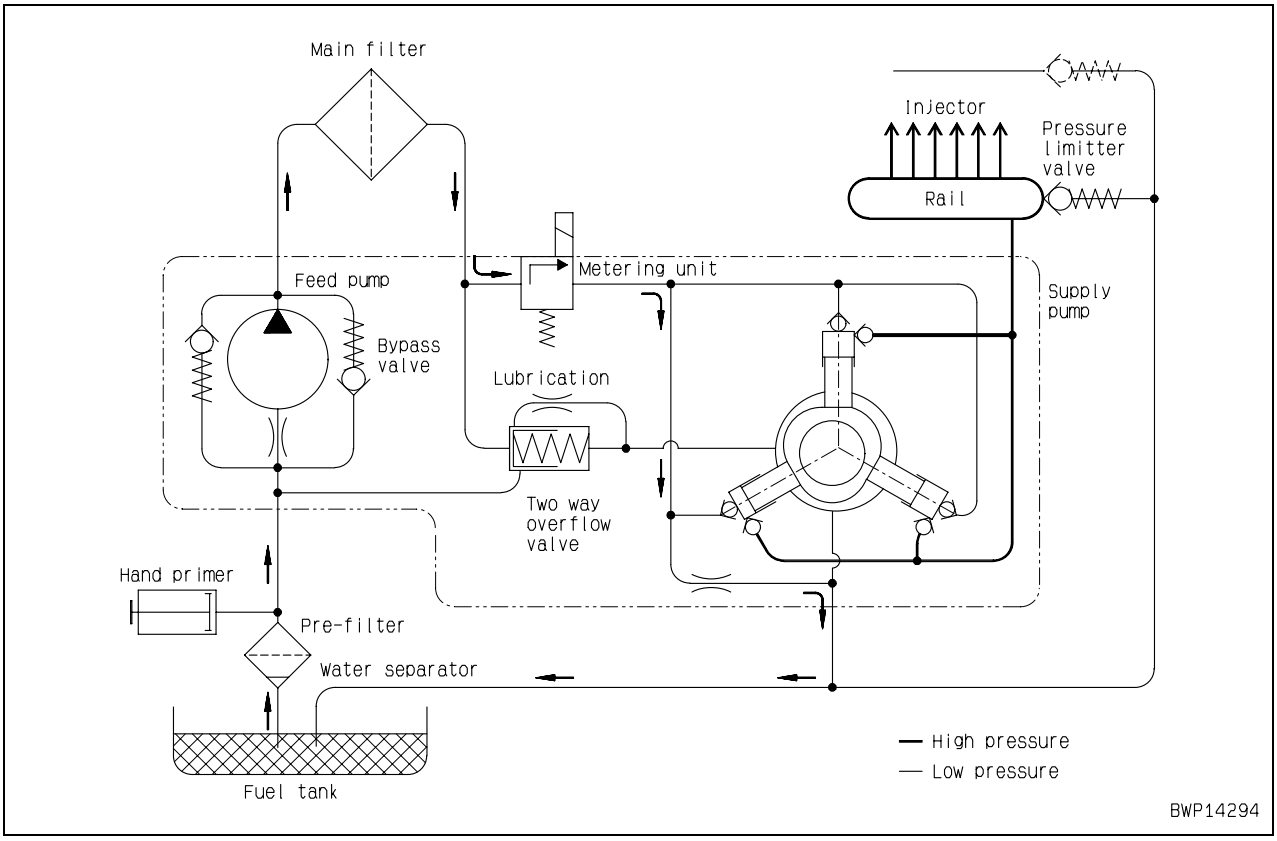
2. Open the side cover of the pump room.

3. Loosen knob (1) of the feed pump and pull it out, and then operate it forward and backward.
   ★ Move the knob until it becomes heavy.
   ★ The plug at the top of the fuel main filter does not need to be removed.



4. After bleeding air, push in and tighten knob (1).

★ Air bleeding route of fuel circuit
Fuel tank → Pre-filter → Feed pump → Main filter → Metering unit → Fuel tank



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 (EMMS)”, “5. Reduced cylinder mode operation function”.

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 (EMMS)”, “6. No-injection cranking function”.

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.

Testing and adjusting air conditioner compressor belt tension

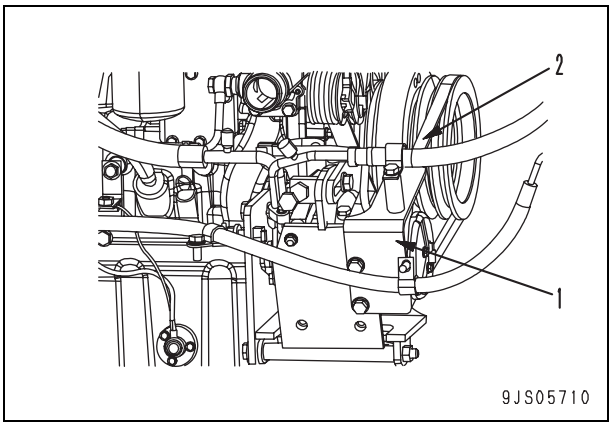
★ Since the alternator belt is equipped with the automatic belt tensioner, its tension usually does not need to be tested or adjusted.

Testing

1. Open the engine left side cover.

2. Remove belt protection cover (1).

3. Press the middle point of air conditioner compressor belt (2) between the air conditioner compressor pulley and crankshaft pulley with a finger and measure the deflection of the belt.
   - Deflection when pressing force is approx. 98 N {approx. 10 kg}: 11 – 15 mm



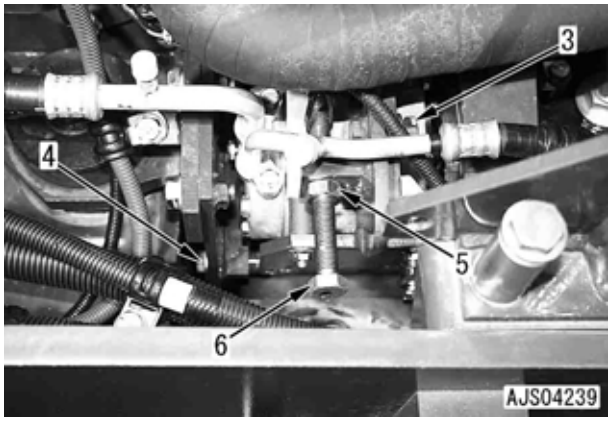
Adjusting

★ If the deflection of the belt is abnormal, adjust it according to the following procedure.

1. Loosen air conditioner compressor mounting bolts (3) and (4).

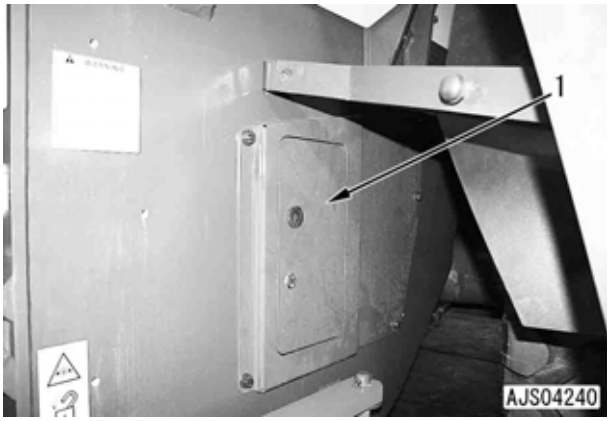
2. Loosen locknut (5) and adjust the air conditioner compressor belt tension by turning adjustment bolt (6).
   ★ Check for breakage of the pulleys, wear of the V-grooves, and contact of the belt and V-grooves.
   ★ If the belt is lengthened to the adjustment limit, cut, or cracked, replace it with new one.

3. After adjusting the tension, tighten locknut (5) and air conditioner compressor mounting bolts (3) and (4).
   ★ If the V-belt is replaced, adjust its tension again after 1 operating hour.



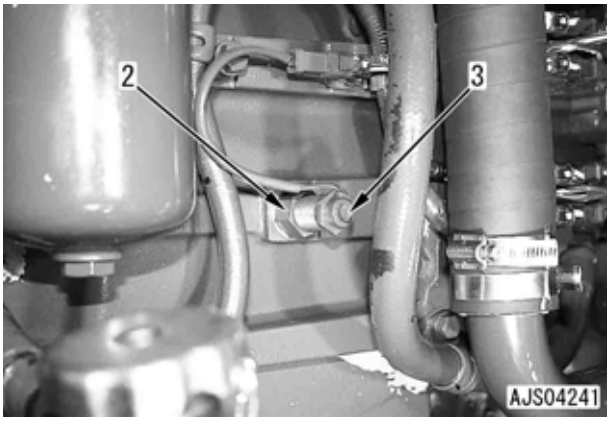
Adjusting transmission speed sensor

1. Open inspection cover (1) on the left side of the rear frame.



2. Loosen locknut (2) and screw in sensor (3) until its tip comes in contact with a tooth tip of gear (4).
   - ★ Before installing the sensor, check that its tip is free from a steel chip, flaw, etc.
   - ★ Apply gasket sealant between the case and threaded part of the sensor.

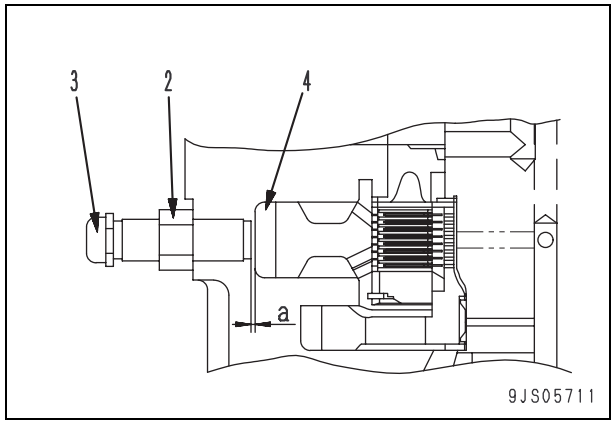
   Threaded part: **Gasket sealant (LG-5)**



3. Return sensor (3) by 1/2 – 1 turn.
   - ★ Adjust clearance (a) between the sensor tip and gear (4) tooth tip to 0.75 –1.5 mm.

4. Fix sensor (3) with locknut (2).

   Nut: **49 – 68.7 Nm {5.0 – 7.0 kgm}**



Measuring directional lever

Measuring instrument

Symbol	Part No.	Part Name
J	79A-264-0021	Push-pull scale

⚠ **Put chocks under the tires securely.**

Operating effort of directional lever

1. Stop the engine.

2. Install tool **J** 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.



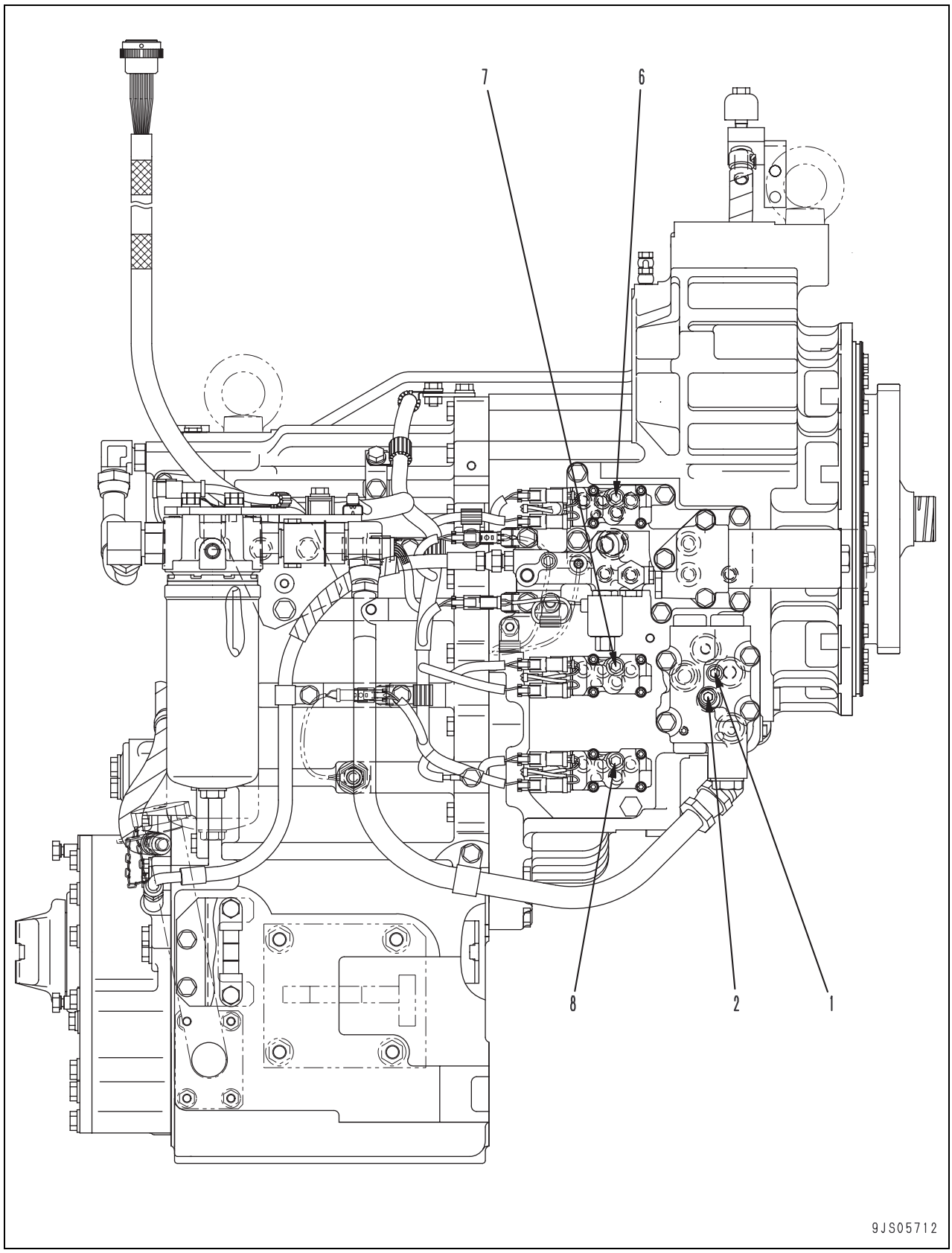
Stroke of directional lever

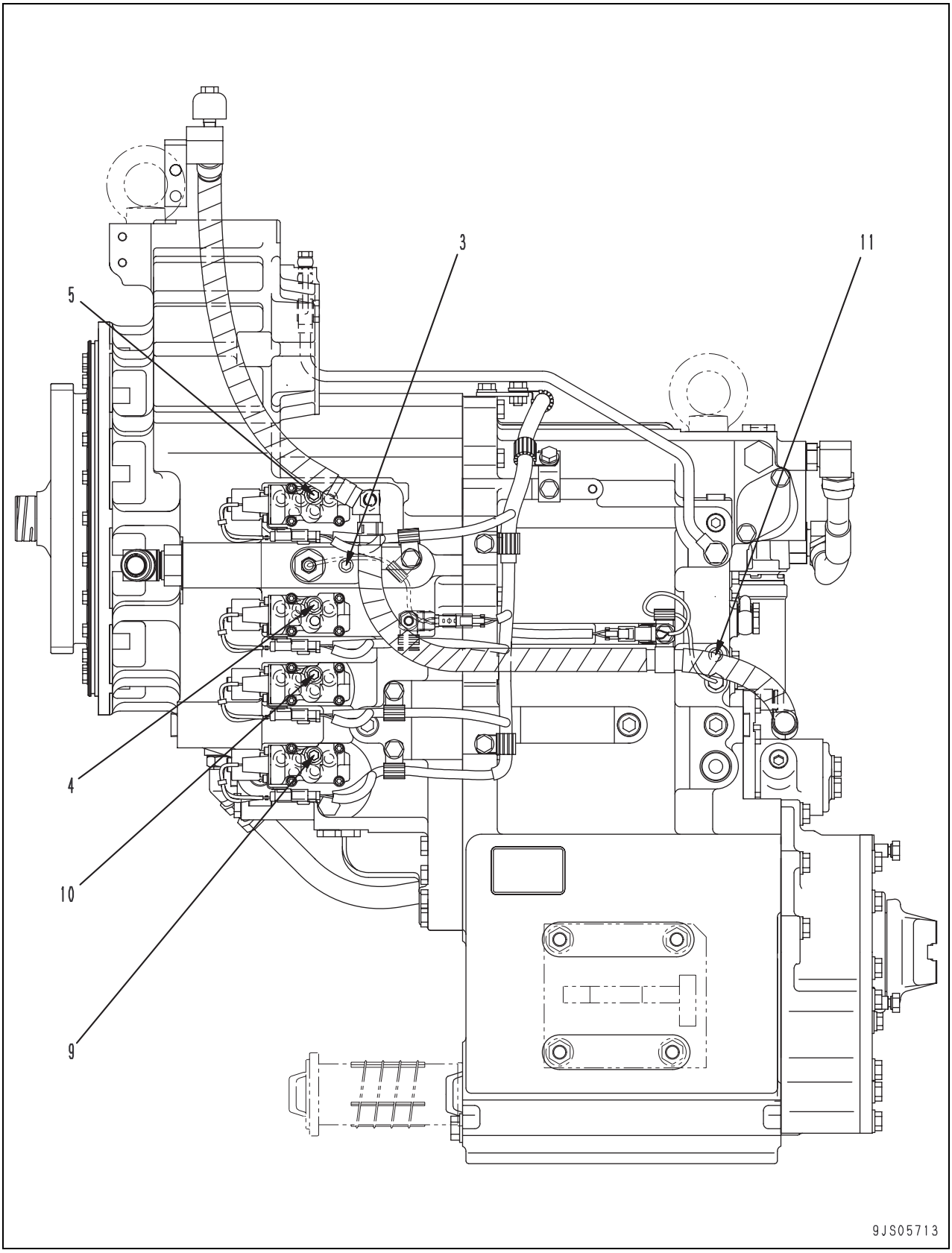
1. Stop the engine.

2. Make mark (a) at the center of the control lever knob. Move the knob in the operating direction and measure its stroke.



Measuring and adjusting power train oil pressure




3
11
5
4
10
9
9JS05713

★ Testing and adjusting instruments for power train oil pressure

Symbol		Part No.	Part Name
K	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

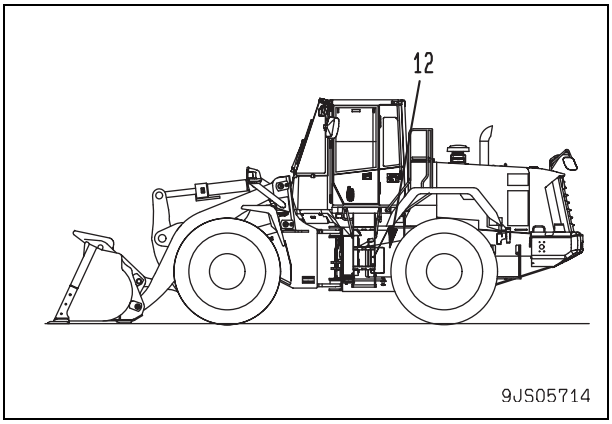
Oil pressure measuring point and measuring gauge

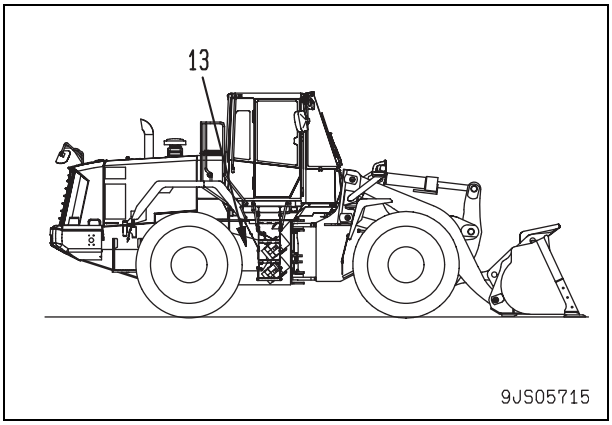
No.	Measured oil pressure	Measuring gauge MPa {kg/cm^2}
1	Main relief pressure	5.9 {60}
2	Torque converter relief pressure	2.5 {25}
3	Torque converter outlet pressure	0.98 {10}
4	Lockup clutch pressure	5.9 {60}
5	Transmission F clutch pressure	5.9 {60}
6	Transmission R clutch pressure	5.9 {60}
7	Transmission 1st clutch pressure	5.9 {60}
8	Transmission 2nd clutch pressure	5.9 {60}
9	Transmission 3rd clutch pressure	5.9 {60}
10	Transmission 4th clutch pressure	5.9 {60}
11	Lubrication pressure	0.98 {10}
12	Parking brake pressure	5.9 {60}

⚠ **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
- Transmission cut off switch: OFF
- Use left brake.

1. Remove rear frame left side cover (12) and right side cover (13).

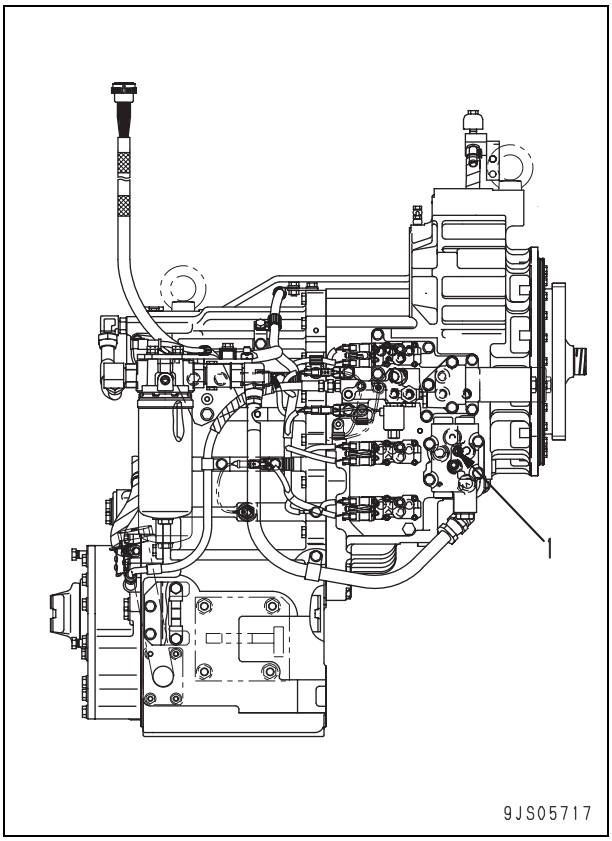




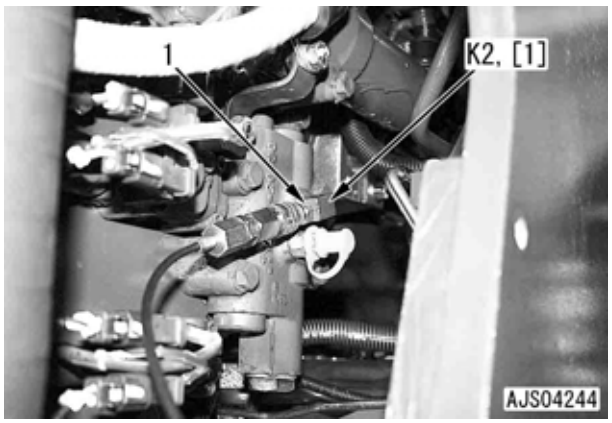
Measurement

1. Measuring transmission main relief pressure

★ Location of transmission main relief pressure pickup nipple (1)



1) Remove transmission main relief pressure pickup nipple (1), install nipple **K2** (10 × 1.25 mm) and elbow [2] of the hydraulic tester, and install nipple (1) again.
2) Connect oil pressure gauge [1] of hydraulic tester **K1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



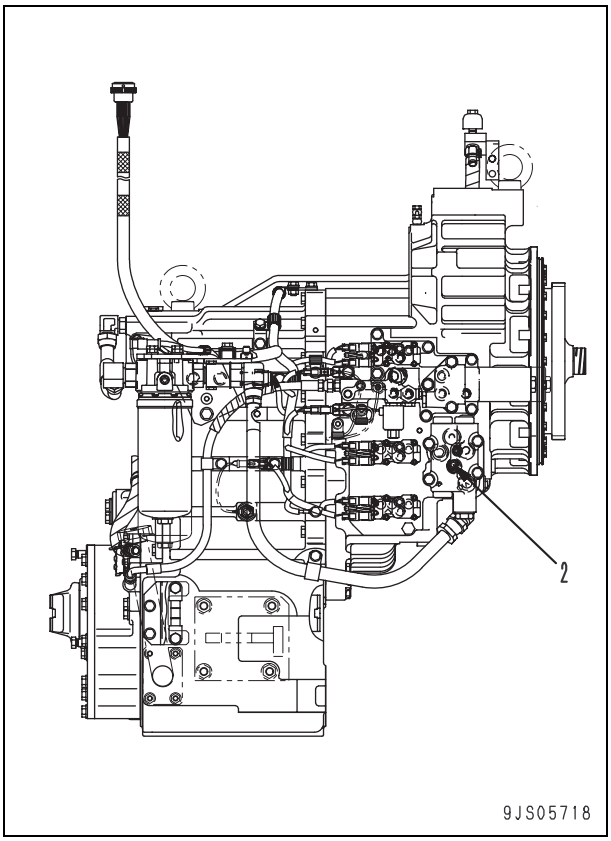
3) Start the engine and keep the directional lever or switch at the N (Neutral) position.
4) While running the engine at low idle and engine speed 2,000 rpm, measure the transmission main relief pressure.



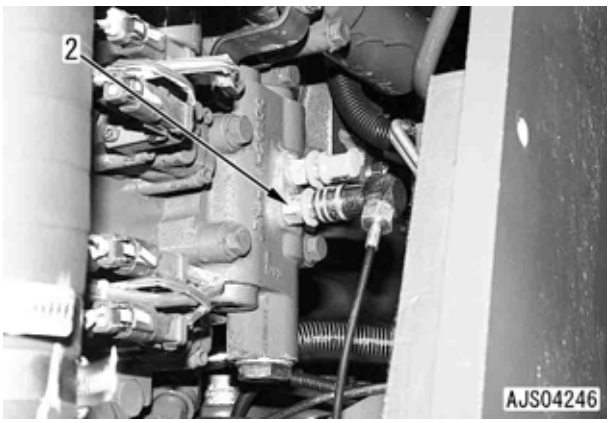
5) After finishing measurement, remove the measuring instruments and return the removed parts.

2. Measuring torque converter relief pressure (inlet pressure)

★ Location of torque converter relief pressure (inlet pressure) pickup nipple (2)



1) Connect oil pressure gauge [1] of hydraulic tester K1 to nipple (2).
   ★ Use the oil pressure gauge of 2.5 MPa {25 kg/cm^2}.



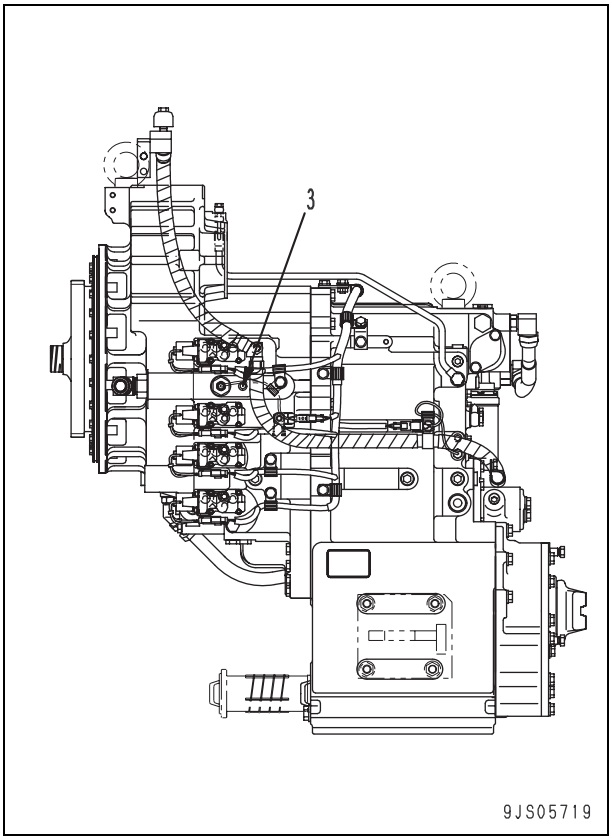
2) Start the engine and keep the directional lever or switch at the N (Neutral) position.
3) While running the engine at engine speed 2,000 rpm, measure torque converter relief pressure (inlet pressure).



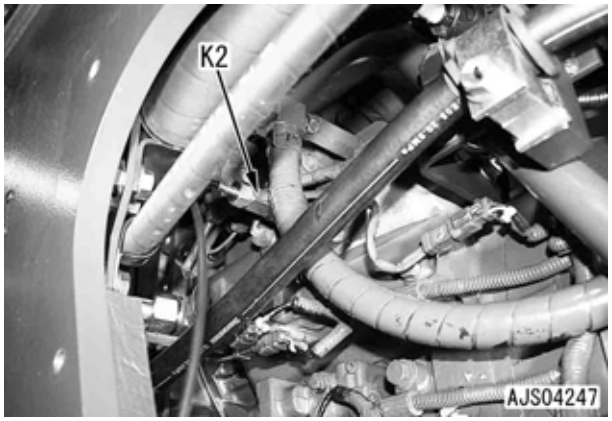
4) After finishing measurement, remove the measuring instruments and return the removed parts.

3. Measuring torque converter outlet pressure

1) Remove torque converter outlet pressure pickup plug (3) (10 × 1.25 mm).



2) Connect nipple **K2** and oil pressure gauge [1] in hydraulic tester **K1**.
   ★ 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 engine speed 2,000 rpm, measure torque converter outlet pressure.

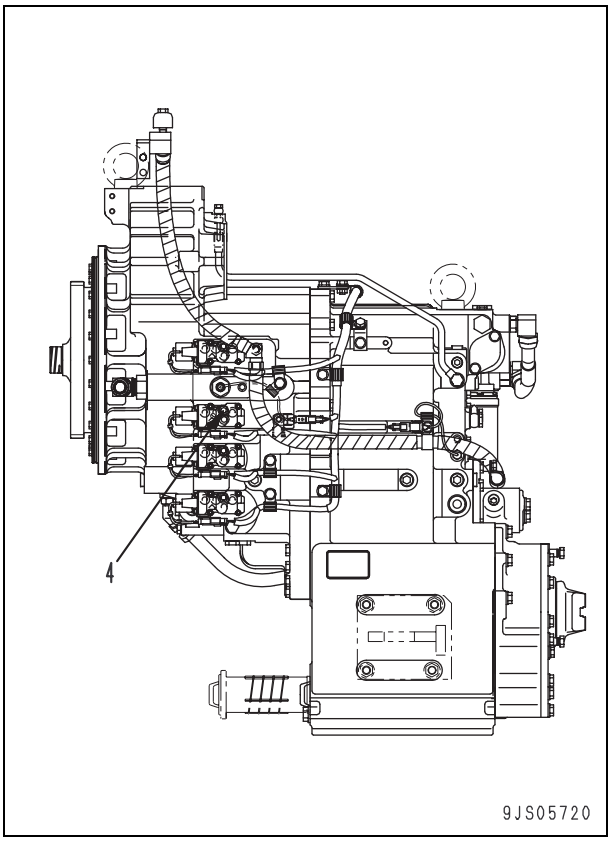


5) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

4. Measuring lockup clutch pressure (Lockup clutch specification)

⚠ 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 (4) (10 × 1.25 mm).



2) Connect nipple **K2** and oil pressure gauge [1] in hydraulic tester **K1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



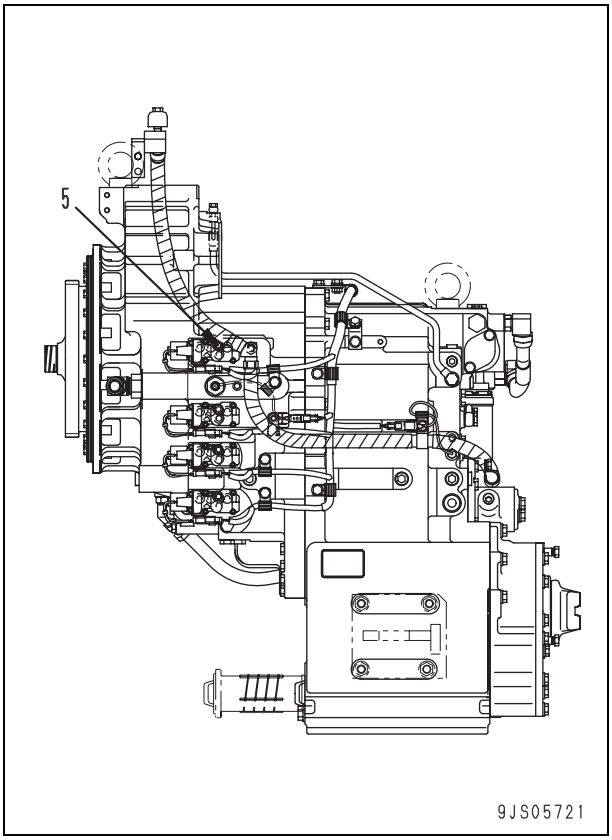
3) Turn the torque converter lockup switch ON.
4) Set the transmission auto shift and manual shift selector switch in the AUTO position.
5) Start the engine and turn the parking brake switch OFF.
6) Set the gear shift lever or gear shift switch to 3rd position.
7) Start traveling while setting the directional 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 engine speed 2,000 rpm.



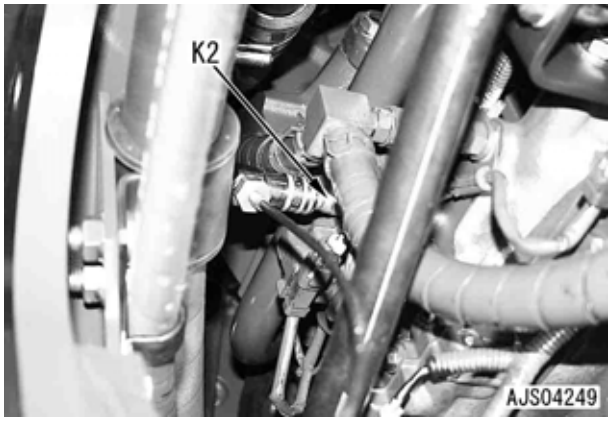
9) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

5. Measuring F (forward) clutch pressure

1) Remove F (forward) clutch pressure pickup plug (5) (10 × 1.25 mm).



2) Connect nipple **K2** and oil pressure gauge [1] in hydraulic tester **K1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



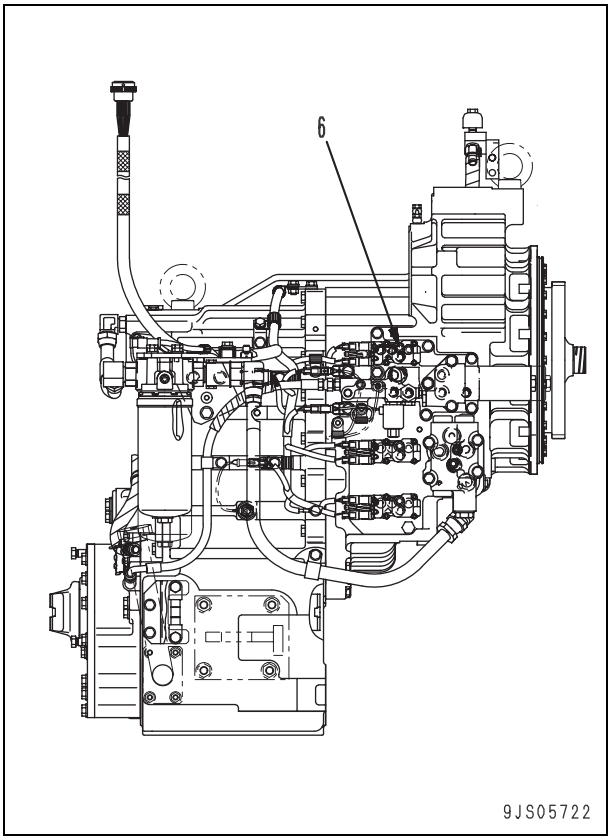
3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever or switch at N (Neutral) position, set the gearshift lever to the 4th position.
7) While pressing the brake pedal, set the directional lever or switch to F (forward).
   ⚠ **Keep pressing the brake pedal securely.**
   ⚠ **Machine will move, especially in lower gears. Before shifting into forward or reverse gear, make sure that no person is standing in front or behind the machine within 8 m.**
8) While running the engine at engine speed 2,000 rpm, measure the F (forward) clutch oil pressure.



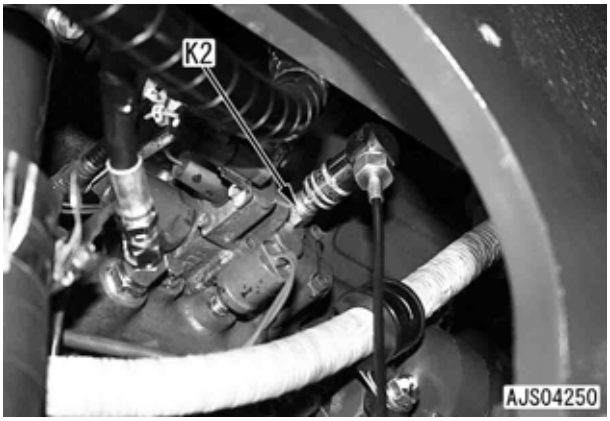
9) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

6. Measuring R (reverse) clutch pressure

1) Remove R (reverse) clutch pressure pickup plug (6) (10 × 1.25 mm).



2) Connect nipple **K2** and oil pressure gauge [1] in hydraulic tester **K1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



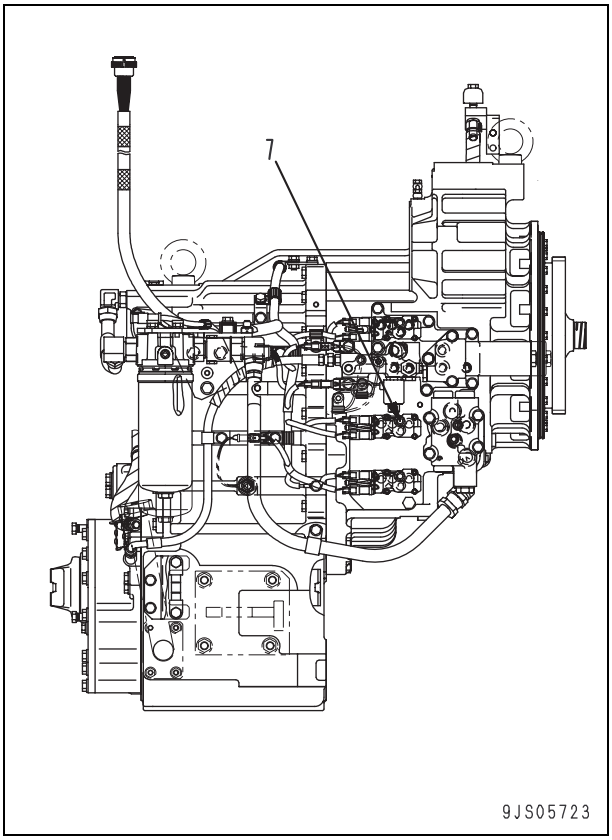
3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever or switch at N (Neutral) position, set the gearshift lever in the 4th position.
7) While pressing the brake pedal, set the directional lever or switch to R (reverse).
   ⚠ **Keep pressing the brake pedal securely.**
   ⚠ **Machine will move, especially in lower gears. Before shifting into forward or reverse gear, make sure that no person is standing in front or behind the machine within 8 m.**
8) While running the engine at engine speed 2,000 rpm, measure the R (reverse) clutch oil pressure.



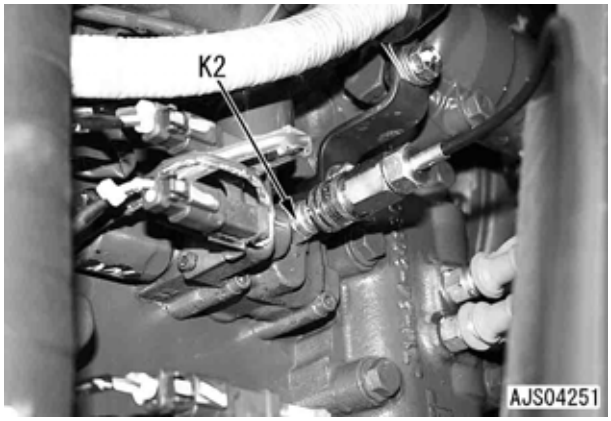
9) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

7. Measuring 1st clutch pressure

1) Remove 1st clutch pressure pickup plug (7) (10 × 1.25 mm).



2) Connect nipple **K2** and oil pressure gauge [1] in hydraulic tester **K1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



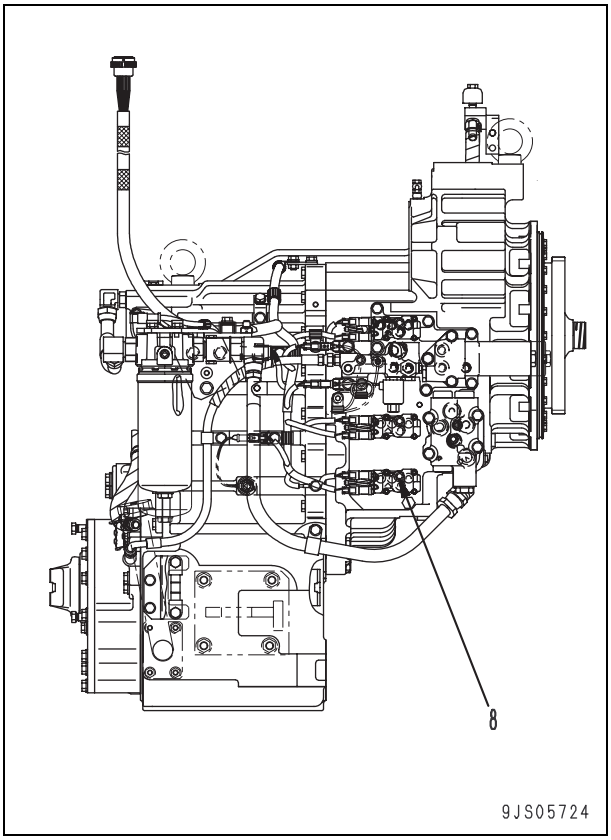
3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever or switch at N (Neutral) position, set the gearshift lever in the 1st position.
7) While pressing the brake pedal with the engine at low idle, set the directional lever or switch to the F (forward) or R (reverse) position once and then return it to N (Neutral) again.
   ⚠ **Keep pressing the brake pedal securely.**
   ⚠ **Machine will move, especially in lower gears. Before shifting into forward or reverse gear, make sure that no person is standing in front or behind the machine within 8 m.**
   ★ If the directional lever or switch is in N (Neutral), the gear speed is not changed even if the gearshift lever is moved. To avoid this, perform the above operation.
8) While running the engine at engine speed 2,000 rpm, measure the 1st clutch oil pressure.



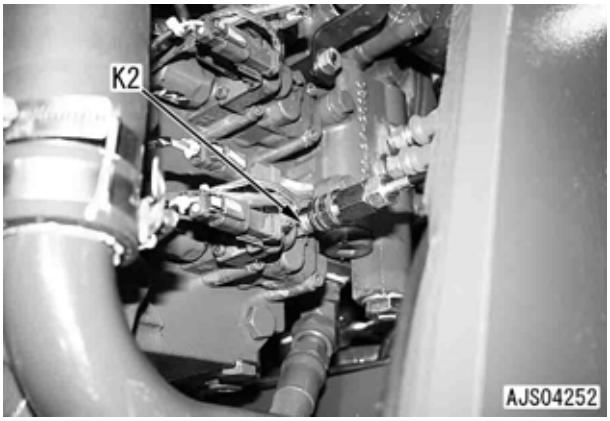
9) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

8. Measuring 2nd clutch pressure

1) Remove 2nd clutch pressure pickup plug (8) (10 × 1.25 mm).



2) Connect nipple **K2** and oil pressure gauge [1] in hydraulic tester **K1**.
   ★ Use the oil pressure gauge with capacity 5.9 MPa {60 kg/cm^2}.



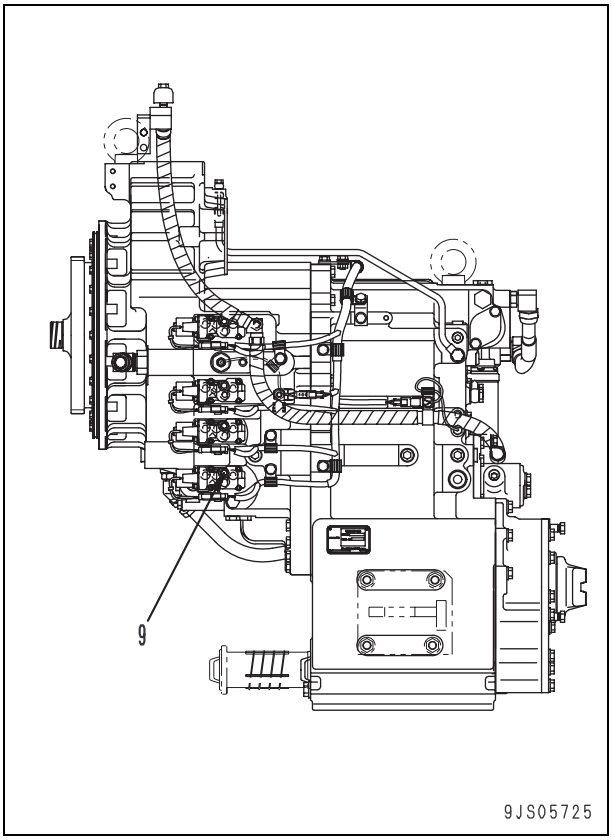
3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever or switch at N (Neutral) position, set the gearshift lever in the 2nd position.
7) While pressing the brake pedal with the engine at low idle, set the directional lever or switch to the F (forward) or R (reverse) position once and then return it to N (Neutral) again.
   ⚠ **Keep pressing the brake pedal securely.**
   ⚠ **Machine will move, especially in lower gears. Before shifting into forward or reverse gear, make sure that no person is standing in front or behind the machine within 8 m.**
   ★ If the directional lever or switch is in N (Neutral), the gear speed is not changed even if the gearshift lever is moved. To avoid this, perform the above operation.
8) While running the engine at engine speed 2,000 rpm, measure the 2nd clutch oil pressure.



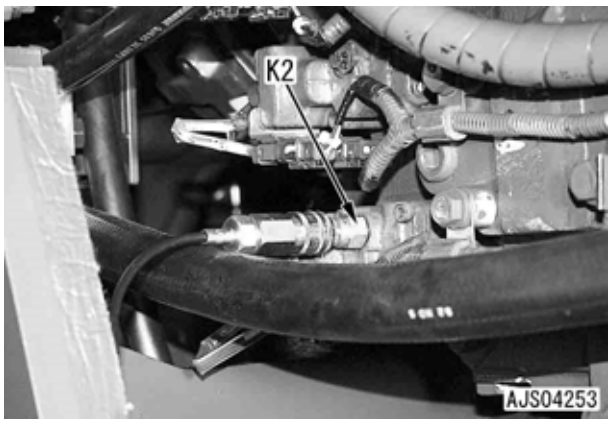
9) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

9. Measuring 3rd clutch pressure

1) Remove 3rd clutch pressure pickup plug (9) (10 × 1.25 mm).



2) Connect nipple **K2** and oil pressure gauge [1] in hydraulic tester **K1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



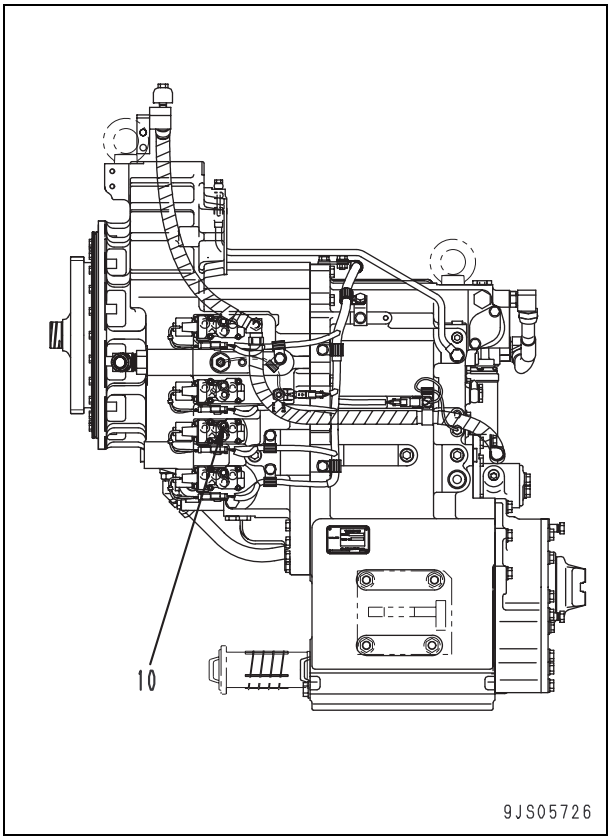
3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever or switch at N (Neutral) position, set the gearshift lever in the 3rd position.
7) While pressing the brake pedal with the engine at low idle, set the directional lever or switch to the F (forward) or R (reverse) position once and then return it to N (Neutral) again.
   ⚠ **Keep pressing the brake pedal securely.**
   ⚠ **Machine will move, especially in lower gears. Before shifting into forward or reverse gear, make sure that no person is standing in front or behind the machine within 8 m.**
   ★ If the directional lever or switch is in N (Neutral), the gear speed is not changed even if the gearshift lever is moved. To avoid this, perform the above operation.
8) While running the engine at engine speed 2,000 rpm, measure the 3rd clutch oil pressure.



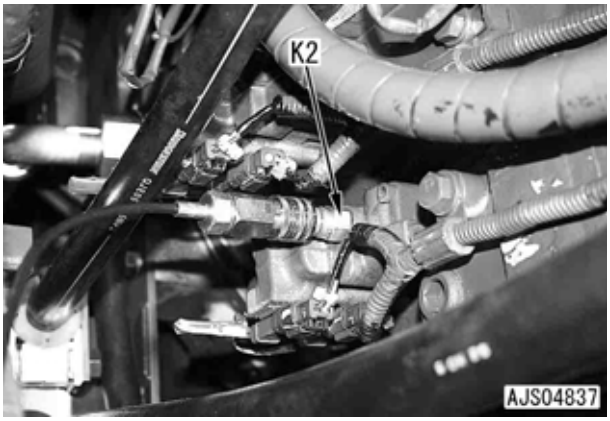
9) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

10. Measuring 4th clutch pressure

1) Remove 4th clutch pressure pickup plug (10) (10 × 1.25 mm).



2) Connect nipple **K2** and oil pressure gauge [1] in hydraulic tester **K1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



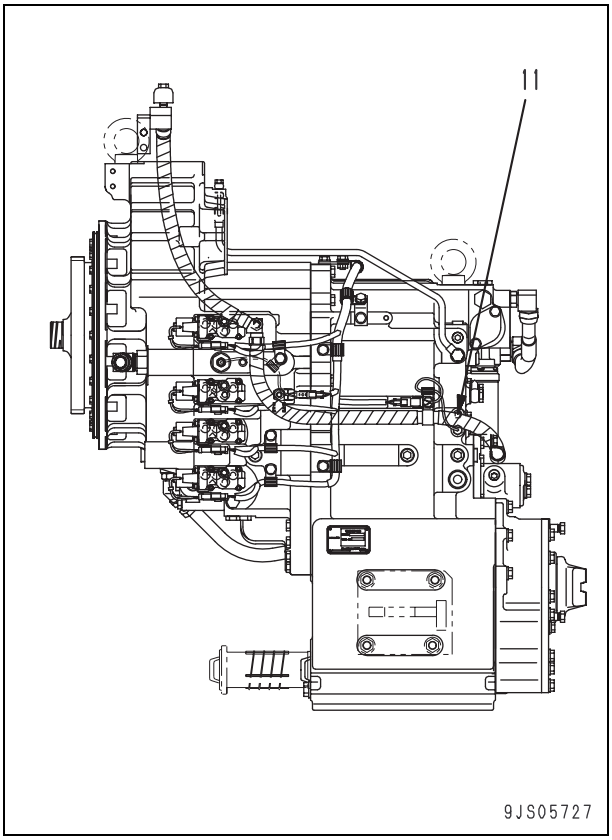
3) Set the transmission auto shift and manual shift selector switch in the MANUAL position.
4) Press the brake pedal.
5) Start the engine and turn the parking brake switch OFF.
6) While keeping the directional lever or switch at N (Neutral) position, set the gearshift lever in the 4th position.
7) While pressing the brake pedal with the engine at low idle, set the directional lever or switch to the F (forward) or R (reverse) position once and then return it to N (Neutral) again.
   ⚠ **Keep pressing the brake pedal securely.**
   ⚠ **Machine will move, especially in lower gears. Before shifting into forward or reverse gear, make sure that no person is standing in front or behind the machine within 8 m.**
   ★ If the directional lever or switch is in N (Neutral), the gear speed is not changed even if the gearshift lever is moved. To avoid this, perform the above operation.
8) While running the engine at engine speed 2,000 rpm, measure the 4th clutch oil pressure.



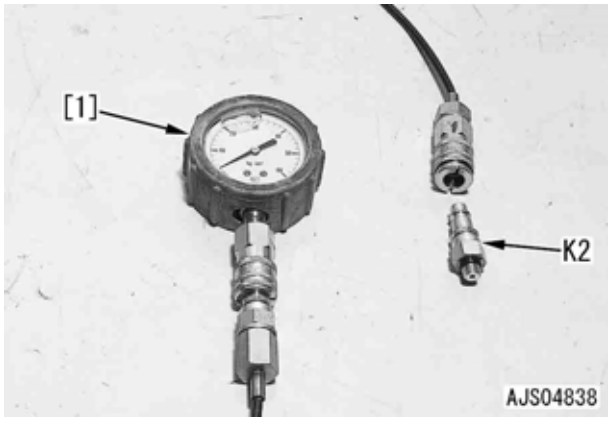
9) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

11. Measuring lubrication pressure

1) Remove lubrication pressure pickup plug (11) (10 × 1.25 mm).



2) Connect nipple **K2** and oil pressure gauge [1] in hydraulic tester **K1**.
   ★ 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) Measure the lubricating oil pressure while the engine is running at engine speed 2,000 rpm.



5) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

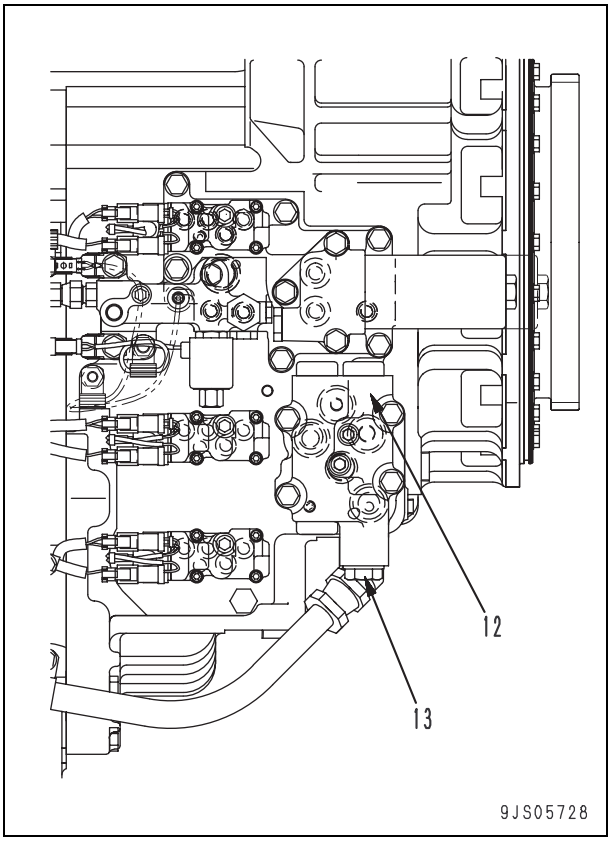
Adjustment

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 (13) from transmission and torque converter relief valve (12).

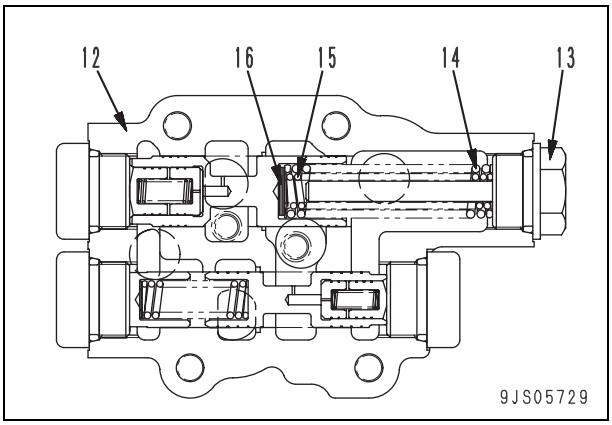


2) Remove inner spring (14) and outer spring (15).

3) Adjust the torque converter relief pressure by changing the number of shims (16).

★ Standard shim thickness:
2.5 mm (0.5 × 5 piece)

★ Quantity of adjustment per shim:
0.04 MPa {0.4 kg/cm^2}

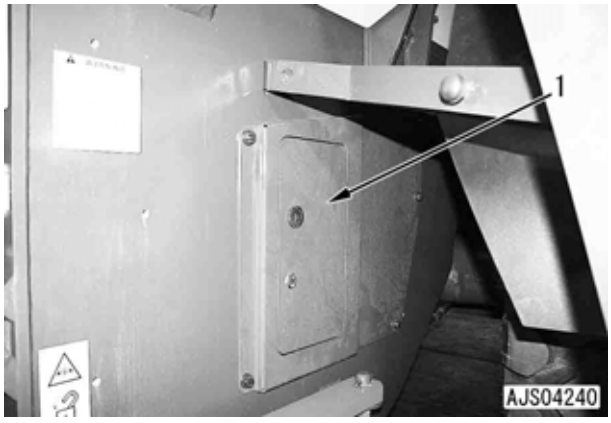


Procedure for flushing torque converter and transmission hydraulic circuit

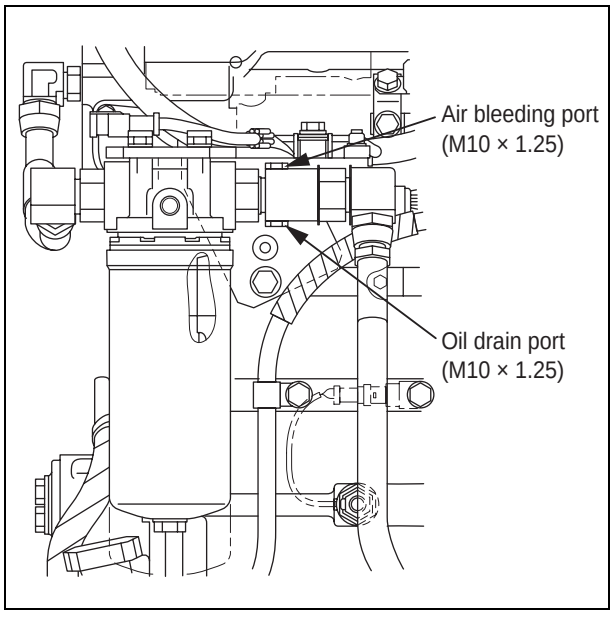
★ Metal chips and dirt in the torque converter and transmission hydraulic circuit shorten the lives of the torque converter and transmission and can cause internal breakage. Accordingly, flush the hydraulic circuit to remove the metal chips and dirt.

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 a new filter cartridge.
   1) Open inspection cover (1) on the left side of the rear frame.



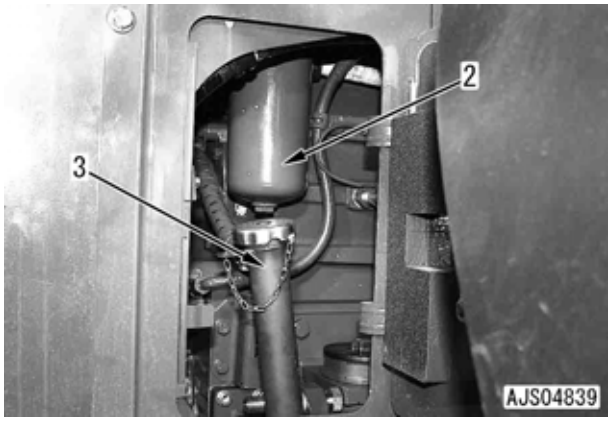
   2) Drain the oil from the filter piping.



   3) Remove transmission oil filter cartridge (2) and install cartridge (714-07-28712).

3. Fill the transmission case with oil.
   - Add oil through oil filler (3) to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

     Transmission case: **38 ℓ (Refill capacity)**

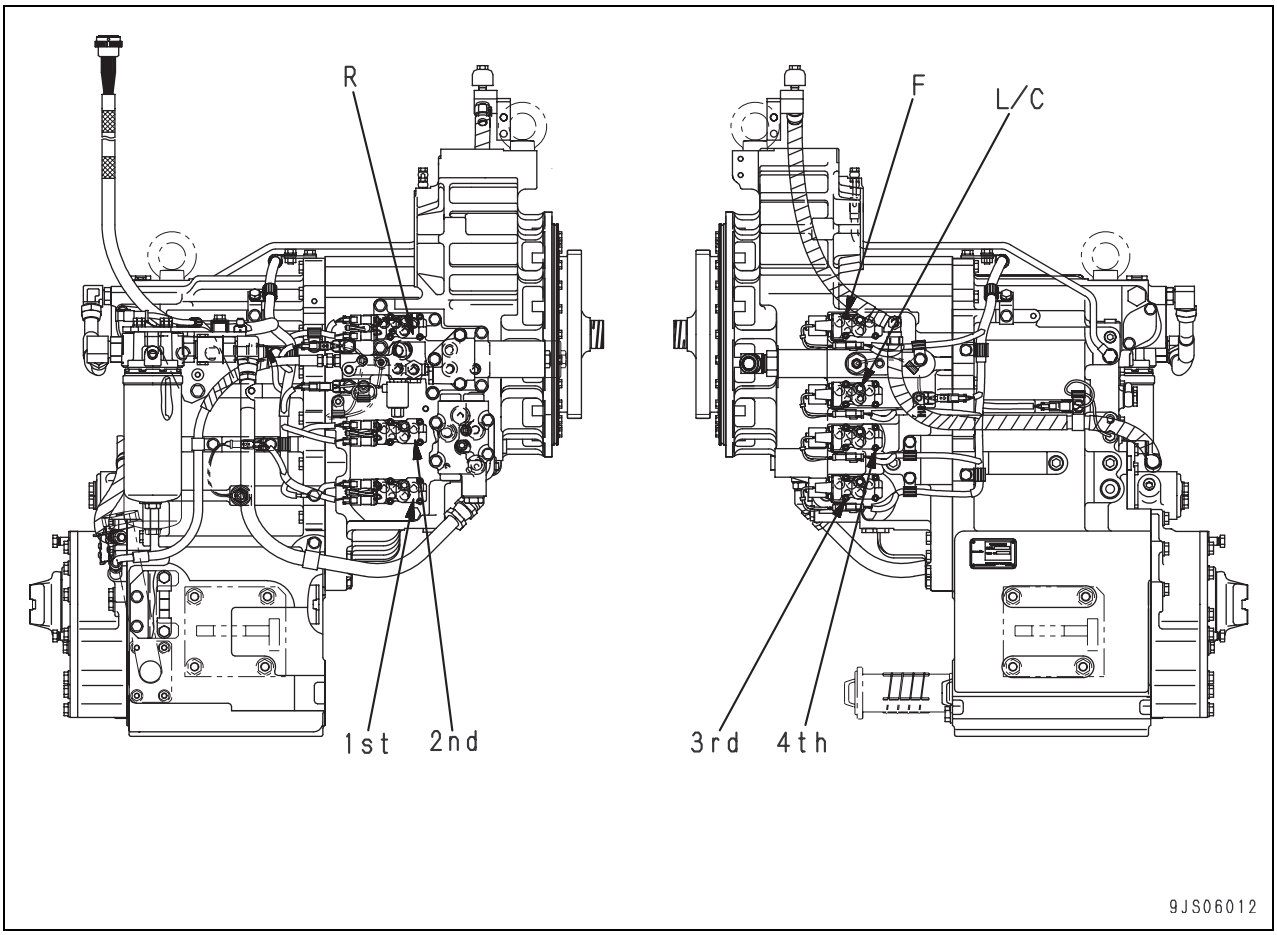


4. Flush the hydraulic circuit according to the following procedure.
   1) Start the engine and run it at low idle without operating the gearshift lever or directional lever for about 20 minutes.
      ★ Increase the engine speed to about 1,500 rpm sometimes.
      ★ If the engine coolant temperature gauge does not rise to the operating range because of low ambient 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).
   3) Run the engine at low idle for about 20 minutes, similarly to 4-1).

5. Replace the filter cartridge.
   1) Replace cartridge (1) used for flushing with new cartridge (714-07-28712), similarly to 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.**
   2) Add oil and check the oil level again.

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
L	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 **L**.

⚠ **Installation of plugs L 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.**

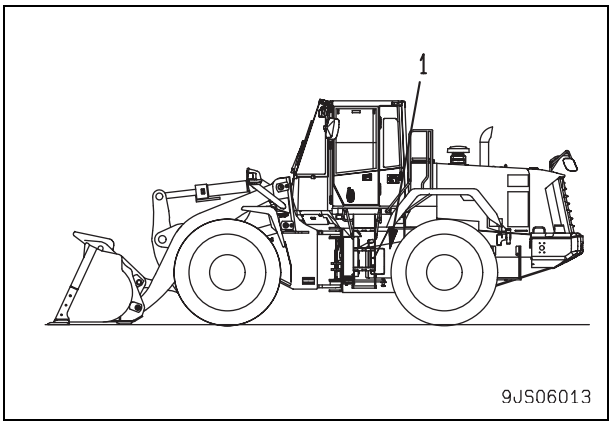
⚠ **When moving the machine by this method, observe the procedure and take care of safety.**

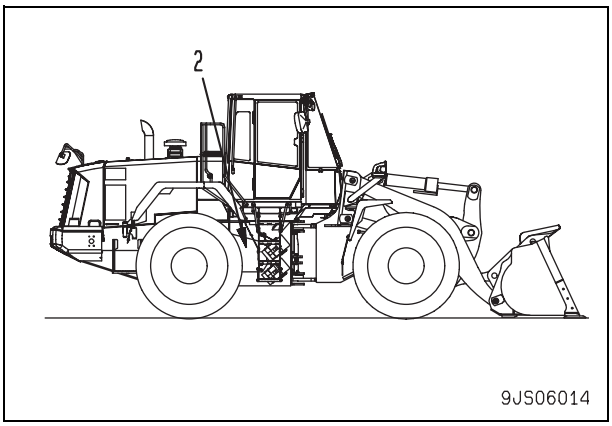
⚠ **Lower the work equipment to the ground fully, apply the parking brake, and put chocks under the tires to prevent the machine from moving.**

⚠ **When working, stop the engine.**

⚠ **When working while the oil temperature is still high, take care not to burn your body.**

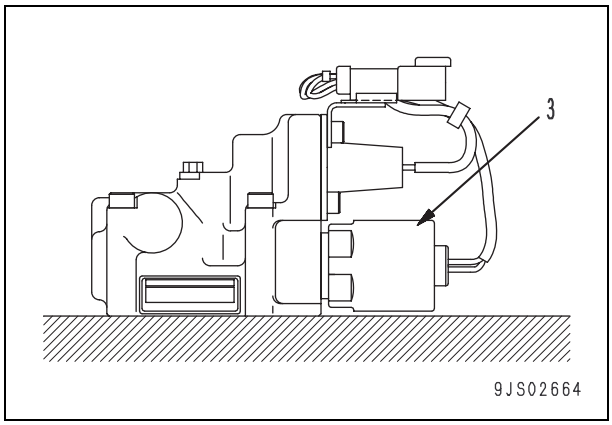
1. Remove right side cover (1) and left side cover (2) from the rear frame.
   ★ Remove mud and dirt from around the ECMV.

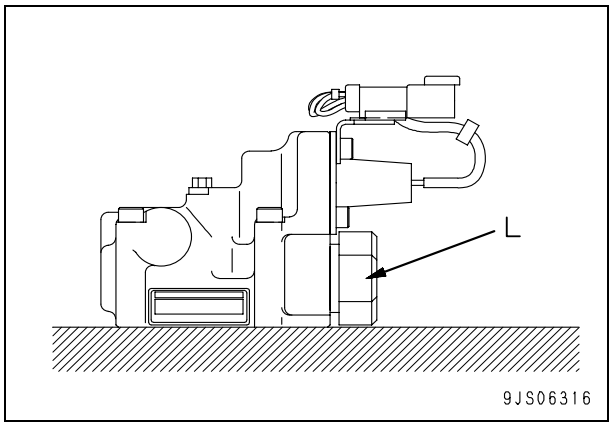




2. Disconnect the 2nd ECMV connector and F or R ECMV connector from each ECMV.
   - F ECMV (Forward) connector: F. SW and F. PS
   - R ECMV (Reverse) connector: R. SW and R. PS
   - 2nd ECMV (2nd) connector: 2. SW and 2. PS
   ★ Select F ECMV or R ECMV according to the moving direction of the machine (forward or reverse).

3. Remove 2 ECMV solenoids (3) from the 2nd ECMV and F or R ECMV and install plugs **L**.
   - 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 **L** 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.





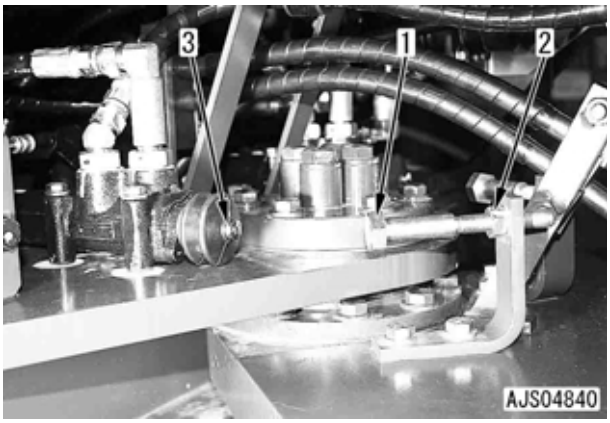
4. Press the brake pedal securely.

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.**

Testing and adjusting steering stop valve

Testing

1. Straighten the front frame and rear frame.
2. Make sure locknut (2) of stopper bolt (1) is not loosened.

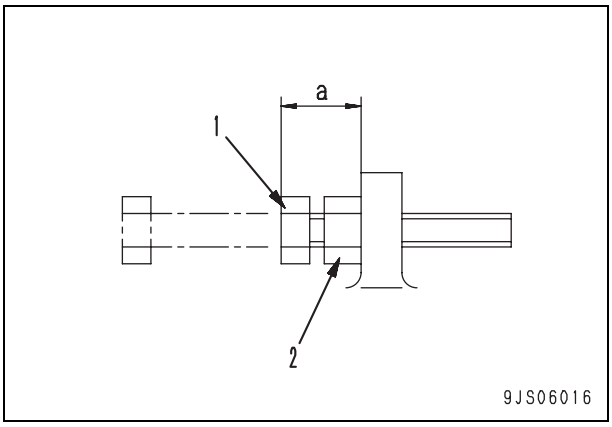


3. Start the engine and turn the steering wheel to the right and left. Make sure that a clearance is maintained between the front frame stopper and rear frame stopper when above operation is executed.
   - ⚠ **Stop the engine before measuring the clearance.**
   - ★ If the checkup is not available because of missing frame stopper and the like, do necessary repair and then make sure clearance is provided on both sides.

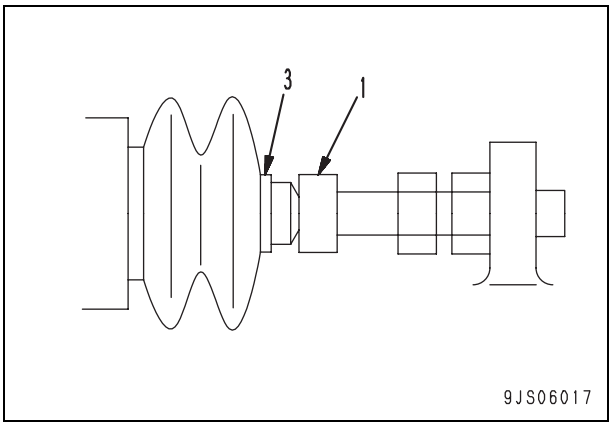
Adjusting

- ★ When the clearance between the front and rear frames is out of the specified range, adjust it according to the following procedure.

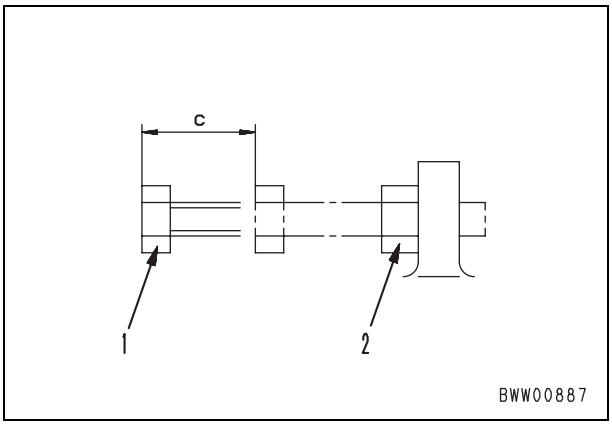
1. Loosen locknut (2) and tighten stopper bolt (1) to minimize distance (a) so that it will not touch the end of steering stop valve (3) when the machine is steered.



2. Run the engine at low idle and then bring front frame and rear frame 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 loosen stopper bolt (1) until it touches the end of steering stop valve (3).
4. Run the engine at low idle and return the steering wheel gradually at least 10°.



5. Loosen stopper bolt (1) by 8.5 turns (Distance c: Approx. 15 mm) and fix it with locknut (2).
   ★ Adjust the right and left sides by steps 1 – 5 above.



6. Start the engine, turn the steering wheel, and check that there is a clearance between front frame (4) and rear frame (5) when steering stop valve (3) touches stopper bolt (1) and the steering wheel is stopped.

Testing and adjusting steering wheel

★ Testing and adjusting device for steering wheel

Symbol	Part No.	Part name
M	79A-264-0021	Push-pull scale

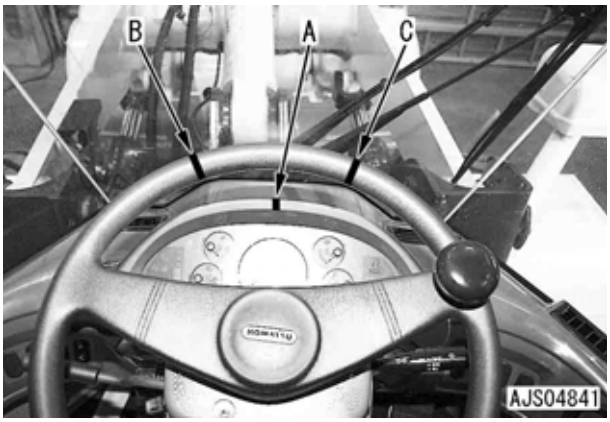
Measuring play of steering wheel

★ Measure the play of the steering wheel under the following condition.
- Engine: Stopped
- Position of machine: Straight travel condition

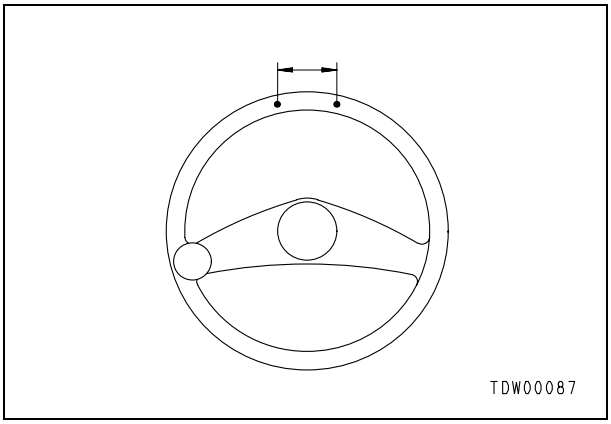
Measuring method

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 **M** to the steering wheel knob.
   ★ Install push-pull scale **M** to the center.

2. Start the engine.
   ★ After starting the engine, raise the bucket about 400 mm and release the safety lever.

3. Pull push-pull scale **M** 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 safety 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

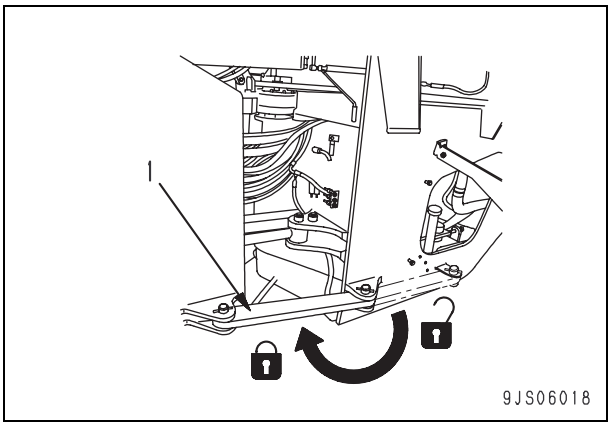
Symbol		Part No.	Part Name
N	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25 mm)
		07002-11023	O-ring
	3	799-401-2701	Differential pressure gauge
	4	799-401-3200	Adapter (Size 03)

★ Measure the steering oil pressure under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range

Measuring

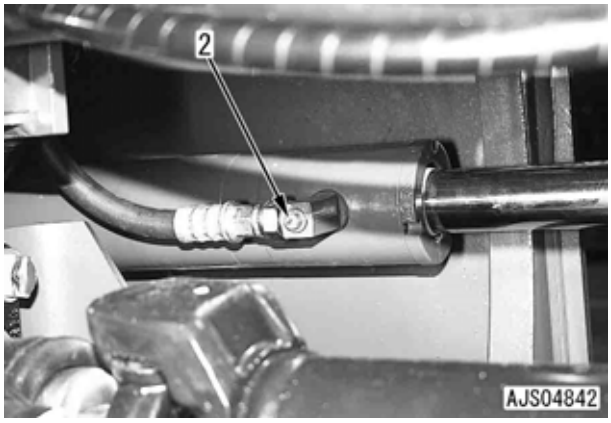
⚠ **Loosen the oil filler cap of the hydraulic tank to release the internal pressure of the hydraulic tank, then operate the steering wheel 2 – 3 times to release the residual pressure from the piping.**

⚠ **Apply frame lock lever (1).**

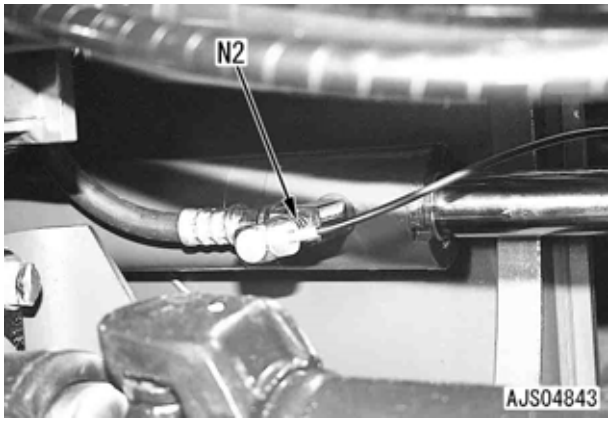


1. Steering relief pressure

1) Remove steering circuit oil pressure pickup plug (2) (10 × 1.25 mm) on the right steering cylinder head side.



2) Connect nipple **N2** and oil pressure gauge [1] of hydraulic tester **N1**.
★ Use the oil pressure gauge of 39.2 MPa {400 kg/cm^2}.



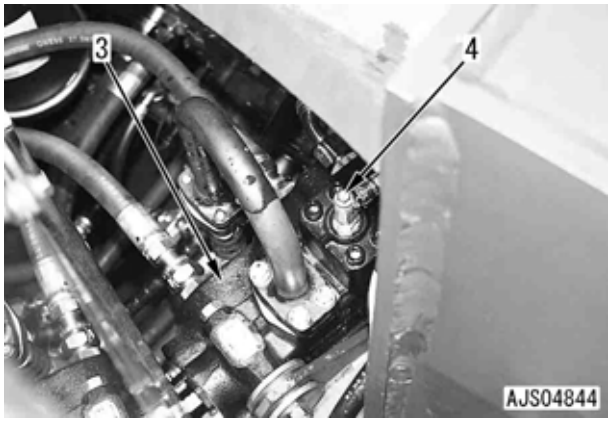
3) Run the engine at high idle and turn the steering wheel to the right. When the steering relief valve operates, measure the oil pressure.
   ★ When the gauge was connected to steering circuit pickup plug at the head of the left side steering cylinder, measure the pressure by turning the steering wheel to the left.



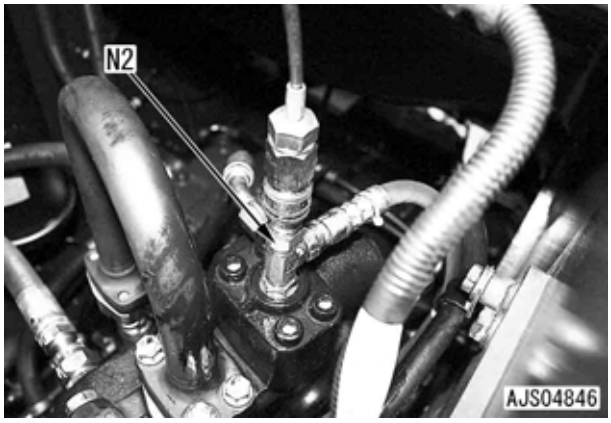
4) After finishing measurement, remove the measuring instruments and return the removed parts.

2. Steering pilot circuit pressure

1) Remove steering control circuit pressure pickup plug (10 × 1.25 mm) (4) of steering valve assembly (3) through the clearance between the front side of the operator's cab and front frame.



2) Connect nipple **N2** (10 × 1.25 mm) and oil pressure gauge [1] of hydraulic tester **N1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



3) Run the engine at low idle, keep the steering wheel in neutral, and measure the oil pressure.



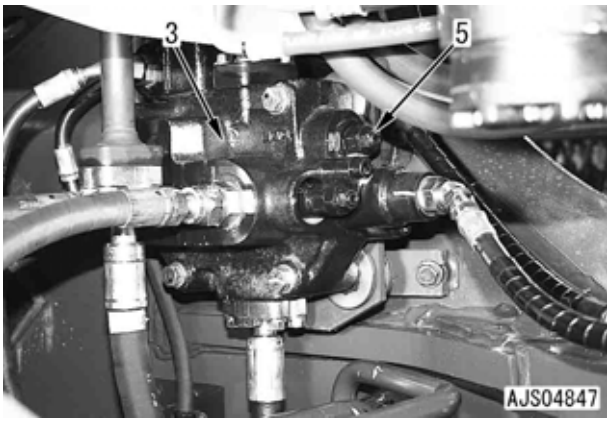
4) After finishing measurement, remove the measuring instruments and return the removed parts.

Adjusting

⚠ When adjusting the oil pressure, be sure to stop the engine.

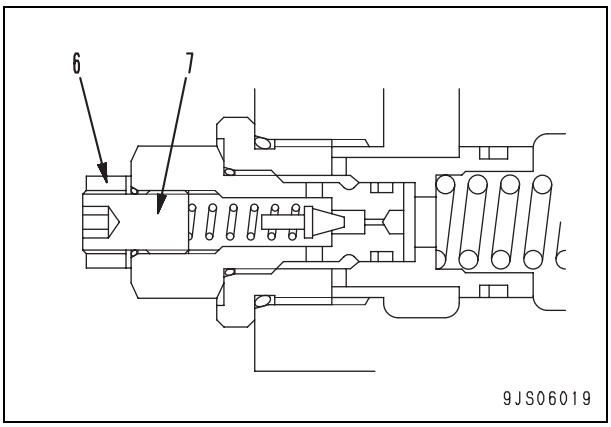
1. Steering relief pressure

1) If the steering relief pressure is abnormal, adjust steering relief valve (5) of steering valve assembly (3) according to the following procedure.



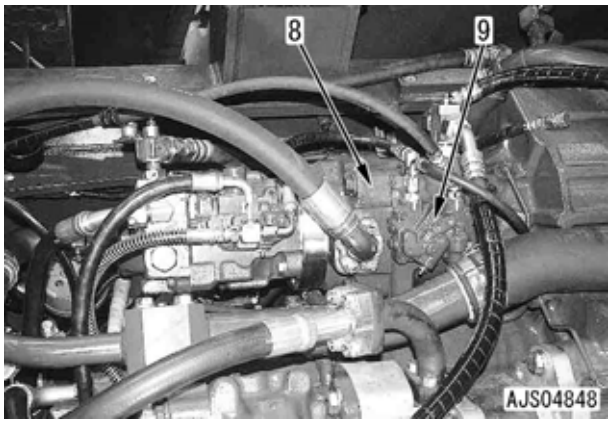
2) Loosen locknut (6) and turn adjustment screw (7) to adjust the pressure.
   - ★ Adjustment screw:
     - Turned to the right, the pressure rises.
     - Turned to the left, the pressure lowers.
   - ★ Quantity of adjustment per turn of adjustment screw:
     Per turn:
     17.8 MPa {181.5 kg/cm^2}

   Locknut:
   27 – 31 Nm {2.8 – 3.2 kgm}



2. Adjusting steering control circuit pressure

1) Remove the front frame assembly. For details, see Disassembly and assembly, “Removal and installation of floor frame assembly”.
2) Remove servo assembly (9) from steering pump assembly (8) and install new one.

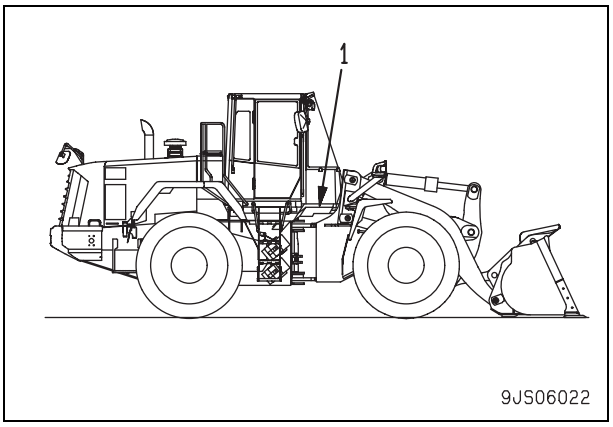


Bleeding air from steering circuit

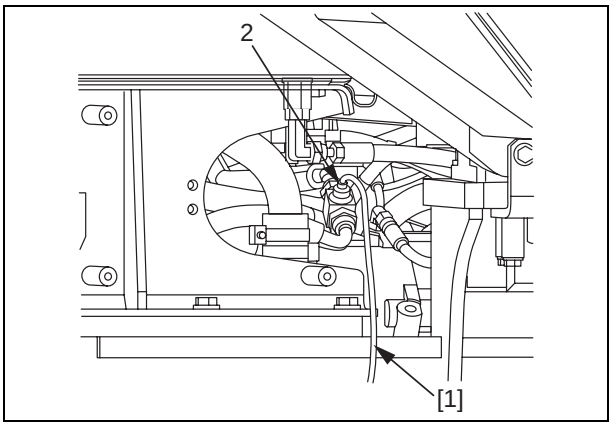
★ Before starting the operation, make sure the specified level of hydraulic oil is provided.
★ If the steering valve or the steering cylinder was removed and installed, bleed air from the steering circuit according to the following procedure.

1. Bleeding air from steering pump

1) Remove cover (1) under the right of the operator's cab.



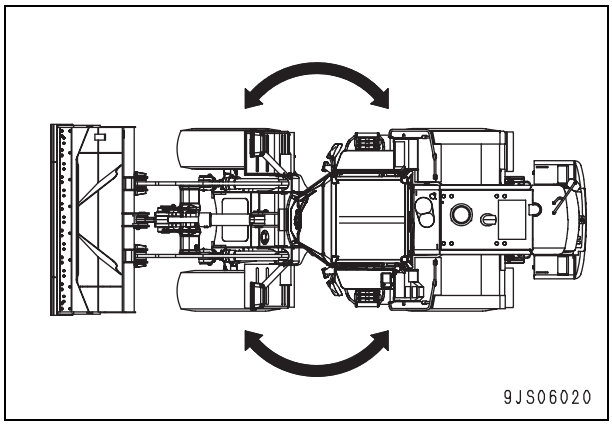
2) While the engine is stopped, loosen air bleeder (2) of the fan pump and connect air bleeder hose [1].



3) As oil free from air started to flow out of air bleeder (2), tighten air bleeder (2).
   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 steering cylinder circuit.

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.



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

30 Testing and adjusting

Testing and adjusting, Part 2

Testing and adjusting, Part 2 3
Testing hydraulic drive fan 3
Bleeding air from hydraulic drive fan circuit 5
Measuring brake pedal 7
Measuring brake performance 8
Testing and adjusting accumulator charge pressure 9
Testing wheel brake oil pressure 10
Measuring wear of wheel brake disc 12
Bleeding air from wheel brake circuit 13
Releasing residual pressure in brake accumulator circuit 14
Testing parking brake performance 15
Measuring parking brake oil pressure 16
Testing wear of parking brake disc 18
Method of releasing parking brake manually 19
Measuring and adjusting work equipment control lever 20
Measuring and adjusting work equipment PPC oil pressure 21

Measuring and adjusting work equipment oil pressure 24
Bleeding air from work equipment circuit 28
Releasing residual pressure in work equipment circuit 29
Testing and adjusting bucket positioner 30
Testing and adjusting boom kick-out 32
Checking proximity switch operation pilot lamp..... 33
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Preparation work for troubleshooting for electric system 35
How to start operation of KOMTRAX terminal..... 40
Lamp display of KOMTRAX terminal..... 45
Adjusting machine monitor..... 48
Adjusting replaced, reassembled or added sensor, controller, etc. with machine monitor..... 49

Testing and adjusting, Part 2

Testing hydraulic drive fan

★ Testing tools for hydraulic drive fan

Symbol		Part No.	Part Name
P	1	799-205-1100	Tachometer kit
	2	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester

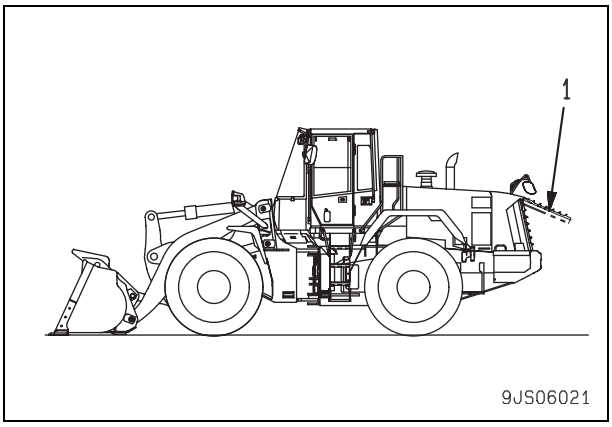
⚠ **Set the bucket bottom horizontally and lower it to the ground, and then put chocks under the tires.**

⚠ **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.**

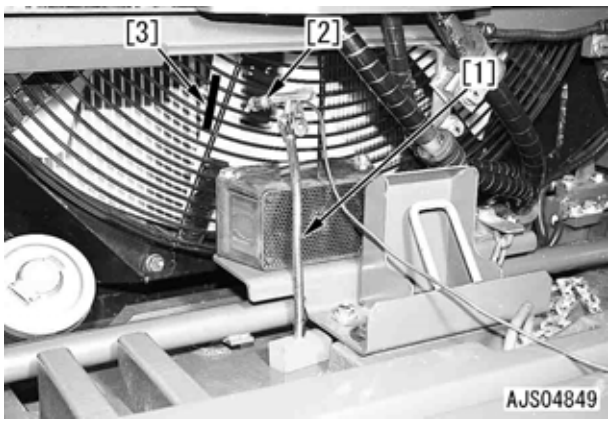
★ Measurement condition
- Engine coolant temperature: Min. 95°C
- Hydraulic oil temperature: Min. 95°C
- Torque converter oil temperature: Min. 105°C

1. Measuring fan speed

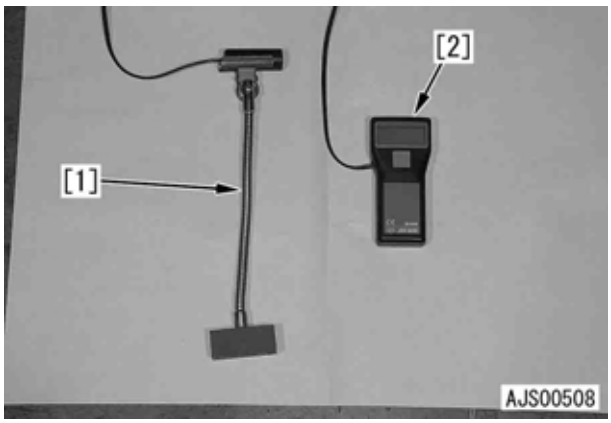
1) Open radiator grille (1).



2) Set probe [2] to stand [1] of tachometer kit **P1** and stick reflection tape [3] to the fan.



Tachometer kit P1

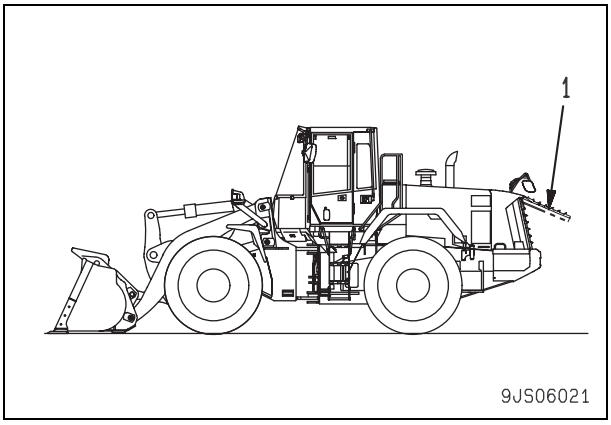


3) While running the engine at high idle and low idle, measure the fan speed.

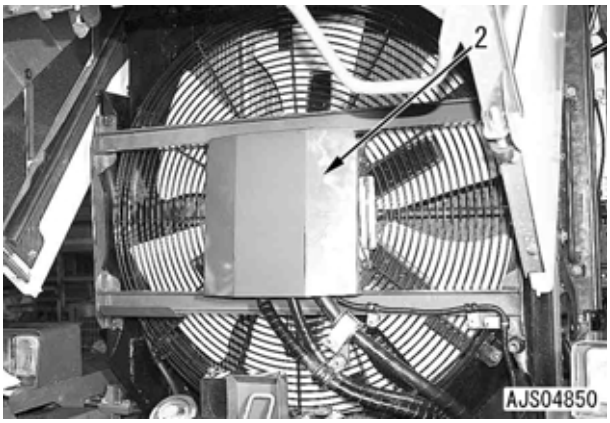
4) After finishing measurement, remove the measuring instruments and return the removed parts.

2. Measuring fan drive oil pressure

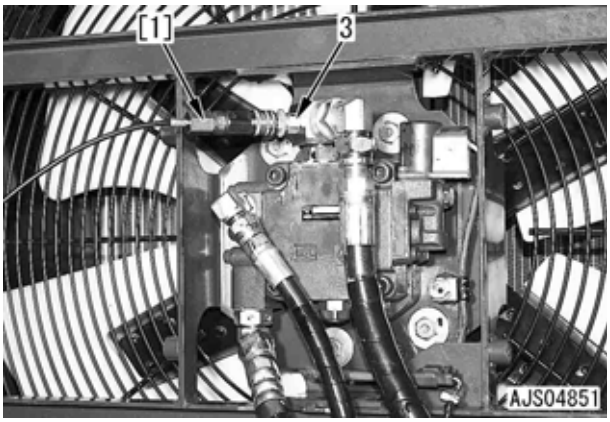
1) Open radiator grille (1).



2) Remove cover (2).



3) Connect oil pressure gauge [1] of hydraulic tester **P2** to pressure pickup nipple (3).
   ★ Use the oil pressure gauge of 39.2 MPa {400 kg/cm^2}.



4) While running the engine at high idle, measure the fan drive oil pressure.



5) After finishing measurement, remove the measuring instruments and return the removed parts.

Bleeding air from hydraulic drive fan circuit

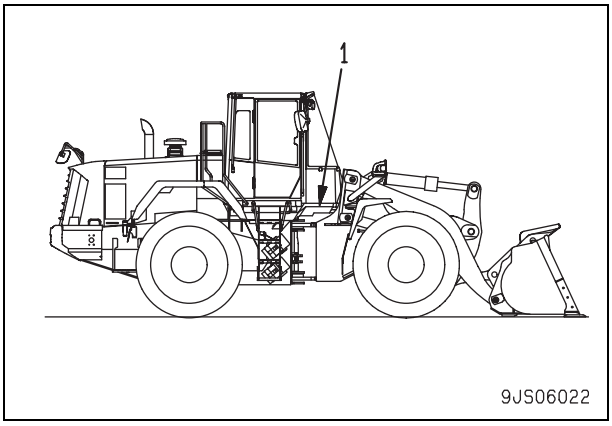
★ Testing tools for bleeding air from hydraulic drive fan circuit

Symbol		Part No.	Part Name
Q	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	790-261-1130	Coupling

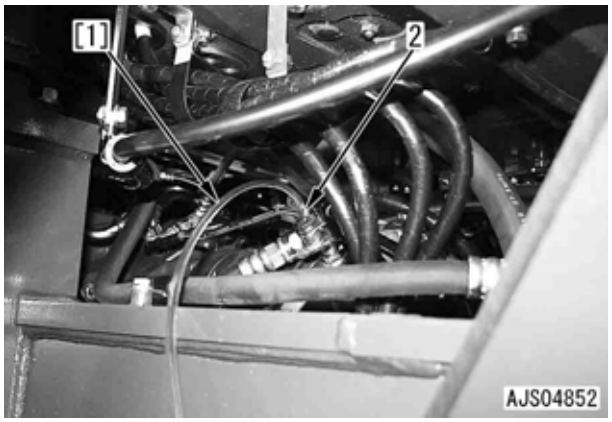
★ Before starting the operation, make sure the specified level of hydraulic oil is provided.

1. Bleeding air from fan pump

1) Remove cover (1) under the right of the operator's cab.



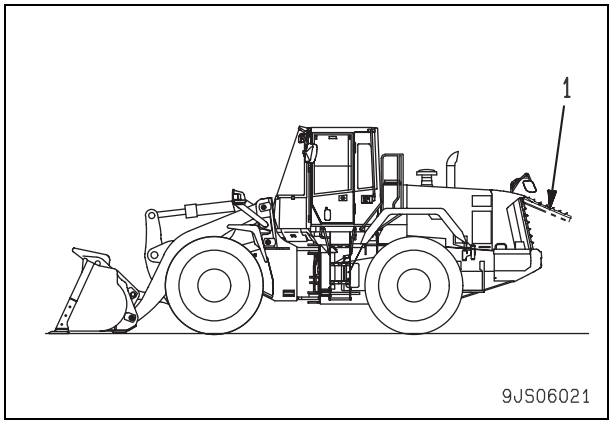
2) While the engine is stopped, loosen air bleeder (2) of the fan pump and connect air bleeder hose [1].



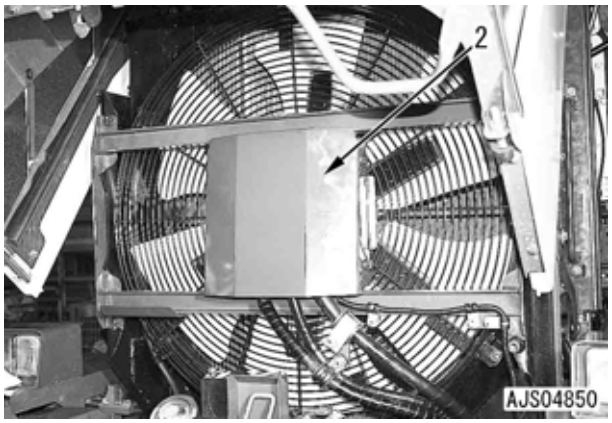
3) As oil free from air started to flow out of air bleeder (2), tighten air bleeder (2).
   Air bleeder:
   7.8 – 9.8 Nm {0.8 – 1.0 kgm}
4) Start the engine and run it at low idle for 5 minutes minimum.

2. Bleeding air from fan motor circuit

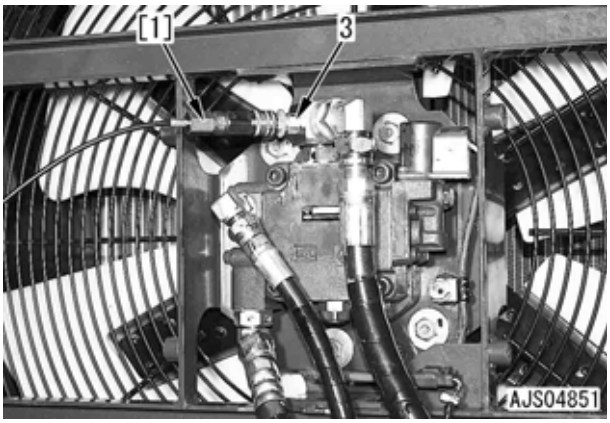
1) Open radiator grille (1).

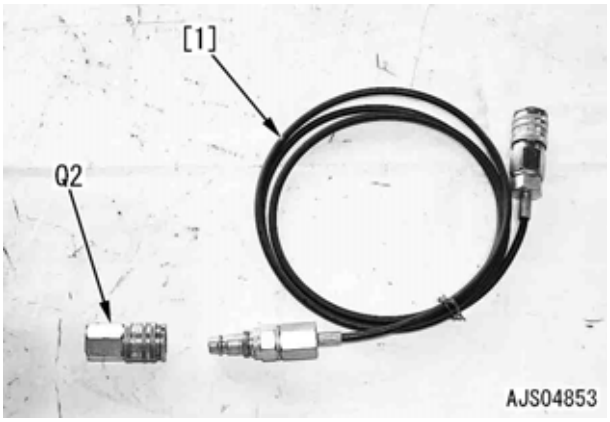


2) Remove cover (2).



3) Connect hose [1] of hydraulic tester **Q1** to pressure pickup nipple (3) and connect air bleeder coupling **Q2** to the outlet end of the hose.
   ★ Put the outlet end of the hose in an oil receiver.





4) Run the engine. When the oil flows out of the outlet end of the hose, stop the engine.
5) After finishing bleeding air, remove the tools and return the removed parts.

Measuring brake pedal

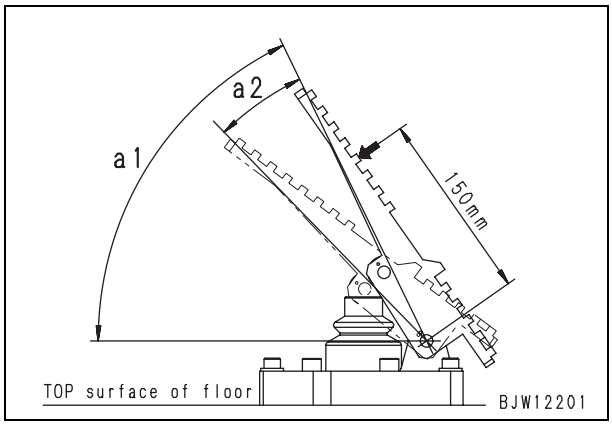
★ Measurement condition
- Engine coolant temperature: Within operating range
- Engine speed: Low idle

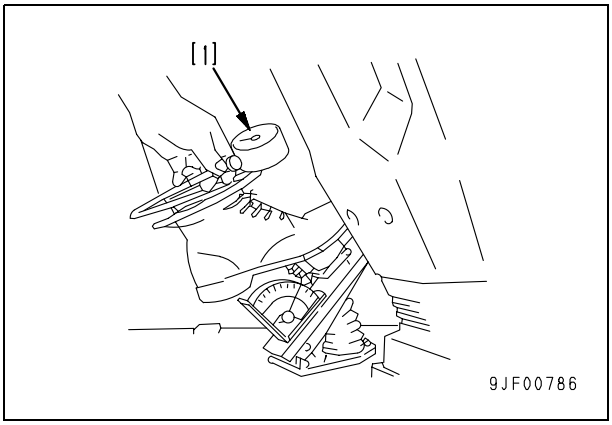
Measuring pressing angle of pedal

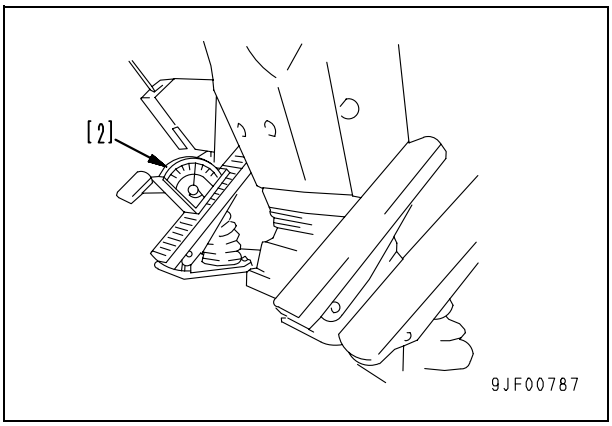
1. Install push gauge [1] to the foot of the measurer.
   ★ Set the push gauge in a position 150 mm from the fulcrum of the pedal.

2. While running the engine at low idle, measure pedal pressing angle (a1).

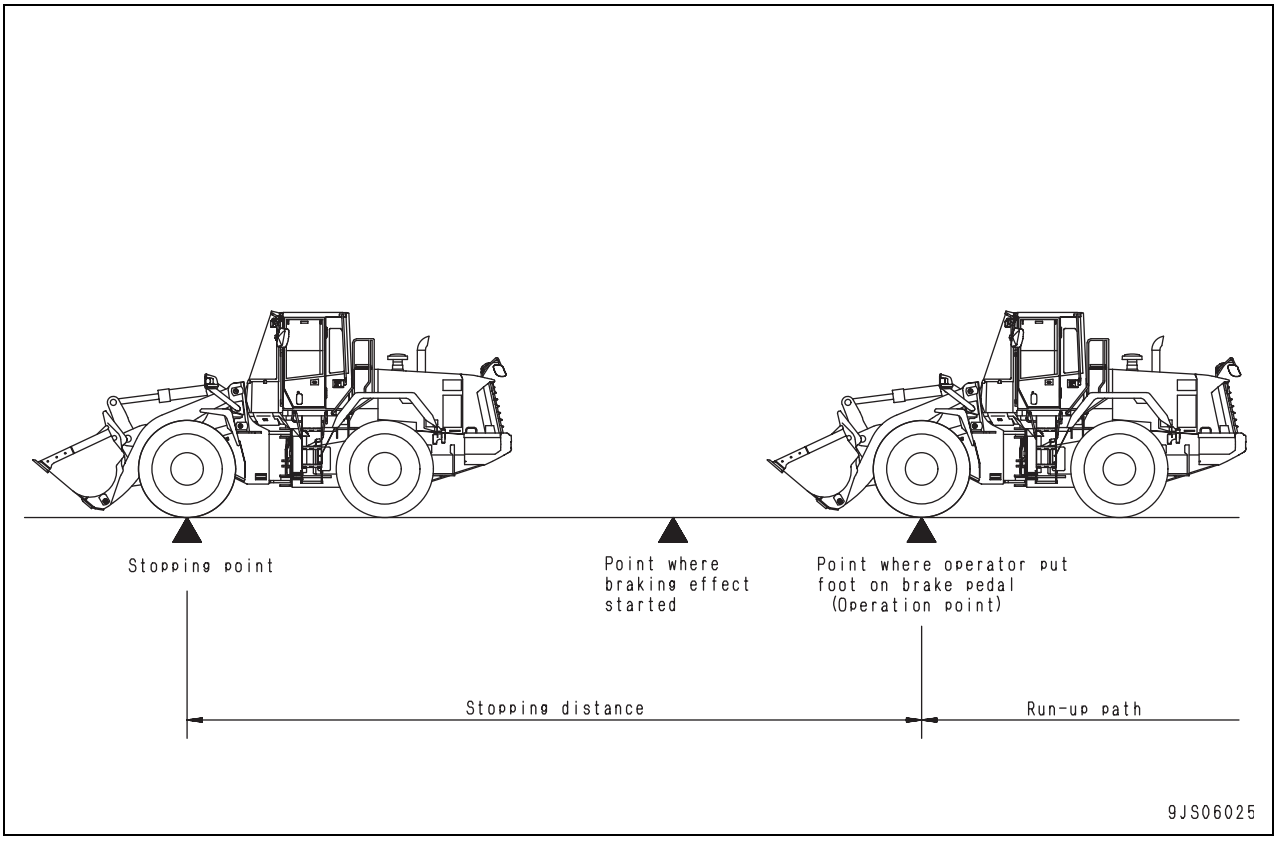
3. Apply angle gauge [2] to the brake pedal and measure neutral angle (a1) and maximum pressing angle (a2).
   - (a2): Pressing angle at pressing effort of 323 ± 30 N {32.9 ± 3.0 kg}







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: 23.5-25
- Brake pedal pressing force: Specified pressing force
  323 ± 30 Nm {32.9 ± 3 kgm}
- 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

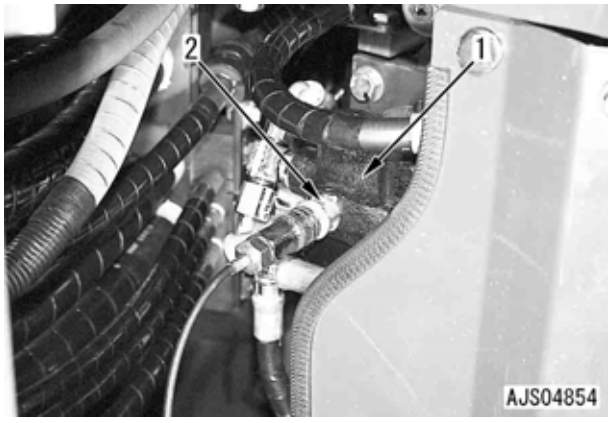
Symbol	Part No.	Part Name
R	799-101-5002	Analog hydraulic tester
	790-261-1204	Digital hydraulic tester

★ 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. Connect oil pressure gauge [1] of hydraulic tester **R** to accumulator charge pressure pickup plug (2) of accumulator charge valve (1).
   ★ Use the oil pressure gauge of 39.2 MPa {400 kg/cm^2}.



2. 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}
3. 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}



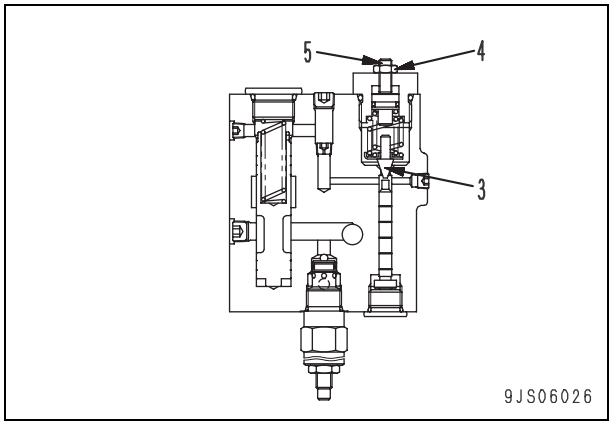
4. After finishing measurement, remove the measuring instruments and return the removed parts.

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.
   ★ If the adjustment screw is
   - Turned to the right, the pressure rises.
   - Turned to the left, the pressure lowers.

   ★ Quantity of adjustment per turn of adjustment screw: 1.45 MPa {14.8 kg/cm^2}
   Locknut: **11.8 – 16.7 Nm {1.2 – 1.7 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
S	1	793-605-1001	Brake test kit
	2	790-101-1430	Coupler
	3	790-101-1102	Pump
	4	790-301-1720	Adapter
	5	799-101-5160	Nipple
	6	799-401-2220	Hose
	7	790-261-1130	Coupling

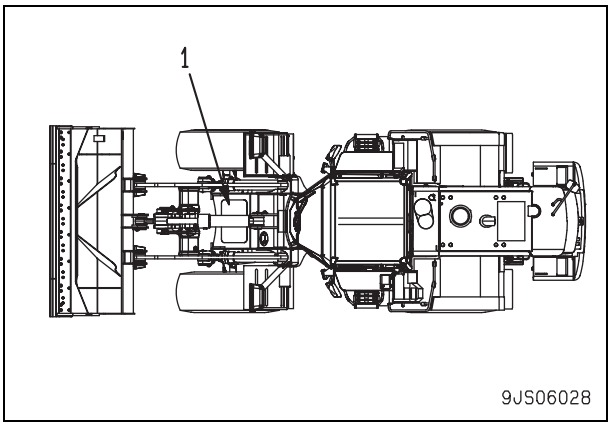
⚠ **Apply the parking brake and put chocks under the tires securely.**

★ 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.

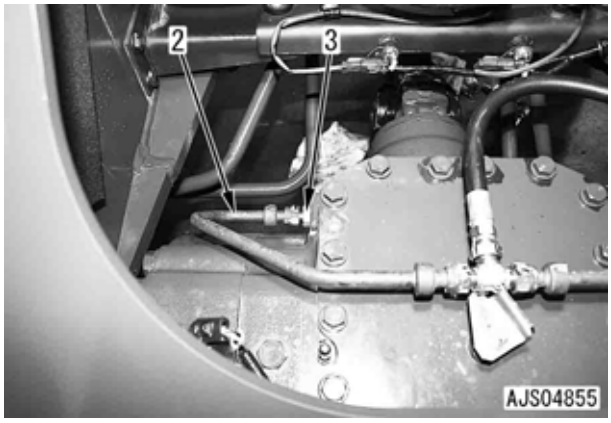
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range

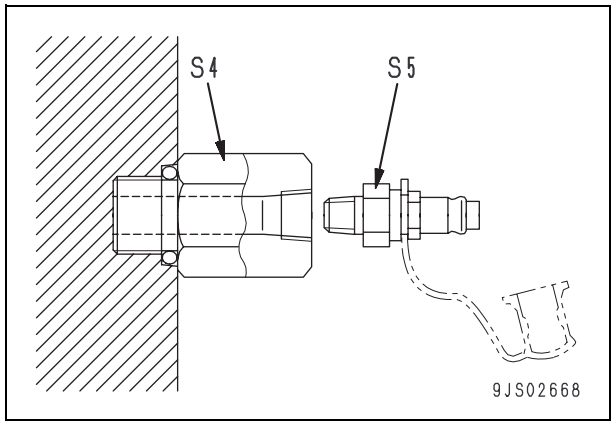
1. Remove front frame inspection cover (1).
   ⚠ **When raising the lift arm to remove the inspection cover, place a stand under it to support securely.**



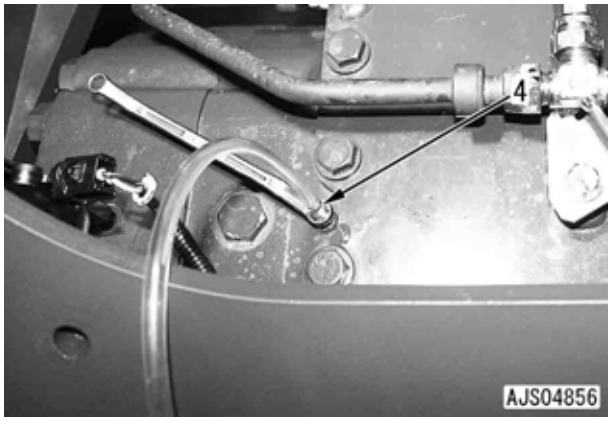
2. Remove brake tube (2) of the measured side.

3. Remove union (3) and install adapter **S4** and nipple **S5**, and then install brake test kit **S1**.
   ★ Use the O-ring fitted to the union.

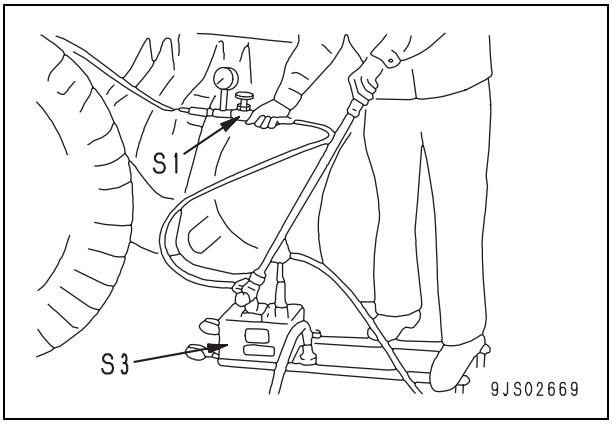




4. Loosen bleeder screw (4) to bleed air.
   ★ Bleed air by operating pump **S3**.

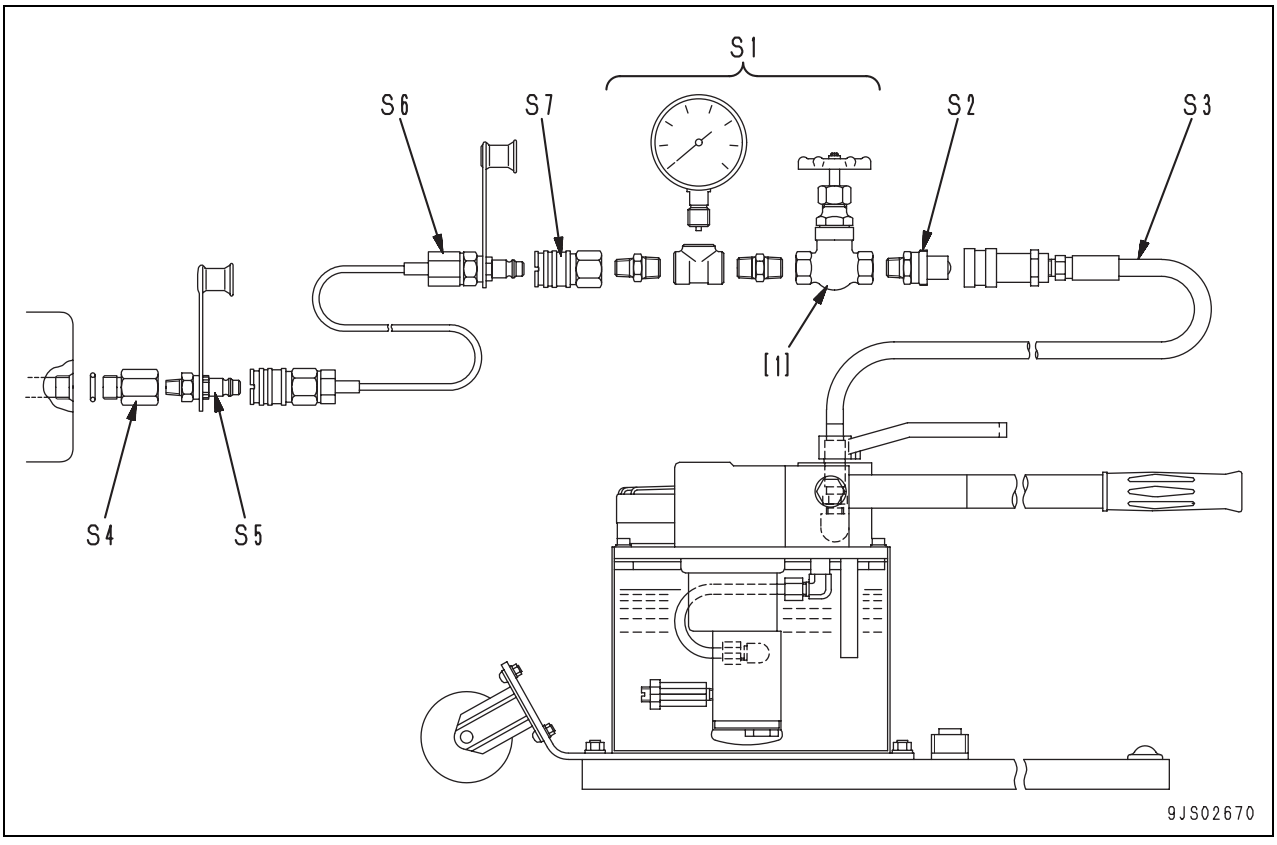


5. Tighten bleeder screw (4). Operate pump **S3** and raise the pressure to 4.9 MPa {50 kg/cm^2}, and then tighten stop valve [1].



6. Leave the brake circuit pressurized for 5 minutes and check lowering of the pressure.
   - ★ If the hose is moved while the pressure is measured, the pressure fluctuates. Accordingly, do not move the hose.
   - ★ After testing the pressure, operate pump **S3** to lower the pressure in brake test kit **S1**, and then remove brake test kit **S1**.
   - ★ After finishing testing, install the brake tube and bleed air from the brake circuit.
   - ★ After finishing testing, remove the measuring instruments and return the removed parts.

Brake test kit S

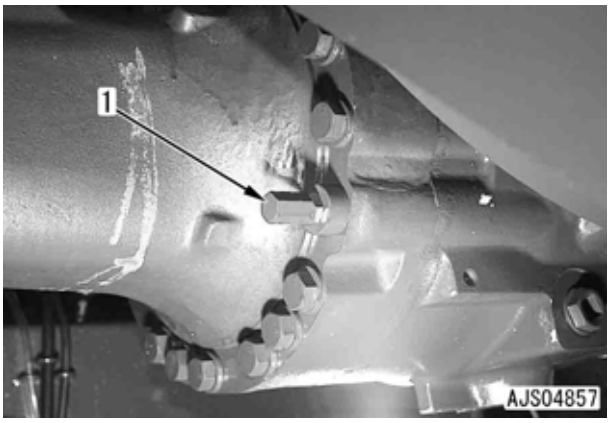


Measuring wear of wheel brake disc

Symbol	Part No.	Part name
T	Commercially available	Slide calipers

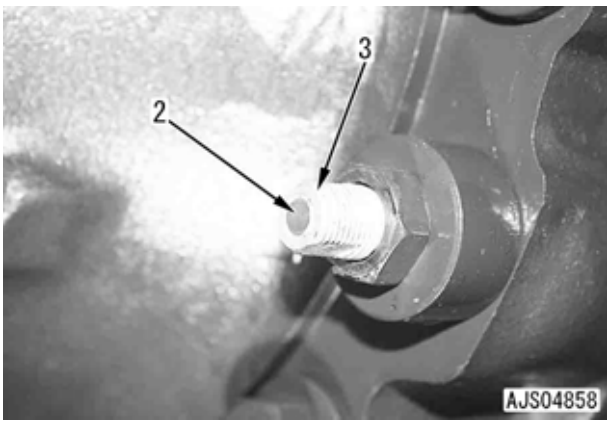
⚠ Stop the machine in a level place and put chocks under the tires.

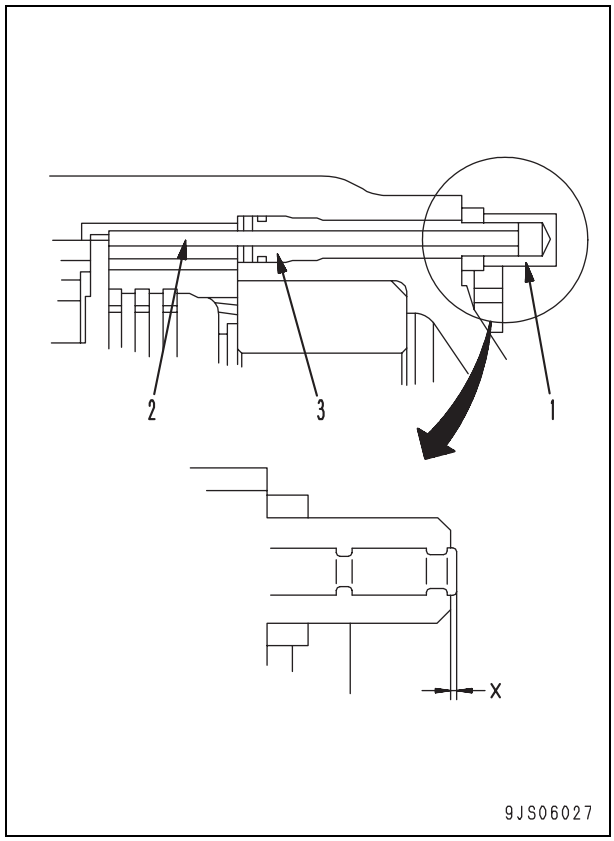
1. Remove cap (1).



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 **T**.
   - ★ 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. 2.4 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

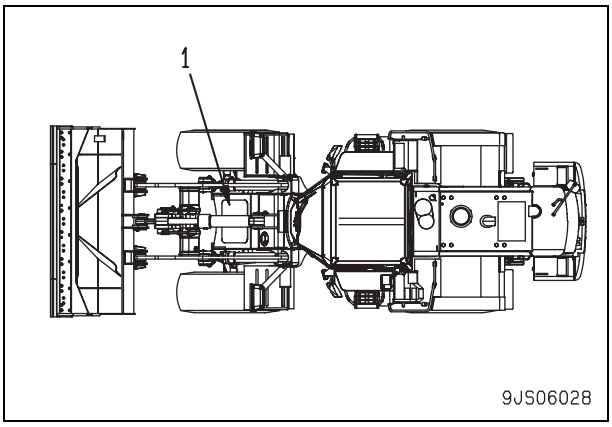
⚠ **Stop the machine in a level place and put chocks under the tires.**

★ If a brake circuit part is removed and installed, bleed air from the brake circuit according to the following procedure.

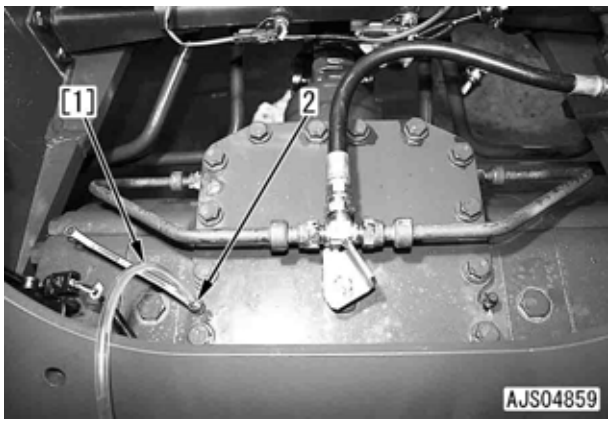
★ Bleed air from the front brake circuit and rear brake circuit similarly (2 places each).

1. Start the engine to accumulate pressure in the accumulator and then stop the engine.

2. Remove front frame inspection cover (1).



3. Connect hose [1] to bleeder screw (2) and place hose [1] in the oil pan.



4. Press the brake pedal and then loosen bleeder screw (2) to bleed air.
   ★ Return the brake pedal slowly after tightening bleeder screw (2).

5. Repeat this operation until the oil flowing through hose [1] becomes free from bubbles. Then press the pedal fully and tighten bleeder screw (2) while the oil is flowing.

6. 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
- Between accumulator charge valve and parking brake solenoid 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

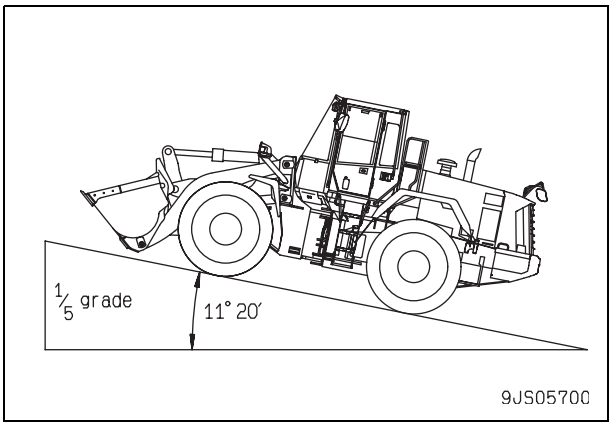
★ Measurement condition
- Tire inflation pressure: Specified pressure
- Road: 1/5 gradient (11° 20'), flat, and dry road
- Machine: Ready for operation

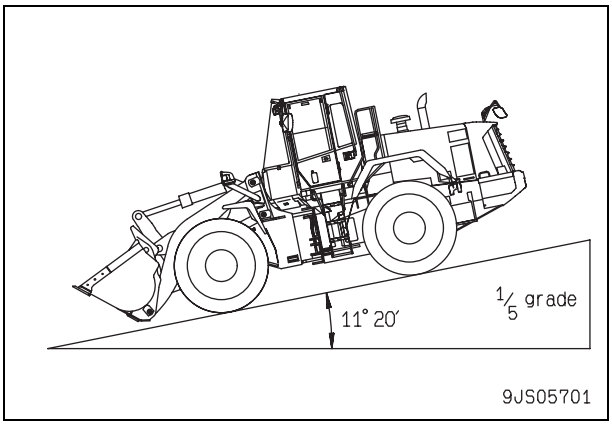
Measuring method

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

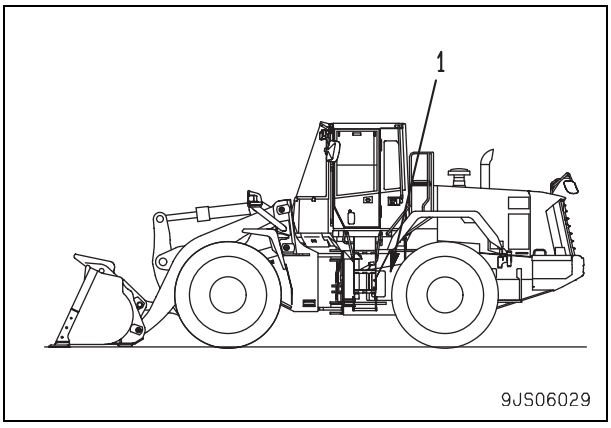
Symbol		Part No.	Part Name
U	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25 mm)
		07002-11023	O-ring

⚠ Put chocks under the tires.
⚠ Install and remove the measuring instruments after the oil temperature lowers fully.

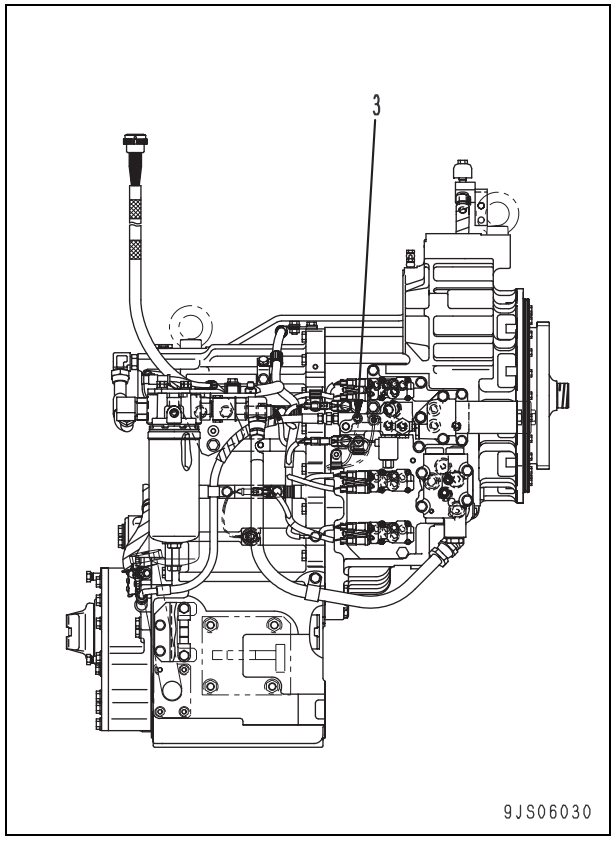
★ Measure the parking brake oil pressure under the following condition.
- Engine coolant temperature: Within operating range
- Power train oil temperature: Within operating range

1. Parking brake pressure

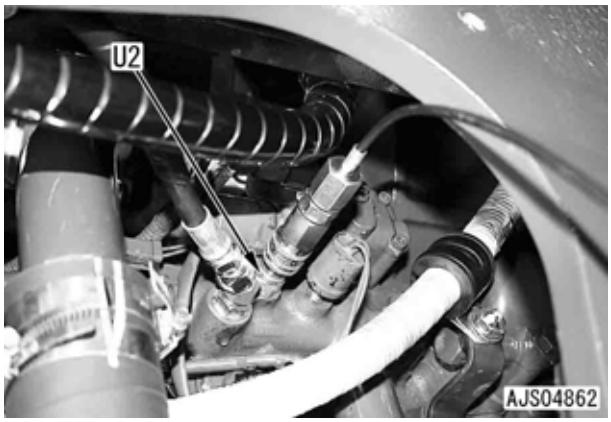
1) Remove rear frame left side cover (1).



2) Remove parking brake pressure pickup plug (3).



3) Connect nipple **U2** and oil pressure gauge [1] of hydraulic tester **U1**.
★ Use the oil pressure gauge with capacity 5.9 MPa {60 kg/cm^2}.



4) Run the engine at low idle and measure the parking brake pressure.
   ⚠ **Keep pressing the brake pedal for safety.**
   ★ Measure the oil pressure at turning OFF of the parking brake.



5) 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
V	Commercially available	Slide calipers

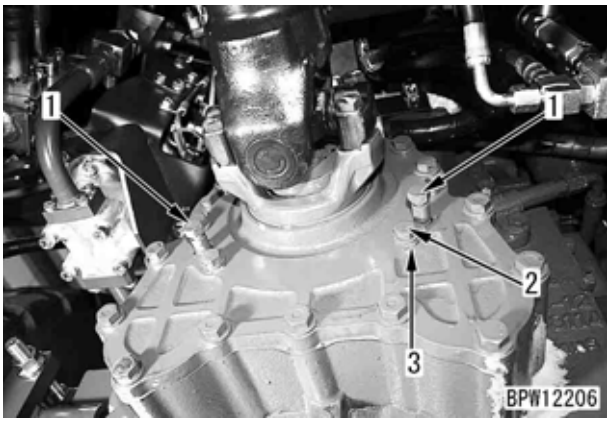
★ If the parking brake does not work effectively, check the parking brake disc for wear according to the following procedure.

⚠ **Lower the work equipment fully and put chocks under the tires.**

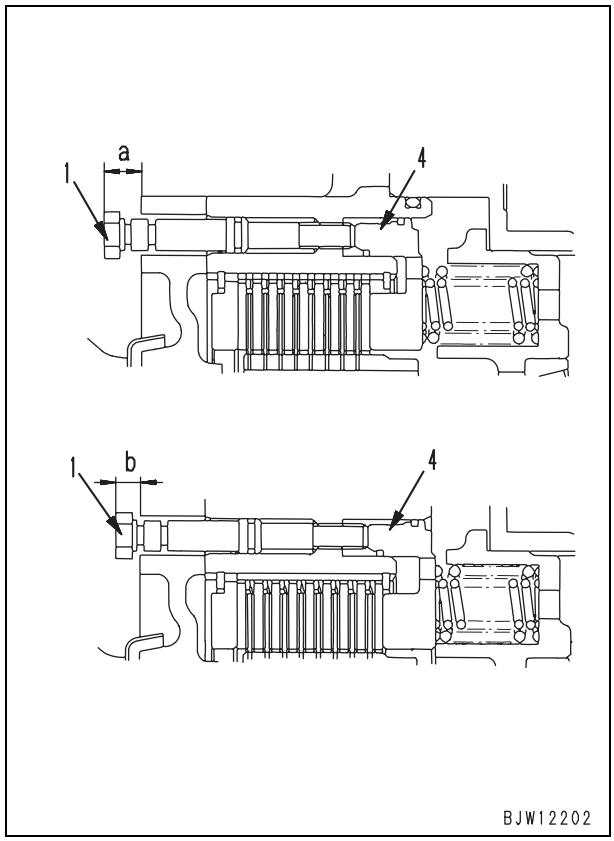
⚠ **When checking, stop the engine.**

1. Loosen bolt (2), then remove lock plate (3) from parking brake manual release bolt (1) (3 places).

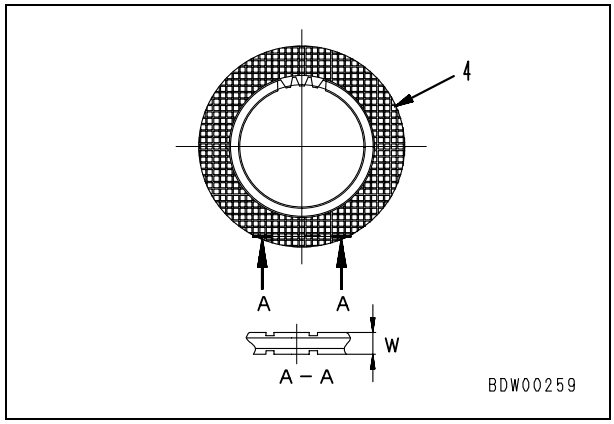
2. Measure dimension (a) with the 3 manual release bolts (1) in contact lightly with brake pistons (4).



3. Tighten the 3 manual release bolts (1) in turn and measure dimension (b) when brake piston (4) is pushed in fully.
   ★ Piston stroke (L) = a – b
   L = Max. 8.4



4. If depth (a) is above the standard, remove parking brake disc (4) and measure its thickness (W), referring to Disassembly and assembly, “Removal of parking brake disc”.
   ● Service limit thickness (W): 3.2 ± 0.08 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.**

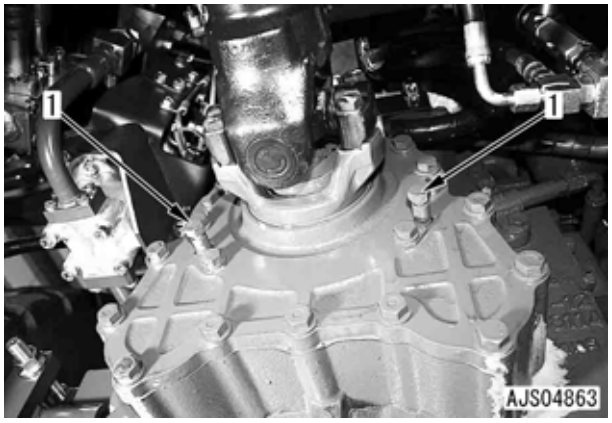
⚠ **Lower the work equipment to the ground and put chocks under the tires to prevent the machine from moving.**

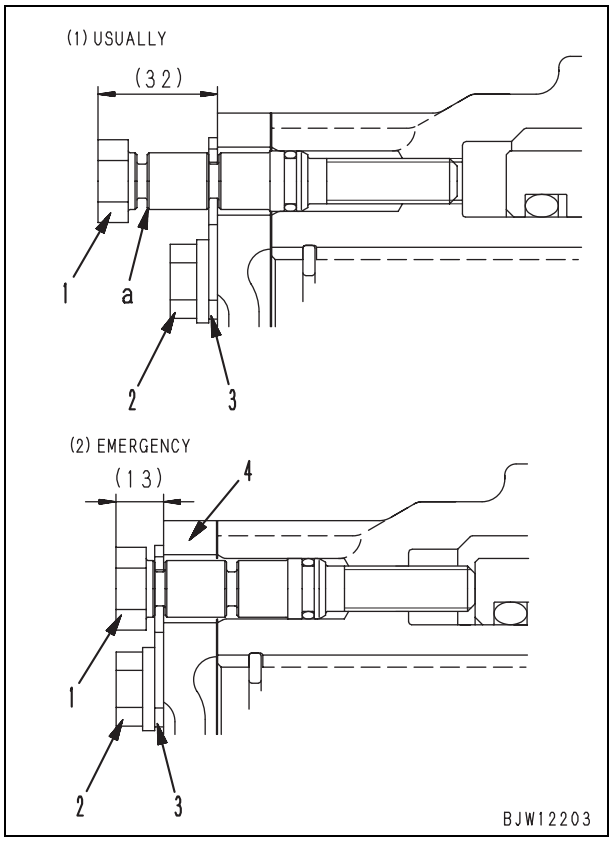
⚠ **When applying this means, stop the engine.**

1. Loosen bolt (2), then remove lock plate (3) from bolt (1) (3 places).

2. Tighten bolts (1) at 3 places in turn as far as the mounting position for the lock plate (3) at portion (a), then install lock plate (3) at portion (a).
   ★ Tighten all 3 bolts uniformly a little at a time.
   ★ Bolt (1) pushes piston and release the parking brake.

3. Tighten bolt (2) to secure lock plate (3) in position.





4. After moving to a safe place, restore the machine to the original condition.

Measuring and adjusting work equipment control lever

★ Measuring and adjusting tools for work equipment control lever

Symbol		Part No.	Part name
W	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

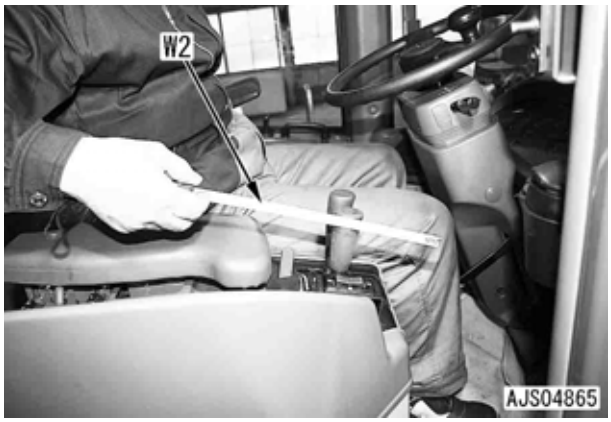
1. Operating effort of work equipment control lever

1) Install and fix tool **W1** to the work equipment control lever.
   ★ Install tool **W1** 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 **W2**.
   ★ If the stroke is out of the standard range, check for play of the linkage and wear of the bushing.



Measuring and adjusting work equipment PPC oil pressure

★ Measuring and adjusting instruments for work equipment PPC oil pressure

Symbol		Part No.	Part name
X	1	799-101-5002	Analog hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25 mm)
		07002-11023	O-ring

⚠ **Loosen the oil filler cap of the hydraulic tank gradually to release the internal pressure of the hydraulic tank**

⚠ **Operate the work equipment control lever 2 – 3 times to release the pressure from the PPC accumulator circuit.**

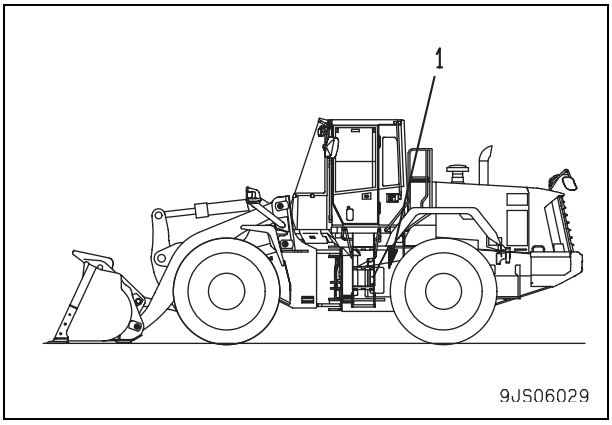
★ Measure the work equipment PPC oil pressure under the following condition.

● Hydraulic oil temperature: Within operating range

Measuring

1. PPC valve basic pressure

1) Remove rear frame left side cover (1).

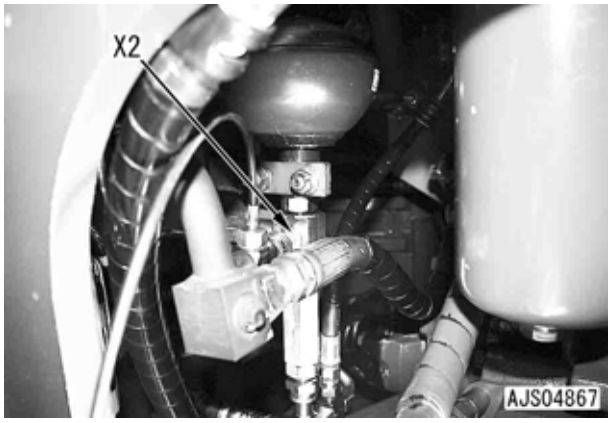


2) Remove oil pressure pickup plug (3) (10 × 1.25 mm) from the underside of PPC accumulator (2).



3) Connect nipple **X2** and oil pressure gauge [1] of hydraulic tester **X1**.

★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



4) While running the engine at high idle, operate the work equipment control lever and measure the PPC basic pressure.

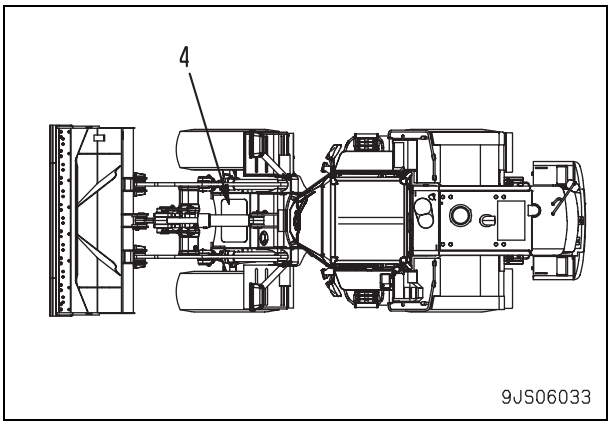


5) After finishing measurement, remove the measuring instruments and return the removed parts.

2. Measuring PPC valve output pressure

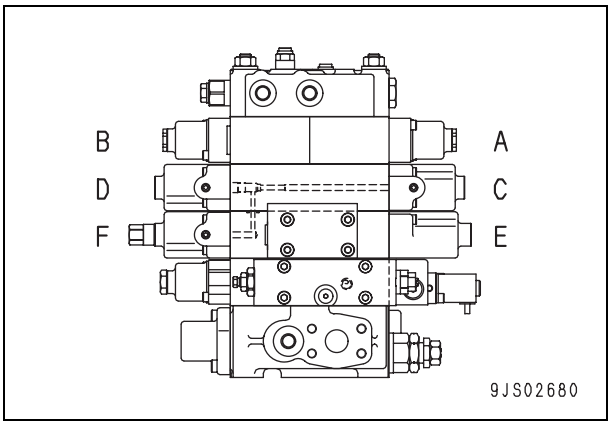
1) Remove front frame inspection cover (4).

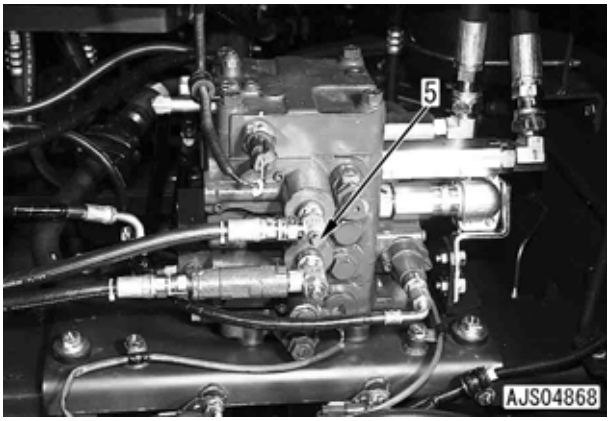
⚠ **When raising the lift arm to remove the inspection cover, place a stand under it to support securely.**



2) Remove oil pressure pickup plug (10 × 1.25 mm) (5) of the measured PPC circuit.

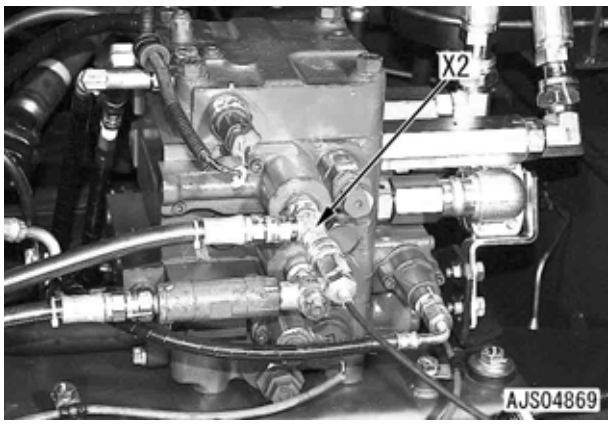
★ A: Attachment
B: Attachment
C: Tilt bucket
D: Dump bucket
E: Raise lift arm
F: Lower and float lift arm





3) Connect nipple **X2** and oil pressure gauge [1] of hydraulic tester **X1**.

★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



4) While running the engine at high idle, operate the work equipment control lever and measure the PPC valve output pressure.

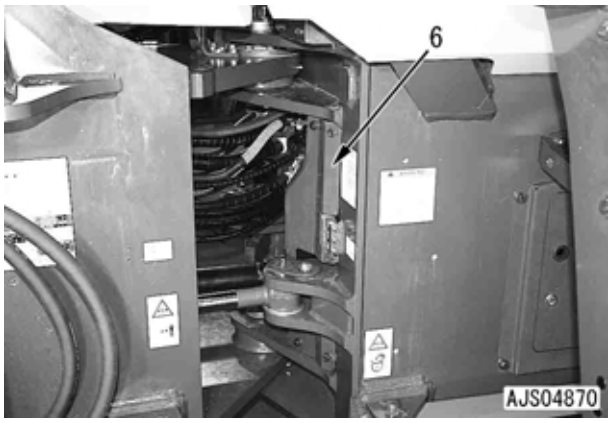


5) After finishing measurement, remove the measuring instruments and return the removed parts.

Adjusting

★ The PPC relief valve is not adjustable.

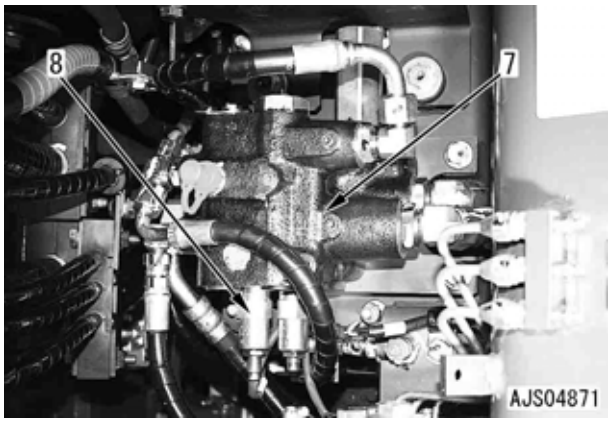
1. Remove cover (6).



★ Remove PPC relief valve cartridge assembly (8) from accumulator charge valve assembly (7) and replace it.

PPC relief valve cartridge assembly:
25 – 33.9 Nm {2.6 – 3.5 kgm}

★ After replacing the cartridge assembly, measure the PPC oil pressure again.



Measuring and adjusting work equipment oil pressure

★ Measuring and adjusting instruments for work equipment oil pressure

Symbol		Part No.	Part name
Y	1	799-101-5002	Analog hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25 mm)
		07002-11023	O-ring
	3	799-401-2701	Differential pressure gauge

★ Measure the work equipment oil pressure under the following condition.
- Hydraulic oil temperature: Within operating range

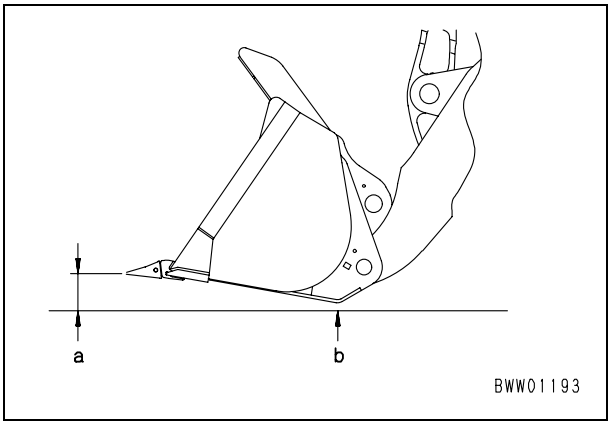
Combination of actuator and valve

★ Note that different actuators relieve different valves.
★ The No. of each actuator in the following table shows the order from the top, when the control valve is seen from the front of the machine. (The service actuator is used when 1 attachment is installed.)

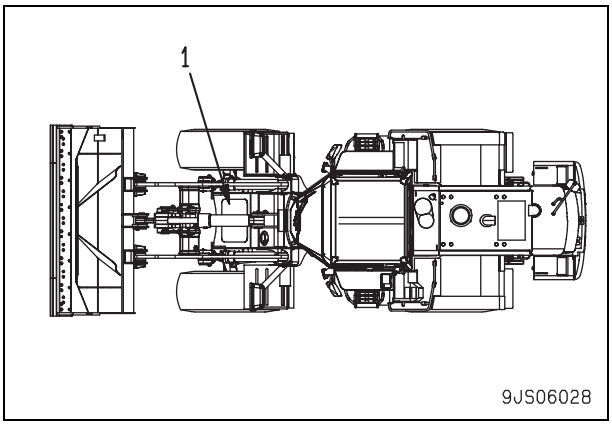
No.	Actuator	Relieved valve
1	Service	Safety valve
2	Bucket	Main relief valve
3	Lift arm	Main relief valve

1. Preparation work

1) Raise part (a) of the bucket about 30 – 50 mm and lower part (b) to the ground.
2) Stop the engine and operate the work equipment control lever to check that both parts (a) and (b) of the bucket are in contact with the ground.
   ★ After lowering the bucket to the ground, operate the work equipment control lever 2 – 3 times to release the residual pressure in the piping.

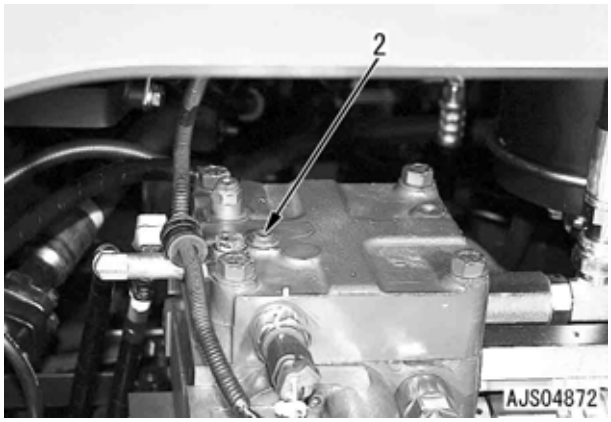


3) Remove front frame inspection cover (1).
   ⚠ **When raising the lift arm to remove the inspection cover, place a stand under it to support securely.**

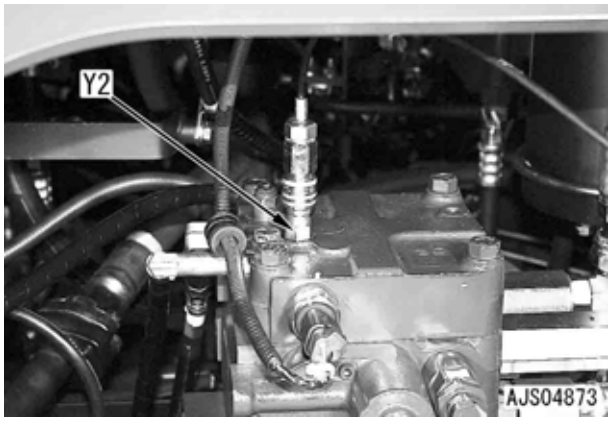


2. Measuring work equipment relief pressure

1) Remove pump pressure pickup plug (10 × 1.25 mm) (2) from the work equipment control valve.



2) Connect nipple **Y2** and oil pressure gauge [1] of hydraulic tester **Y1**.
   ★ Use the oil pressure gauge of 39.2 MPa {400 kg/cm^2}.



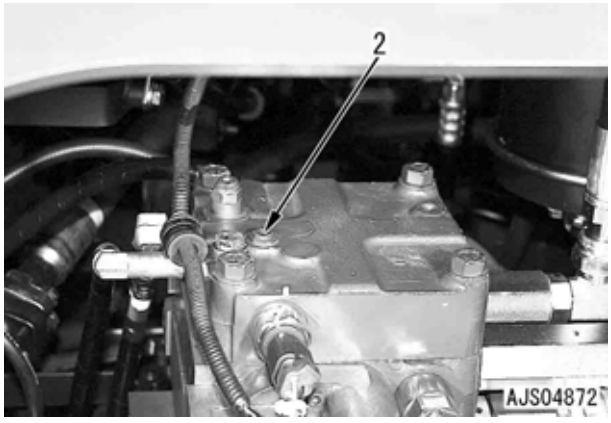
3) Start the engine and raise the lift arm about 400 mm. Then, while running the engine at high idle and tilting back the bucket, measure the oil pressure.



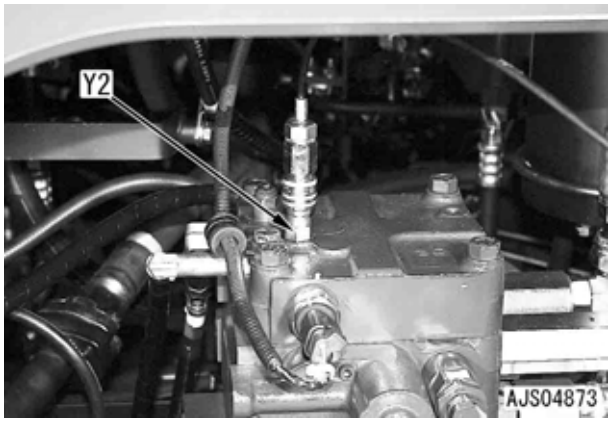
⚠ **After measuring the oil pressure, release the pressure in the circuit according to the procedure for installing the nipple and oil pressure gauge, and then remove the oil pressure gauge and nipple.**

3. Measuring unload pressure

1) Remove pump pressure pickup plug (10 × 1.25 mm) (2) from the work equipment control valve.



2) Connect nipple **Y2** and oil pressure gauge [1] of hydraulic tester **Y1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



3) Start the engine and raise the lift arm about 400 mm. Then, while running the engine at high idle, set all the levers in neutral and measure the oil pressure.



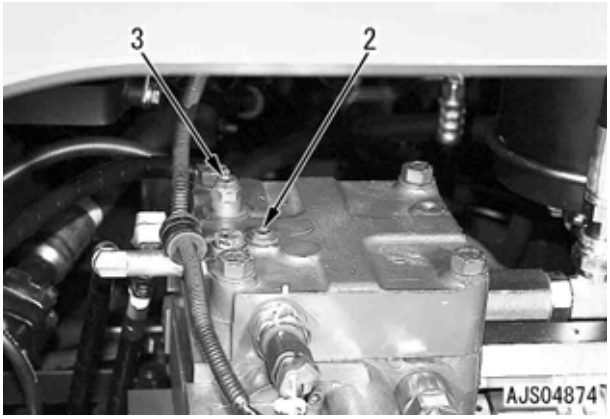
⚠ **After measuring the oil pressure, release the pressure in the circuit according to the procedure for installing the nipple and oil pressure gauge, and then remove the oil pressure gauge and nipple.**

4. Measuring work equipment LS differential pressure

★ Before measuring the LS control circuit pressure, check that the work equipment relief pressure and work equipment PPC oil pressure are normal.

★ To obtain the LS differential pressure, measure the pump discharge pressure and LS pressure (actuator load pressure) simultaneously and calculate the difference between them.

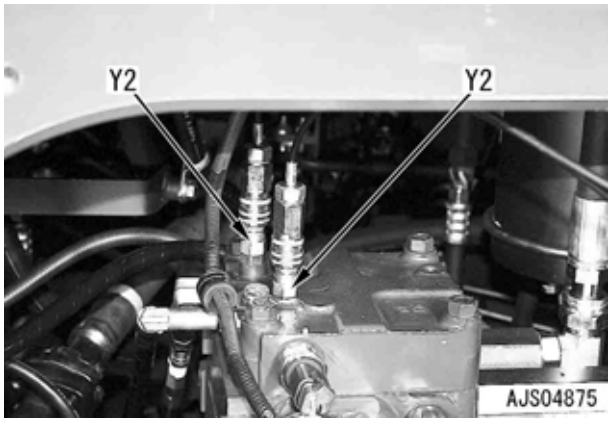
1) Remove pump pressure pickup plug (10 × 1.25 mm) (2) and LS pressure pickup plug (10 × 1.25 mm) (3) from the work equipment control valve.



2) Install nipple **Y2** and connect oil pressure gauge [1] of hydraulic tester **Y1** or differential pressure gauge **Y3**.

★ When using the differential pressure gauge, connect the high pressure side to the pump pressure side and connect the low pressure side to the LS pressure side.
Since the differential pressure gauge needs a 12V power source, connect it to a battery.

★ When using the oil pressure gauge, use the oil pressure gauge of 39.2 MPa {400 kg/cm^2}.
Since the differential pressure is about 2.4 MPa {25 kg/cm^2} at maximum, measure it by installing the same gauge to the pickup plugs alternately.



3) Start the engine and raise the lift arm about 400 mm.

4) While running the engine at high idle, when the following condition is satisfied, measure the pump pressure and LS pressure (actuator load pressure) simultaneously.

- When all the levers are in neutral and when the lift arm lever is moved halfway

★ While measuring, take care not to move the lift arm cylinder to the stroke end.

★ Calculation of LS differential pressure:
LS differential pressure = Pump discharge pressure – LS pressure

★ If the LS differential pressure is as follows, it is normal.

Position of lever	LS differential pressure
All levers in neutral	Unload pressure (See standard value)
Lift arm lever in LIFT position	Specified LS differential pressure (See standard value)



5) After finishing measurement, remove the measuring instruments and return the removed parts.

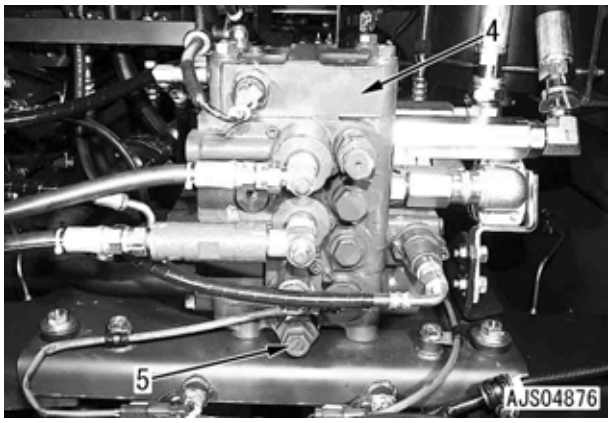
⚠ **After measuring the oil pressure, release the pressure in the circuit according to the procedure for installing the nipple and oil pressure gauge, and then remove the oil pressure gauge and nipple.**

Adjusting

★ The unload valve is not adjustable.

1. Adjusting work equipment relief pressure

1) Adjust main relief valve (5) from work equipment control valve (4).



2) Loosen locknut (6) and turn adjustment screw (7) to adjust the pressure.

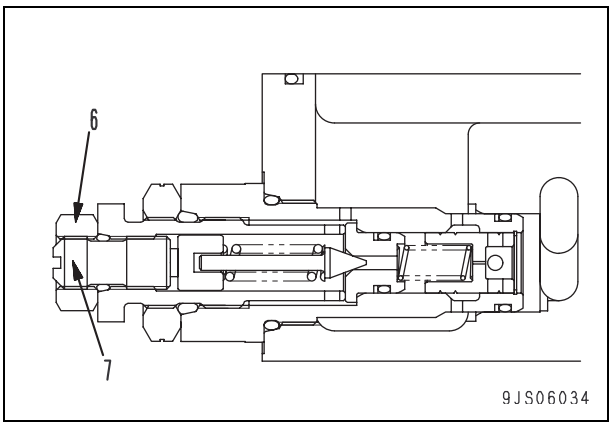
★ If the adjustment screw is
- Turned to the right, the pressure rises.
- Turned to the left, the pressure lowers.

★ Quantity of adjustment per turn of adjustment screw:

12.6 MPa {128 kg/cm^2}

Locknut:

29.4 – 39.2 Nm {3 – 4 kgm}

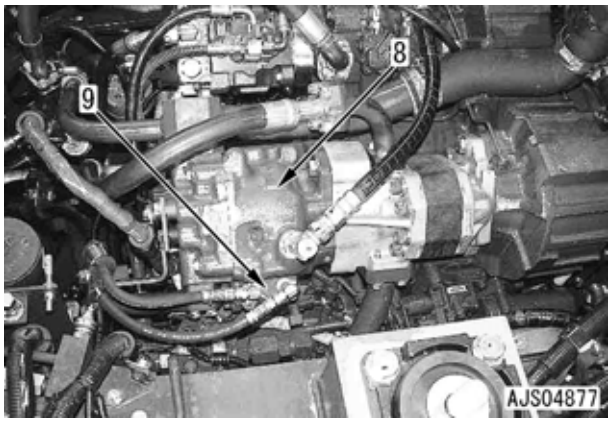


★ After finishing measurement, measure the work equipment relief valve according to the above measurement procedure.

2. Adjusting LS differential pressure

1) Remove the floor frame assembly. For details, see Disassembly and assembly, “Removal and installation of floor frame assembly”.

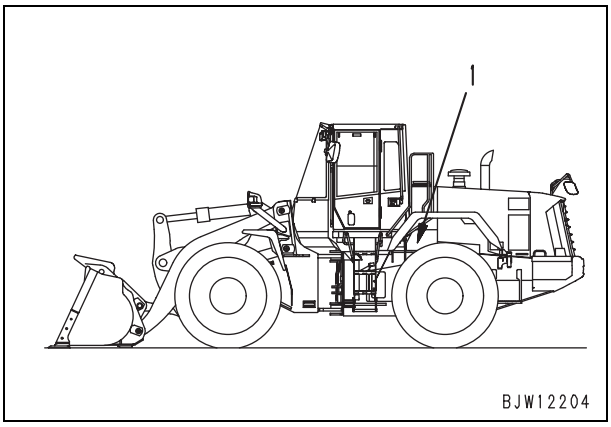
2) Remove servo assembly (9) from work equipment pump assembly (8) and replace it.



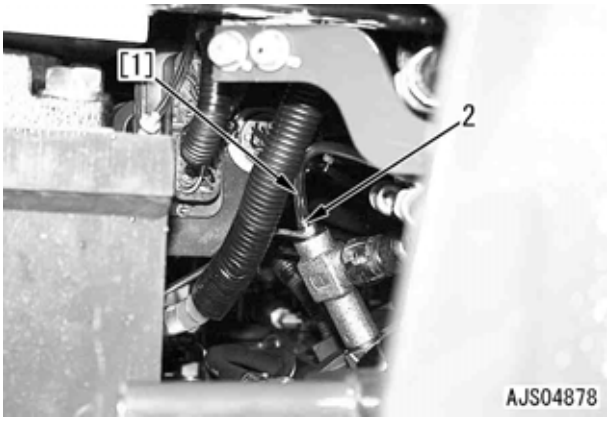
Bleeding air from work equipment circuit

1. Bleeding air from work equipment pump (piston pump)

1) Remove cover (1) under the left of the operator's cab.



2) Stop the engine and then loosen air bleeder (2) of work equipment pump to connect air bleeding hose [1].



3) When hydraulic oil containing no bubbles flows out of air bleeder hose [1], tighten the 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.

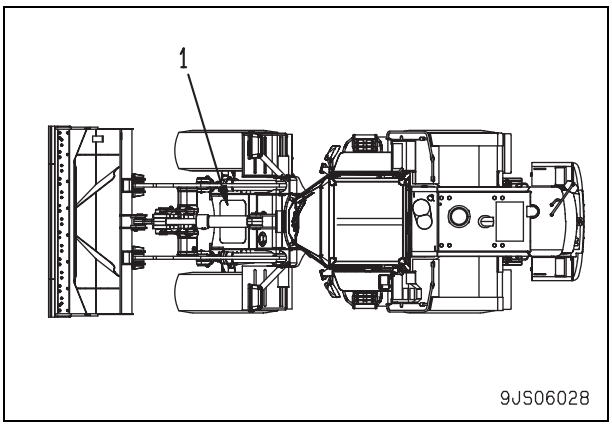
1) Stop the engine.
2) Loosen the oil filler cap gradually to release the internal pressure of the hydraulic tank
3) Set the work equipment lock lever to free position.
4) Turn the starting switch ON.
5) Release residual pressure operating the work equipment lever.

2. Releasing residual pressure from ECSS (travel damper) circuit

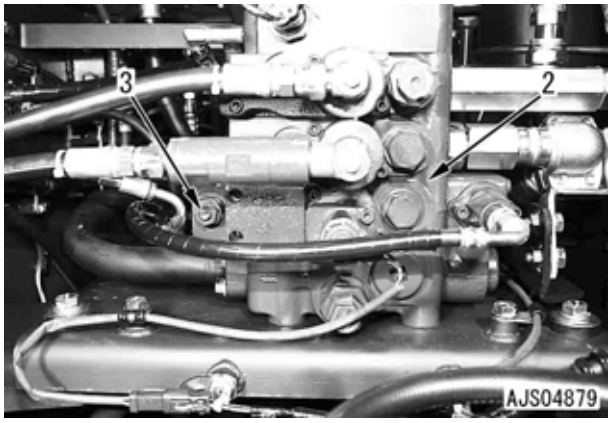
⚠ **When disconnecting the piping of the travel damper circuit (between the accumulator for travel damper and work equipment control valve), release pressure of the accumulator for the travel damper according to the following procedure.**

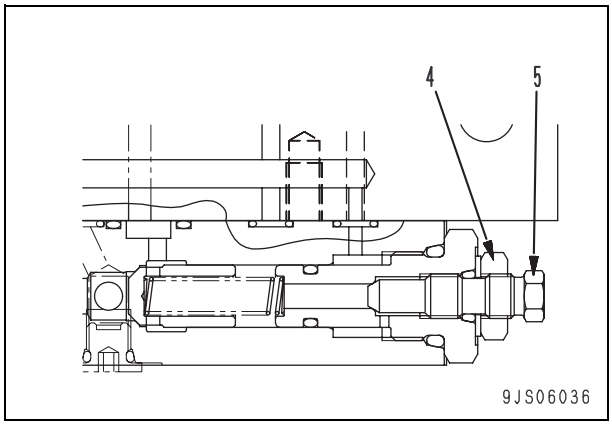
1) Remove inspection cover (1) on the front frame.

⚠ **When raising the lift arm to remove the inspection cover, place a stand under it to support securely.**



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}

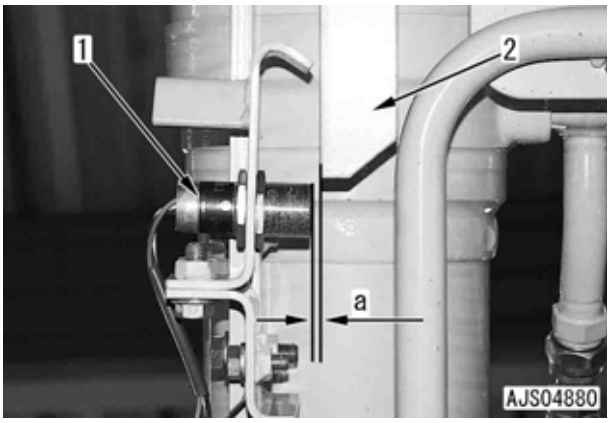
Locknut:
19.6 – 27.5 Nm {2.0 – 2.8 kgm}

Testing and adjusting bucket positioner

★ Engine coolant temperature: Within operating range
★ Hydraulic oil temperature: Within operating range

Testing

1. While the engine is stopped, check that clearance (a) between proximity switch (1) and sensor bar (2) is in the standard range.
   ★ Clearance (a): 3 – 5 mm

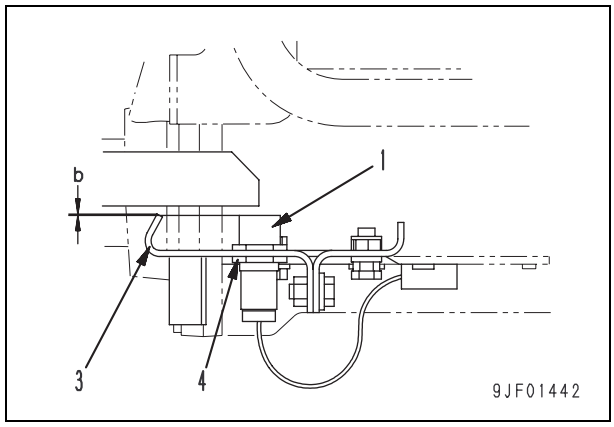


2. While running the engine at high idle, check the operating point. (Check 3 times and obtain the average.)

Adjusting

1. Adjusting clearance

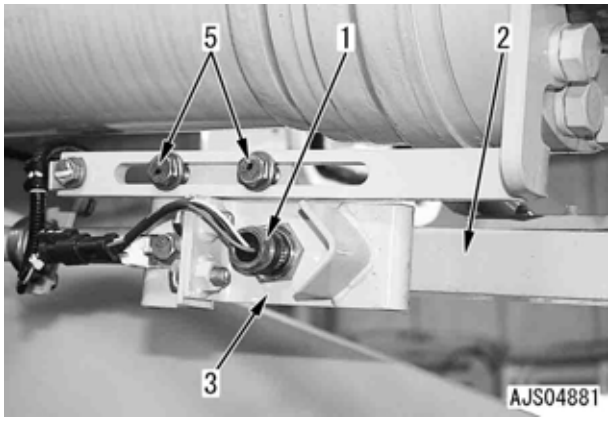
1) Adjust and fix switch nut (4) so that clearance (b) between the end of switch protector (3) and switch sensitive surface (1) will be in the standard range.
   ★ Standard clearance (b): 0.5 – 1.0 mm
   Switch nut:
   14.7 – 19.6 Nm {1.5 – 2.0 kgm}

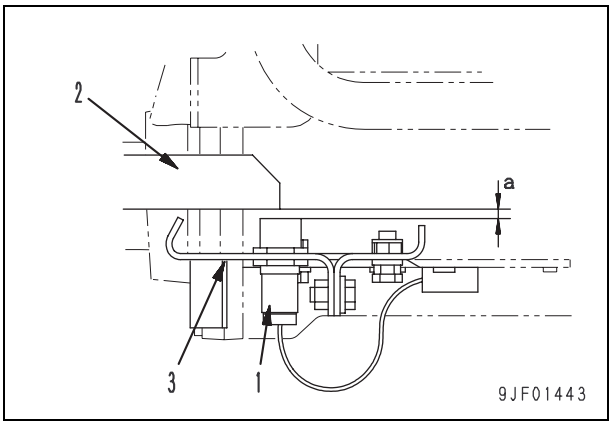


2) Adjust and fix the shim and proximity switch bracket mounting bolt so that clearance (a) between the sensitive surface of proximity switch (1) and sensor bar (2) will be in the standard range.
   ★ Clearance (a): 3 – 5 mm
   ★ Adjust sensor bar (2) with the shim so that clearance (a) will be in the standard range through the stroke of the sensor bar.

2. Adjusting mounting position (stopping position)

1) Lower the bucket to the ground and set it to a desired cutting angle, and then return the lever to the holding position and stop the engine.
2) Loose 2 mounting bolts (5) and adjust the position of switch protector (3) so that the rear end of sensor bar (2) will be at the center of the sensitive surface of proximity switch (1), and then tighten 2 mounting bolts (5).
3) Check again that clearance (a) between proximity switch (1) and sensor bar (2) is 3 – 5 mm.
   - You may check by turning the starting switch ON and turning the pilot lamp ON and OFF. (When the pilot lamp is turned OFF, the bucket stops.)





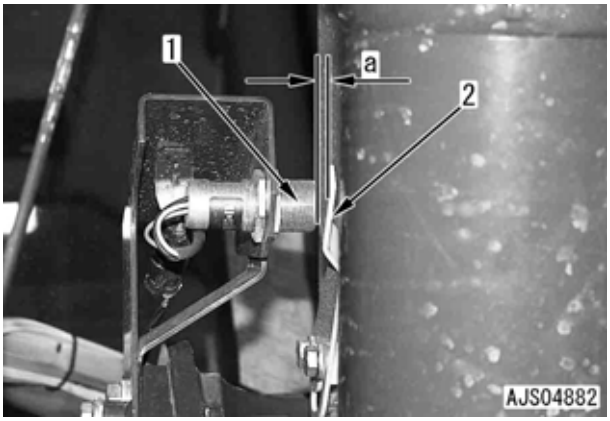
★ After adjusting, start the engine, operate the bucket control lever, and check that the switch operates at the desired position.

Testing and adjusting boom kick-out

Testing

1. Start the engine and operate the lift arm control lever to operate proximity switch (1), and then stop the engine.
   ⚠ **Be sure to apply the work equipment lock lever.**

2. While the engine is stopped, check that clearance (a) between switch (1) and plate (2) is within the standard range.
   ★ Clearance (a): 3 – 5 mm

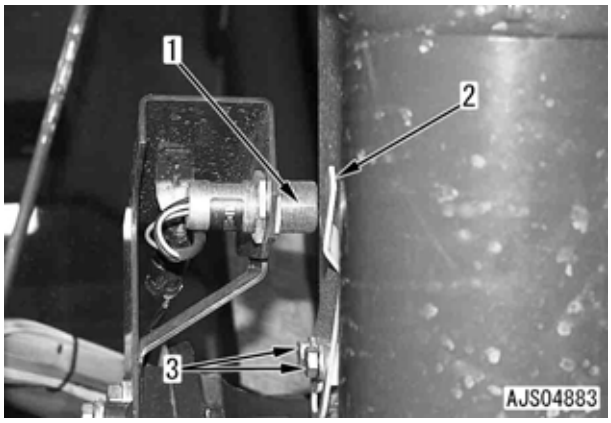


3. While running the engine at high idle, check the operating point.
   (Check 3 times and obtain the average.)

Adjusting

1. Raise the lift arm to a desired position.
   ⚠ **Be sure to apply the work equipment lock lever.**

2. Loosen 2 bolts (3) and adjust the position of plate (2) so that its lower end will be at the center of switch (1), and then tighten bolts (3).



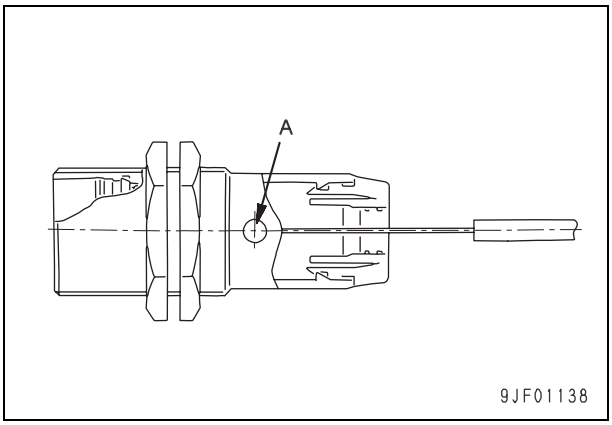
3. Adjust and fix switch nut (4) so that clearance (a) between the sensitive surface of switch (1) and plate (2) will be in the standard range.
   Switch nut:
   14.7 – 19.6 Nm {1.5 – 2.0 kgm}
   ★ After adjusting, operate the work equipment, and check that the switch operates at the desired position.
   ★ Clearance (a): 3 – 5 mm

Checking proximity switch operation pilot lamp

Proximity switch operation pilot lamp (Red)

The proximity switch has a pilot lamp to indicate its operating condition. Use this pilot lamp when adjusting the proximity switch.

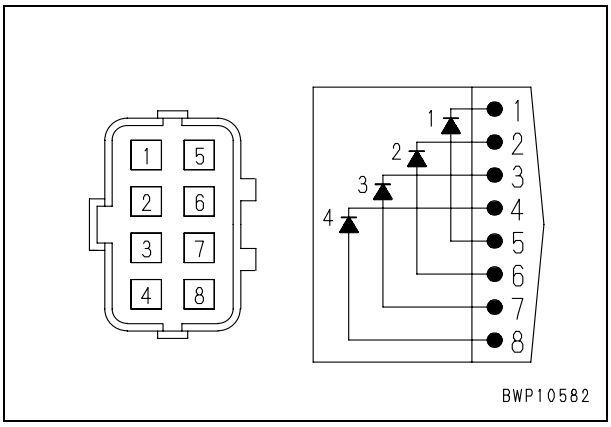
- A: Operation pilot lamp (Red)



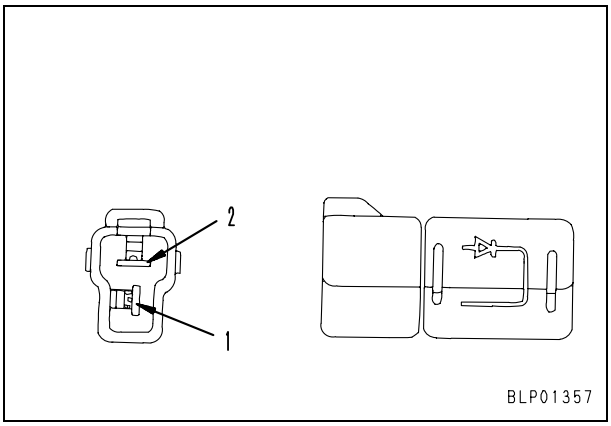
Proximity switch	Positional relationship between sensitive surface of proximity switch and sensing object	Operation pilot lamp	Remarks
Bucket positioner	Near	ON	Operates when center of switch is near
	Far	OFF	
Boom kick-out	Near	ON	Operates when center of switch is far
	Far	OFF	

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.

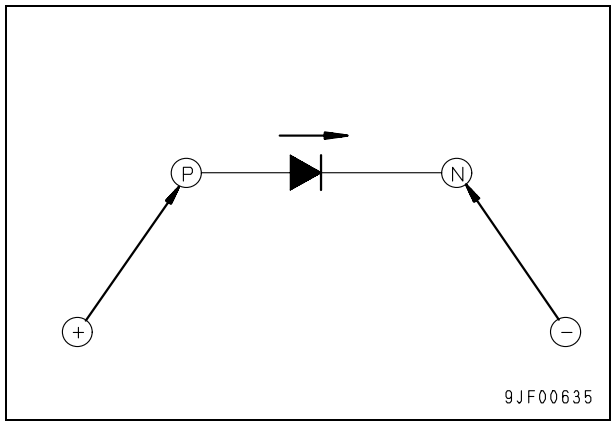


★ The conductive directions of the single diode is indicated on the surface of the diode as shown in the following figure.



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)

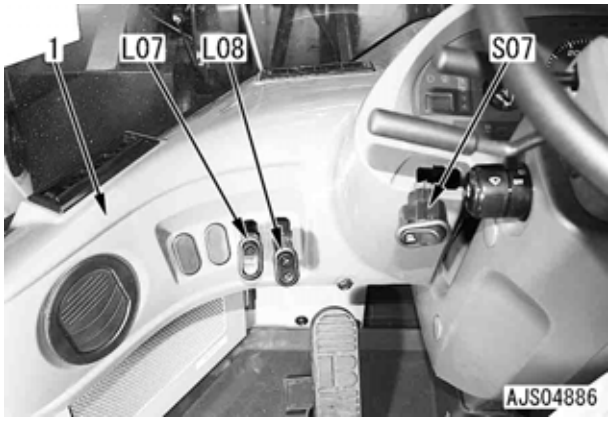
Preparation work for troubleshooting for electric system

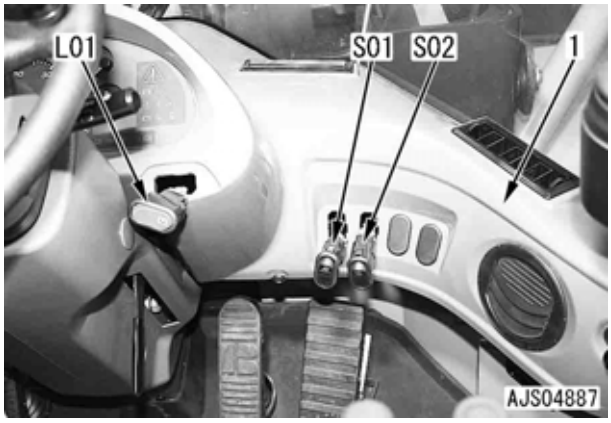
★ When carrying out troubleshooting for an electric circuit related to the machine monitor, transmission controller, work equipment controller, or KOMTRAX terminal, expose the related connectors according to the following procedure.
★ Disconnect and connect the connectors of special lock types according to the following procedure.

1. Machine monitor

1) Disconnect the following connectors from cover (1).
   - Connector **L01**:Parking brake switch
   - Connector **L07**:Machine monitor mode selector switch 1
   - Connector **L08**:Machine monitor mode selector switch 2
   - Connector **S01**:Front working lamp switch
   - Connector **S02**:Rear working lamp switch
   - Connector **S07**:ECSS switch (If equipped)

   ★ Pull the switch out of the cover and disconnect each connector.
   ★ If you insert your hands from under the cover and disconnect a connector forcibly, you many damage the connector or switch. Take care.

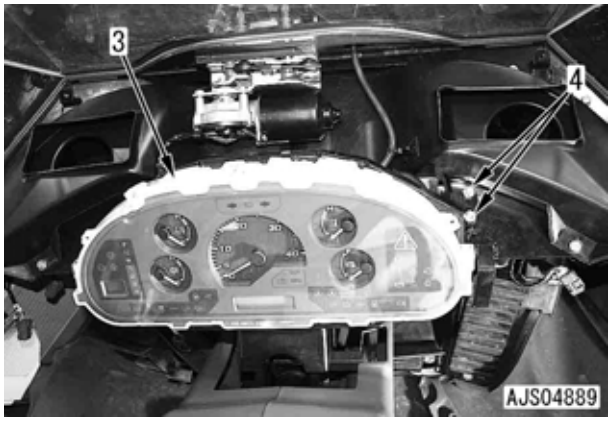




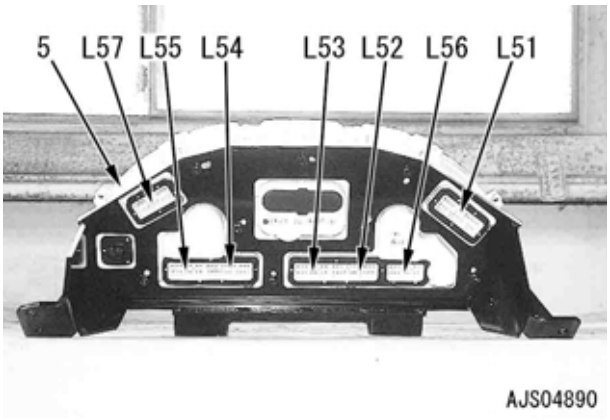
2) Remove interior cover (2) from the front left side.
   ★ Remove the cap and mounting bolts.
3) Remove cover (1).



4) Remove 3 bracket mounting bolts (4) of machine monitor (3) and reverse the machine monitor.
   ★ Take care not to pull the wiring harness forcibly.



5) Connect diagnosis T-adapters to connectors **L51**, **L52**, **L53**, **L54**, **L55**, **L56**, and **L57** of machine monitor (5).



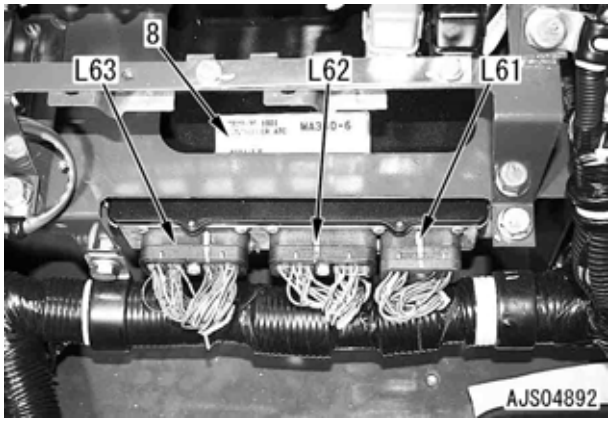
2. Transmission controller

1) Remove covers (6) and (7) from the rear of the cab.



2) Connect diagnosis T-adapters to connectors **L61**, **L62**, and **L63** of transmission controller (8).
   - ★ If the connectors cannot be disconnected and connected easily, remove the transmission controller.
   - ★ Since the connectors are secured with screws, loosen those screws before disconnecting.
   - ★ When connecting the connectors again, tighten their screws to the specified torque.

   Screw:
   2.2 – 2.8 Nm {0.23 – 0.29 kgm}



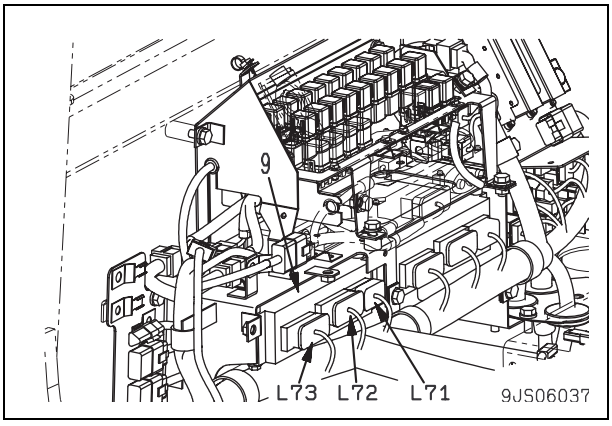
3. Work equipment controller (if equipped)

1) Remove covers (6) and (7) from the rear of the cab.



2) Connect diagnosis T-adapters to connectors **L71**, **L72**, and **L73** of work equipment controller (9).
   - ★ If the connectors cannot be disconnected and connected easily, remove the work equipment controller.
   - ★ Since the connectors are secured with screws, loosen those screws before disconnecting.
   - ★ When connecting the connectors again, tighten their screws to the specified torque.

   Screw:
   2.2 – 2.8 Nm {0.23 – 0.29 kgm}



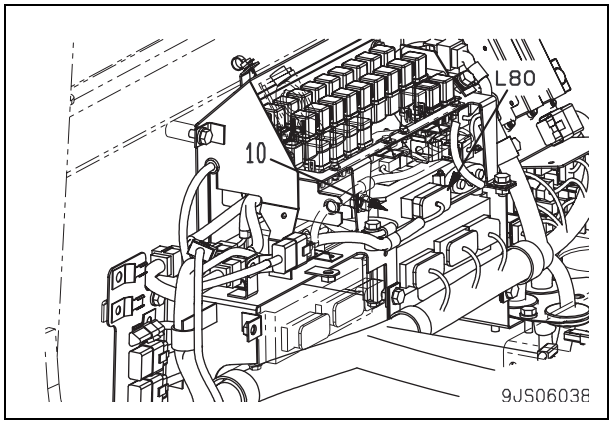
4. KOMTRAX controller

1) Remove cover (10)



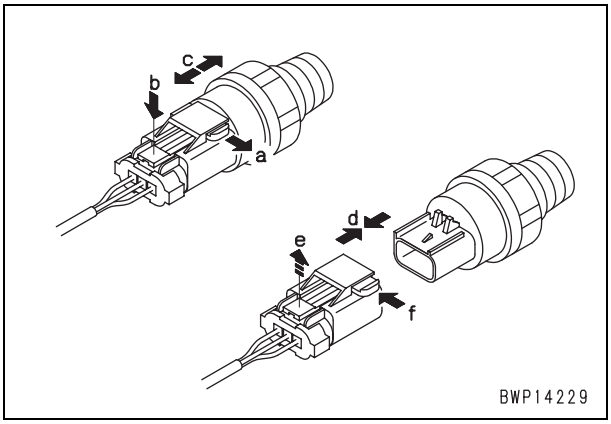
2) Connect diagnosis T-adapter to connector **L80** of KOMTRAX terminal (11).
   - ★ If the connector cannot be disconnected and connected easily, remove the KOMTRAX terminal.
   - ★ Since the connector is secured with screws, loosen those screws before disconnecting.
   - ★ When connecting the connector again, tighten its screws to the specified torque.

   Screw:
   2.2 – 2.8 Nm {0.23 – 0.29 kgm}



5. Ambient pressure sensor (AMBAIR PRESSURE)
Engine Ne speed sensor (CRANK SENSOR)
Engine Bkup speed sensor (CAM SENSOR)
Engine oil pressure switch (OIL PRESSURE SWITCH)

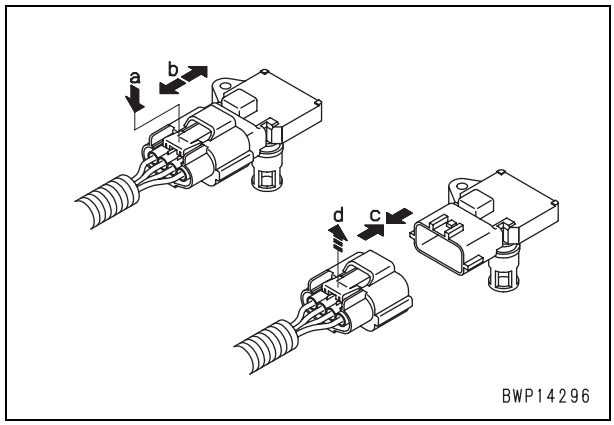
★ Disconnection and connection of connectors
The connectors of the ambient pressure sensor, engine Ne speed sensor, engine Bkup speed sensor, and engine oil pressure switch have a special locking mechanism. Disconnect them according to steps (a) – (c) and connect them according to steps (d) – (f) as shown below.
Disconnection: (a) Slide lever – (b) Unlock – (c) Disconnect connector.
Connection: (d) Connect connector – (e) Lock – (f) Slide lever.



★ Removal and installation of sensor
A deep socket is necessary for removal and installation of the engine oil pressure switch. See Testing adjusting, “Troubleshooting tools table”.

6. Boost pressure and temperature sensor (BOOST PRESS & IMT)

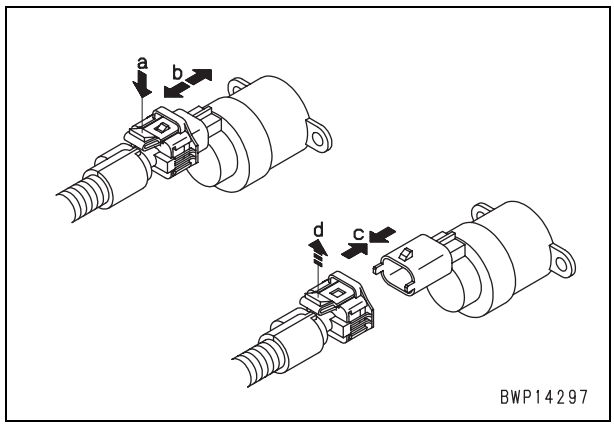
★ Disconnection and connection of connector
The connector of the boost pressure and temperature sensor has a special locking mechanism. Disconnect it according to steps (a) – (b) and connect it according to steps (c) – (d) as shown below.
Disconnection:
(a) Unlock – (b) Disconnect connector.
Connection:
(c) Connect connector – (d) Lock.



★ Removal and installation of sensor
A torque wrench is necessary for removal and installation of the boost pressure and temperature sensor. See Testing adjusting, “Troubleshooting tools table”.

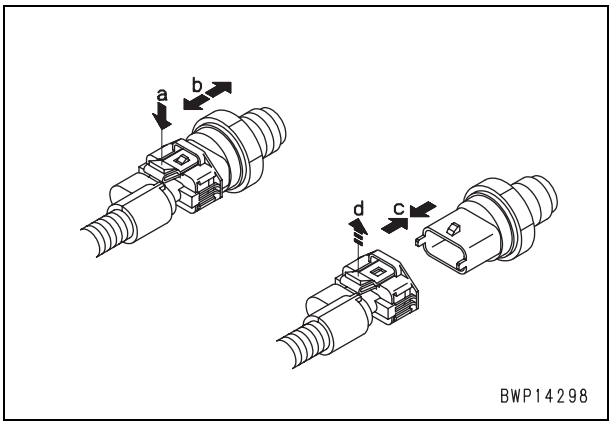
7. Supply pump IMV solenoid (FUEL REGULATOR)

★ Disconnection and connection of connector
The connector of the supply pump IMV solenoid has a special locking mechanism. Disconnect it according to steps (a) – (b) and connect it according to steps (c) – (d) as shown below.
Disconnection:
(a) Unlock – (b) Disconnect connector.
Connection:
(c) Connect connector – (d) Lock.

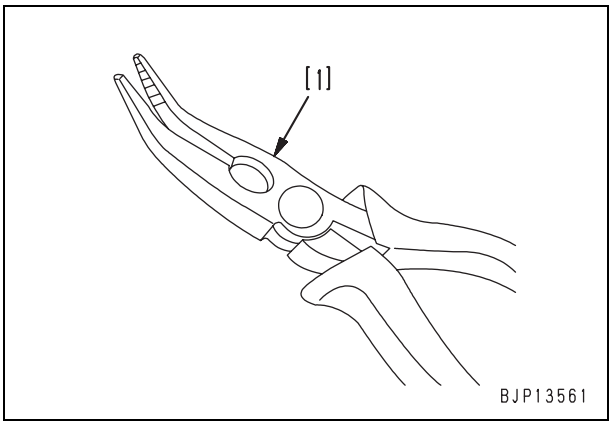


8. Common rail pressure sensor (FUEL RAIL PRESS)

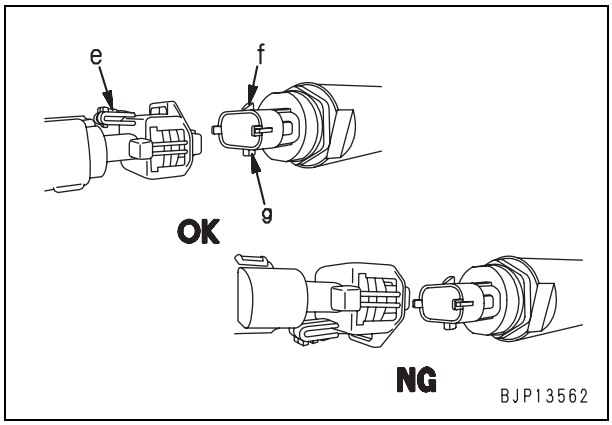
★ Disconnection and connection of connector
The connector of the common rail pressure sensor has a special locking mechanism. Disconnect it according to steps (a) – (b) and connect it according to steps (c) – (d) as shown below.
Disconnection:
(a) Unlock – (b) Disconnect connector.
Connection:
(c) Connect connector – (d) Lock.



★ Precautions for disconnecting connector
The direction of the lock of the connector varies with the tightened position of the sensor and the lock may be in a direction in which it is difficult to reset (on the underside or engine side).
In this case, pinch the lock in direction (a) with bent-nose nippers (commercially available), and the lock is reset.
Since the lock clicks when it is reset, disconnect the connector after a click is heard.

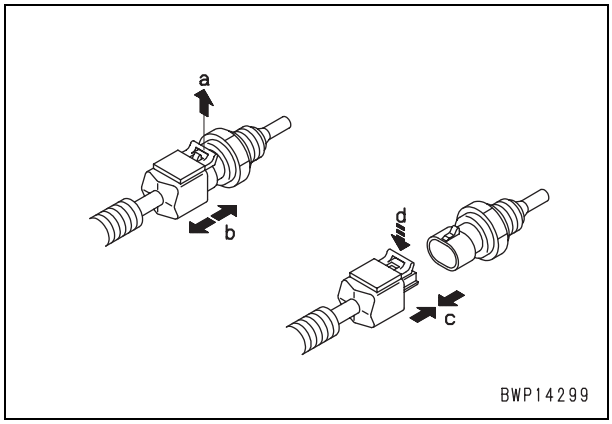


★ Precautions for connecting connector
Take care not to connect the connector reversely.
Engage lock (e) on the wiring harness side with triangular notch (f) on the sensor side (Do not engage lock (e) with square guide (g) on the opposite side of triangular notch (f)).



9. Engine coolant temperature sensor (COOLANT TEMP)

★ Disconnection and connection of connector
The connector of the engine coolant temperature sensor has a special locking mechanism. Disconnect it according to steps (a) – (b) and connect it according to steps (c) – (d) as shown below.
Disconnection:
(a) Unlock – (b) Disconnect connector.
Connection:
(c) Connect connector – (d) Lock.



★ Removal and installation of sensor
A deep socket is necessary for removal and installation of the engine oil pressure switch. See Testing adjusting, “Troubleshooting tools table”.

How to start operation of KOMTRAX terminal

In the case where the KOMTRAX terminal has been installed at the plant before shipment:

★ Implement the following procedure in the case where the KOMTRAX terminal has already been installed at the plant before shipment (as standard equipment).
- Execute "3. Request of opening station of ORBCOMM terminal".

In the case where KOMTRAX terminal is retrofitted on machine after shipment:

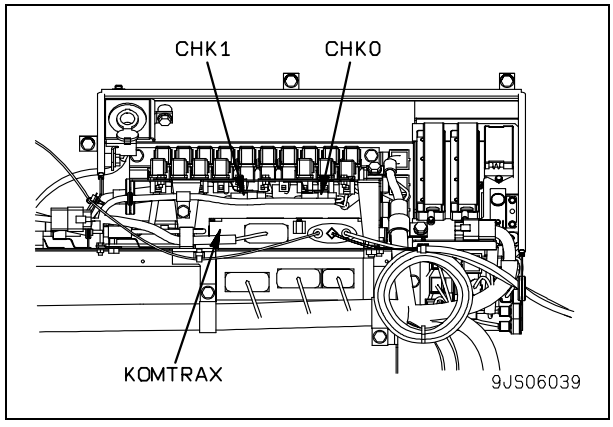
★ Implement the following procedure in the case where the KOMTRAX terminal is retrofitted after shipment of the machine (retrofitted machine).
- Execute "1. Opening station inspection of machine side" and "2. Application of start of use" and "3. Opening station request of ORBCOMM terminal".

How to start operation

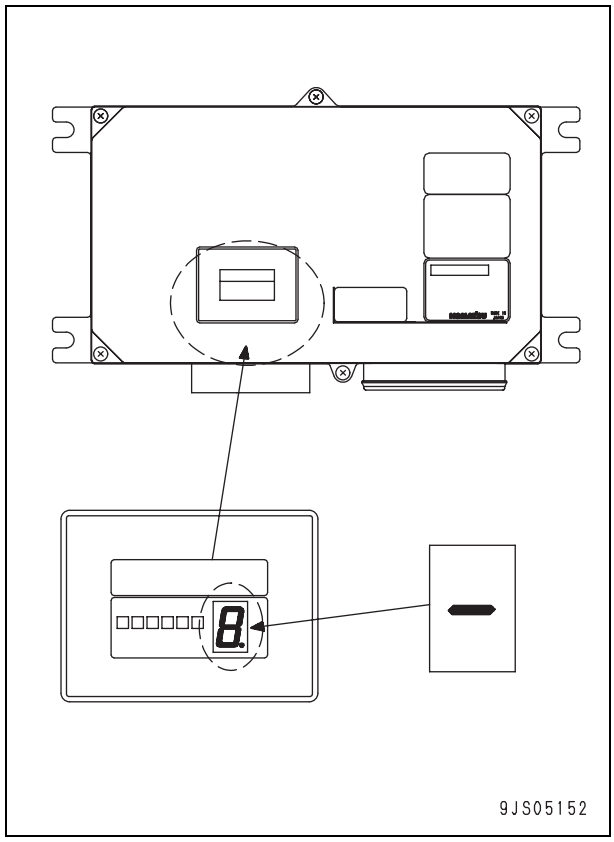
1. Station opening check in machine side

★ Complete steps 3) to 5) within 60 seconds. If 60 seconds or above elapsed, begin with step 1) again.

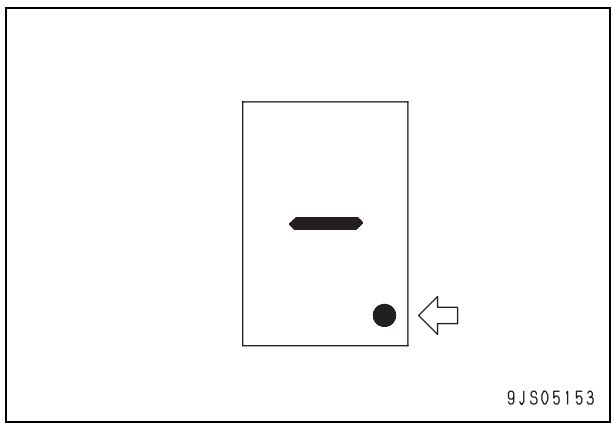
1) Turn OFF the starting switch and then, after making sure 5 seconds have elapsed, proceed to the next step.
2) Visually check that check connectors 1 and 2 are connected.
   - Check connector 1: CHK1
   - Check connector 2: CHK2



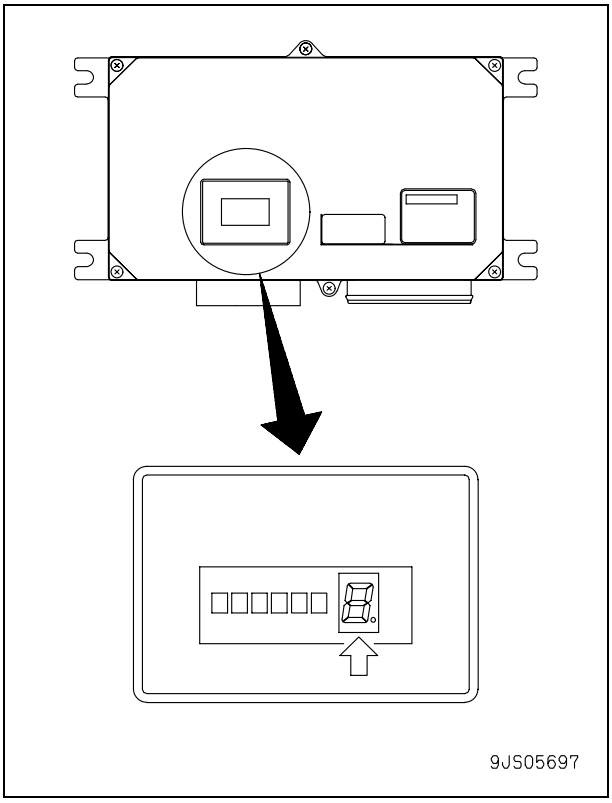
3) When about 3 to 5 seconds elapsed after the starting switch was set to ACC, make sure that the 7-segment indicator lamp changes to hyphen "–" on the KOMTRAX terminal.



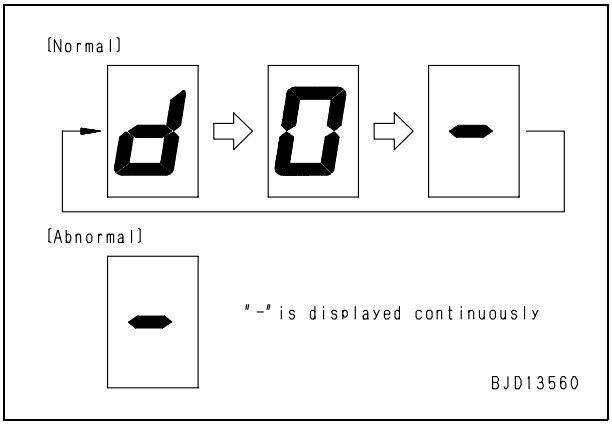
4) Disconnect inspection connector 1, and wait for about 3 to 5 seconds as it is.
   ★ Ensure that the connector is disconnected.
5) Reconnect inspection connector 1, and wait for about 3 to 5 seconds as it is.
   ★ If the KOMTRAX terminal detects that the connector was disconnected and connected, the dot on the 7-segment indicator lamp blinks a few times.



6) Make sure that the 7-segment indicator lamp is indicated normally on the KOMTRAX terminal.
   ★ If so, the 7-segment indicator lamp will indicate characters "d", "0", and "– " repeatedly for 30 seconds after step 5) was ended.
   ★ Those characters, even if displayed normally, will change to a character other than hyphen "–" after 30 seconds or above elapsed.
   The display may change to a character other than "–" even within 30 seconds.

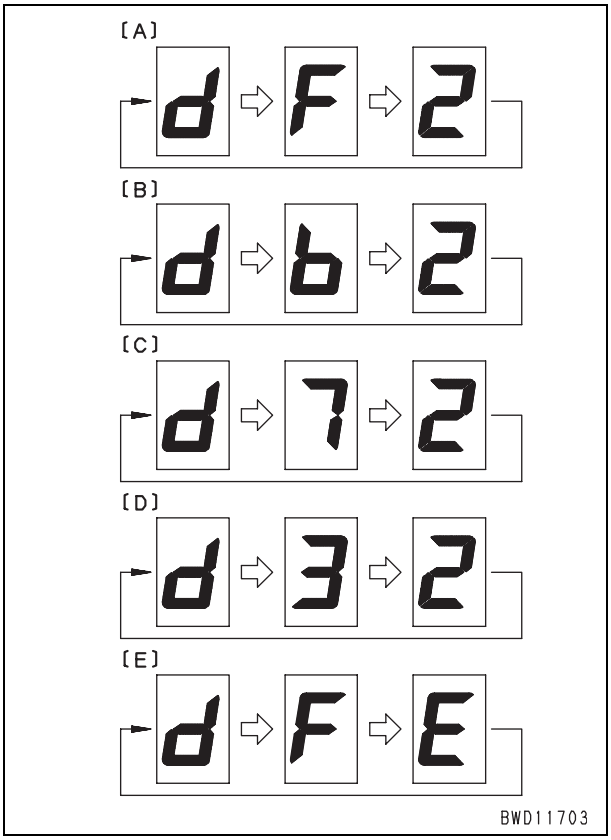


   ★ As [Normal] is indicated, proceed to the next step.
   ★ If "–" remains displayed, execute steps 1) to 5) again.

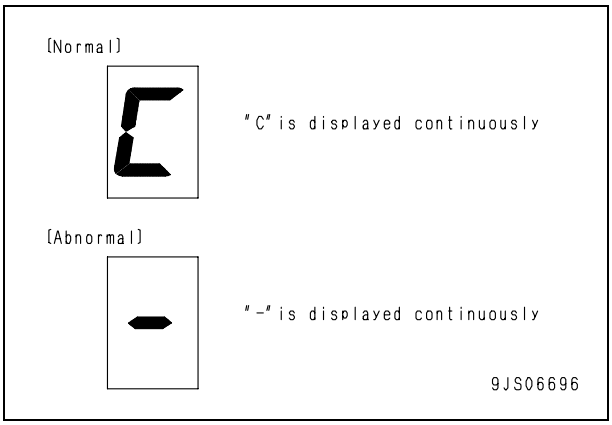


7) Turn the starting switch to START position for about 3 to 5 seconds, and make sure that the engine does not start.
   ★ If the engine starts, re-execute the procedure above from step 1).
   ★ Do not return the starting switch to OFF position.
8) Turn the starting switch from ACC position to START position again, and make sure that the engine starts.
9) Make sure that the KOMTRAX terminal's indicator lamps are normally turned on.
   ★ Move on to the next step if you can check that the display is [Normal]. (It takes from 90 seconds to 15 minutes before the display turns normal.)
   ★ If [GPS position data detection trouble] is indicated, check if there is any abnormality on the GPS antenna or cable. If there is any abnormality, repair it and start from procedure 1) again.
   ★ If [Reception trouble] is indicated, check if there is any abnormality on the appearance of the communication antenna or cable. If there is any abnormality, repair it then repeat from procedure 1) again.
   ★ If [GPS position data detection trouble and reception trouble] is indicated, check if there is any abnormality on the GPS antenna/ cable or communication antenna/ cable. If there is any abnormality, repair it and start from procedure 1) again.
   ★ If [Network trouble] is indicated, check the display of [LED-C4] referring to "Lamp display of KOMTRAX terminal". If the CAN is not recognized, check the CAN harness of the KOMTRAX terminal, and then if there is any abnormality, repair it and start from procedure 1) again.

[A]: Normal
[B]: GPS position data detection trouble
[C]: Reception trouble
[D]: GPS position data detection trouble and reception trouble
[E]: Network trouble



10) Turn the starting switch OFF.
11) Make sure that the 7-segment indicator lamp is displayed normally after 5 seconds elapsed.
★ When [Normal] appears, station opening check is completed.
★ If [Abnormal] appears, station opening check does not end normally, so you should perform the procedure above from step 1) again.
★ If station opening check ends normally, it should not be rechecked.

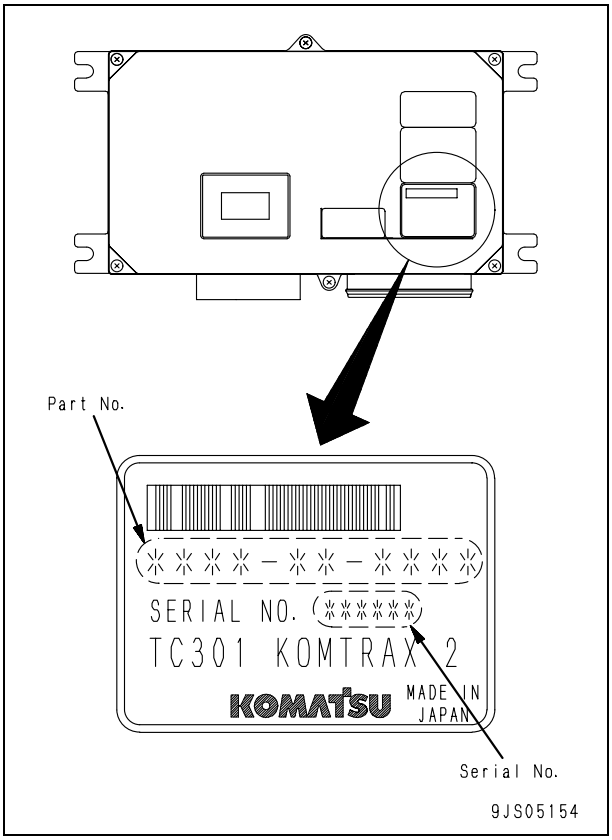


12) When station opening check ended normally, a communication with the KOMTRAX server starts automatically, and settings are stored in KOMTRAX. (This requires about 25 minutes to 4 hours.)
★ During this time, you may turn the starting switch off and start the engine.
★ During the communication and check above, you should park the machine outside to enable a frequent communication with the ORBCOMM satellite. The station opening check may not be completed in doors that cause radio waves from the satellite to be intercepted.

2. Application for the start of use

★ Application for the start of use is made only after the sign-up test on the machine side is finished.

1) Notify to the KOMTRAX operations administrator the following information concerning the machine whose sign-up test on the machine is completed.
   1] Information on the machine whose sign-up test on the machine system is completed (model, model number and serial number).
   2] Part number and serial number of the KOMTRAX terminal
   3] Reading of the service meter when the KOMTRAX terminal is installed (0.1 h unit)



2) The KOMTRAX operations administrator registers the body using a KOMTRAX client personal computer.
   ★ For the procedure, see the following.
   - "Global KOMTRAX Web Reference Manual" (For key person)

3. Opening station request of ORBCOMM terminal

Fill in the necessary matters in the paper of "opening request of ORBCOMM terminal" and send KOMTRAX service hotline by fax or mail.

宛）KOMTRAXサービスホットライン
〒254-8555 神奈川県平塚市四之宮 3-25-1
フリーダイアル：0120-649-300(Japan domestic only)
電話：0463-22-8780
ファックス：0463-22-8448
eメール：cs_kom@komatsu.co.jp

TO::KOMTRAX Service Hotline
Phone:+81-463-22-8780
Fax:+81-463-22-8448
Address:3-25-1 Shinomiya,Hiratsuka-shi,Kanagawa 254-8555,Japan
e-mail:cs_kom@komatsu.co.jp

重要 Important

オーブコム端末開局依頼

Request for Orbcomm Terminal Activation

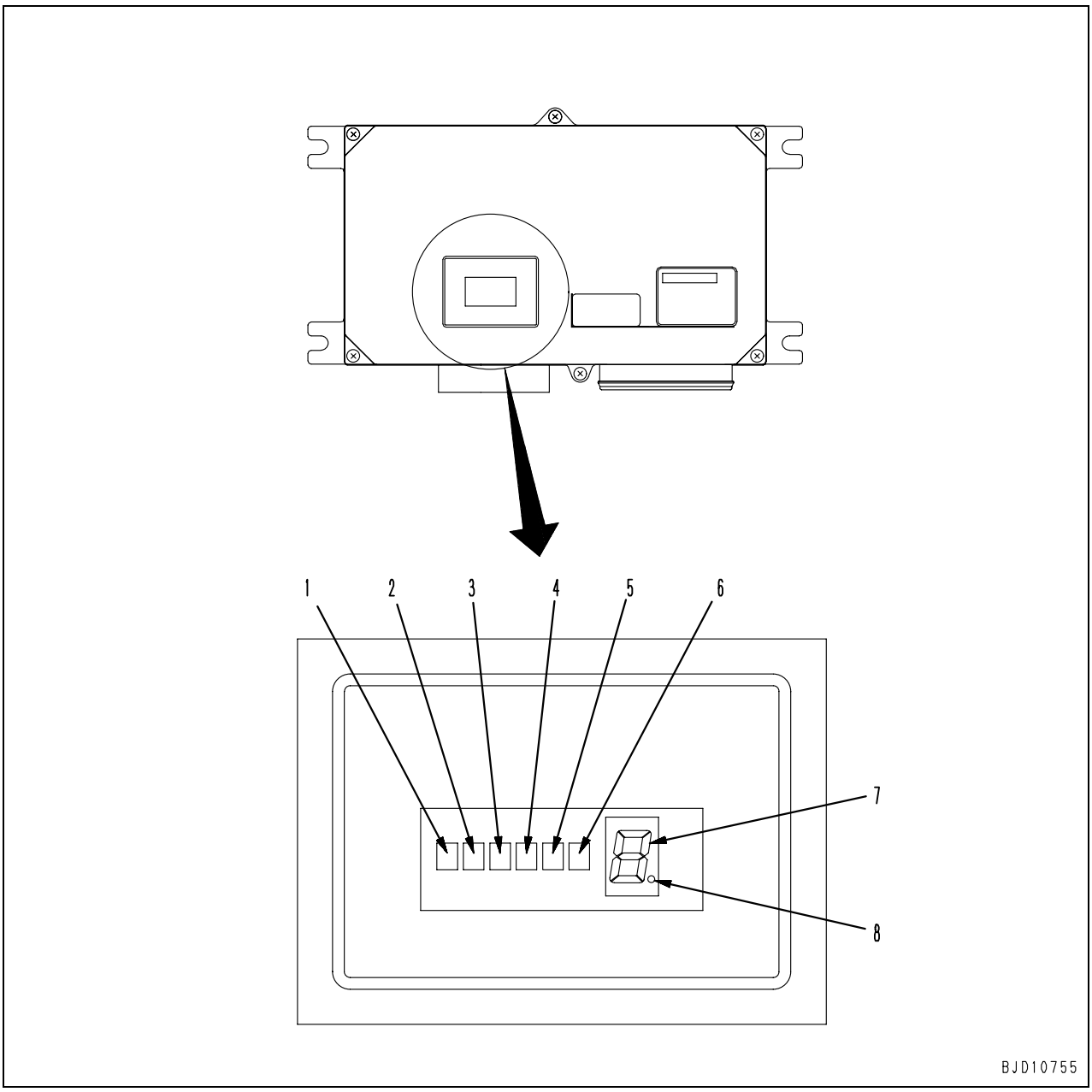
オーブコム衛星通信端末使用開始にあたり、ご面倒ですが下記項目をご記入の上、本用紙を上記の弊社ＫＯＭＴＲＡＸサービスホットライン宛てにファックスまたは郵送お願い致します。
Please fill in the form below and fax or send by mail to Customer Support Gr.,Kltd.to activate Orbcomm terminal.

端末情報 Terminal Information	
端末品番 Terminal Parts Number:	（端末のP/N,S/Nを記入又は同梱のシールをここに貼ってください） (Please fill in terminal P/N&S/N or put on enclosed sticker here)
端末シリアルナンバ Terminal S/N:	品番P/N: シリアルナンバS/N:
通信開始希望日　（注） Terminal Activation Date of your choice(Notes):	年/月/日 (YY/MM/DD) ／ ／
使用国 Country to use:	
車両情報 Machine info.	機種･型式･機番 Model･Type･#S/N ・ #
お客様連絡先 Customer's Contact Address	
会社名称（又は工場） Company(or Plant):	( )
電話番号 Phone number:	(市外/市内/) (Country-Area-Local-Local) - - -
ファックス Fax number:	(市外/市内/) (Country-Area-Local-Local) - - -
e-mailアドレス e-mail address:	
申し込み者お名前 Name(Please print):	姓　名 First Middle Family
ご署名 Signature:	

注）Notes)
・本依頼書が届いてから使用開始可能まで２～３週間かかります。３週間後、又はそれ以降の通信開始希望日を記入下さい。
It will take two or three weeks to activate Orbcomm terminal after being received this sheet.Therefore, Please enter terminal activation date of your choice three weeks after or later the submission of this sheet.
・登録が終了するまでオーブコム端末は通信することができません。
Orbcomm terminal is unable to communicate befor registration being completed.

BJH12077

Lamp display of KOMTRAX terminal



CPU LED

1. LED-C1 (R signal, ACC signal)
2. LED-C2 (Starting output status)
3. LED-C3 (S-NET, C signal status)
4. LED-C4 (Condition of CAN communication)
5. LED-C5 (downloading and writing status)
6. LED-C6 (downloading and writing status)

7 segments and dot for CPU

7. 7 segments (number of mails not yet sent)
8. Dot (GPS positioning status)

In the KOMTRAX system, various information and processing details are displayed on the LEDs on the upper surface of the KOMTRAX terminal. Therefore, if a detect is suspected in the system, perform the following checks.

- Check of antennas
- Check of terminal LED displays

Application for the start of use and sign-up test on the vehicle bodies should be completed before using KOMTRAX system.
On the bodies for which these procedures have not been completed yet, all the LEDs for the communication module are light-off. This is not a defect.

Check of antennas

★ Before checking the LED displays, check that there is no abnormality around the communication antenna and GPS antenna.
- The communication antenna should not be disconnected or damaged.
- The communication antenna cable should not be broken and be connected normally with the KOMTRAX terminal.
- The GPS antenna should not be disconnected or damaged.
- The GPS antenna cable should not be broken and normally be connected to the KOMTRAX terminal.

Check of terminal LED displays

1. Display contents of LED for CPU

★ The LED displays should be checked with the starting switch ON, starting switch START, or with the engine started.

No.	LED	Name and function	Display (refer to *1)	Display contents
1	LED-C1	Starting switch ACC signal and alternator R signal	Lighting on	Starting switch ACC signal: ON, alternator R signal: ON
			Fast blinking	Starting switch ACC signal: OFF, alternator R signal: ON
			Slow blinking	Starting switch ACC signal: ON, alternator R signal: OFF
			Lighting off	Starting switch ACC signal: OFF, alternator R signal: OFF
2	LED-C2	Engine control signal status	Lighting on	Engine control signal: ON
			Lighting off	Engine control signal: OFF
3	LED-C3	S-NET connection status and starting switch C signal status	Lighting on	S-NET: connected, starting switch C signal: OFF
			Fast blinking	Starting switch C signal: ON
			Slow blinking	(Not used)
			Lighting off	S-NET: disconnected, starting switch C signal: OFF
4	LED-C4	CAN status	Lighting on	CAN: active (fuel sensor: inactive)
			Fast blinking	CAN: active (fuel sensor: active)
			Slow blinking	CAN: inactive (fuel sensor: active)
			Lighting off	CAN: inactive (fuel sensor: inactive)
5	LED-C5	Downloading and writing status	One side is ON	Downloading and writing status (special function for system administrator)
6	LED-C6		Both lighting off	Normal operation mode

* 1: Blinking type and time
Fast blinking: blinking on an approximately 1 second cycle
Slow blinking: blinking on an approximately 4 second cycle

2. Display contents of 7-segment and dot for CPU

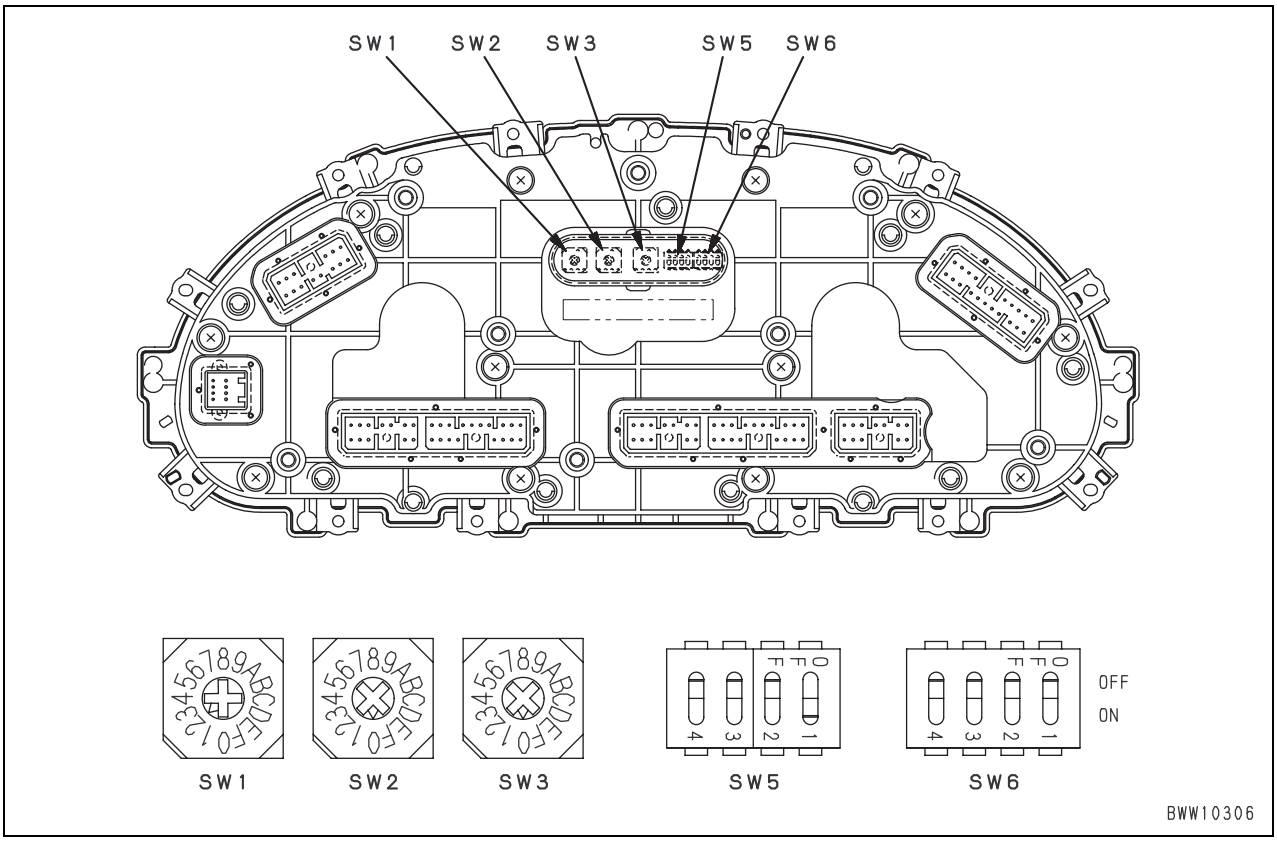
★ LED displays should be checked with the starting switch ON.

No.	LED	Name and function	Display (refer to *2)	Display contents
7	7 segments	Number of mails not yet sent and waiting status acquiring satellite	0 – 9 lighting on	Number means number of mails not yet sent (9 is displayed even if there are more than 9 mails). Lighting on indicates status acquiring satellite.
			0 – 9 fast blinking	Number means number of mails not yet sent (9 is displayed even if there are more than 9 mails). Fast blinking means waiting status acquiring satellite.
8	Dot	GPS positioning status	Lighting on	GPS positioning has been completed. (Position has been recognized. Refer to *3.)
			Lighting off	GPS positioning has not been completed. (Position has not been recognized. Refer to *3.)

* 2: Blinking type and time
  Fast blinking: blinking on an approximately 0.5 second cycle
  Slow blinking: blinking on an approximately 2.0 second cycle
* 3: Supplementary explanation of GPS positioning status
  It may take more than 1 minute from turning on the starting switch to the completion of positioning even in an outdoor place where radio wave can reach.
  Positioning is impossible in areas with extremely weak radio waves or areas beyond the reach of radio waves.

Adjusting machine monitor

Rotary switches (SW1, SW2, and SW3) and DIP switches (SW5 and SW6)



- Do not change the setting of the rotary switches (SW1, SW2, and SW3) and DIP switches (SW5 and SW6) on the back side of the machine monitor.

Adjusting replaced, reassembled or added sensor, controller, etc. with machine monitor

1. Items to be set when sensor or controller is replaced, reassembled or added

★ If any of the following components and parts is replaced or reassembled, initialize the sensors, solenoids, etc. with the machine monitor.

★ Adjust the items in alphabetical order (A –) with the machine monitor.

Replaced, reassembled, or added component or option	Adjustment item
Machine monitor	D, E, F
Change of tire size	J
Transmission	A, B, C
Transmission controller	A, B, C, D, E
Transmission ECMV solenoid	A, B, C
Work equipment controller	G, H
Taking automobile inspection	E
Addition or removal of option	E

Adjustment item	Contents of adjustment	Description No.
A	Resetting transmission initial learning	7-2 (*1)
B	Transmission initial learning	7-2 (*1)
C	Adjustment of transmission ECMV current	7-1 (*1)
D	Selection of machine model	12 (*1)
E	Selection of option	10 (*1)
F	Inputting of machine serial No.	11 (*1)

*1: Description No. of “Service mode” in “Special functions of machine monitor (EMMS)”

2. Adjustment for user's needs

If the user makes the following indications or requests, change or adjust the items shown below with the machine monitor.

Contents of indication/request	Adjustment item
Change indication unit of speedometer	G
Turn ECO lamp OFF	H
Change interval of fan automatic reverse operation (Automatic reverse fan specification)	J
Change continuance of fan automatic reverse operation (Automatic reverse fan specification)	K
Travel speed is indicated too quickly/slowly	L
Turn engine speed/travel speed on character display OFF	M

Adjustment item	Contents of change/adjustment	Description No. (*1)
G	Setting of option/Selection of speed unit	10
H	Setting of option/Selection of indication of ECO lamp	10
J	Adjustment of sensor/Adjustment of interval of fan automatic reverse operation	7–18
K	Adjustment of sensor/Adjustment of continuance of fan automatic reverse operation	7–19
L	Setting of option/Change of tire size	10
M	Setting of option/Change of indication of engine speed or travel speed on normal screen of character display	10

*1: Description No. of “Service mode” in “Special functions of machine monitor (EMMS)”

★ Change of the indication unit of the speedometer and weight meter of the specification for the SI unit countries cannot be set.

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

30 Testing and adjusting

Testing and adjusting, Part 3

Testing and adjusting, Part 3 2
Special functions of machine monitor (EMMS) 2
Pm-click inspection table 61

Testing and adjusting, Part 3

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.

1) **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.
2) **Special functions: Service mode**
   Functions which the serviceman can display and operate with the special switches to carry out inspection, maintenance, and troubleshooting.

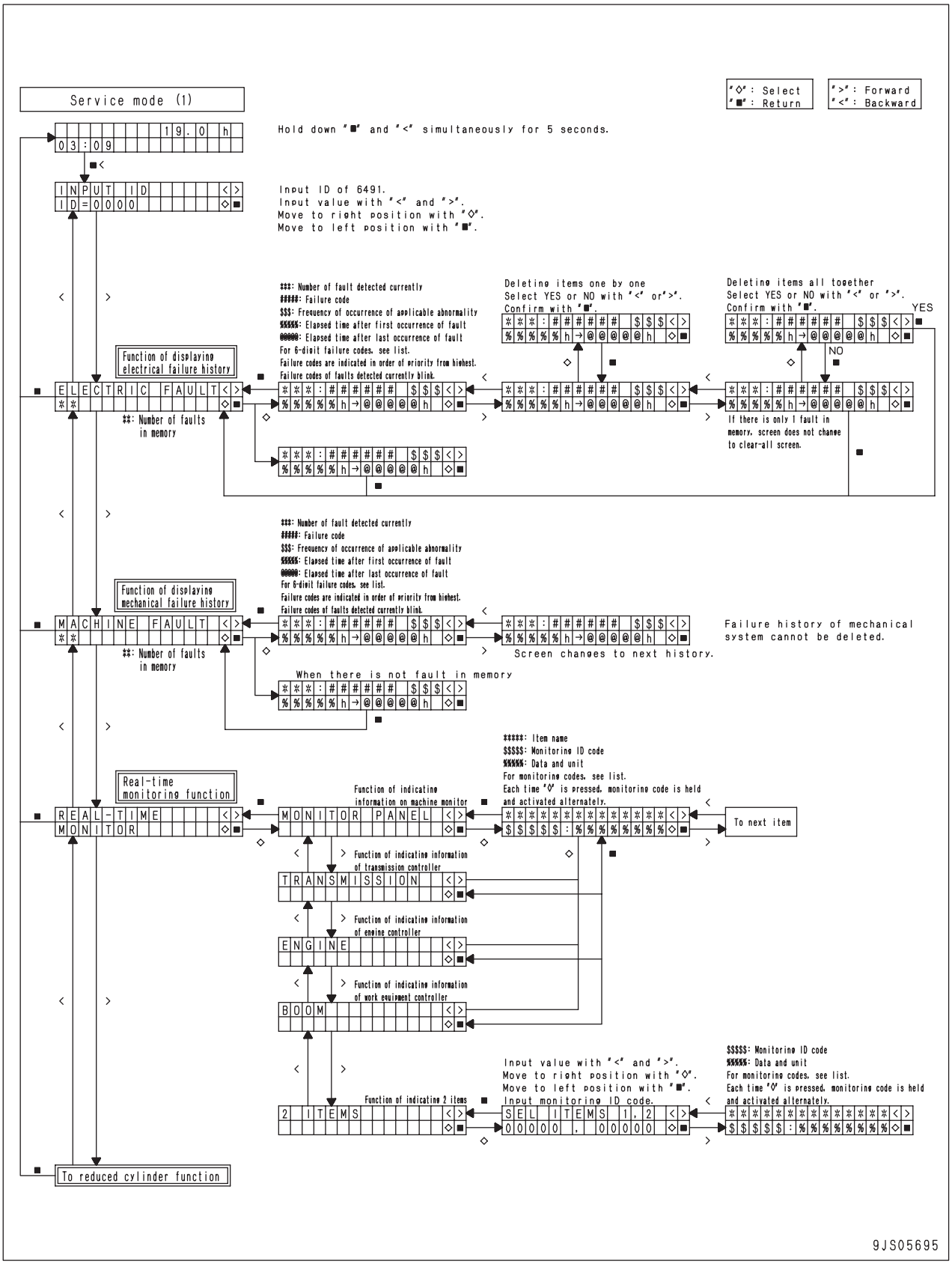
Operator mode	
1	Service meter/clock display function (*2)
2	Load meter function (If equipped) (*1)
3	Odometer display function
4	Maintenance monitoring function
5	Telephone number input function
6	Language selection function
7	Monitor brightness adjustment function
8	Time adjustment function (*2)
9	Travel speed/engine speed display selecting function
10	Function of turning ON/OFF speed/engine speed indicated on character display (*3)
11	Action code display function
12	Failure code display function

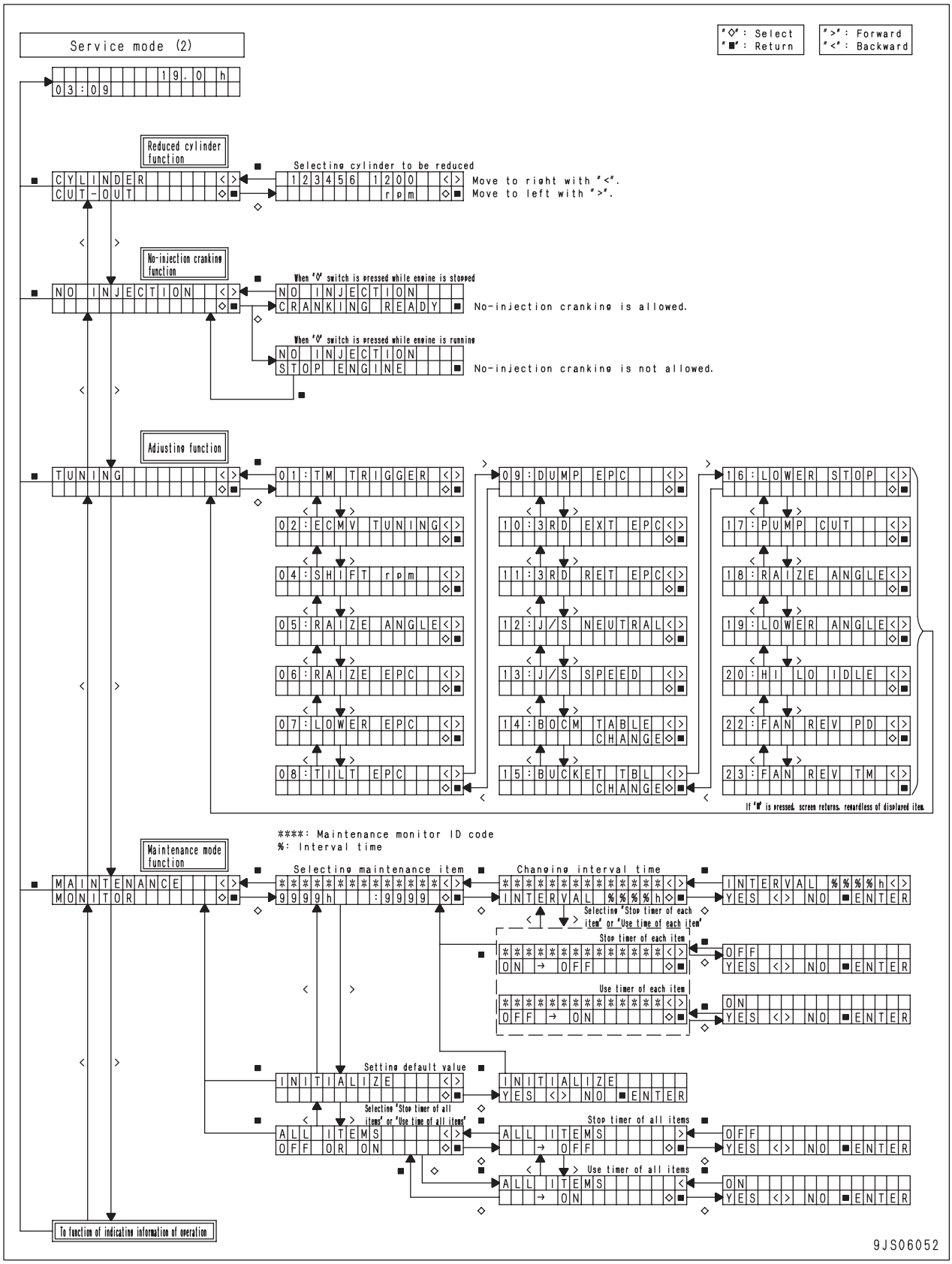
⇔

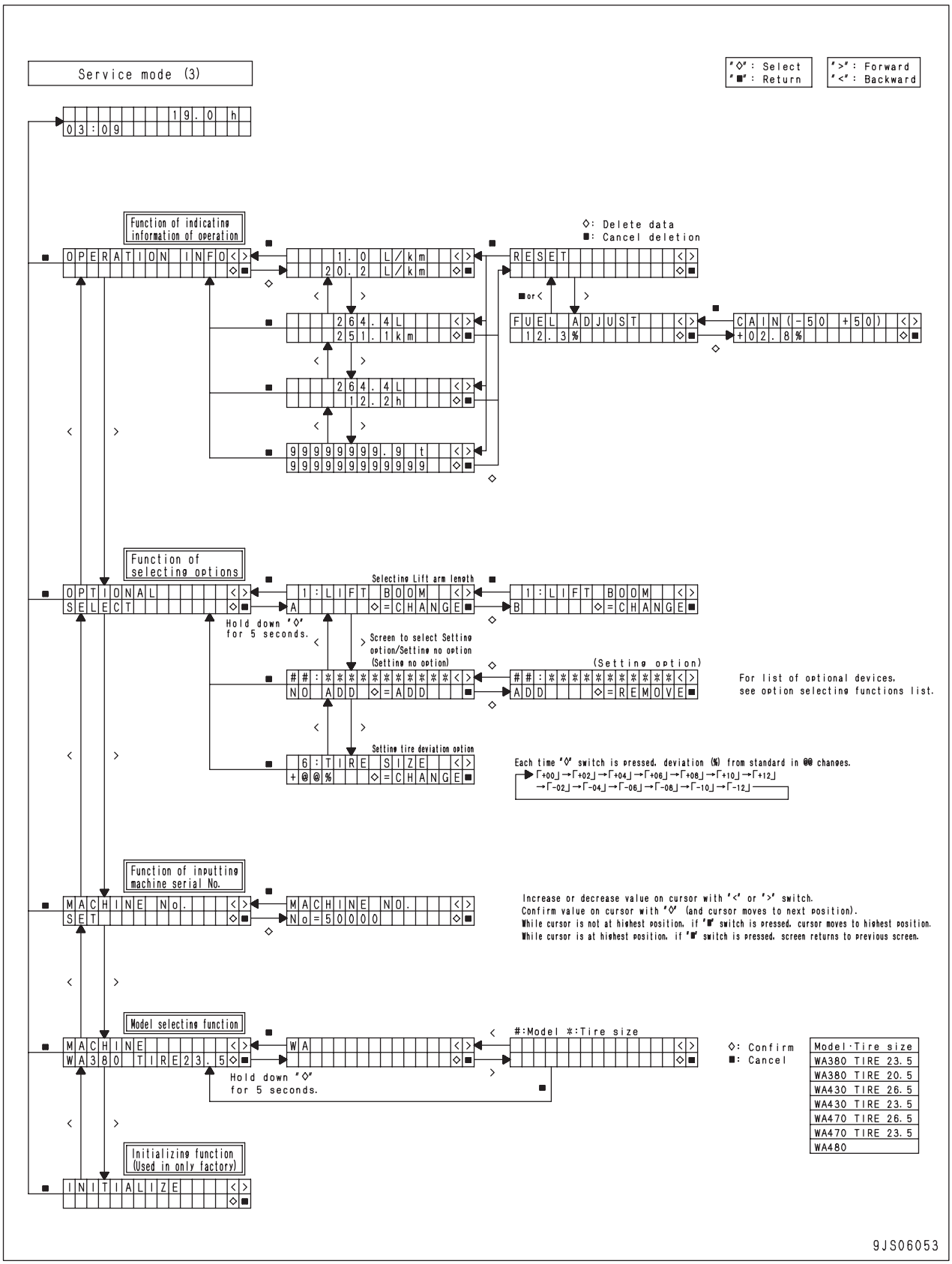
Service mode	
1	Electrical system fault history display function
2	Mechanical system fault history display function
3	Real-time monitoring function
4	Engine reduced-cylinder function
5	No injection cranking function
6	Adjustment function
7	Maintenance monitoring function
8	Operating information display function
9	Optional device selecting function
10	Machine serial number input function
11	Model selection function
12	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.
*3: If the speed/engine speed indicated on character display is turned OFF optionally in the service mode, it is not indicated.

Functions and flow of the service mode




Service mode (2)
"◇": Select
"■": Return
">": Forward
"<": Backward
19.0h
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:BOCM TABLE CHANGE
15:BUCKET TBL CHANGE
16:LOWER STOP
17:PUMP CUT
18:RAIZE ANGLE
19:LOWER ANGLE
20:HI LO IDLE
22:FAN REV PD
23:FAN REV TM
If "M" 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
9JS06052

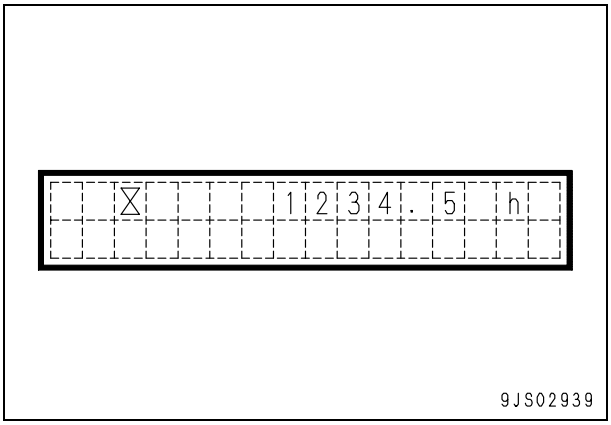

Service mode (3)
"◇": Select
"■": Return
">": Forward
"<": Backward
19.0 h
03:09
Function of indicating information of operation
OPERATION INFO
1.0 L/km
20.2 L/km
264.4 L
251.1 km
264.4 L
12.2 h
99999999.9 t
◇: Delete data
■: Cancel deletion
RESET
■or<
FUEL ADJUST
12.3%
CAIN (-50 +50)
+02.8%
Function of selecting options
OPTIONAL SELECT
Selecting Lift arm length
1:LIFT BOOM
A ◇=CHANGE
B ◇=CHANGE
Hold down "◇" for 5 seconds.
Screen to select Setting option/Setting no option (Setting no option)
(Setting option)
##:******** NO ADD ◇=ADD
ADD ◇=REMOVE
For list of optional devices, see option selecting functions list.
Setting tire deviation option
6:TIRE SIZE
+@@% ◇=CHANGE
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」
Function of inputting machine serial No.
MACHINE No. SET
MACHINE NO.
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 WA380 TIRE23.5
WA
#:Model *:Tire size
◇: Confirm
■: Cancel
Hold down "◇" for 5 seconds.
Model·Tire size
WA380 TIRE 23.5
WA380 TIRE 20.5
WA430 TIRE 26.5
WA430 TIRE 23.5
WA470 TIRE 26.5
WA470 TIRE 23.5
WA480
Initializing function (Used in only factory)
INITIALIZE
9JS06053

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

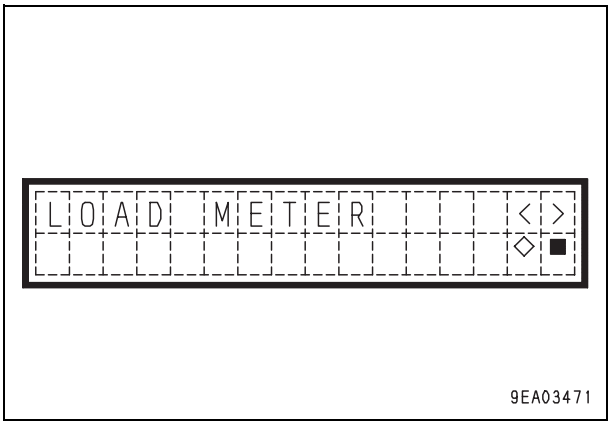
Turning on the starting switch displays the service meter in the upper space and the clock in the lower space.



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.

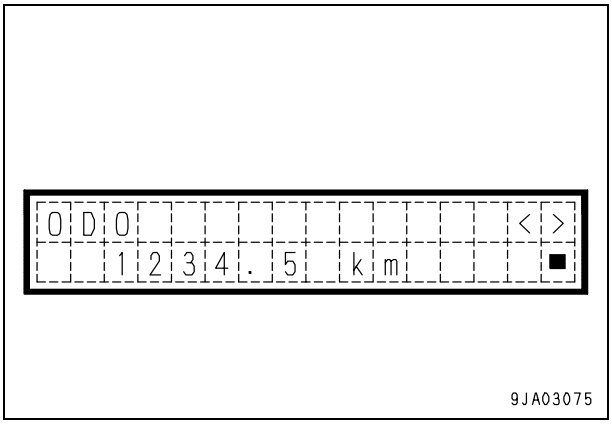


3. Odometer display function

Press [◇] switch from the ordinary service meter and clock display screen to display the odometer.

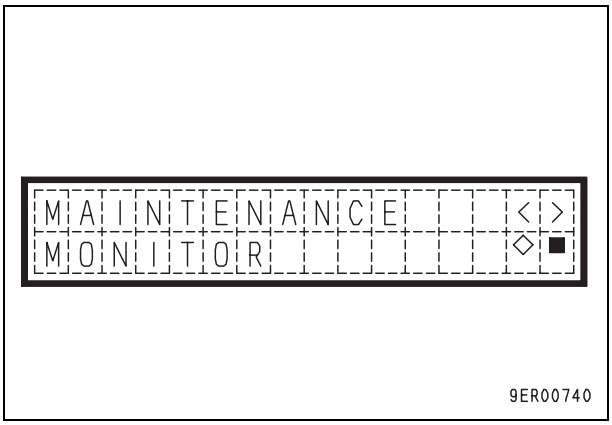
The load meter specifications displays the odometer as [<] switch is pressed succeeding to display of the load meter function.

★ 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.

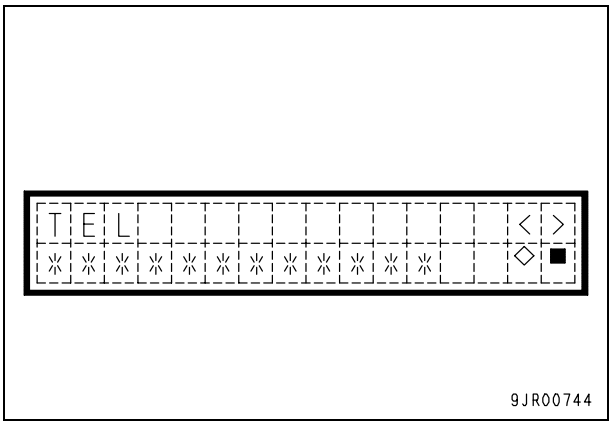


5. Telephone number input function

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.



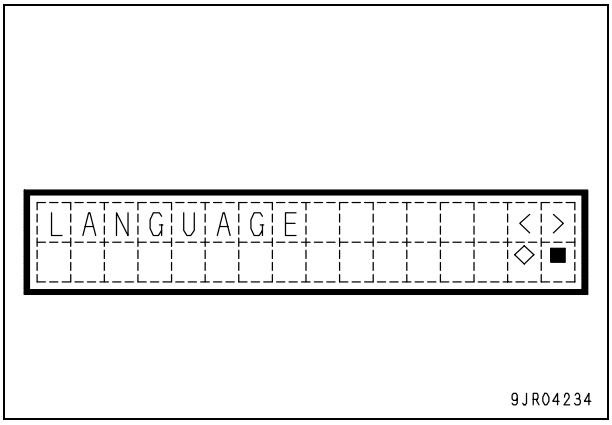
6. Language selection function

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.

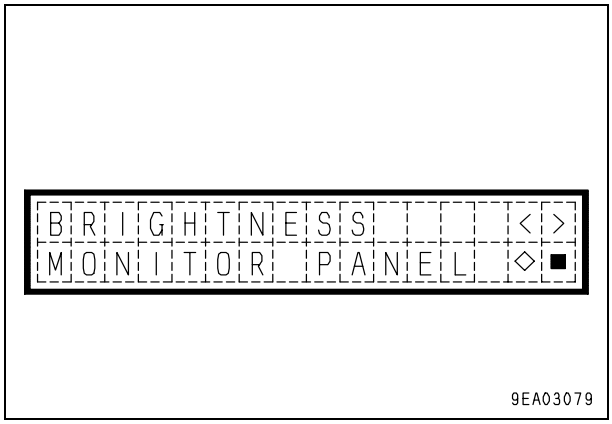


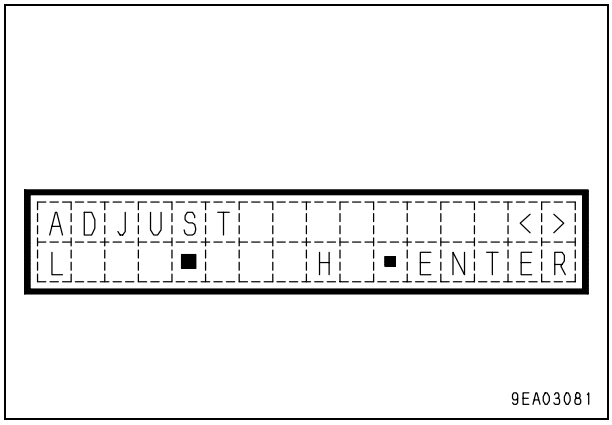
7. Monitor brightness adjustment function

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.

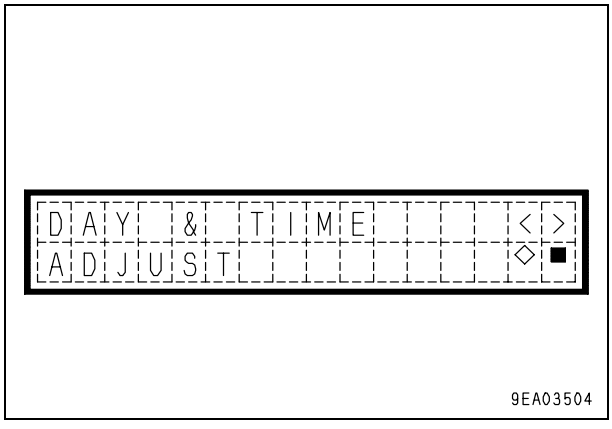




8. Time adjustment function

The time indicated by the clock of the machine monitor is adjustable.

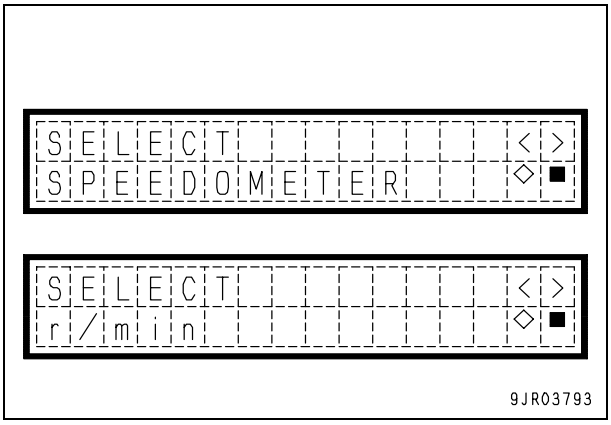
★ For details, see the “Other functions of machine monitor” of the Operation section in the Operation and maintenance manual.



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.

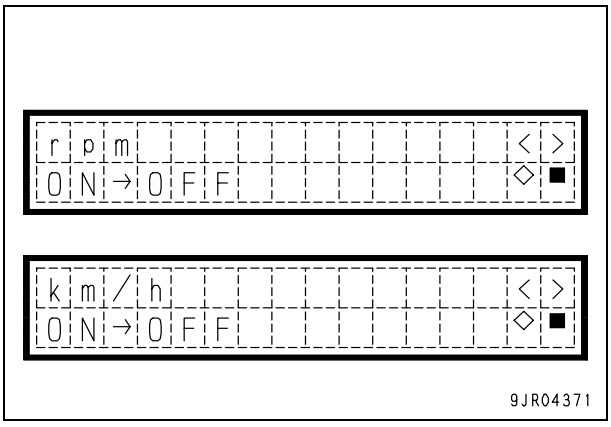
★ For details, see the “Other functions of machine monitor” of the Operation section in the Operation and maintenance manual.



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.

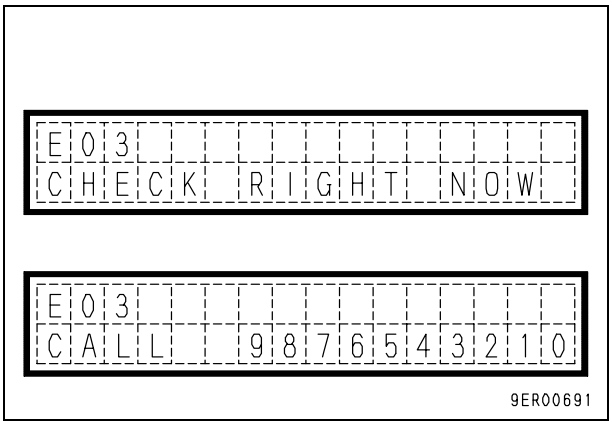


11. Action code display function

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.

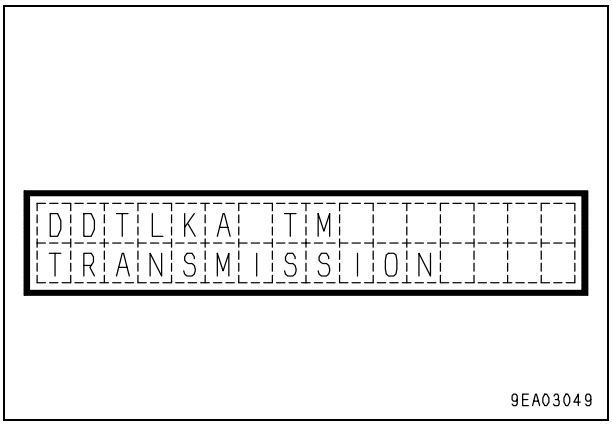
12. Failure code display function

Pressing [>] switch once while an action is displayed on the machine monitor displays the failure code corresponding to the failure currently warned.

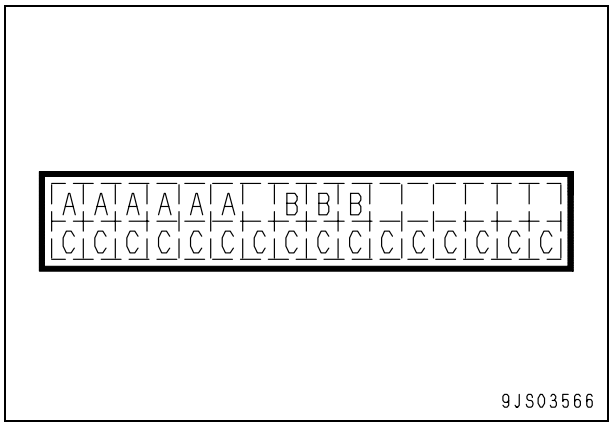
★ The failure codes detected in the past are divided into failures of the electrical system and the mechanical system and are recorded as fault history. (For details, see “Service mode”.)

★ 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
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.

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.

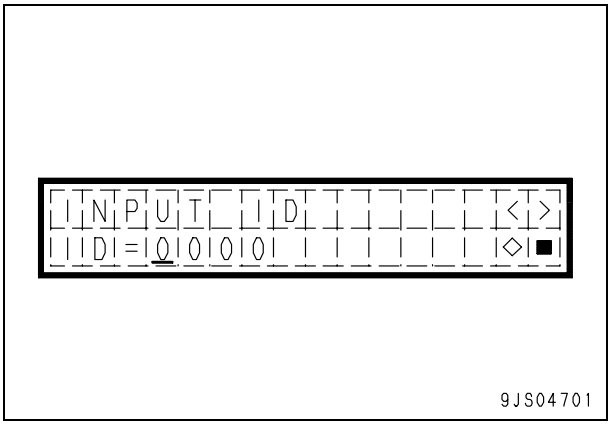
1-1. Checking screen display

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

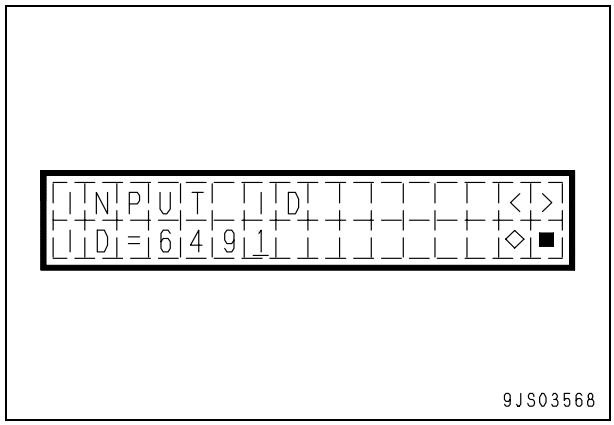
1) Cursor (C) is positioned at the highest-order digit. Pressing [<] and [>] switches changes the value of this digit in the range of 0 – 9.
2) Press [◇] switch when the intended value appeared to specify it.

★ 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).

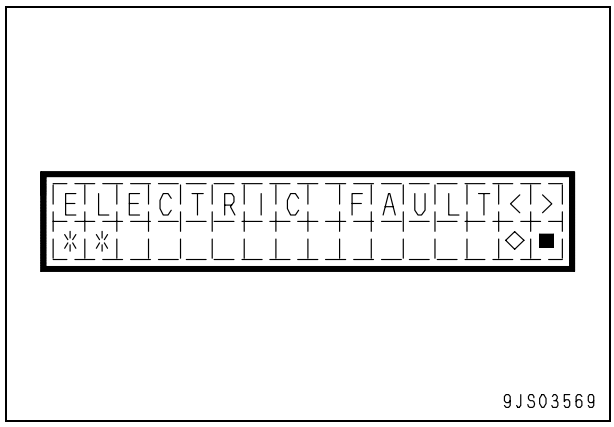
(*1): When the cursor is located at the leftmost position, pressing the switch restores the normal screen (Operator mode).
When the cursor is at a location other than the leftmost position, pressing the switch returns the cursor to the leftmost position.
If any switch operation is not done for 60 seconds 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

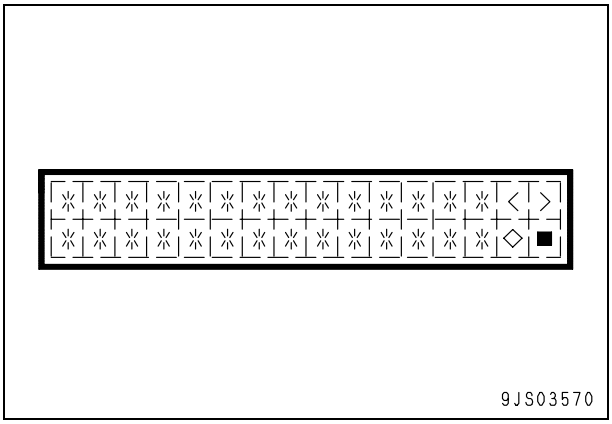
★ Pressing [<] and [>] switches from the menu screen displays Service mode menus endlessly in the following order.

★ 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] OPTIONAL SELECT: Optional device selecting function
[10] MACHINE No. SET: Machine serial number input function
[11] MACHINE WA380 TIRE 23.5: Model selection function
[12] INITIALIZE: Initialize function (Function specialized for plant)

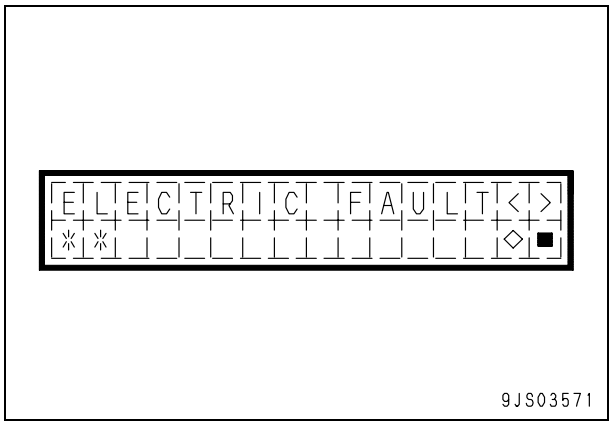
★ The menu is indicated in the parts of [*].



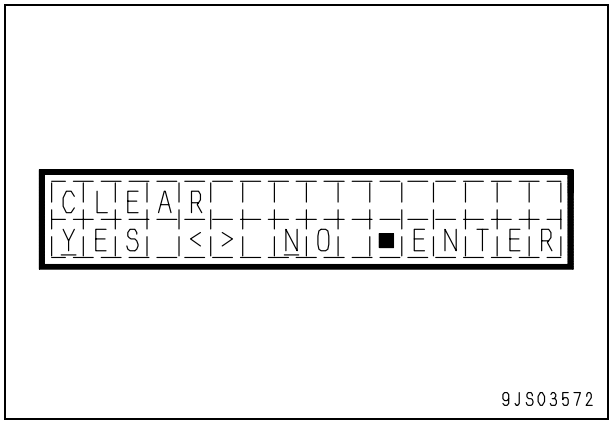
1-6. Completion of mode and function
Either of the following procedures ends a mode or function independent of the function being selected and the layer in which it is used.
1) When the operation is to be continued using another mode or function: Press [■] switch to return to the mode screen or menu screen to be used next.
★ 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 electric 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).

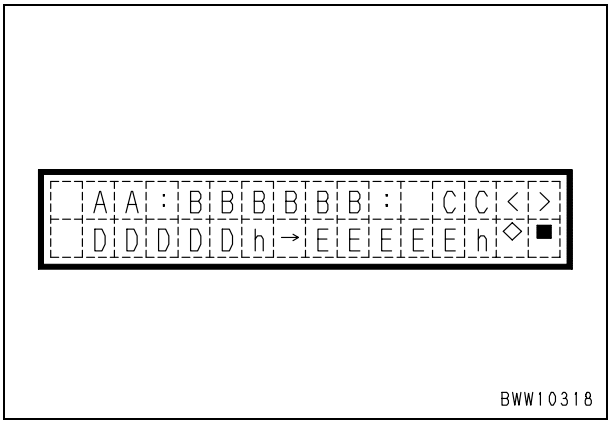


2-2. Displaying fault history
Press [◇] button while the menu is selected to display the recorded fault history.



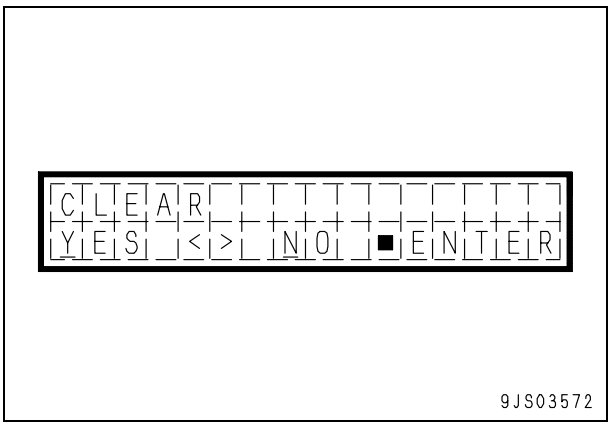
2-3. Displayed fault history
The electric system fault history display function displays the following information.
A: Record number
B: Failure code (Location code in four digits + Problem code in two digits)
C: Number of occurrences (number of occurrences of same code in past)
D: Elapsed time 1 (Elapsed 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.

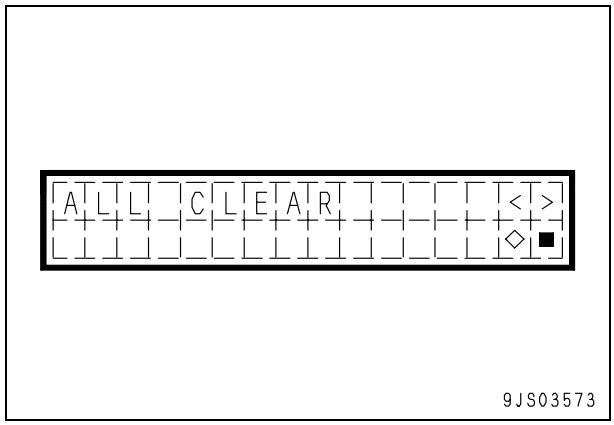


2-4. Switching fault history display
Pressing [<] or [>] switch while a set of fault history is on the screen displays another set of recorded fault history.

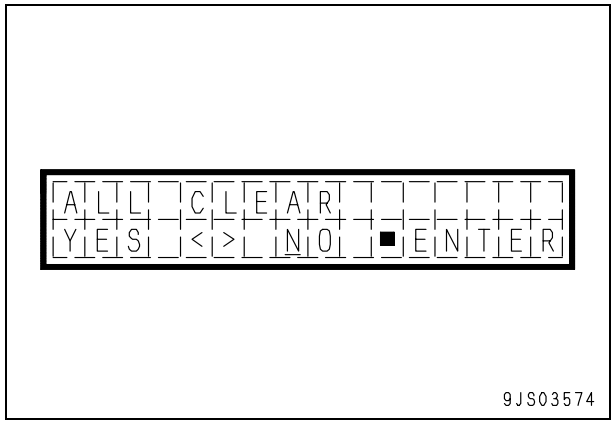
2-5. Deleting individual fault history
1) Press [◇] switch while the target fault history of deletion is on the screen to turn on CLEAR screen.
2) Select “YES” or “NO” using [<] or [>] switch.
★ The selected cursor will start flashing. If “YES” is selected and [■] switch is pressed, the information will 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.



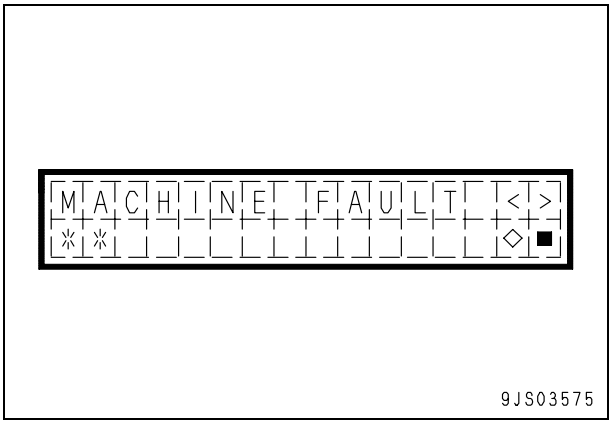
3. Mechanical system fault history display function (MACHINE FAULT)

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

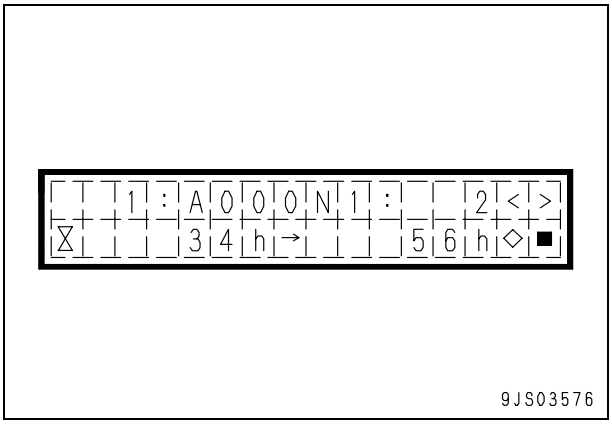
★ Select MACHINE FAULT from the menu screen of Service mode.

★ [**] 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 mechanical 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)

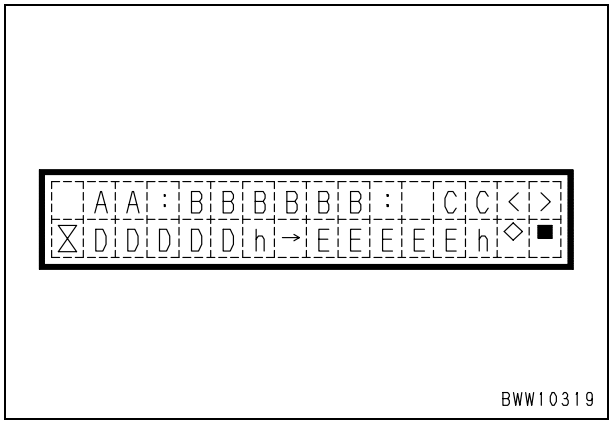
E: Elapsed time 2 (Elapsed time on service meter from the last occurrence)

★ The code of a failure currently occuring 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)

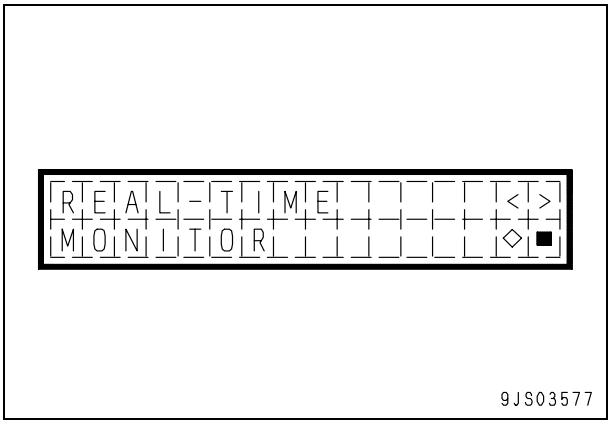
The machine monitor checks state of the machine on real-time basis referencing signals of the sensors being installed in various parts of the machine.

The real-time monitoring functions displays following two types of information.

- 1 item independent display (for each controller)
- 2 items simultaneous display (code input)

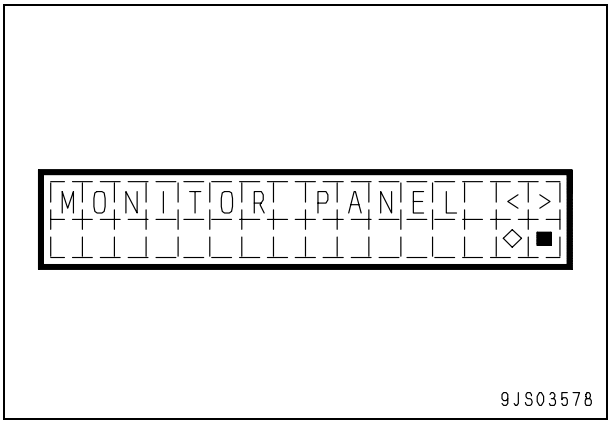
4-1. Selecting the menu

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

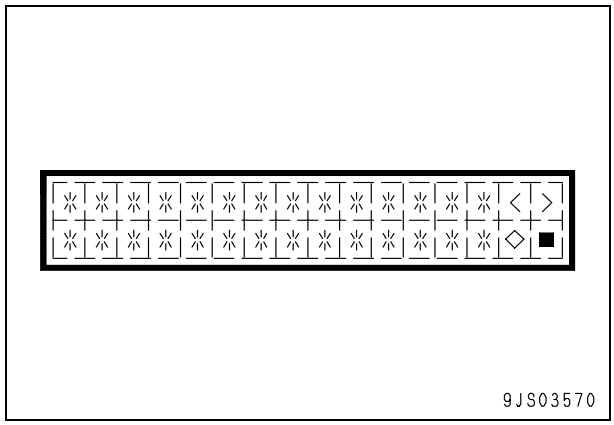
[2] TRANSMISSION: Transmission controller system

[3] BOOM: Work equipment controller system (*1)

[4] ENGINE: Engine controller system

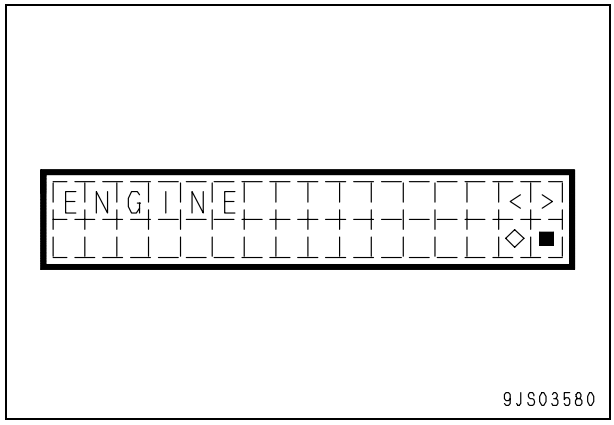
[5] 2 ITEMS: 2 items display

*1: The menu is indicated in the parts of [*].



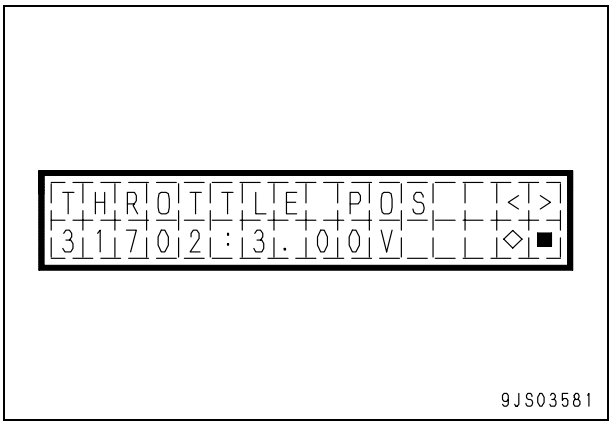
4-4. Setting the 1 item individual monitoring

1) Select the target controller system of monitoring from the sub menu screen.

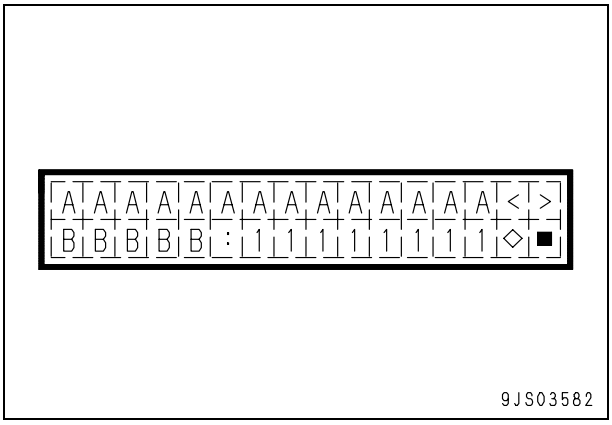


2) Press [◇] switch while the sub menu is selected to display the MONITOR PANEL screen.

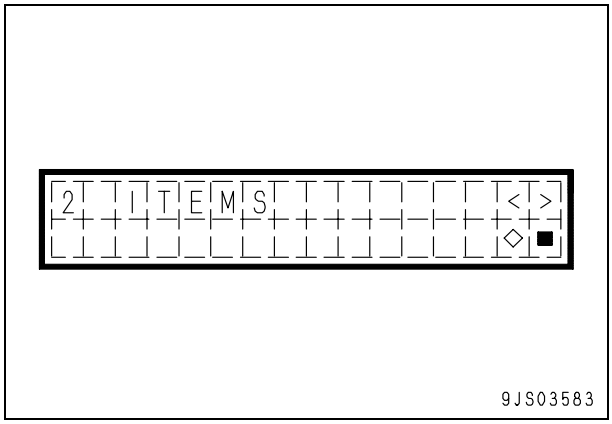
3) Press [<] or [>] switch to select a monitoring item.
★ The monitoring items are scrolled according to the internally set order.
★ Holding down [◇] switch turns on high-speed scrolling.
★ Holding and cancelling the monitoring data: Pressing [◇] switch while the monitoring is in progress holds the monitoring data and [◇] mark starts flashing.Pressing [◇] switch again restores the active state.



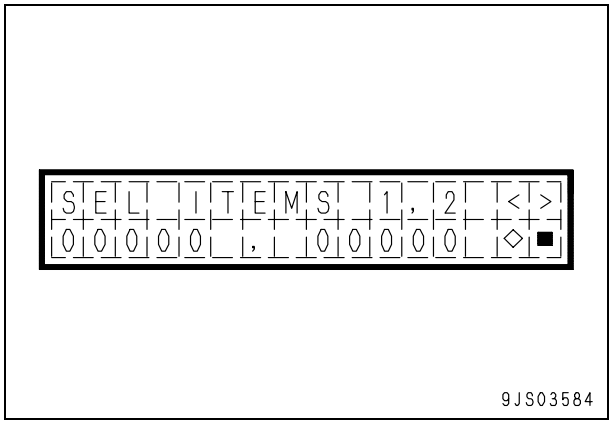
4) Display data for 1 item individual monitoring
The 1 item individual monitoring screen displays the following information.
A: Item display
B: Monitoring codes (5 digits)
1: Monitoring data (including the unit used)
★ See the “Real-time monitoring code list” for details.



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.

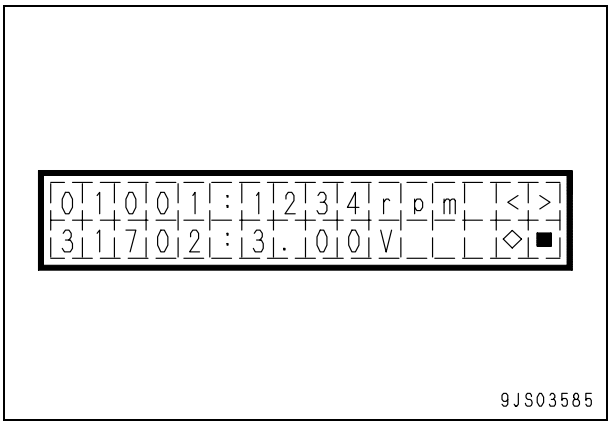


1] This cursor (C) is located at the highest-order digit. Pressing [<] or [>] switch changes the value of this digit in the range of 0 – 9.
2] Press [◇] switch when the intended value appeared to specify it as the set value.
★ The cursor moves to the 2nd position.
3] Set the value in the same order and 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.



3) As both monitoring codes are settled, the 2 ITEMS screen will be turned on.

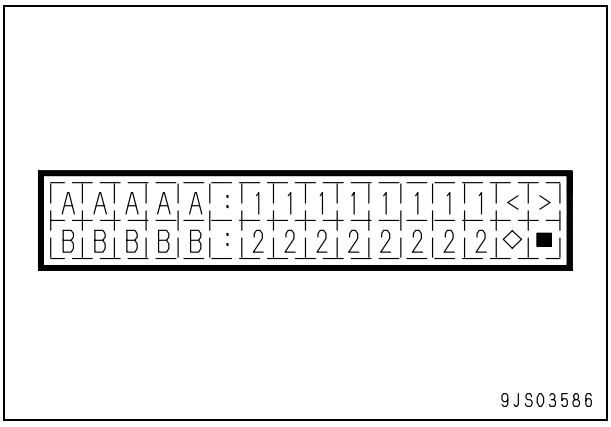
★ Holding and cancelling the monitoring data:
Pressing [◇] switch while the monitoring is in progress holds the monitoring data and [◇] mark starts flashing.Pressing [◇] switch again restores the active state.



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 “Real-time monitoring colde list” for details.



Real-time monitoring code table

MONITOR PANEL [Machine monitor system]				
No.	Monitoring code	Monitoring item (*1)	Indication item (*2)	Data indication range (*3)
1	20200	Part No. of monitor software	VERSION	Arabic numerals
2	20221	Version of application software	VERSION (APP)	Arabic numerals
3	20222	Version of data	VERSION (DATA)	Arabic numerals
4	01001	Engine speed	ENG SPEED	0 – 3000
5	40000	Travel speed	SPEED	0 – 50
6	04202	Fuel level	FUEL SENSOR	0 – 100
7	04207	Fuel level	FUEL SENSOR	0.00 – 5.00
8	04103	Engine coolant temperature	COOLANT TEMP	–40 – 210
9	40100	Torque converter oil temperature	TC OIL TEMP	24 – 131
10	40101	Torque converter oil temperature	TC OIL TEMP	0.00 – 5.00
11	04401	Hydraulic oil temperature	HYD TEMP	24 – 131
12	04404	Hydraulic oil temperature	HYD TEMP	0.00 – 5.00
13	30202	Rear brake oil temperature	R BRAKE OIL	24 – 131
14	30205	Rear brake oil temperature	R BRAKE OIL	0.00 – 5.00
15	04302	Battery charge level	ALTERNATOR R	0.00 – 30.00
16	40200	Small lamp voltage	SMALL LAMP	0.00 – 30.00
17	40300	Electrolyte level A	BATTERY A	0.00 – 30.00
18	40301	Electrolyte level B	BATTERY B	0.00 – 30.00
19	06001	Boom angle	BOOM ANG	–90 – 90
20	06003	Boom angle	BOOM ANG	0.00 – 5.00
21	40400	Boom bottom pressure	BOOM BTM PRESS	0.00 – 50.00
22	40402	Boom bottom pressure	BOOM BTM PRESS	0.00 – 5.00

MONITOR PANEL [Machine monitor system]		
Contents of indication in normal state	Unit (*4)	Remarks (*5)
As per part No. of software	Indication of condition	
As per version No. of application software	Indication of condition	
As per version No. of data	Indication of condition	
Low idle : 850 ± 25 rpm High idle: 2230 ± 50 rpm (P-mode) 1880 ± 50 rpm (E-mode)	rpm	
F1/R1: 6.7/7.3 km/h ±5% (P-mode) F2/R2: 11.7/12.8 km/h ±5% (P-mode) F3/R3: 20.3/22.0 km/h ±5% (P-mode) F4/R4: 33.8/37.0 km/h ±5% (P-mode)	km/h	
0 – 100%	%	
Gauge FULL (100%, 10 Ω): 0.31 V Gauge 1/2 (50%, 29.5 Ω): 0.82 V Gauge 1/2 (50%, 28.5 Ω): 0.80 V Caution (80 Ω): 1.74 V Gauge EMPTY (0%, 85 Ω): 1.81 V	V	When sensor is disconnected or has hot short: Gauge EMPTY When sensor has ground fault: Gauge FULL
Depends on condition of machine (°C)	°C	Engine coolant temperature: Max. 100°C Data are received from engine controller
Depends on condition of machine (°C)	°C	Overheating: 120°C
Gauge enters red range(120°C): 1.62 V (80°C): 2.91 V	V	When sensor is disconnected or has hot short: Gauge MIN When sensor has ground fault: Gauge MAX
Depends on condition of machine (°C)	°C	Hydraulic tank oil temperature Max. 100°C
Gauge enters red range(120°C): 1.62 V (80°C): 2.91 V	V	When sensor is disconnected or has hot short: Gauge MIN When sensor has ground fault: Gauge MAX
Depends on condition of machine (°C)	°C	
(120°C): 1.62 V (80°C): 2.91 V	V	
Depends on condition of machine (0.0 – 30 V)	V	
Depends on condition of machine (0.0 – 30 V)	V	
Min. 2 V	V	Only when option is set
—	V	Unused
Standard boom Boom at max. height: 45.8 ± 2.0 deg Boom at min. height: –40.0 ± 3.0 deg High lift boom Boom at max. height: 50.4 ± 2.0 deg Boom at min. height: –35.0 ± 3.0 deg	deg (°)	Only when load meter option is set
Standard boom Boom at max. height: 3.77 ± 0.3 V Boom at min. height: 1.37 ± 0.5V High lift boom Boom at max. height: 3.90 ± 0.3 V Boom at min. height: 1.53 ± 0.5 V	V	Only when load meter option is set
Depends on condition	MPa	Only when load meter option is set
0 MPa: 0.5 V 10 MPa: 1.3 V 20 MPa: 2.1 V 50 MPa: 4.5 V	V	Only when load meter option is set

MONITOR PANEL [Machine monitor system]				
No.	Monitoring code	Monitoring item (*1)	Indication item (*2)	Data indication range (*3)
23	40500	Boom head pressure	BOOM HEAD PRESS	0.00 – 50.00
24	40501	Boom head pressure	BOOM HEAD PRESS	0.00 – 5.00
25	40600	Calibration pressure	CAL PRESS	0.00 – 50.00
26	40800	Weight calculated by load meter	MES LOAD	0.00 – 50.00
27	30802	Setting condition of rotary switch	SW1, SW2, SW3	F, F, F
28	30904	Setting condition of DIP switch	SW5-1, SW5-2	ON/OFF, ON/OFF
29	30905	Setting condition of DIP switch	SW5-3, SW5-4	ON/OFF, ON/OFF
30	30906	Setting condition of DIP switch	SW6-1, SW6-2	ON/OFF, ON/OFF
31	30907	Setting condition of DIP switch	SW6-3, SW6-4	ON/OFF, ON/OFF
32	40900	Input signal D_IN_0-7	D-IN--0------7	See separate table
33	40901	Input signal D_IN_8-15	D-IN--8------15	See separate table
34	40902	Input signal D_IN_16-23	D-IN--16------23	See separate table
35	40903	Input signal D_IN_24-31	D-IN--24------31	See separate table
36	40904	Input signal D_IN_32-39	D-IN--32------39	See separate table
37	40925	Output signal D_OUT_0-3	D-OUT--0--3	See separate table

*1: All items, including ones for which sensors are not installed on some models and optional components, are displayed.
*2: Abbreviated as number of characters is limited.
*3: A number below (above) the display range is fixed within the display range.
*4: If a unit is necessary, the SI unit is used.
*5: If a code or a monitoring item is displayed on the machine monitor but cannot be monitored, “Unused for this machine” is entered.

MONITOR PANEL [Machine monitor system]		
Contents of indication in normal state	Unit (*4)	Remarks (*5)
Depends on condition	MPa	Only when optional load meter is set, rated load is applied, engine speed is high idle, lift arm lever is operated to stroke end, and arm is level: Approx. 0.5 MPa {5.1 kg/cm^2}
0 MPa: 0.5 V 10 MPa: 1.3 V 20 MPa: 2.1 V 50 MPa: 4.5 V	V	Only when load meter option is set
—	MPa	Unused
Load weight (t)	ton	Only when load meter option is set
	Indication of condition	
	Indication of condition	
	Indication of condition	
	Indication of condition	
	Indication of condition	
	Indication of condition	
	Indication of condition	
	Indication of condition	
	Indication of condition	
	Indication of condition	
	Indication of condition	
	Indication of condition	

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	—	—
		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	—	—
		D-IN-23	Load meter total weight indication selector switch	Pressing of switch = ON (GND)/OFF (OPEN)
4	40903	D-IN-24	—	—
		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	Emergency steering normal (Machine with optional emergency steering)	Emergency steering normal = ON (GND)/OFF (OPEN)
		D-IN-31	—	—

MON [Mechanical monitor system]				
No.	Monitoring codes	Input/Output signal	Displayed items	Description of ON/OFF switch
5	40904	D-IN-32	Load meter subtotal switch (Load meter specification)	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-33	Load meter cancel switch (Load meter specification)	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	Emergency steering operation (Machine with optional emergency steering)	Emergency steering operation = ON (GND)/OFF (OPEN)
6	40952	D-OUT-0	Alarm buzzer	Output ON = (24 V)/OFF (OPEN)
		D-OUT-1	—	—
		D-OUT-2	—	—
		D-OUT-3	—	—

TRANSMISSION [Transmission controller system]				
No.	Monitoring code	Monitoring item (*1)	Indication item (*2)	Data indication range (*3)
1	20201	Part No. of transmission controller ROM	VERSION	Arabic numerals
2	20223	Version No. of application software	VERSION APP	20223
3	20224	Version No. of data	VERSION DATA	20224
4	41600	Selection of engine mode	ENGINE MODE	Arabic numerals
5	41400	Fan pump EPC current (command)	FAN EPC DIR	0 – 1000
6	93400	Fan reverse switch input	FAN REVERSE SW	Arabic numerals
7	95200	Loader pump oil pressure	PUMP PRESS	0.00 – 50.00
8	95201	Input voltage of loader pump oil pressure	PUMP PRESS	0.00 – 5.00
9	95100	Output command value of loader pump EPC	PUMP EPC DIR	0 – 1000
10	95300	Steering pump oil pressure	S/T OIL PRESS	0.00 – 50.00
11	95301	Input voltage of steering pump oil pressure	S/T OIL PRESS	0.00 – 5.00
12	31400	Transmission output shaft speed	T/M SPEED: OUT	0 – 32767
13	41203	Setting of transmission cut-off operation	T/M CUT SET	0 – 50.0
14	41201	Transmission cut-off pressure	T/M CUT OFF P	0.00 – 5.00
15	41202	Transmission cut-off sensor input voltage	T/M CUT OFF P	0.00 – 5.00
16	93600	Transmission oil temperature	T/M OIL TEMP	0 – 150
17	93601	Transmission oil temperature sensor input voltage	T/M OIL TEMP	0.00 – 5.00

TRANSMISSION [Transmission controller system]		
Contents of indication in normal state	Unit (*4)	Remarks (*5)
As per part No. of software	Indication of condition	
As per version No. of application software	Indication of condition	
As per version No. of data	Indication of condition	
0: Power mode 2: Economy mode	Indication of condition	
0 – 1000 [mA] When engine speed is below 500 rpm = 670 mA While engine is cranked (C terminal is operated) = 800 mA While fan is being prepared for reverse operation = 800 mA While fan is operated in reverse = 0 mA	mA	
0: When fan reverse switch is in FORWARD 1: While manual reverse switch is operated 2: When fan reverse switch is in AUTO REVERSE	Indication of condition	
When work equipment is in neutral: 2.0 ± 2.0 MPa When work equipment circuit is relieved: 31.0 ± 2.0 MPa	MPa	
When work equipment is in neutral: 0.70 ± 0.2 V When work equipment circuit is relieved: 3.00 ± 0.2 V	V	
P-mode: 0 ± 10 mA E-mode: 350 ± 10 mA	mA	
When steering is in neutral: 2.0 ± 2.0 MPa When steering circuit is relieved: 24.4 ± 2.0 MPa	Nm	
When steering is in neutral: 0.70 ± 0.2 V When steering circuit is relieved: 2.44 ± 0.2 V	V	Not used
0 – 32767 [min-1] 0 km/h = 0 rpm 10 km/h = 738 rpm 20 km/h = 1476 rpm 30 km/h = 2215 rpm 40 km/h = 2953 rpm	rpm	
0.00 – 50.0 [MPa]	MPa	Indicated value changes according to cut-off setting operation
0.00 – 5.00 [MPa]	MPa	When foot brake is released: 0.00 ± 0.1 MPa When foot brake is pressed: Indicated value changes according to brake pressing operation
0.00 – 5.00 [V]	V	When foot brake is released: 1.00 ± 0.1 V When foot brake is pressed: Indicated value changes according to brake pressing operation
0 – 150 [°C]	°C	
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	V	

TRANSMISSION [Transmission controller system]				
No.	Monitoring code	Monitoring item (*1)	Indication item (*2)	Data indication range (*3)
18	95400	Throttle correction command output	THROTTLE MOD	–100 – 100
19	44200	Throttle upper limit value output	THROT LIMIT UP	0 – 100.0
20	44201	Throttle lower limit value output	THROT LIMIT LO	0 – 100.0
21	93801	Acceleration mode	THROTTLE MODE	Arabic numerals
22	95000	Lockup selector switch input signal	LOCK UP SW	Arabic numerals
23	31602	1st ECMV current (command)	ECMV 1 DIR	0 – 1000
24	31603	2nd ECMV current (command)	ECMV 2 DIR	0 – 1000
25	31604	3rd ECMV current (command)	ECMV 3 DIR	0 – 1000
26	31605	4th ECMV current (command)	ECMV 4 DIR	0 – 1000
27	31608	F (Forward) ECMV current (command)	ECMV F DIR	0 – 1000
28	31609	Lockup clutch ECMV current (command)	ECMV LU DIR	0 – 10000
29	31606	R (Reverse) ECMV current (command)	ECMV R DIR	0 – 1000
30	93300	ECSS (Electronically Controlled Suspension System) solenoid valve current (command)	ECSS V DIR	0 – 1000
31	41802	1st fill time	FILL TIME 1	0 – 2.55 (When not filled: 0)
32	41803	2nd fill time	FILL TIME 2	0 – 2.55 (When not filled: 0)
33	41804	3rd fill time	FILL TIME 3	0 – 2.55 (When not filled: 0)
34	41805	4th fill time	FILL TIME 4	0 – 2.55 (When not filled: 0)
35	41808	F (Forward) fill time	FILL TIME F	0 – 2.55 (When not filled: 0)
36	41806	R (Reverse) fill time	FILL TIME R	0 – 2.55 (When not filled: 0)
37	40905	Input signal D_IN_0-7	D-IN--0------7	See separate table
38	40906	Input signal D_IN_8-15	D-IN--8-----15	See separate table
39	40907	Input signal D_IN_16-23	D-IN-16-----23	See separate table
40	40908	Input signal D_IN_24-31	D-IN-24-----31	See separate table
41	40942	Input signal D_IN_32-39	D-IN-32-----39	See separate table

TRANSMISSION [Transmission controller system]		
Contents of indication in normal state	Unit (*4)	Remarks (*5)
0 [%]	%	0% is always indicated
100% is usually indicated When F1 drive is limited: Limit data is indicated	%	
0% is usually indicated When engine stall prevention device operates, Changing operation from F2 to R2: Max. 15% Changing operation from R2 to F2: Max. 25% When 2-stage low idle system operates: As per idle set value	%	
Changes according to operation of accelerator pedal When accelerator pedal is released = 0 When accelerator pedal is pressed partially (Release side) = 1 When accelerator pedal is pressed partially (Pressing side) = 2 When accelerator pedal is pressed fully = 3	Indication of condition	
0: Lockup selector switch OFF 1: Lockup selector switch ON	Indication of condition	
Indicated value changes when clutch is used 0 – 1000 [mA]	mA	
Indicated value changes when clutch is used 0 – 1000 [mA]	mA	
Indicated value changes when clutch is used 0 – 1000 [mA]	mA	
Indicated value changes when clutch is used 0 – 1000 [mA]	mA	
Indicated value changes when clutch is used 0 – 1000 [mA]	mA	
Indicated value changes when clutch is used 0 – 1000 [mA]	mA	
Indicated value changes when clutch is used 0 – 1000 [mA]	mA	
0 [mA]	mA	
Each time clutch is used, previous fill time is indicated 0 – 2.55 [sec], When not filled: 0	sec	
Each time clutch is used, previous fill time is indicated 0 – 2.55 [sec], When not filled: 0	sec	
Each time clutch is used, previous fill time is indicated 0 – 2.55 [sec], When not filled: 0	sec	
Each time clutch is used, previous fill time is indicated 0 – 2.55 [sec], When not filled: 0	sec	
Each time clutch is used, previous fill time is indicated 0 – 2.55 [sec], When not filled: 0	sec	
Each time clutch is used, previous fill time is indicated 0 – 2.55 [sec], When not filled: 0	sec	
	Indication of condition	
	Indication of condition	
	Indication of condition	
	Indication of condition	
	Indication of condition	

TRANSMISSION [Transmission controller system]				
No.	Monitoring code	Monitoring item (*1)	Indication item (*2)	Data indication range (*3)
42	40949	Output signal D_OUT_0-7	D-OUT-0------7	See separate table
43	40950	Output signal D_OUT_8-15	D-OUT-8-----15	See separate table
44	40951	Output signal D_OUT_16-23	D-OUT-16----23	See separate table
45	94100	Clutch trigger initial learning flag	TRIG FR1234	0/1(ON/OFF)

TRANSMISSION [Transmission controller system]		
Contents of indication in normal state	Unit (*4)	Remarks (*5)
	Indication of condition	
	Indication of condition	Unused for this machine
	Indication of condition	Unused for this machine
0: ON 1: OFF	Indication of condition	

*1: All items, including ones for which sensors are not installed on some models and optional components, are displayed.
*2: Abbreviated as number of characters is limited.
*3: A number below (above) the display range is fixed within the display range.
*4: If a unit is necessary, the SI unit is used.
*5: If a code or a monitoring item is displayed on the machine monitor but cannot be monitored, “Unused for this machine” is entered.

TM [Transmission controller system]				
No.	Monitoring codes	Input/Output signal	Indication item	Function of ON/OFF switch
1	40905	D-IN-0	Steering pressure switch (Normally open)	Steering pump pressure is applied = ON (GND) /OFF (OPEN)
		D-IN-1	Steering pressure switch (Normally closed)	Steering pump pressure is applied = ON (OPEN) /OFF (GND)
		D-IN-2	Transmission cut-off switch	Pressing switch = ON (GND) /OFF (OPEN)
		D-IN-3	Transmission cut-off set switch	Pressing switch = 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	2-stage low idle selector switch	Pressing switch = ON (24 V) /OFF (OPEN)
		D-IN-7	ECSS selector switch	Pressing switch = ON (24 V) /OFF (OPEN)
2	40906	D-IN-8	• Gearshift lever 1st	• Gearshift lever 1st = ON (24 V) /OFF (OPEN)
		D-IN-9	• Gearshift lever 2nd	• Gearshift lever 2nd = ON (24 V) /OFF (OPEN)
		D-IN-10	• Gearshift lever 3rd	• Gearshift lever 3rd = ON (24 V) /OFF (OPEN)
		D-IN-11	• Gearshift lever 4th	• Gearshift lever 4th = ON (24 V) /OFF (OPEN)
		D-IN-12	• Joystick steering shift-up switch	• Shift-up switch = ON (24 V) /OFF (OPEN)
		D-IN-13	• Joystick steering shift-down switch	• Shift-down switch = ON (24 V) /OFF (OPEN)
		D-IN-14	Electric emergency steering manual switch	Pressing switch = ON (24 V) /OFF (OPEN)
		D-IN-15	Right FNR (directional) or joystick steering selector switch	Pressing switch = ON (24 V) /OFF (OPEN)
3	40907	D-IN-16	C terminal signal	Start of starting motor = ON (24 V) /OFF (OPEN)
		D-IN-17	Right FNR (directional) switch or joystick steering (directional) switch F (Forward)	F (Forward) = ON (24 V) /OFF (OPEN)
		D-IN-18	Right FNR (directional) switch or joystick steering (directional) switch N (Neutral)	N (Neutral) = ON (24 V) /OFF (OPEN)
		D-IN-19	Right FNR (directional) switch or joystick steering (directional) switch R (Reverse)	R (Reverse) = ON (24 V) /OFF (OPEN)
		D-IN-20	FNR (Directional) lever F (Forward)	F (Forward) = ON (24 V) /OFF (OPEN)
		D-IN-21	FNR (Directional) lever N (Neutral)	N (Neutral) = ON (24 V) /OFF (OPEN)
		D-IN-22	FNR (Directional) lever R (Reverse)	R (Reverse) = ON (24 V) /OFF (OPEN)
		D-IN-23	Parking brake (Neutralizer) signal	Parking brake = ON (24 V) /OFF (OPEN)

TM [Transmission controller system]				
No.	Monitoring codes	Input/Output signal	Indication item	Function of ON/OFF switch
4	40908	D-IN-24	ECMV fill switch F (Forward)	ECMV fill switch F (Forward) = ON (GND) /OFF (OPEN)
		D-IN-25	ECMV fill switch R (Reverse)	ECMV fill switch R (Reverse) = ON (GND) /OFF (OPEN)
		D-IN-26	ECMV fill switch 1st	ECMV fill switch 1st = ON (GND) /OFF (OPEN)
		D-IN-27	ECMV fill switch 2nd	ECMV fill switch 2nd = ON (GND) /OFF (OPEN)
		D-IN-28	ECMV fill switch 3rd	ECMV fill switch 3rd = ON (GND) /OFF (OPEN)
		D-IN-29	ECMV fill switch 4th	ECMV fill switch 4th = ON (GND) /OFF (OPEN)
		D-IN-30	Kick-down switch	Pressing switch = ON (GND) /OFF (OPEN)
		D-IN-31	Shift hold switch	Pressing switch = ON (GND) /OFF (OPEN)
5	40942	D-IN-32	Engine mode selector switch	Engine mode selector switch (Power mode) = ON (GND) /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	Electric emergency steering relay	Output ON = ON (24 V) /OFF (OPEN)
		D-OUT-1	ECSS solenoid	Output ON = ON (24 V) /OFF (OPEN)
		D-OUT-2	—	—
		D-OUT-3	Neutral safety relay	Output ON = ON (24 V) /OFF (OPEN)
		D-OUT-4	Fan reverse solenoid	Output ON = ON (24 V) /OFF (OPEN)
		D-OUT-5	Low-temperature bypass solenoid (if equipped)	Output ON = ON (24 V) /OFF (OPEN)
		D-OUT-6	—	—
		D-OUT-7	—	—

TM [Transmission controller system]				
No.	Monitoring codes	Input/Output signal	Indication item	Function of ON/OFF switch
7	40950	D-OUT-8	—	—
		D-OUT-9	—	—
		D-OUT-10	—	—
		D-OUT-11	—	—
		D-OUT-12	—	—
		D-OUT-13	—	—
		D-OUT-14	—	—
		D-OUT-15	—	—
8	40951	D-OUT-16	Transmission cut-off indicator	Output ON = ON (24 V) /OFF (OPEN)
		D-OUT-17	Low-temperature bypass solenoid	Output ON = ON (24 V) /OFF (OPEN)
		D-OUT-18	Backup lamp relay	Output ON = ON (24 V) /OFF (OPEN)
		D-OUT-19	—	—
		D-OUT-20	—	—
		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	Engine oil pressure sensor	ENG OIL PRESS	–99.9 – 999.9	kPa	Not used
7	37201	Engine oil pressure sensor voltage	ENG OIL PRESS	0.00 – 5.00	V	Not used
8	42700	Engine oil temperature	ENG OIL TEMP	–40 – 210	°C	Not used
9	42702	Engine oil temperature sensor voltage	ENG OIL TEMP	0.00 – 5.00	V	Not used
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	Not used
15	18401	Air intake temperature sensor voltage	INTAKE TEMP	0.00 – 5.00	V	Not used
16	04204	Fuel temperature	FUEL TEMP	–40 – 210	°C	Not used
17	14201	Fuel temperature sensor voltage	FUEL TEMP	0.00 – 5.00	V	Not used
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	Not used
23	17901	EGR valve differential pressure sensor voltage	EGR DIF PRESS	0.00 – 5.00	V	Not used
24	18000	EGR valve inlet pressure	EGR IN PRESS-A	–99.9 – 999.9	kPa	Not used
25	18002	EGR valve inlet pressure sensor voltage	EGR IN PRESS-A	0.00 – 5.00	V	Not used
26	18100	EGR valve position	EGR VALVE POS	0.00 – 99.99	mm	Not used
27	18101	EGR valve position sensor voltage	EGR VALVE POS	0.00 – 5.00	V	Not used
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	1/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	
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	Not used
37	18202	Bypass valve position sensor voltage	BPS VALVE POS	0.00 – 5.00	V	Not used
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	Not used

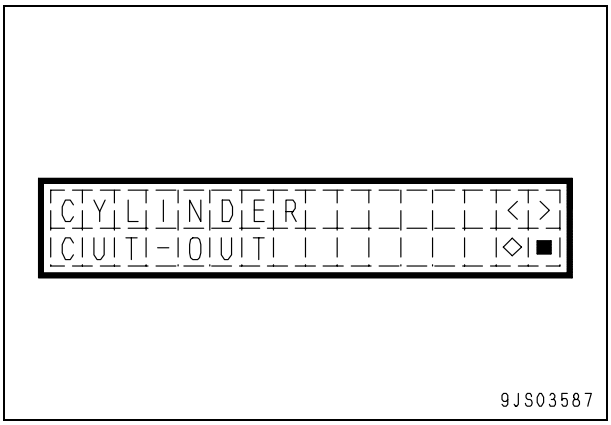
ENG [Engine controller system]						
No.	Monitoring code	Monitoring items (*1)	Displayed items (*2)	Data display range (*3)	Unit (*4)	Remarks (*5)
43	17500	Selection of engine mode	POWER MODE	0 – 4	Status display	
44	00400	Name of selected model (upper 8 digits)	MACHINE ID (H)	Incoming value is displayed 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	

*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.

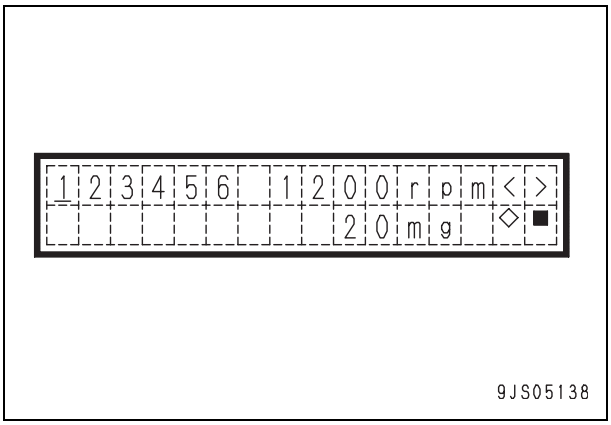
5. Engine reduced-cylinder function (CYLINDER CUT-OUT)

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.



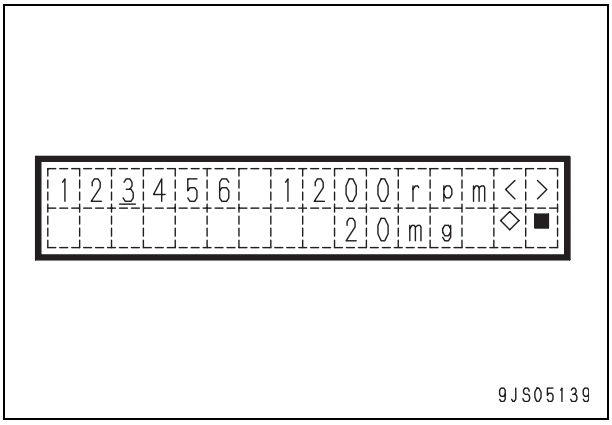
2) Displaying sub menu
Press [◇] switch while the menu is selected to display the sub menu.



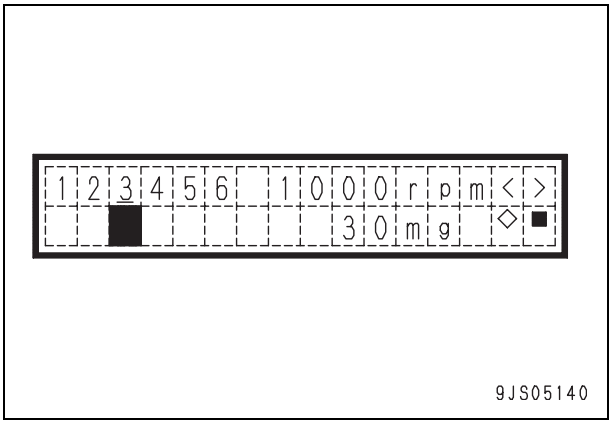
3) Selecting a cylinder to be reduced
Using [<] or [>] switch, select a cylinder to be reduced from No. 1 – No. 6 cylinders and then settle the selected cylinder using [◇] switch.

★ The cylinder to be reduced is selectable while the engine is run.

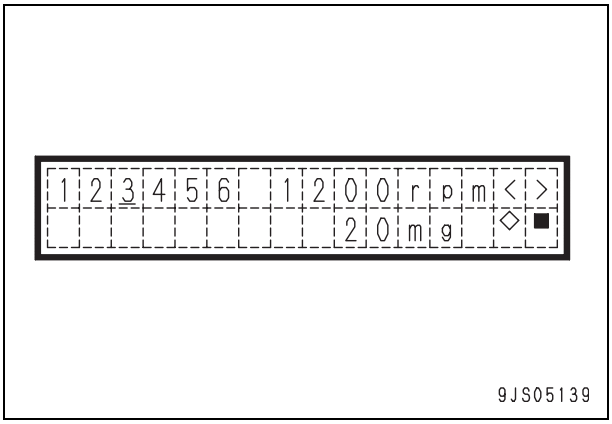
★ Any number of cylinders can be reduced – a single unit or two or more units.
- [>] switch: Advances the cursor rightward
- [<] switch: Advances the cursor leftward
- [◇] switch: Settles the cylinder to be reduced (the cursor starts flashing after the settlement)
- [■] switch: Restores the CYLINDER 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.

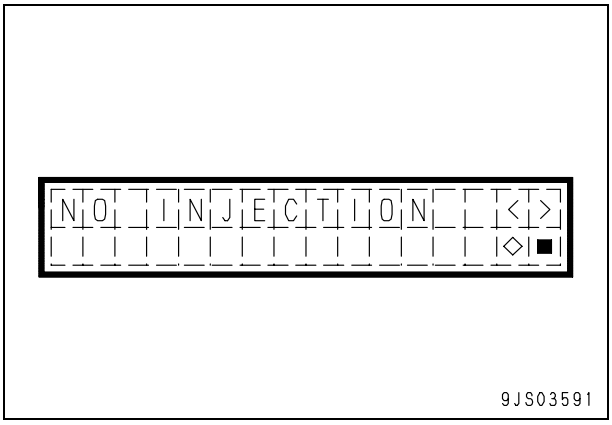


4) Cancelling a reduced cylinder
Using [<] or [>] switch, select the currently stopped cylinder and then press [◇] switch to cancel the reduced-cylinder command from the engine controller. The black display will disappear.



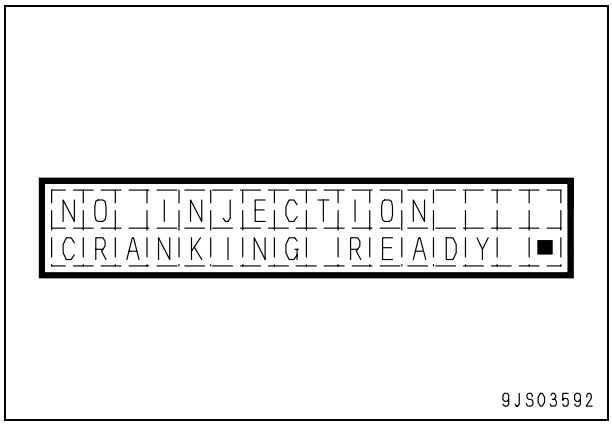
6. No injection cranking function
The machine monitor is equipped with the function capable of lubricating the engine through no injection cranking. When a machine has been stored for a long time, this function is used to lubricate the engine prior to its restart in order to prevent its wear or damages 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.



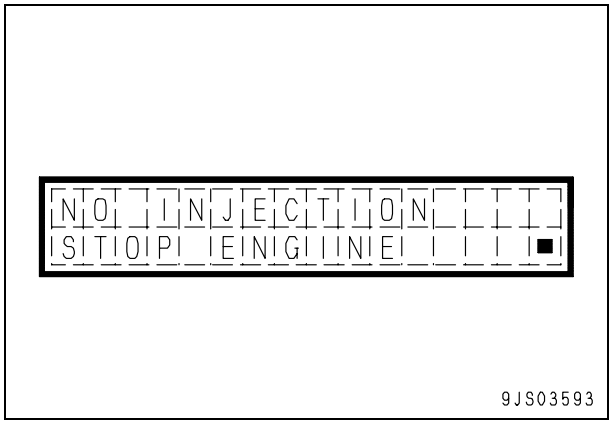
2) Pressing [◇] switch sets up the no injection cranking.

★ 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 (TUNING)

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

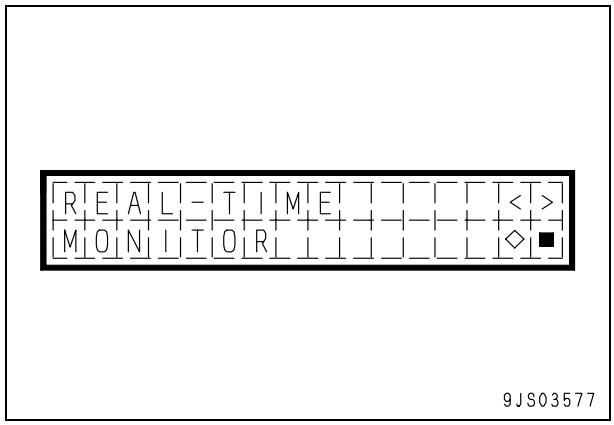
No.	Adjustment item	Remarks
7-1	Adjustment of transmission ECMV current	
7-2	Setting of transmission initial learning	
7-3	Adjustment of transmission L mode gearshift point	(*1)
7-4	Adjustment of lift arm angle sensor (raise) (for EPC lever)	(*1)
7-5	Adjustment of neutral zone dispersion of lift arm raise lever and EPC	(*1)
7-6	Adjustment of neutral zone dispersion of lift arm lower (float) lever and EPC	(*1)
7-7	Adjustment of neutral zone dispersion of bucket tilt lever and EPC	(*1)
7-8	Adjustment of neutral zone dispersion of bucket dump lever and EPC	(*1)
7-9	Adjustment of neutral zone dispersion of 3rd (3-spool valve) EPC cylinder extension lever and EPC	(*1)
7-10	Adjustment of neutral zone dispersion of 3rd (3-spool valve) EPC cylinder retraction lever and EPC	(*1)
7-11	Adjustment of starting point dispersion of joystick steering right lever and EPC	(*1)
7-12	Adjustment of starting point dispersion of joystick steering left lever and EPC	(*1)
7-13	Change of lift arm lever pattern	(*1)
7-14	Change of bucket lever pattern	(*1)
7-15	Adjustment of lift arm lower stop modulation	(*1)
7-16	Adjustment of pump cut-off pressure during raise of lift arm	(*1)
7-17	Adjustment of lift arm angle sensor (upper) (Load meter specification)	(*1)
7-18	Adjustment of lift arm angle sensor (lower) (Load meter specification)	(*1)
7-19	Adjustment of 2-stage low idle throttle position	(*1)
7-20	Adjustment of interval of fan automatic reverse operation	
7-21	Adjustment of continuance of fan automatic reverse operation	

(*1): This item is not used.

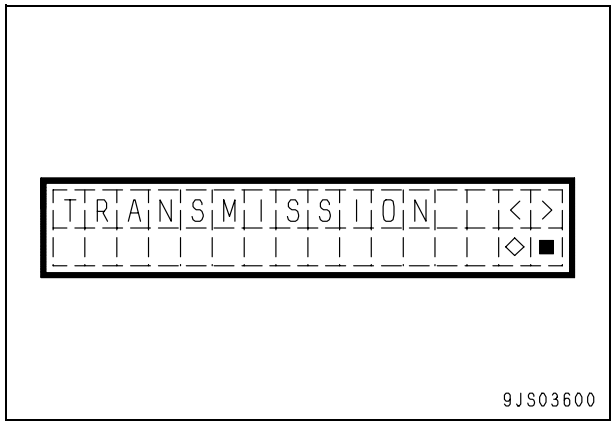
7-1. Adjustment of transmission ECMV current

7-1-1. Preparations for transmission ECMV current adjustment

1) Display the REAL-TIME MONITOR from the menu screen of Service mode.



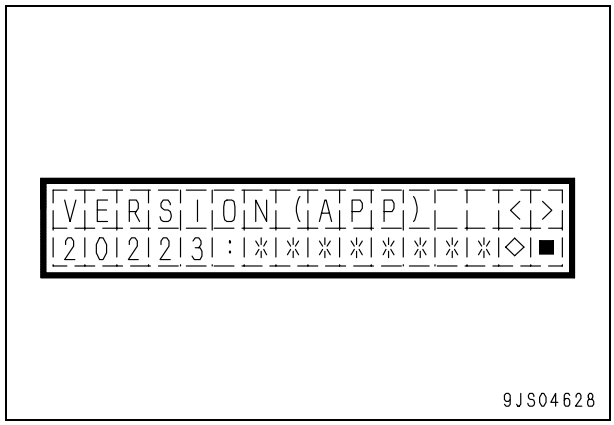
2) Press [◇] switch to display the sub menu and then select TRANSMISSION using [<] or [>] switch. (TRANSMISSION screen)



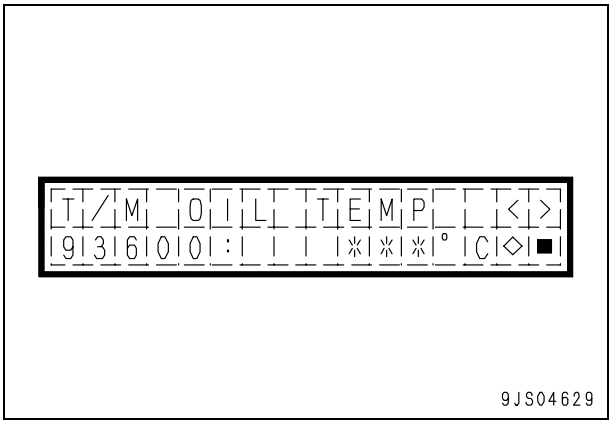
3) Press [◇] switch to settle the real-time monitoring of the transmission controller.

★ 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 in MANUAL, set the FNR (directional) lever or joystick steering FNR (directional) switch or right FNR (directional) switch in F (forward), and set the gearshift lever or gearshift switch in the 4th position. (F4)
3) Make sure from "7-1-1 Preparations for transmission ECMV current adjustment" that the transmission controlled oil temperature is 55 – 70°C.If it is out of the range, stall the torque converter and adjust the temperature to 55 – 70°C.
4) Return the FNR (directional) lever or joystick steering FNR (directional) switch or right FNR (directional) switch to N (Neutral) and check that the oil leak tester is 55 – 70°C after 3 minutes.
5) Operate the FNR (directional) lever or joystick steering FNR (directional) switch or right FNR (directional) switch and gearshift lever or gearshift switch as shown below to circulate the oil through the transmission.
   - ★ When performing the following operation, run the engine at low idle, turn manual switch ON, turn the torque converter lockup switch OFF, and turn lockup switch 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.

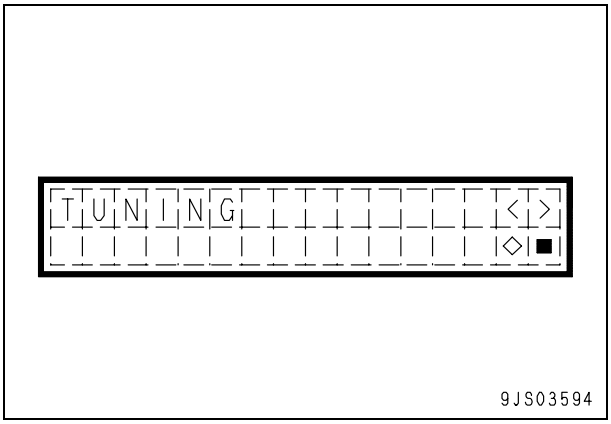
Operating order	5	6	7	8
Gear speed	F3	F4	F3	F2
Holding time	Min. 2 sec.	Min. 2 sec.	Min. 2 sec.	Min. 2 sec.

Operating order	9	10	11
Gear speed	N2	R2	N2
Holding time	Min. 2 sec.	Min. 2 sec.	Min. 2 sec.

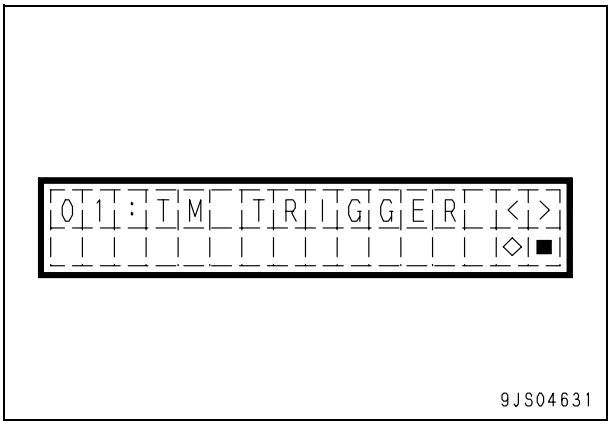
7-1-3. Adjustment of transmission ECMV current

★ 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 55 – 70°C range.
   1) Turn on the starting switch (engine is not started) and then display T/M OIL TEMP referencing "7-1-1 Preparations for transmission ECMV current adjustment".
   2) Run the engine at low idle, release the accelerator pedal, set the FNR (directional) lever or joystick steering FNR (directional) switch or right FNR (directional) switch in N (Neutral), and check that the transmission control oil temperature is 55 – 70°C.

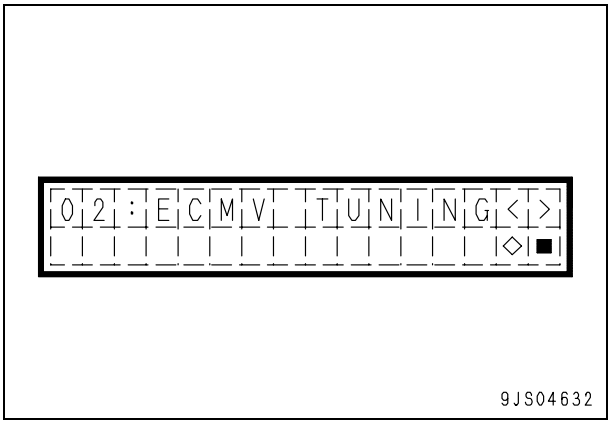
3) Display the TUNING screen from the menu screen of Service mode.



4) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.

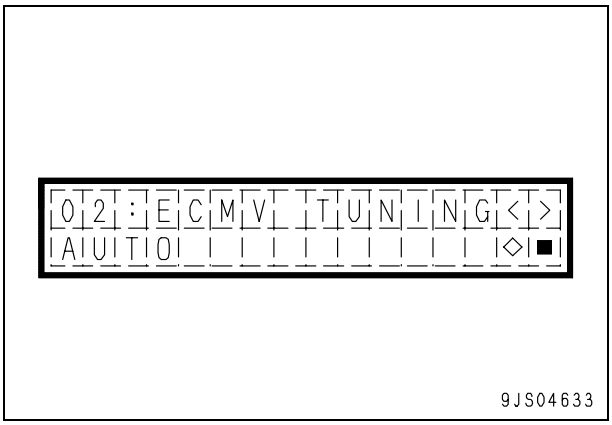


5) Using [<] or [>] switch from the sub menu, select 02: ECMV TUNING.

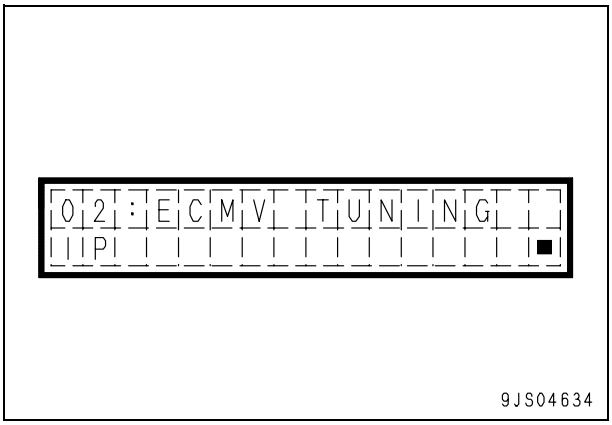


6) Press [◇] switch to settle the adjustment item.

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

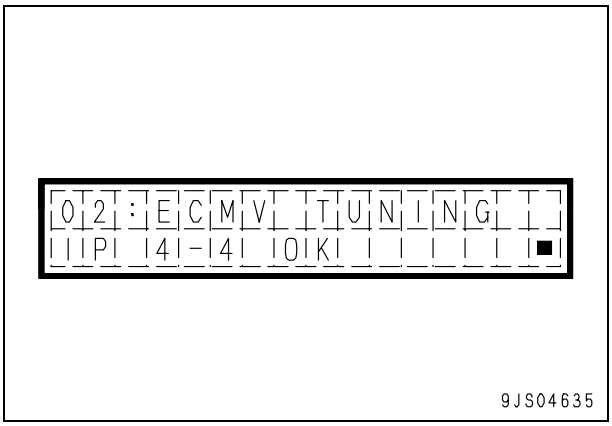
Operating order	9	10	11	12
IP	[IP 1-1]	[IP 1-2]	[IP 1-3]	[IP 1-4]
ECMV/ frequency	1st/1st time	1st/2nd time	1st/3rd time	1st/4th time

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

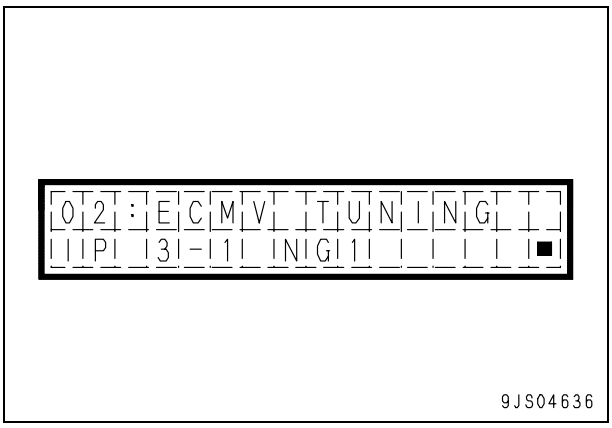
Operating order	17	18	19	20
IP	[IP 3-1]	[IP 3-2]	[IP 3-3]	[IP 3-4]
ECMV/ frequency	3rd/1st time	3rd/2nd time	3rd/3rd time	3rd/4th time

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.

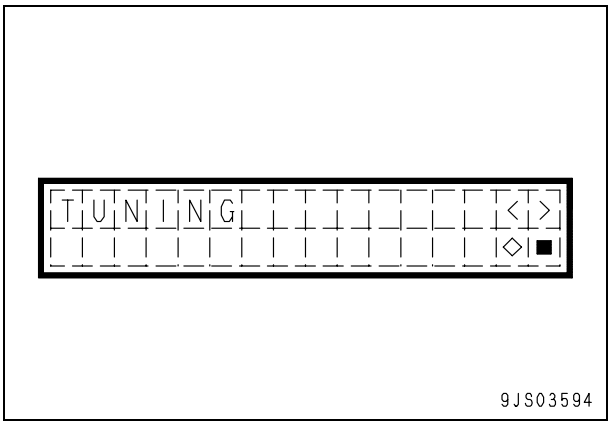
★ When it is required to turn on the starting switch immediately after the adjustment, maintain the starting switch, just in case, at off position for 10 seconds minimum and then turn it on.

7-2. Setting of transmission initial learning

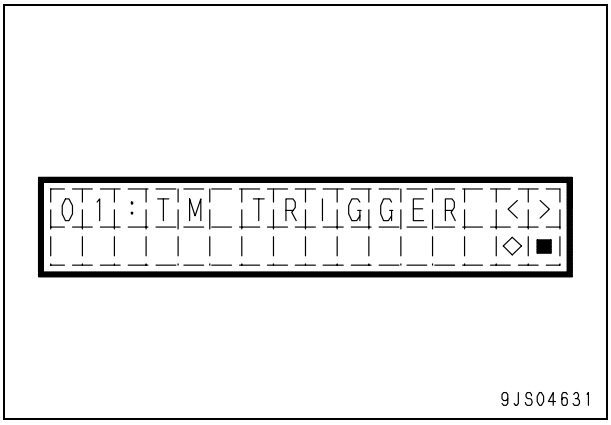
When initializing all the past initial trigger learning data stored on the transmission controller, employ the following procedure.

7-2-1. Reset of initial learning

1) Turn on the starting switch. (Engine does not start)
2) Set the FNR (directional) lever or joystick steering FNR (directional) switch or right FNR (directional) switch in N (Neutral).
3) Display the TUNING screen from the menu screen of Service mode.

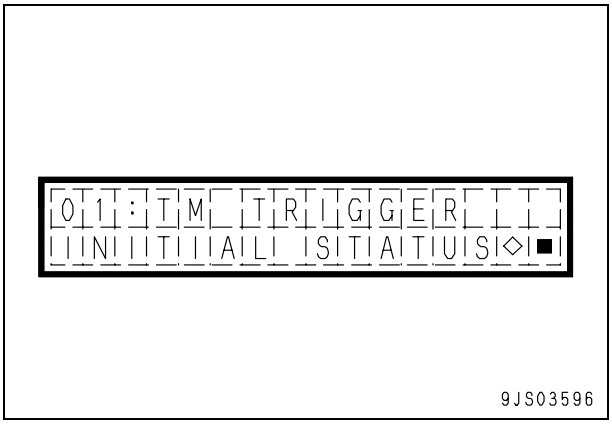


4) Hold down [◇] switch for 5 seconds minimum to display 01: TM TRIGGER screen.

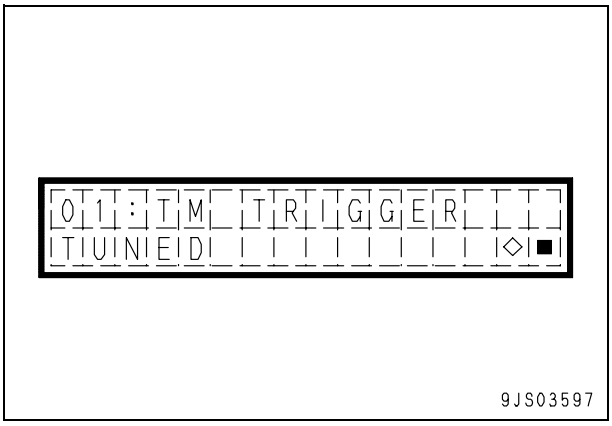


5) Press [◇] switch to settle the adjustment item. As the item is settled, the initial learning reset screen appears.

★ If the initial learning is not done, INITIAL STATUS will be displayed.



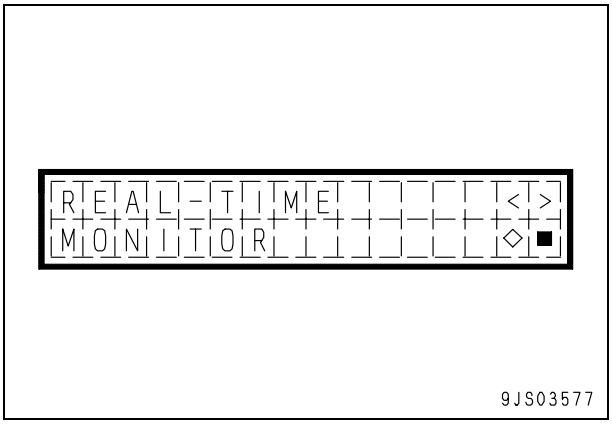
★ When the initial learning is completed, TUNED will be displayed.



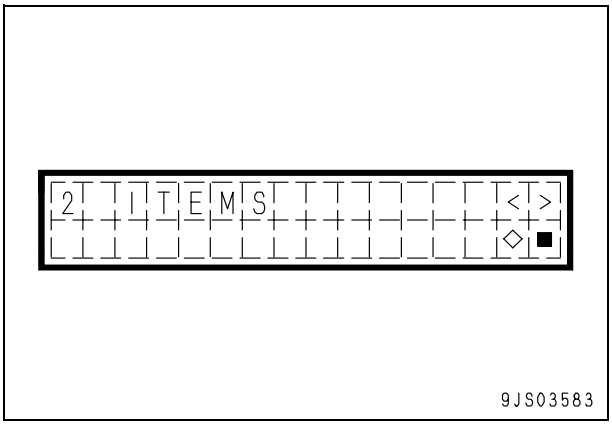
1] When TUNED is displayed, press [◇] switch to display the initial learning reset screen.
2] Press [<] or [>] switch from the initial learning reset screen to move the cursor to YES position and then press [■] switch to reset the initial learning.
3] When suspending the reset operation, select NO from above 2] or press [■] switch on TUNED screen.

7-2-2. Preparations for transmission initial learning

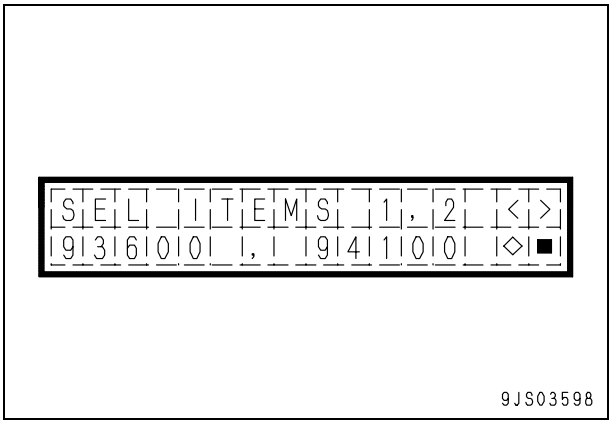
1) Display the REAL-TIME MONITOR from the menu screen of Service mode.



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)

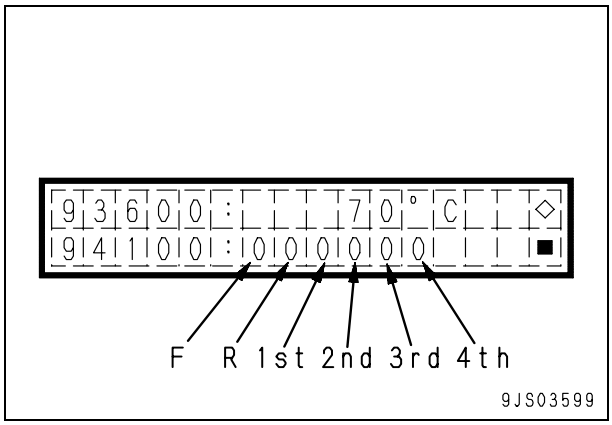


3) From the SEL ITEMS 1,2 screen, enter ID number 93600 of the transmission control oil temperature and ID number 94100 for displaying the trigger learning.
   ★ Referring to “4-5. Setting 2 items simultaneous monitoring”.



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 in MANUAL, set the FNR (directional) lever or joystick steering FNR (directional) switch or right FNR (directional) switch in F (forward), and set the gearshift lever or gearshift switch in the 4th position.
3) Make sure from “7-2-2 Preparations for transmission initial learning” that the transmission control oil temperature is 55 – 70°C. If it is out of the range, stall the torque converter and adjust the temperature to 55 – 70°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) Operate the FNR (directional) lever or joystick steering FNR (directional) switch or right FNR (directional) switch and gearshift lever or gearshift switch as shown below to perform the initial learning.

7-3. Adjustment of transmission L mode gearshift point
★ This item is not used.

7-4. Adjustment of lift arm angle sensor (raise) (for EPC lever)
★ This item is not used.

7-5. Adjustment of neutral zone dispersion of lift arm raise lever and EPC
★ This item is not used.

7-6. Adjustment of neutral zone dispersion of lift arm lower (float) lever and EPC
★ This item is not used.

7-7. Adjustment of neutral zone dispersion of bucket tilt lever and EPC
★ This item is not used.

7-8. Adjustment of neutral zone dispersion of bucket dump lever and EPC
★ This item is not used.

7-9. Adjustment of neutral zone dispersion of 3rd (3-spool valve) EPC cylinder extension lever and EPC
★ This item is not used.

7-10. Adjustment of neutral zone dispersion of 3rd (3-spool valve) EPC cylinder retraction lever and EPC
★ This item is not used.

7-11. Adjustment of starting point dispersion of joystick steering right lever and EPC
★ This item is not used.

7-12. Adjustment of starting point dispersion of joystick steering left lever and EPC
★ This item is not used.

7-13. Change of lift arm lever pattern
★ This item is not used.

7-14. Change of bucket lever pattern
★ This item is not used.

7-15. Adjustment of lift arm lower stop modulation
★ This item is not used.

7-16. Adjustment of pump cut-off pressure during raise of lift arm
★ This item is not used.

7-17. Adjustment of lift arm angle sensor (upper) (Load meter specification)
★ This item is not used.

7-18. Adjustment of lift arm angle sensor (lower) (Load meter specification)
★ This item is not used.

7-19. Adjustment of 2-stage low idle throttle position
★ This item is not used.

7-20. Adjustment of interval of fan automatic reverse operation (Automatic reverse fan (if equipped) specification)

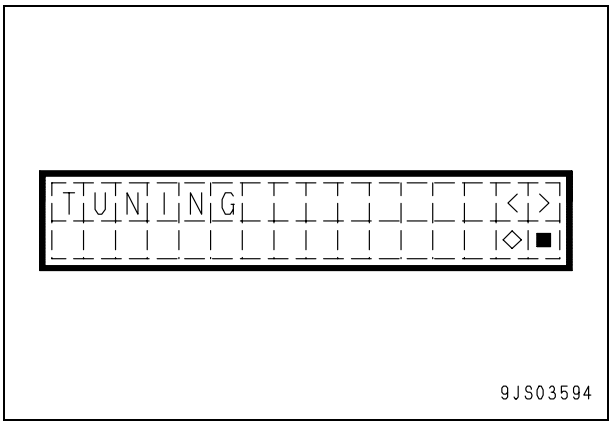
★ This function is used to change the interval of the forward and reverse operations of the fan when the fan automatic reverse operation is selected.

★ The interval of the fan automatic reverse operation is adjustable in the range from 0.1 h (6 minutes) to 200 h. It must be set to at least twice the continuance of the fan automatic reverse operation, however, and cannot be set shorter than twice.

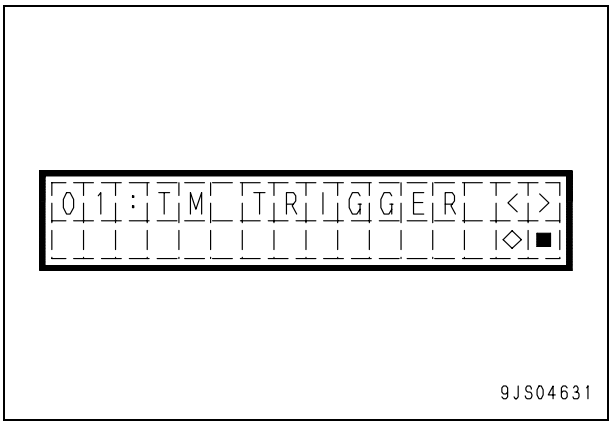
★ When the machine is delivered, the interval of fan automatic reverse operation is set to 2.0 h.

★ When the machine is delivered, the continuance of the fan automatic reverse operation is set to 2 minutes.

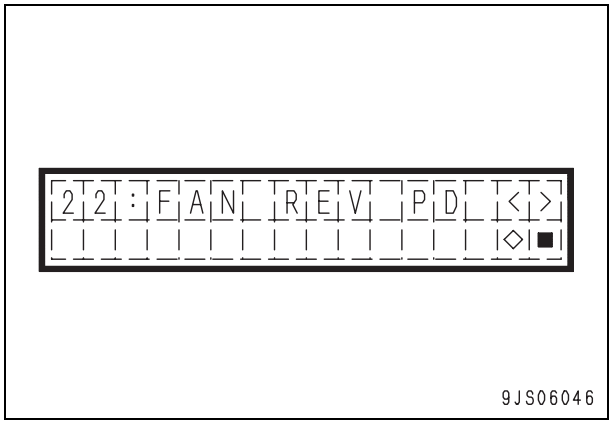
1) On the service mode menu screen, display the TUNING screen.



2) Hold down the [◇] switch for at least 5 seconds to display 01: Transmission trigger adjustment select screen.



3) With the [<] and [>] switches, select 22: Adjust interval of fan automatic reverse operation.



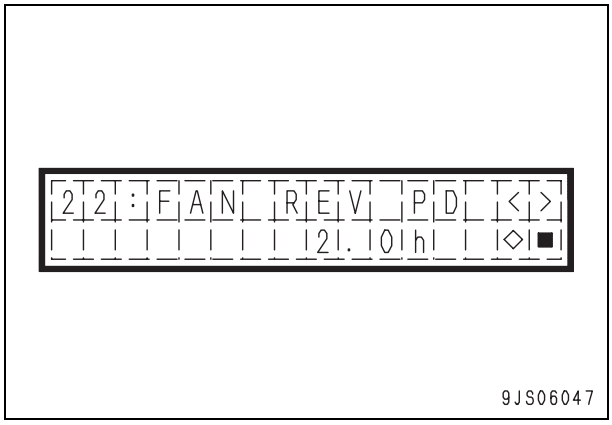
4) Press the [◇] switch to settle.

★ If the [◇] switch is pressed, the screen to adjust the interval of fan automatic reverse operation is displayed.

5) With the [<] and [>] switches, select an interval in the range from “0.1” to “200” (Unit: h).

6) Press the [■] switch to settle the setting.

★ The selected interval of fan automatic reverse operation is not changed to a value less than twice the continuance of the fan automatic reverse operation.



7-21. Adjustment of continuance of fan automatic reverse operation (Automatic reverse fan (if equipped) specification)

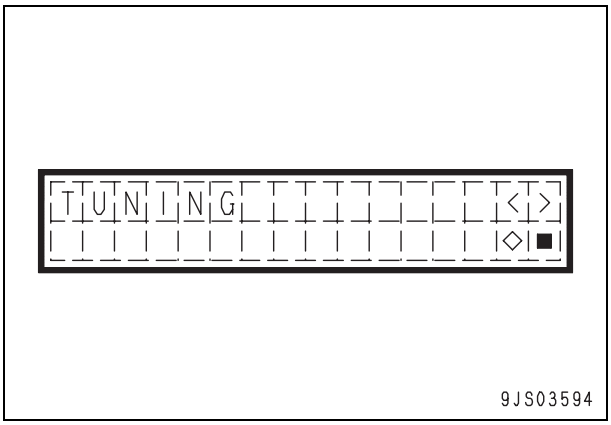
★ This function is used to change the continuance of the reverse operation when the fan automatic reverse operation is selected.

★ The continuance of the fan automatic reverse operation is adjustable in the range from 0.5 minutes to 10 minutes. It must be set to below 1/2 of the interval of the fan automatic reverse operation, however, and cannot be set longer than 1/2.

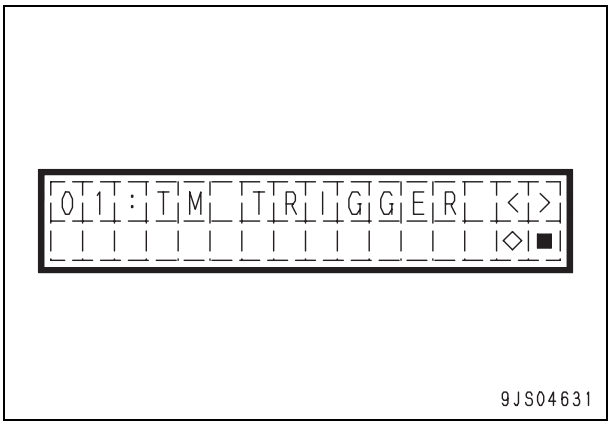
★ When the machine is delivered, the continuance of fan automatic reverse operation is set to 2.0 minutes.

★ When the machine is delivered, the interval of the fan automatic reverse operation is set to 2.0 h.

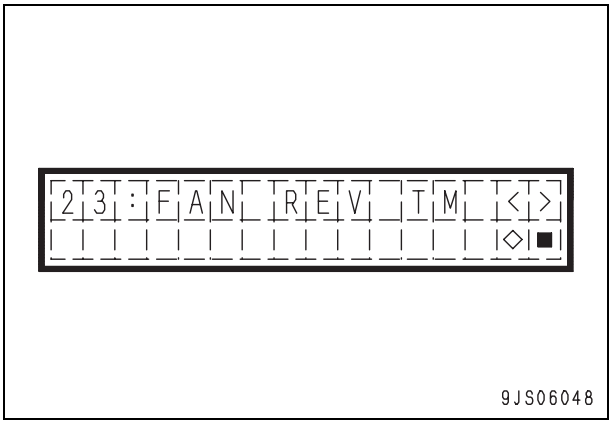
1) On the service mode menu screen, display the TUNING screen.



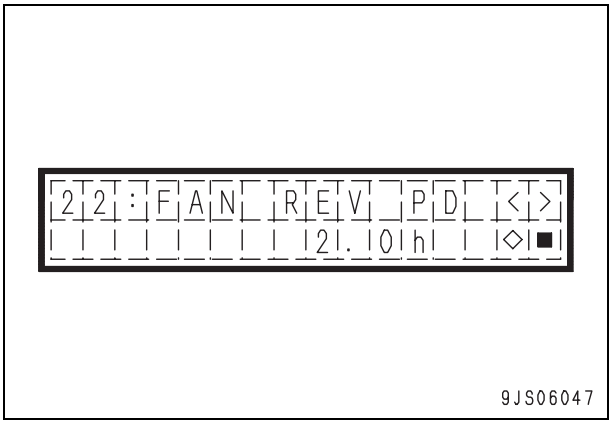
2) Hold down the [◇] switch for at least 5 seconds to display 01: Transmission trigger adjustment select screen.



3) With the [<] and [>] switches, select 23: Adjust continuance of fan automatic reverse operation.



4) Press the [◇] switch to settle.
   ★ If the [◇] switch is pressed, the screen to adjust the continuance of fan automatic reverse operation is displayed.
5) With the [<] and [>] switches, select a continuance in the range from “0.5” to “10” (Unit: minute).
6) Press the [■] switch to settle the setting.
   ★ The selected continuance of fan automatic reverse operation is not changed to a value longer than 1/2 of the interval of the fan automatic reverse operation.



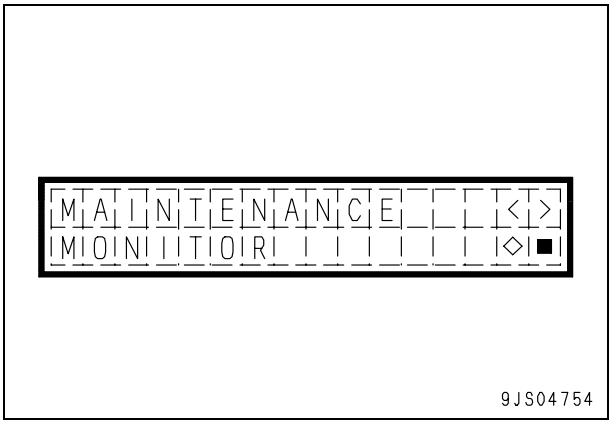
8. Maintenance monitoring function

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.

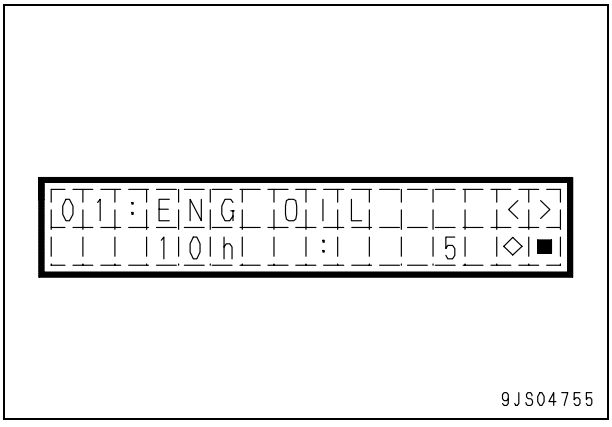


2) Press [◇] switch to display 01: ENG OIL screen.

★ The lower left side space indicates the time remained up to the replacement.

★ The lower right side space indicates the cumulative replacement frequencies.

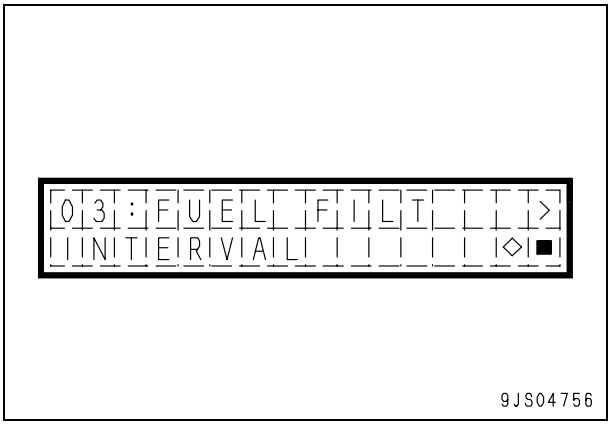
3) Using [<] or [>] switch, select the item for which the maintenance interval is to be changed from the following.



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 FILT	500
Fuel pre-filter	41	FUEL P FILT	500
Fuel filter	03	FUEL FILT	1000
Corrosion resistor (if equipped)	06	CORR RES	1000
Transmission oil	12	TM OIL	1000
Transmission oil filter	13	TM FILT	1000
Hydraulic oil filter	04	HYD FILT	2000
Hydraulic tank breather element	05	HYD BREATH	2000
Hydraulic oil	10	HYD OIL	2000
Axle oil	15	AXLE OIL	2000

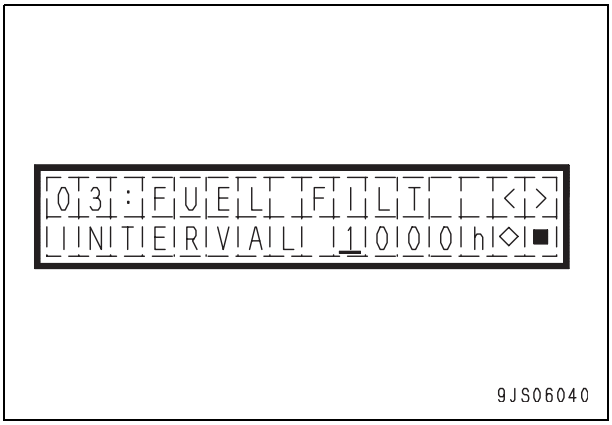
4) Settle the target items of interval change by use of [◇] switch.



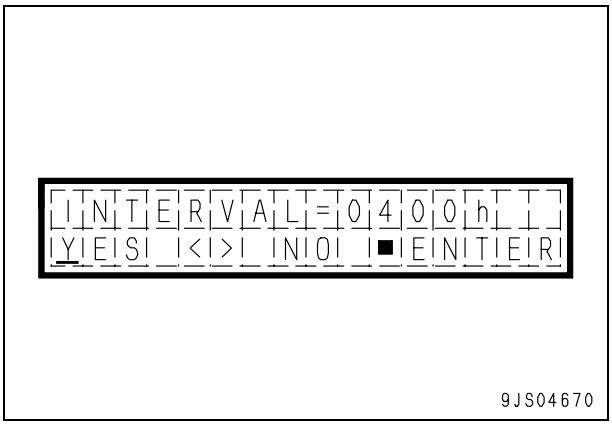
5) Maintenance interval time change procedure
   1] This cursor is located at the highest-order digit. Pressing [<] or [>] switch changes the value of this digit in the range of 0 – 9.
   2] Press [◇] switch when the intended value appeared to specify it as the set value.
   ★ The cursor moves to the 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.

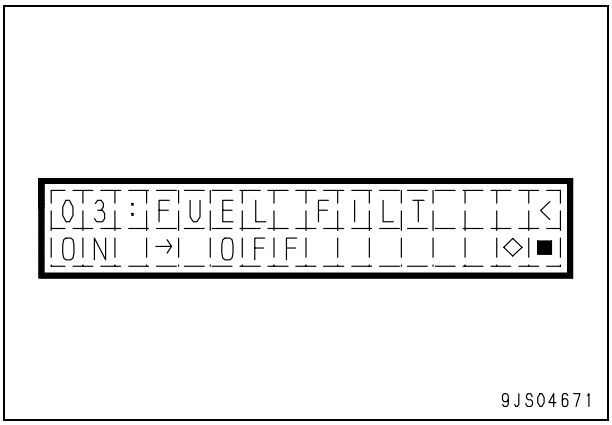
★ When you have entered a wrong value to a position except the highest-order digit, move to the highest-order digit using [■] switch and repeat the procedure from the first. In this case, the value that had been entered remains as it is until modified. When the cursor is at the highest-order digit, move to the higher layer using [■] switch.



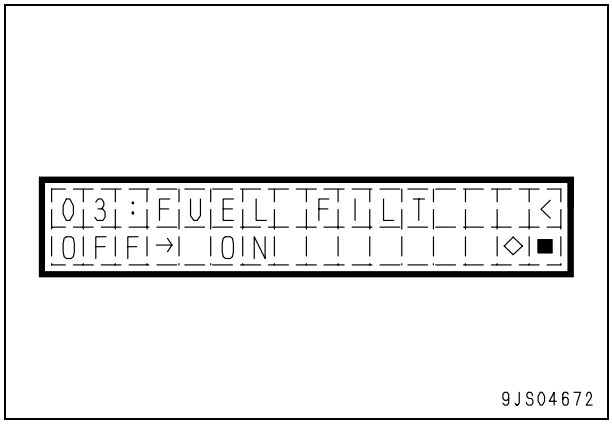
6) Select “YES” or “NO” using [<] or [>] switch.
★ The selected cursor will start flashing. If “YES” is selected and [■] switch is pressed, the information will be deleted. If “NO” is selected and [■] switch is pressed, deletion is cancelled and the maintenance interval change item screen is restored.
★ 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



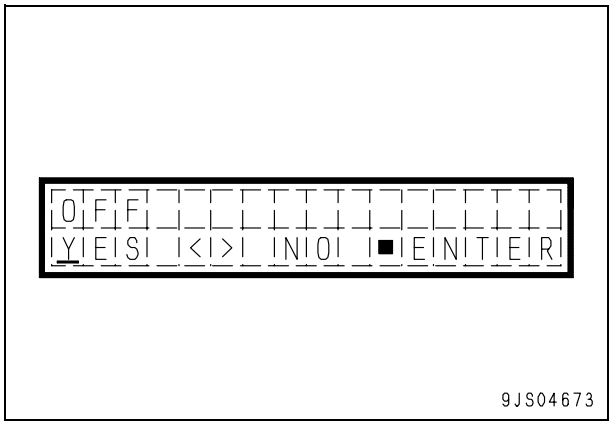
8-2. Selection between enabling or disabling timer by item
1) Pressing [<] or [>] switch from 8-1-3) Interval time change screen displays the “Selection between enabling or disabling timer by item” screen.
★ When “Timer by item” is enabled, the order of display is ON → OFF.



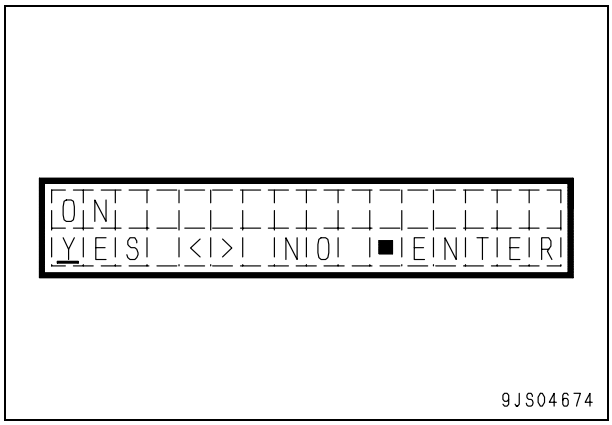
★ When “Timer by item” is disabled, the order of display becomes OFF → ON.
★ The default display is ON.



2) Press [◇] switch from this state.
★ If “Timer by item” is disabled, OFF will be displayed in the upper column.

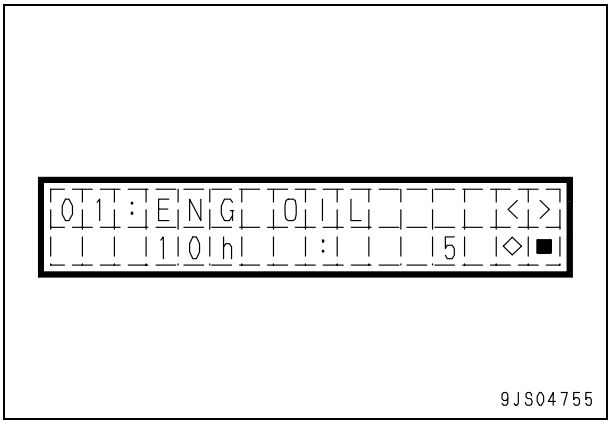


★ If “Timer by item” is enabled, ON will be displayed in the upper column.



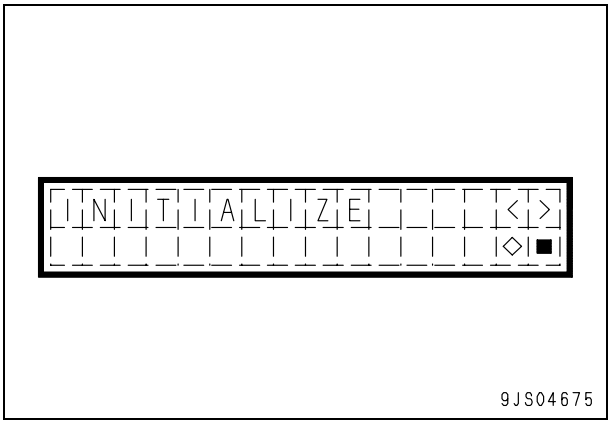
3) Select “YES” or “NO” using [<] or [>] switch.
★ The selected cursor will start flashing. If “YES” is selected and [■] switch is pressed, the information will be deleted. If “NO” is selected and [■] switch is pressed, deletion is cancelled and the maintenance interval change item screen is restored.
★ 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.



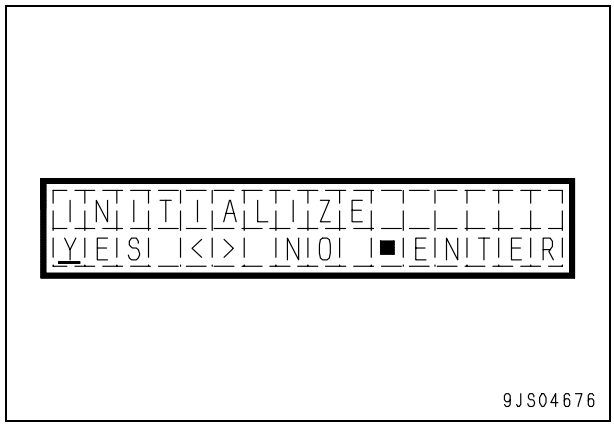
9JS04755

2) Using [<] or [>] switch, select the INITIALIZE screen from the following table.



9JS04675

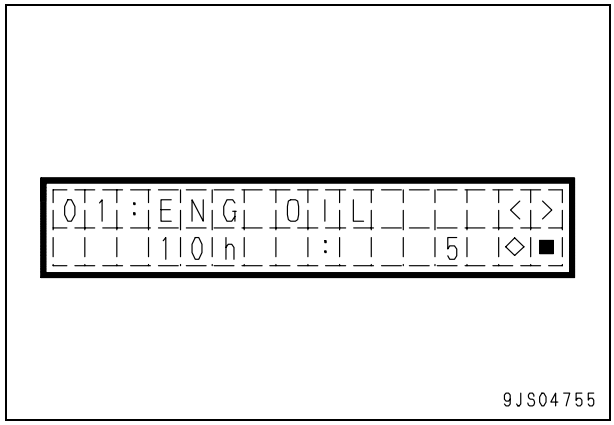
3) Press [◇] switch from this state.
4) Select “YES” or “NO” using [<] or [>] switch.
★ The selected cursor will start flashing. If “YES” is selected and [■] switch is pressed, the change will be enabled If “NO” is selected and [■] switch is pressed, the change will not be implemented and the maintenance monitoring screen will be restored.
★ By default, the cursor is set to NO (cancel) to prevent resetting error.



9JS04676

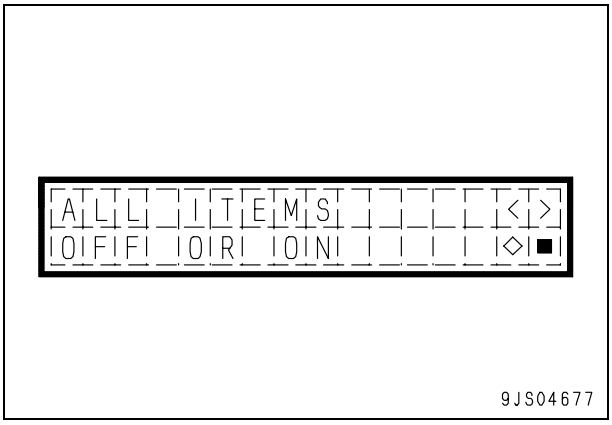
★ If the default value setting is executed, all the currently changed interval times are returned to the default values. It is executed on every item independent of whether or not the function is enabled for a specific item.
★ Timer remaining time shall be Default value – Elapsed time since the last 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.

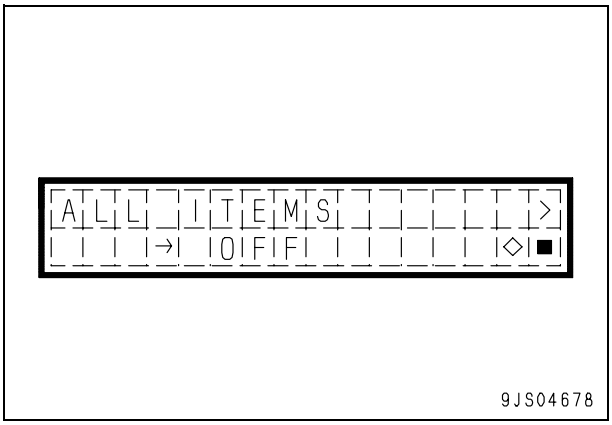


9JS04755

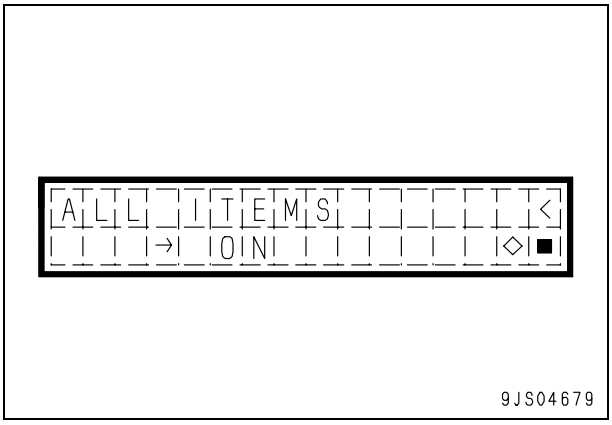
2) Using [<] or [>] switch, select the ALL ITEMS OFF OR ON screen from the following table.



3) Press [◇] switch to display the ALL ITEMS → OFF screen.

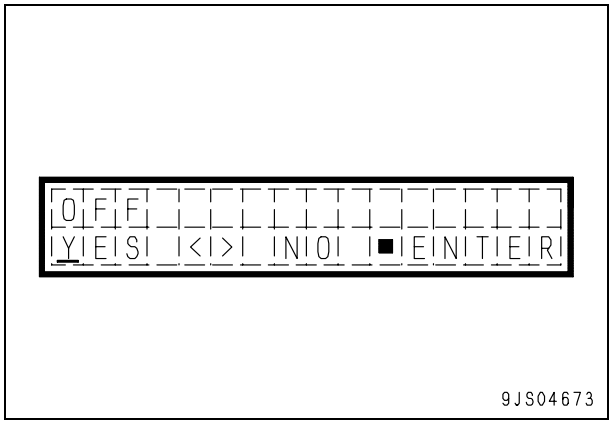


4) Press [<] or [>] switch when selecting the ALL ITEMS → ON.



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.

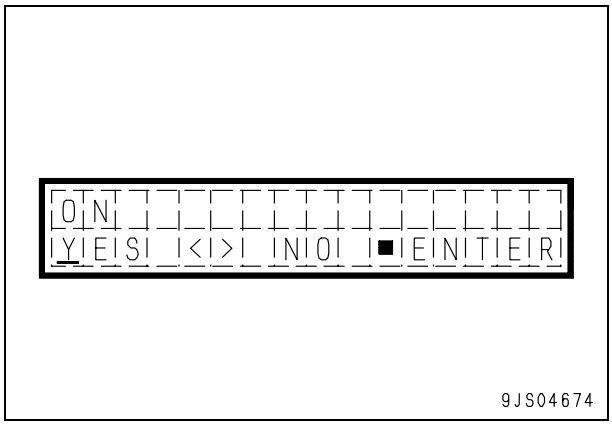


★ When [◇] switch is pressed from the ALL ITEMS → ON screen, ON will be is displayed in the upper space.

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.



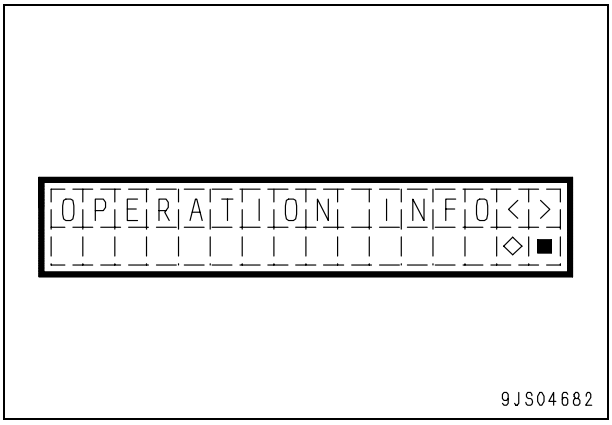
7) As the timer stop for all items is executed:
★ The timer function for all items is stopped and the MAINTENANCE MONITOR screen is restored.
★ Setting for individual items is also disabled.
★ If cancelled: The operation is cancelled and the MAINTENANCE MONITOR screen is restored.
8) When timer enable 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.)

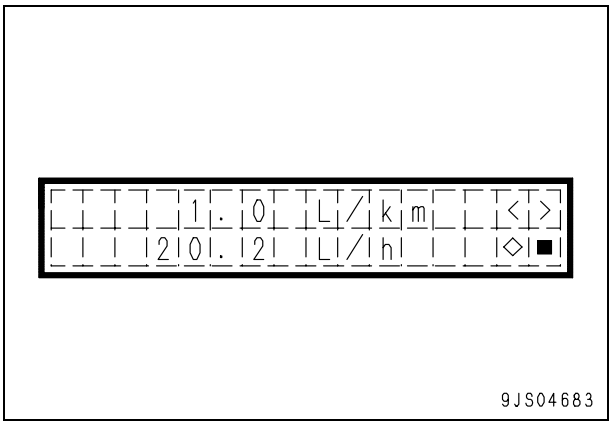
1) Selecting menu
Display the OPERATION INFO screen from the menu screen of Service mode.



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

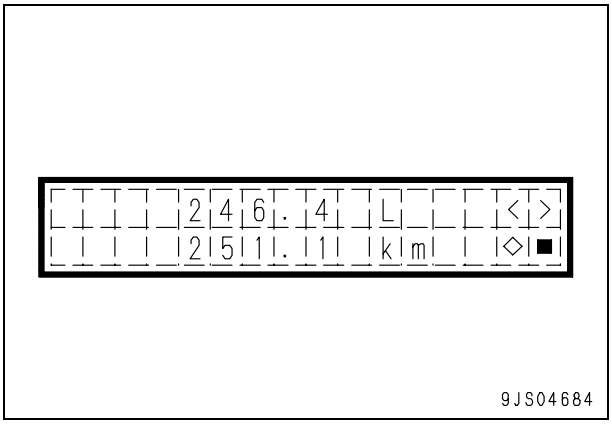
★ The upper column displays the cumulative fuel consumption [L] from the last resetting.

- 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

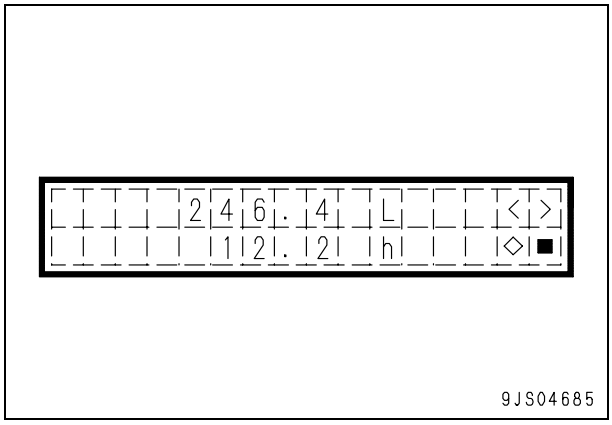
★ The upper column displays the cumulative fuel consumption [L] from the last resetting.

- 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

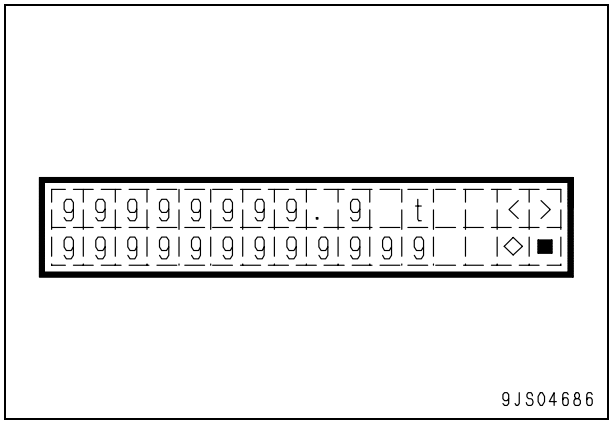
★ The upper column displays the loaded volume [ton] from the last resetting.

- Upper limit: Counting is stopped at 199999999.9 or 999999999.9.
- Short ton or metric ton depends on optional setting.

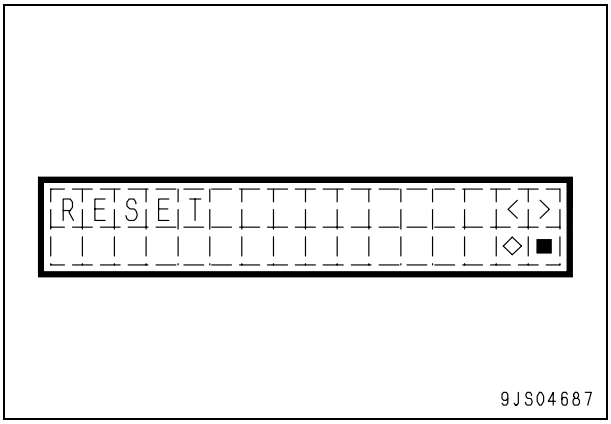
★ The lower column displays the loading frequency from the last resetting.

- Upper limit: Counting starts stopped at 65000 or 99999999999.

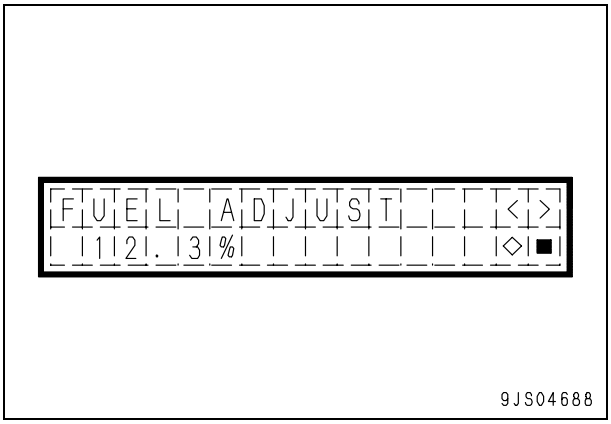
★ Calculation is done only for the duration in which the engine is run and the optional device is used.



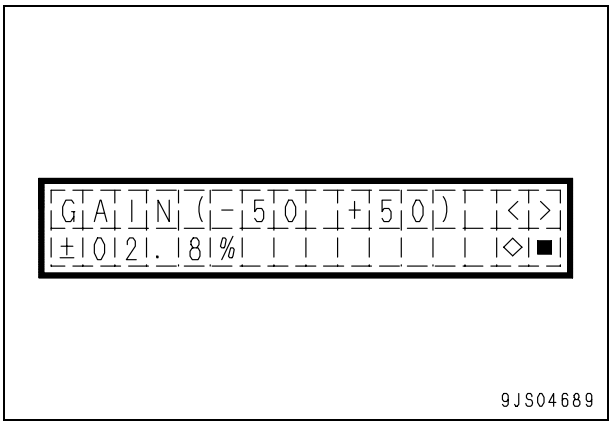
4) Deleting display data
★ Data on screens 5) – 8) allow deletion.
★ Select a desired item and then delete it using [◇] switch.
★ Use [■] switch when canceling deletion of data.



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. OPTIONAL SELECT function

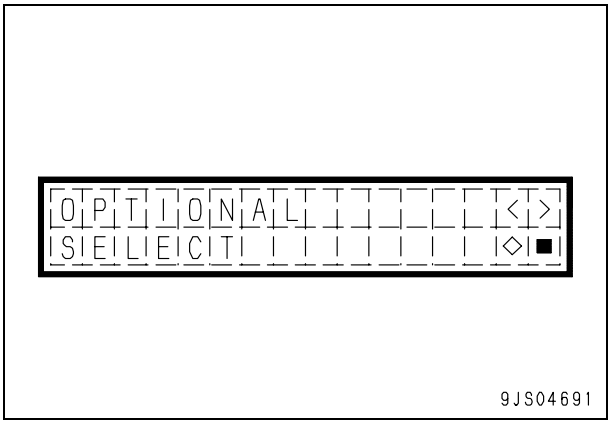
★ The procedure for setting an option is as follows; Set the option and turn the starting switch OFF. After the power for each controller is turned OFF (about 15 seconds), turn the starting switch ON again, and the option is effective.

★ Before setting an option, check that the machine model has been selected. (Select the machine model before setting the option.)

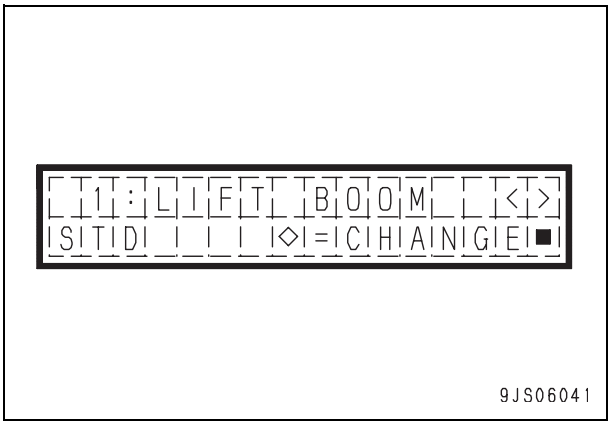
★ Optional component setting table

Item	Display in English	Item No.	Setting at delivery	Contents of selection
Boom specification	LIFT BOOM	1	STD	Set following items according to boom specification. • If standard boom is used, select “STD”. • If high lift boom (optional) is used, select “HI LIFT”.
Auto grease	AUTO GREASE	2	NO ADD	If there is option, select “ADD”.
Electrolyte level sensor	BAT LIQUID	3	NO ADD	If there is option, select “ADD”.
Transmission filter clogging sensor	TRANSM CLOG	4	NO ADD	If there is option, select “ADD”.
Printer	PRINTER	5	NO ADD	If there is option, select “ADD”.
Tire size	TIRE SIZE	6	0	Set to “0” normally and do not change.
Selection of short ton	SHORT TON	7	NO ADD	Since setting is made specially in factory, it cannot be changed.
Unit of travel speed	SPEED (UNIT)	8	MPH	Since setting is made specially in factory, it cannot be changed.
Machine which must take automobile inspection	RPM OPT	9	NO ADD	Select “NO ADD” and do not change it.
Indication of engine speed/travel speed on normal screen of character display	RPM/SPEED	10	ADD	Normally select “ADD” and do not change it.
Load meter	LOAD METER	11	NO ADD	Select “NO ADD” and do not change it.
Emergency steering	EMERG S/T	13	ADD	If option is not installed, select “NO ADD”.
Joystick steering and/or right FNR (directional) switch are/is not installed	J/S-FNR SW	14	NON	When joystick steering or right FNR (directional) switch is installed, set necessary items. • When only steering wheel is used, set “NON”. • When joystick steering is set, set “J/S”. • When right FNR (directional) switch is set, set “FNR SW”.
Joystick steering 4th and lockup clutch function	J/S 4TH L/U	15	ADD	Normally select “ADD” and do not change it. “NO ADD” is selected, 4th and lockup clutch do not operate in joystick steering mode.
Low-temperature bypass solenoid function	BYPASS SOL	16	NO ADD	Select “NO ADD” and do not change it.
Loader pump high altitude mode	HIGHLAND MD	17	NO ADD	Select “NO ADD” and do not change it.
Tooth mode	THOOTH MODE	18	NO ADD	Select “NO ADD” and do not change it.
Operation of ECO lamp	ECO LAMP	19	ADD	Normally select “ADD” and do not change it.
ECSS	E.C.S.S	20	NO ADD	If there is option, select “ADD”.
Torque converter lockup	LOCK UP	22	NO ADD	If there is option, select “ADD”.
Prohibition of 4th	FORBID 4TH	23	NO ADD	If there is option, select “ADD”. If “ADD” is selected, transmission is not set in 4th in auto-shift and manual shift modes.
Throttle lock	THROT LOCK	24	NO ADD	Select “NO ADD” and do not change it.
Work equipment controller	WORK LOCK	29	NO ADD	If controller is installed, select “ADD”.
EPC 3-piece lever	EPC 3RD	31	NO ADD	If there is option, select “ADD”.
EPC lever	EPC LEVER	32	NO ADD	If there is option, select “ADD”.

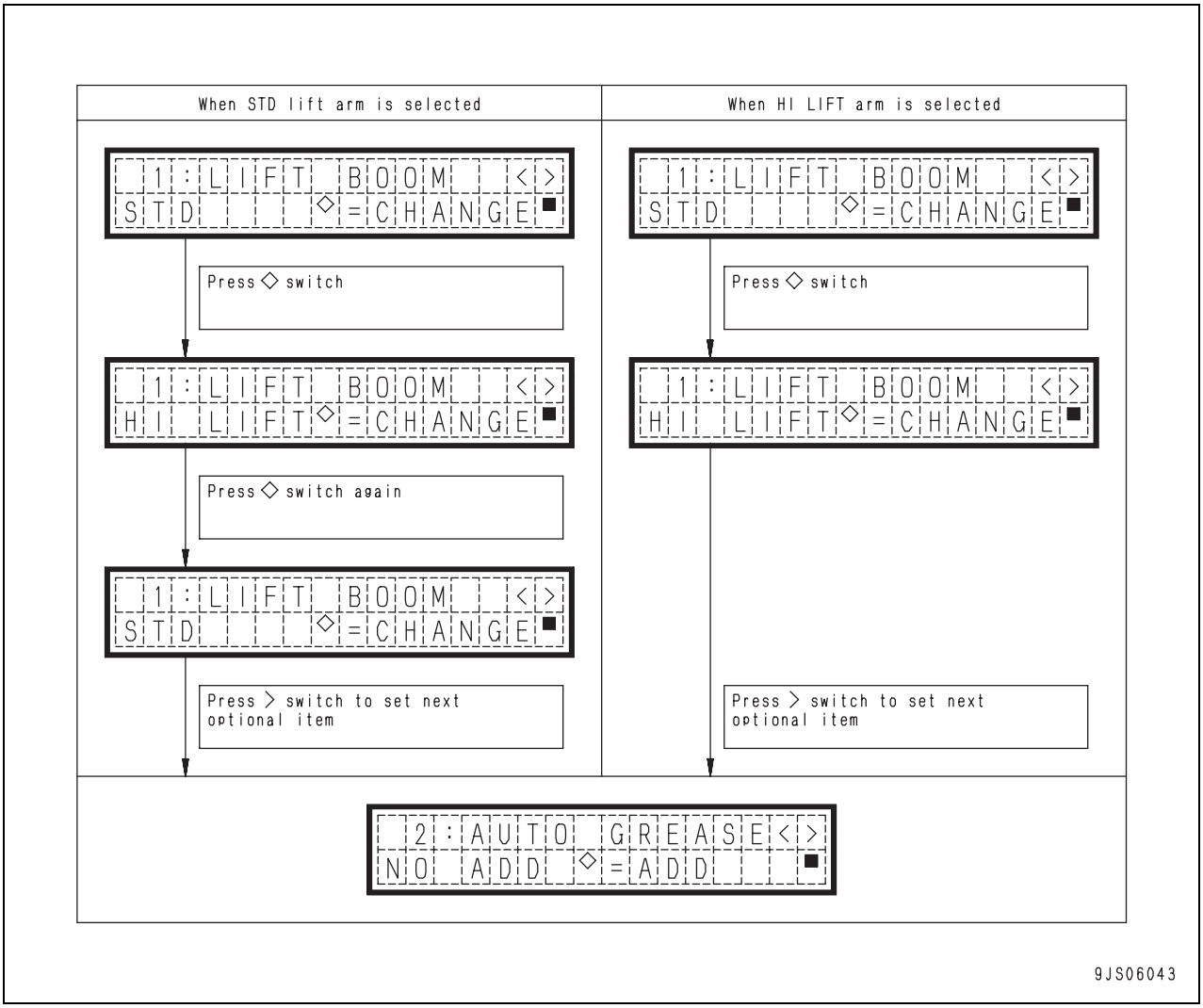
1) Display the OPTIONAL SELECT screen from the menu screen of Service mode.



2) Hold down [◇] switch for 5 seconds or longer.
3) The 1: LIFT BOOM screen will appear.
   ★ If the [■] switch is pressed, the screen returns to the OPTIONAL SELECT screen.



★ Be sure to start setting of each option on BOOM TYPE OPTION SELECT screen. After changing or settling the option, set other items in order on the next AUTO GREASE OPTION SELECT screen and the following screens.



10-1. Change or settlement of “BOOM TYPE OPTION SELECT”

★ If the [◇] switch is pressed on the BOOM TYPE OPTION SELECT screen, “STD” or “HI LIFT” is selected alternately.

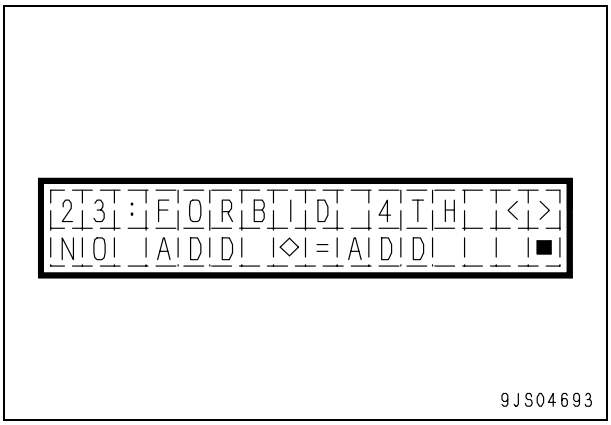
★ If “STD” or “HI LIFT” is selected, the operation receiving sound (beep) is made.

- STD: Standard boom
- HILIFT: High lift boom (Optional)

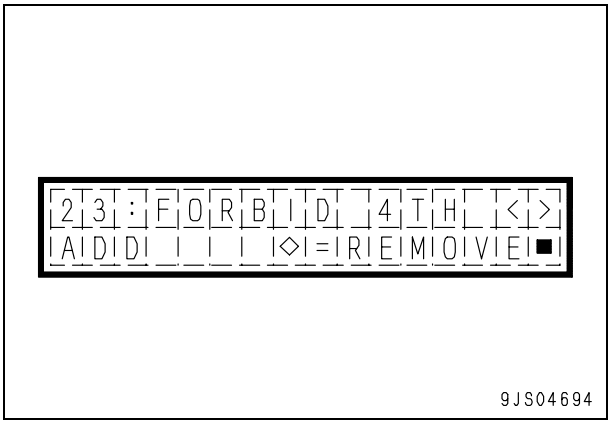
10-2. Option setting/not setting selection

★ 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 (NO ADD) is displayed.



★ If the options are selected, the option elected screen (ADD) is displayed.



★ [◇] switch allows alternately displaying the option non-selection screen and the option-selected screen.

10-3. Setting tire deflection option

★ Select the tire deflection option from the list of installed optional devices and their setting.

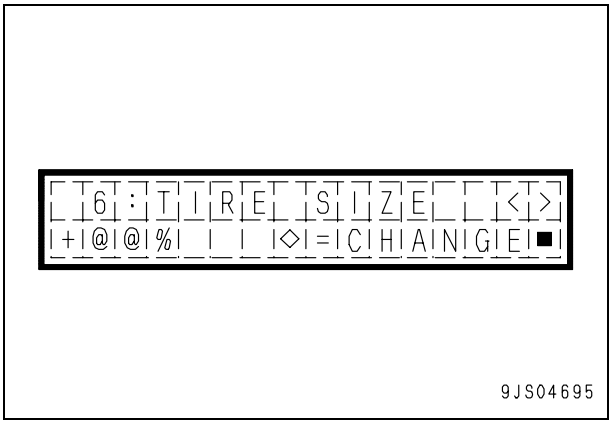
★ Pressing [◇] switch sequentially displays [@@]% in the following order.

★ 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.



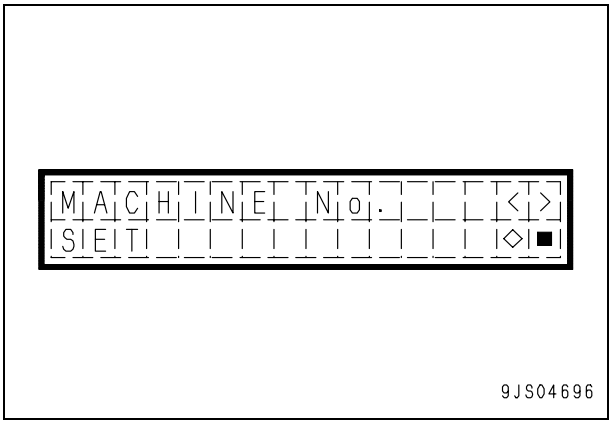
10-4. Storing option selection

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 15 seconds without doing any switch operation.)
2) The specified option selection is enabled as the starting switch is turned on.

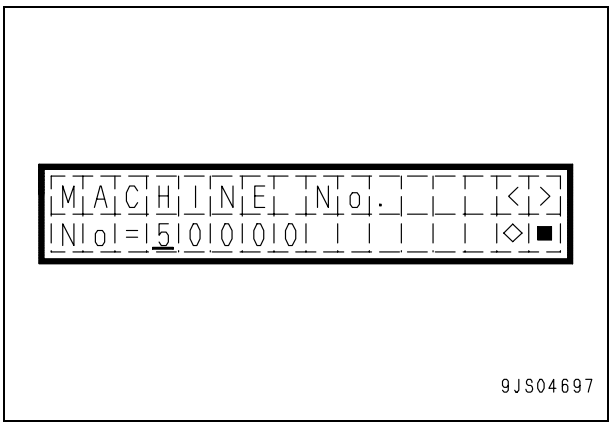
★ Whenever an option selection is made, turn off the starting switch once and then turn it on again in approximately 15 seconds.

11. 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.

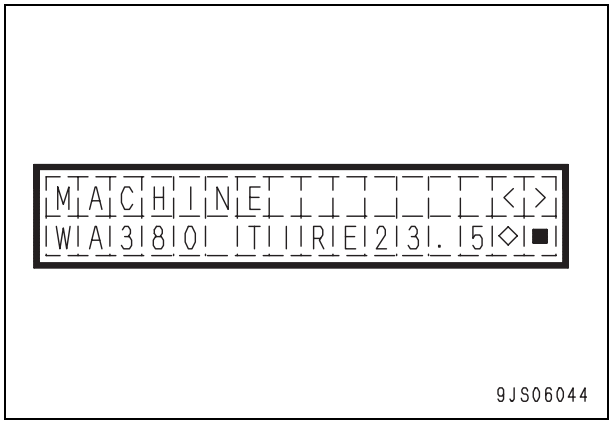


12. Machine model select function (MACHINE WA380, TIRE 23.5)

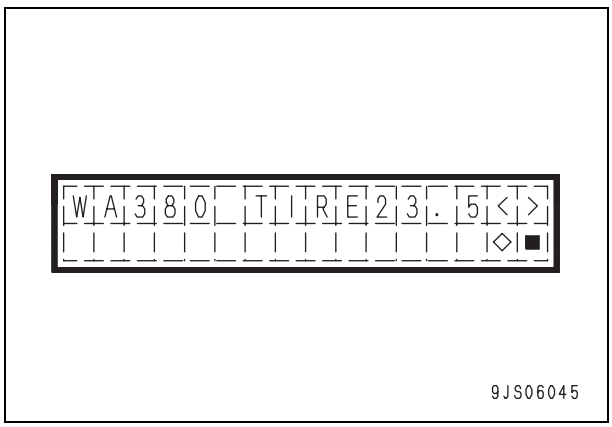
- ★ The setting of the machine model of the machine monitor can be changed with the machine model select function.
- ★ If the machine monitor is initialized, perform the machine model select operation first.
- ★ If the machine model select operation is performed, the setting of options is reset. Accordingly, start with the option select operation and select all the options.

12-1. Implementing the model change

1) Display the MACHINE screen from the menu screen of Service mode.
   - ★ The currently selected machine model and tire size are displayed on the lower line.
     - WA380 TIRE 23.5
     - WA380 TIRE 20.5
     - WA430 TIRE 26.5
     - WA430 TIRE 23.5
     - WA470 TIRE 26.5
     - WA470 TIRE 23.5
     - WA480



2) Hold down [◇] switch for 5 seconds to display the model selection screen.



3) With the [<] and [>] switches, select the machine model or tire size.
Select model and tire size based on installed tire.

Tire size	Display
23.5-25	WA380 TIRE 23.5
20.5-25	WA380 TIRE 20.5

★ If wrong model and tire are set, machine does not work correctly.

★ 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) With the [◇] switch, settle the changed machine model and tire size.

★ As the selection is settled, the sound (beep) indicating acceptance of the operation will be generated, restoring the MACHINE screen.

★ Check that the desired machine model and tire size are displayed on the machine model select screen.

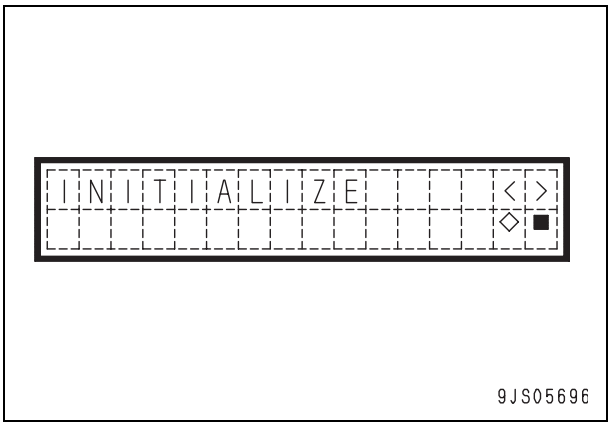
12-2. Storing model change

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 15 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.

13. Initialize function

This function is used only in the factory. It is, therefore, not used for a service purpose.



Pm-click inspection table

WA380-6 Serial No. H60051 and up

	hour inspection	Machine serial No.	#
		Engine serial No.	SAA6D107E-1 #

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	Measure-ment result	Good	Bad
Engine	Engine speed	Engine at low idle		rpm	825 – 875	825 – 875			
		Engine at high idle			2,180 – 2,280	2,180 – 2,280			
		Engine at high idle and torque converter stalled			2,080 – 2,180	2,030 – 2,230			
		Engine at high idle and work equipment relieved			2,120 – 2,320	2,020 – 2,420			
		Torque converter stalled + Work equipment relieved			1,995 – 2,195	1,895 – 2,295			
	Blow-by pressure	Engine at high idle and torque converter stalled		kPa {mmH2O}	Max. 0.98 {Max. 100}	1.96 {200}			
	Lubricating oil pressure	SAE0W30EOS SAE5W40EOS SAE10W30DH SAE15W40DH SAE30DH	Engine at high idle	MPa {kg/cm2}	Min. 0.29 {Min. 3.0}	0.25 {2.5}			
			Engine at low idle		Min. 0.10 {Min. 1.0}	0.07 {0.7}			
	Boost pressure	Engine at high idle and torque converter stalled		kPa {mmHg}	Min. 140 {Min. 1,050}	113 {850}			
	Exhaust temperature	Engine at high idle and toque converter stalled Outside temperature: 20°C		°C	Max. 550	600			

★ When shifting transmission gear to forward/reverse position, apply brake securely.

								Good	Bad
Transmission valve	Main relief pressure	Engine at high idle	• Torque converter oil pressure: Within operating range • Transmission: Neutral	MPa {kg/cm2}	2.69 – 3.09 {27.5 – 31.5}	2.69 – 3.09 {27.5 – 31.5}			
		Engine at low idle			2.53 – 2.93 {25.9 – 29.9}	2.53 – 2.93 {25.9 – 29.9}			
	Torque converter inlet pressure	Engine at high idle			Max. 0.88 {Max. 9.0}	Max. 0.88 {Max. 9.0}			
	Torque converter outlet pressure	Engine at high idle			0.34 – 0.59 {3.5 – 6.0}	0.34 – 0.59 {3.5 – 6.0}			
	ECMV output (clutch) pressure	1st	• Torque converter oil pressure: Within operating range • Engine at high idle • Manual switch: ON		2.15 – 2.45 {22 – 25}	2.15 – 2.45 {22 – 25}			
		2nd							
		3rd							
		4th							
		F							
		R							
		Lockup			1.22 – 2.22 {16 – 19}	1.22 – 2.22 {16 – 19}			

Pm-click inspection table

WA380-6 Serial No. H60051 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	Engine at high idle		MPa {kg/cm^2}	23.3 – 25.7 {237.5 – 262.5}	22.0 – 25.7 {225 – 262.5}			
Brake	Parking brake inlet pressure	Torque converter oil temperature: Within operating range Engine at low idle As parking brake is released		MPa {kg/cm^2}	Min. 2.4 {Min. 24.5}	Min. 2.4 {Min. 24.5}			
	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			
	Parking brake disc thickness			mm	3.12 – 3.28	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}	5.9 – 6.4 {60 – 65}	5.4 – 6.88 {55 – 70}			
	Charge cut-out pressure		Measure when brake oil pressure starts lowering after rising.		9.8 – 10.78 {100 – 110}	9.4 – 11.3 {95 – 115}			
	Brake oil pressure	Hydraulic oil temperature: Within operating range Engine at low idle			4.2 – 5.0 {42.8 – 51}	Min. 3.99 {Min. 40.7}			
	Lowering of brake oil pressure	Engine: Stopped Measure lowering of oil pressure from 4.9 MPa {50 kg/cm^2} in 5 minutes.			Max. 0.1 {Max. 1.0}	Max. 0.1 {Max. 1.0}			
	Wheel brake performance	Tire inflation pressure: Specified pressure Test on flat, level, straight, and dry paved road. Braking initial speed: 20 km/h, Delay in pressing pedal: Max 0.1 sec Brake pedal pressing force: Specified force, 293 – 353 Nm {29.9 – 35.9 kg} Measure braking distance.		m	Max. 5	Max. 5			
	Wear of wheel brake disc	Measure with disc wear indicator.		mm	0	Max. 2.4			
Work equipment	Work equipment valve relief pressure	P-mode Hydraulic oil temperature: Within operating range Engine at high idle	Bucket circuit relieved	MPa {kg/cm^2}	29.8 – 33.0 {304 – 336}	29.5 – 33.0 {280 – 336}			
	Work equipment valve LS differential pressure		Work equipment control lever moved halfway		1.27 – 1.67 {13 – 17}	1.08 – 1.86 {11 – 19}			
	Lift arm speed		Rising time	sec	5.4 – 6.4	Max. 7.6			
			Lowering time		2.8 – 3.8	Max. 4.4			
	Bucket tilt back speed		Bucket full stroke time		2.0 – 2.6	Max. 3.0			
			Bucket at level time		1.3 – 1.9	Max. 2.2			
	Hydraulic drift of work equipment	Hydraulic oil temperature: Within operating range Engine: Stopped	Bucket cylinder	mm/ 15 min.	Max. 17	Max. 20			
			Lift cylinder		Max. 20	Max. 24			
Axle	Draining of differential	Front axle		—	There must not be excessive metal powder.				
	Visual check of plug	Rear axle							

Memo

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

40 Troubleshooting

General information on troubleshooting

General information on troubleshooting 2
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

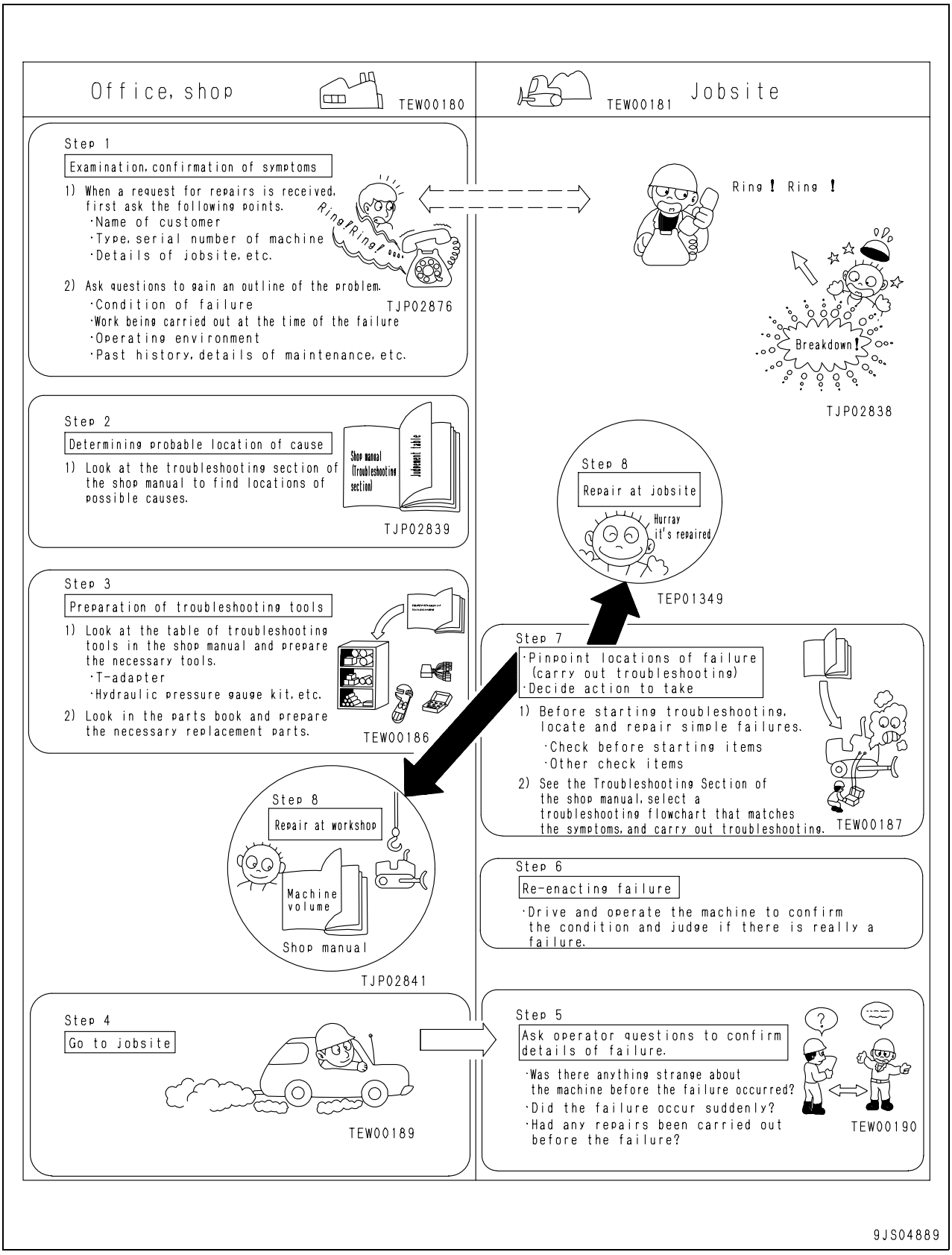
- ⚠ **Stop the machine in a level place, and check that the safety pin, blocks, and parking brake are securely fitted.**
- ⚠ **When carrying out the operation with 2 or more workers, keep strictly to the agreed signals, and do not allow any unauthorized person to come near.**
- ⚠ **If the radiator cap 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) Are abnormal symptoms detected in 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 by yourself, and judge whether to treat it as a real failure or as a problem of handling, 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 table or flowchart (matrix) to find out the failure part 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 immediate failure is repaired, the same failure may occur again, unless the root cause of the failure is repaired. To prevent this, always investigate why the cause of the failure occurred. Then, remove the root cause.

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 Check fuel filter and fuel pre-filter for clogging	—	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	Between H and L	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 of electrical system
H-mode	Troubleshooting of hydraulic and mechanical system
S-mode	Troubleshooting of engine

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“.

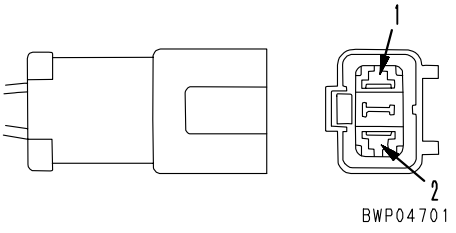
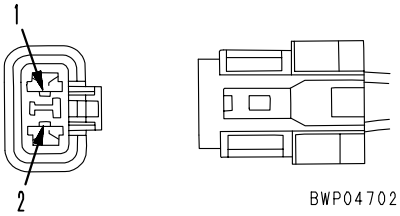
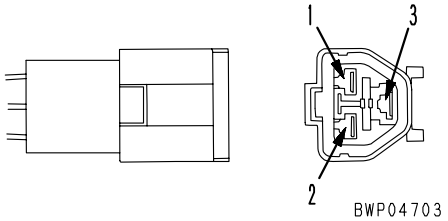
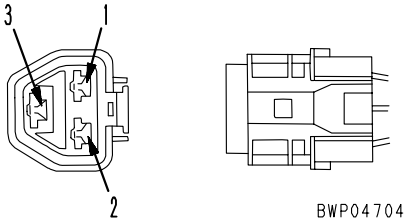
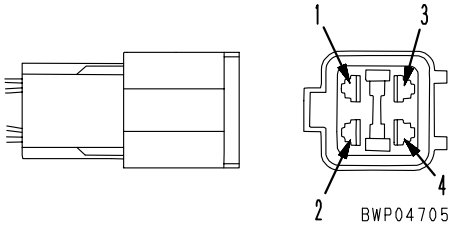
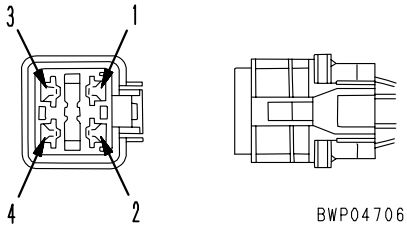
Phenomena looking like troubles and troubleshooting Nos.

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 turn		**E-1**		**S-2 a)**
5		Engine turns but no exhaust smoke 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 does not rotate smoothly					**S-5**
10	Engine lacks output (or lacks power)					**S-6**
11	Exhaust smoke is black (Incomplete combustion)					**S-7**
12	Oil consumption is excessive (or exhaust smoke is blue)					**S-8**
13	Oil becomes contaminated quickly					**S-9**
14	Fuel consumption is excessive					**S-10**
15	Coolant contains oil (blows back or reduces)					**S-11**
16	Oil pressure drops					**S-12**
17	Oil level rises (Water or fuel is mixed in oil)					**S-13**
18	Coolant temperature is too high (Overheating)					**S-14**
19	Abnormal noise is made					**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) [Lockup clutch specification (If equipped)]				**H-2**	
23	Torque converter lockup is not turned on [Lockup clutch specification (If equipped)]				**H-3**	
24	Travel speed is slow, the thrusting force is weak, the uphill traveling power is weak, and the gear is not shifted				**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	Steering does not turn				**H-8**	
29	Steering does not turn [Joystick steering specification (If equipped)]				**H-9**	
30	Steering response is low				**H-10**	
31	Steering response is low [Joystick steering specification (If equipped)]				**H-11**	
32	Steering is heavy				**H-12**	
33	Steering wheel shakes or makes large shocks				**H-13**	
34	Steering wheel shakes or makes large shocks [Joystick steering specification (If equipped)]				**H-14**	

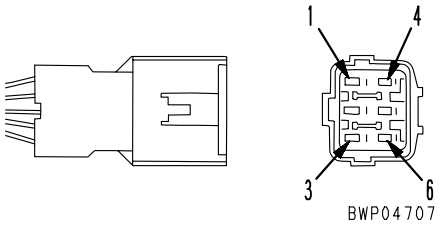
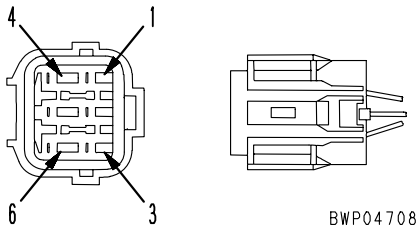
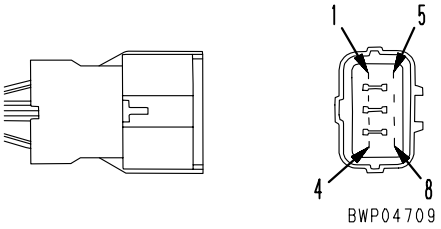
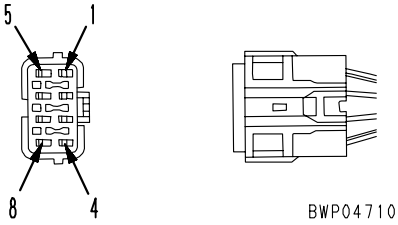
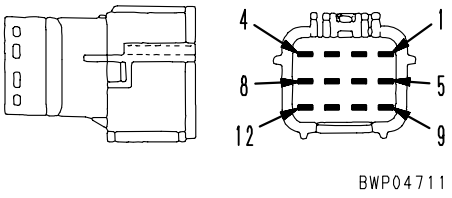
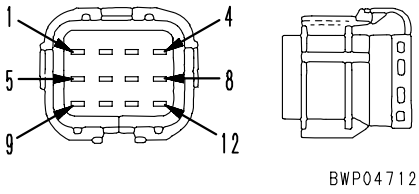
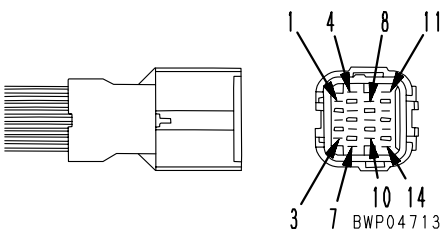
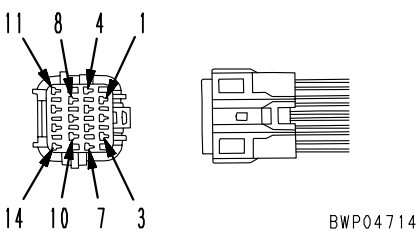
Phenomena related to brake					
35	Wheel brake does not work or braking force is low			**H-15**	
36	Wheel brake is not reset or drags			**H-16**	
37	Parking brake does not work or braking force is low			**H-17**	
38	Parking brake does not reset or drags (including emergency release system)			**H-18**	
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 tilt-back force is insufficient			**H-26**	
47	Bucket speed 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	Lift arm and bucket control levers do not move smoothly and are heavy			**H-31**	
52	Engine speed lowers remarkably or engine stalls during work equipment control			**H-32**	
53	Large shock is made when work equipment starts and stops			**H-33**	
54	When work equipment is relieved singly, other work equipment moves			**H-34**	
55	ECSS does not operate, and pitching or bouncing occurs			**H-35**	
Others					
56	Wiper does not operate		**E-2**		
57	Windshield washer does not operate.		**E-3**		
58	Headlamp, clearance lamp, tail lamp, and license lamp do not light up or go off		**E-4**		
59	Working lamp does not light up or go off		**E-5**		
60	Turn signal lamp and hazard lamp do not light up or go off		**E-6**		
61	Brake lamp does not light or it keeps lighting up		**E-7**		
62	Backup lamp does not light or it keeps lighting up		**E-8**		
63	Backup buzzer does not sound or it keeps sounding		**E-9**		
64	Horn does not sound or it keeps sounding		**E-10**		
65	Alarm buzzer does not sound or it keeps sounding		**E-11**		
66	Air conditioner does not operate or stop		**E-12**		
67	KOMTRAX system does not operate normally		**E-13**		

Connection table for connector pin numbers

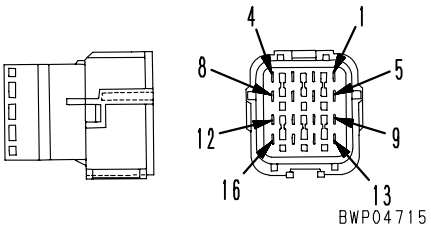
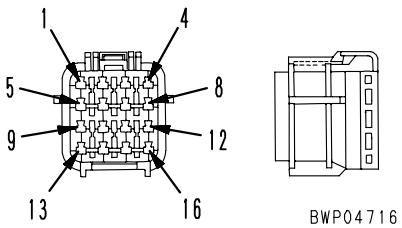
★ The terms male and female refer to the pins, while the terms male housing and female housing refer to the mating portion of the housing.

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	—

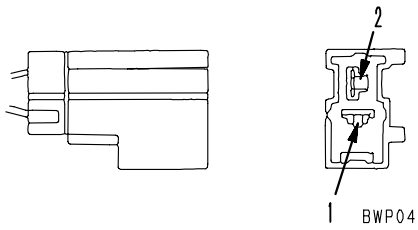
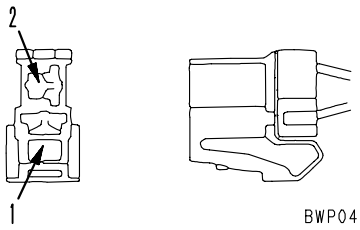
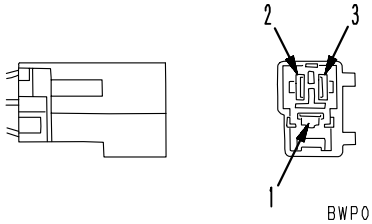
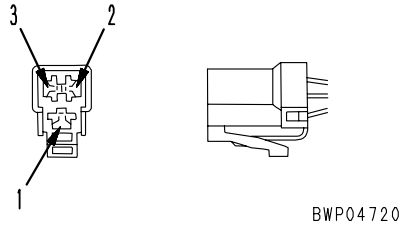
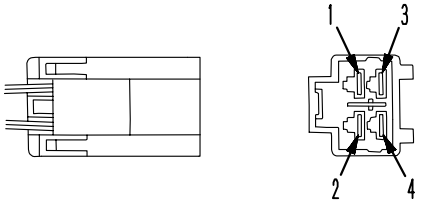
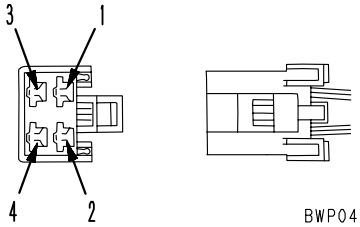
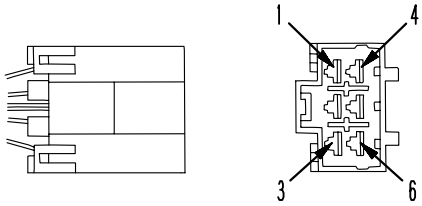
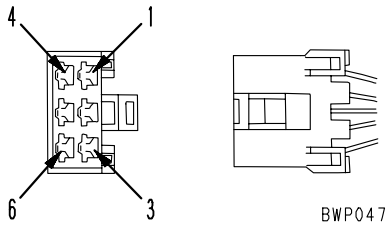
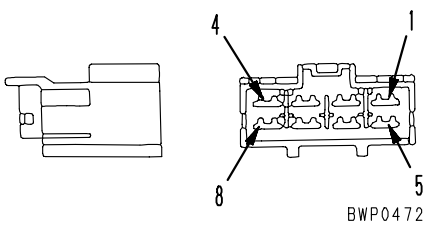
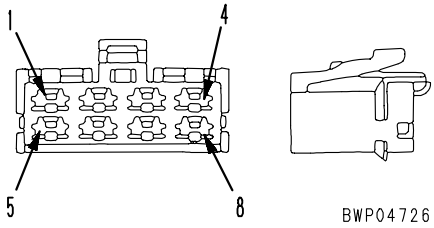
9JS04890

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	

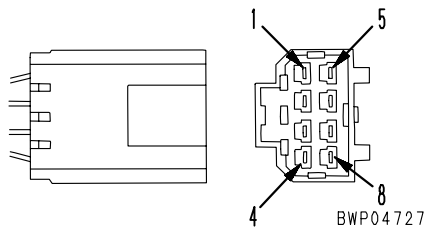
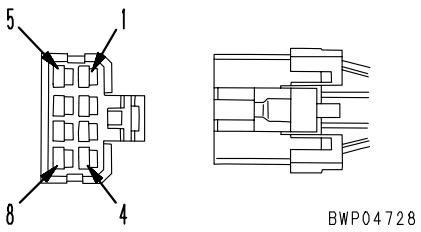
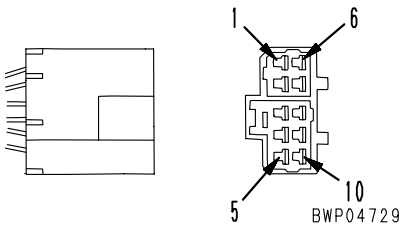
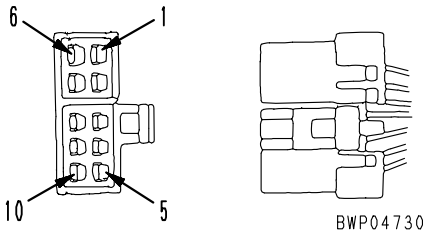
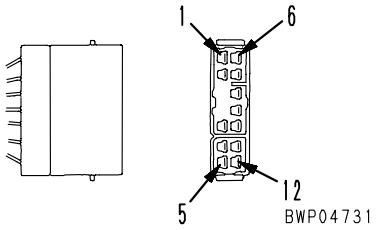
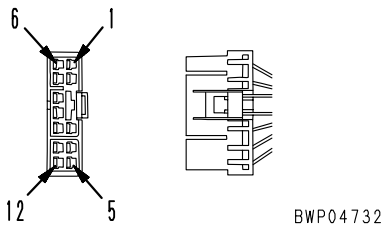
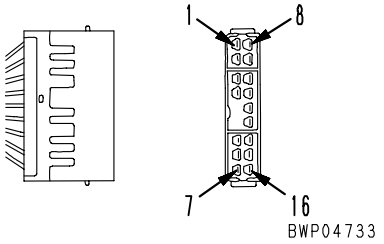
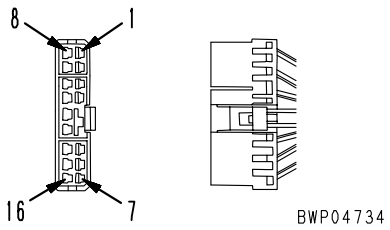
9JS04891

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	—

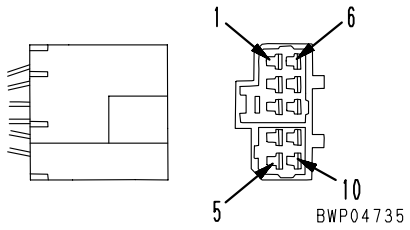
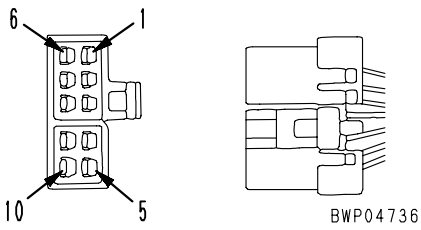
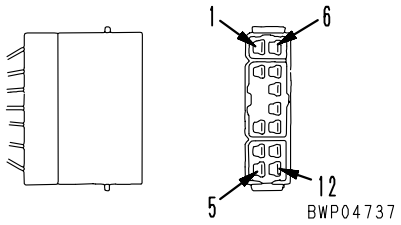
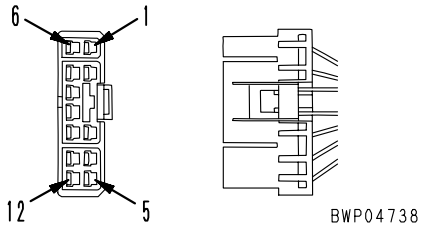
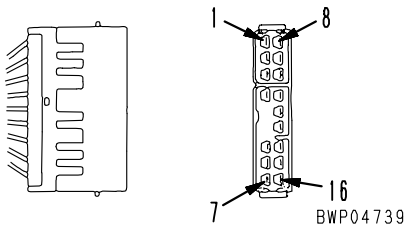
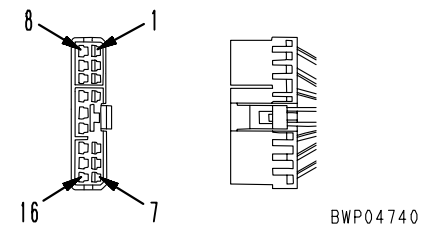
9JS04892

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	

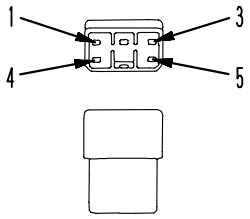
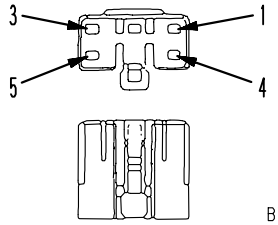
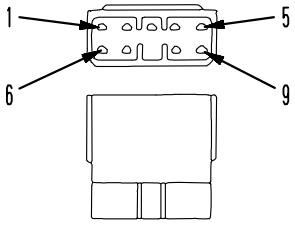
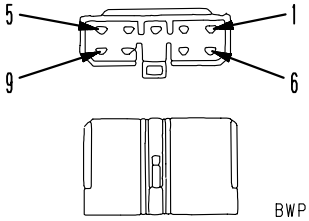
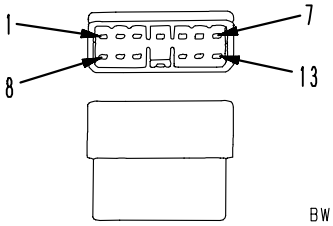
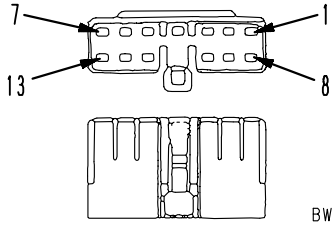
9JS04893

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	

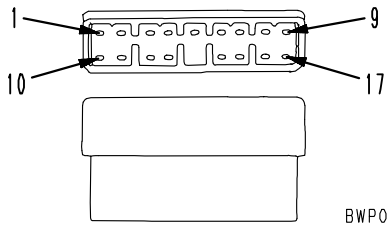
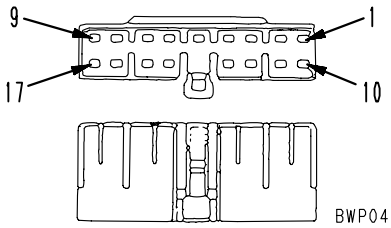
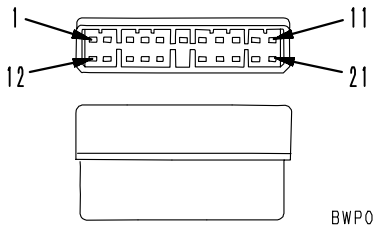
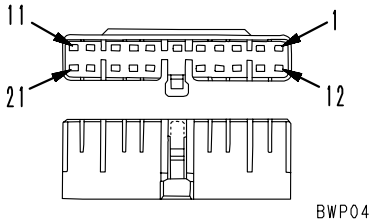
9JS04894

No. of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10 (Blue)	 BWP04735	 BWP04736	—
	—	—	
12 (Blue)	 BWP04737	 BWP04738	799-601-7160
	Part No. : 08056-11272	Part No. : 08056-11282	
16 (Blue)	 BWP04739	 BWP04740	799-601-7170
	Part No. : 08056-11672	Part No. : 08056-11682	

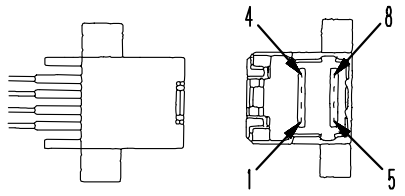
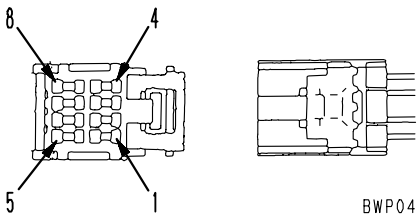
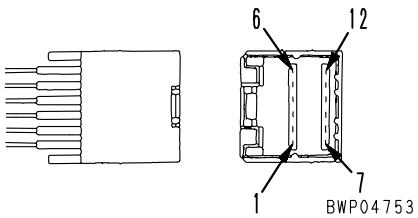
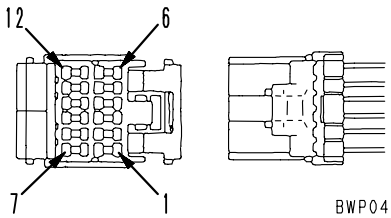
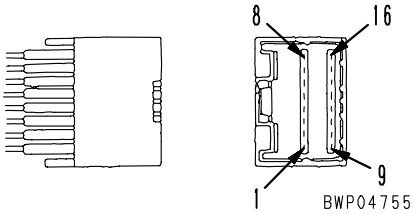
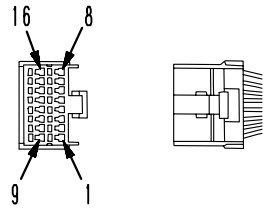
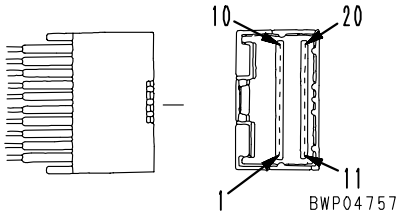
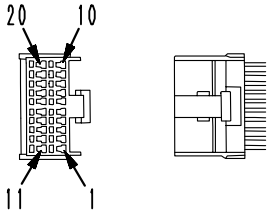
9JS04895

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

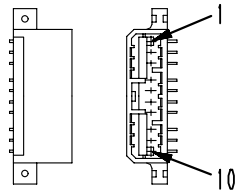
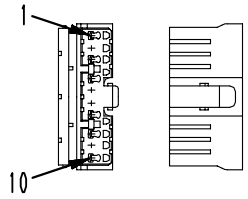
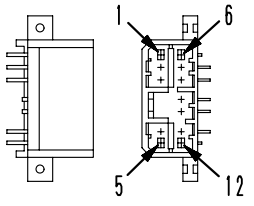
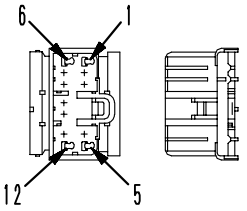
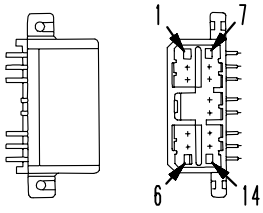
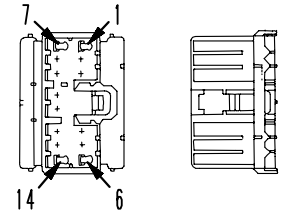
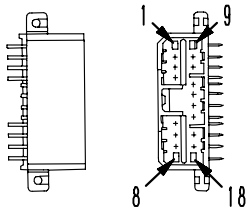
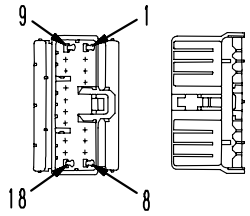
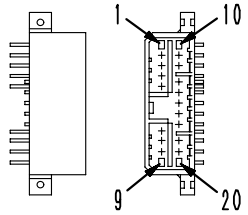
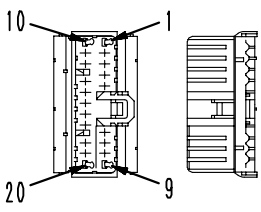
No. of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
17	 BWP04747	 BWP04748	799-601-2730
	Body part No. : 79A-222-2730 (Q'ty:2)	Body part No. : 79A-222-2720 (Q'ty:2)	
21	 BWP04749	 BWP04750	799-601-2740
	Body part No. : 79A-222-2750 (Q'ty:2)	Body part No. : 79A-222-2740 (Q'ty:2)	
	Terminal part No. : 79A-222-2770 (Q'ty:50)	Terminal part No. : 79A-222-2760 (Q'ty:50)	

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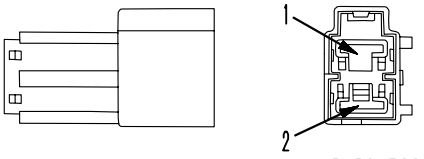
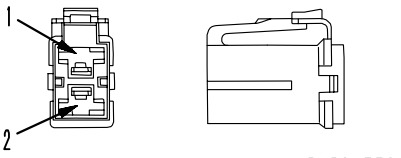
No. of pins	AMP040 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8	 BWP04751	 BWP04752	799-601-7180
	—	Housing part No. : 79A-222-3430 (Q'ty:5)	
12	 BWP04753	 BWP04754	799-601-7190
	—	Housing part No. : 79A-222-3440 (Q'ty:5)	
16	 BWP04755	 BWP04756	799-601-7210
	—	Housing part No. : 79A-222-3450 (Q'ty:5)	
20	 BWP04757	 BWP04758	799-601-7220
	—	Housing part No. : 79A-222-3460 (Q'ty:5)	

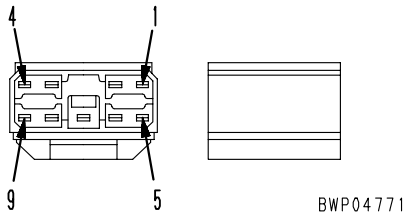
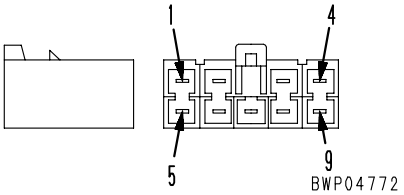
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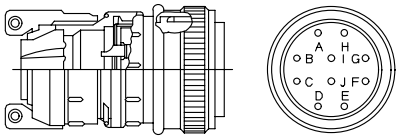
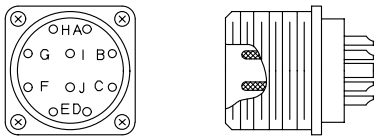
9JS04898

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	

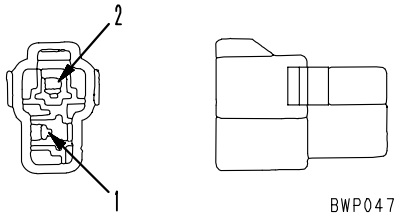
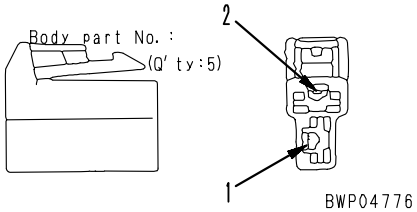
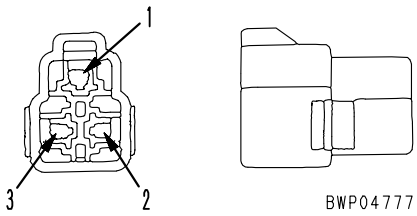
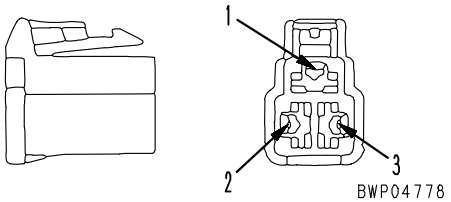
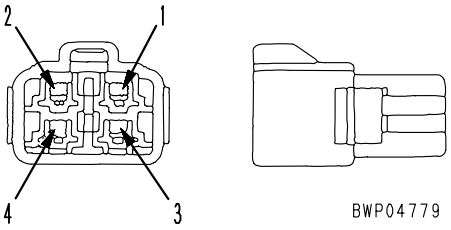
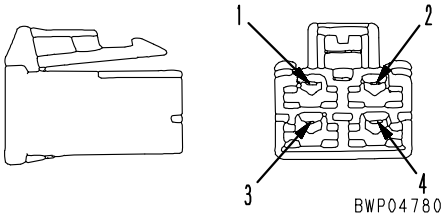
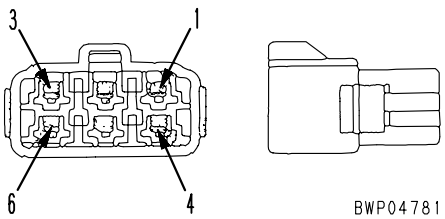
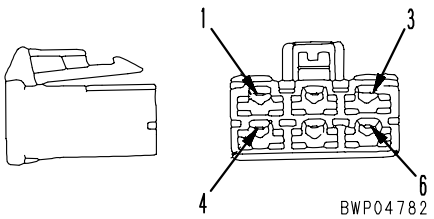
9JS04899

No. of pins	L type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
2	 BWP04769	 BWP04770	—
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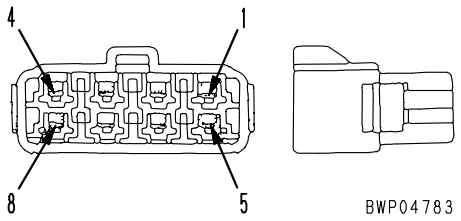
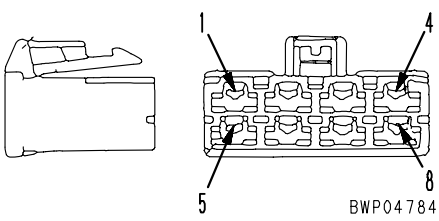
No. of pins	Connector for PA		
	Male (female housing)	Female (male housing)	T-adapter Part No.
9	 BWP04771	 BWP04772	—
	—	—	

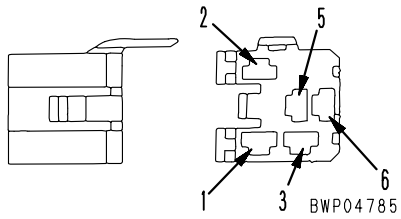
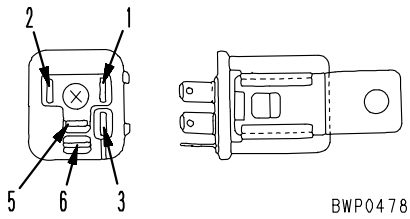
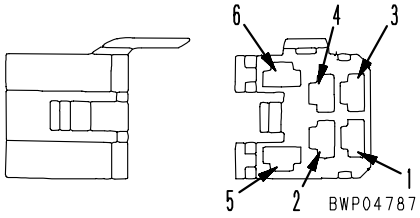
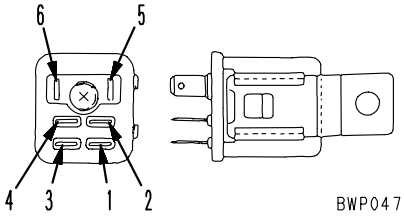
No. of pins	Bendix MS connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10	 BWP04773	 BWP04774	799-601-3460
	—	—	

9JS04900

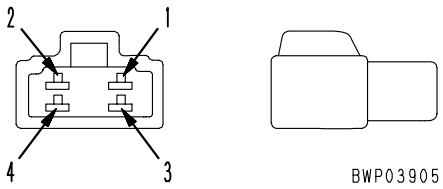
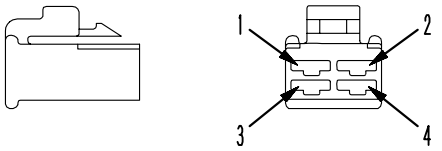
No. of pins	KES 1 (Automobile) connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
2			—
	Part No. : 08027-10210 (Natural color) 08027-10220 (Black)	Part No. : 08027-10260 (Natural color) 08027-10270 (Black)	
3			—
	Part No. : 08027-10310	Part No. : 08027-10360	
4			—
	Part No. : 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)	

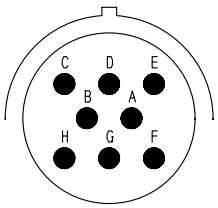
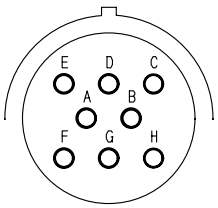
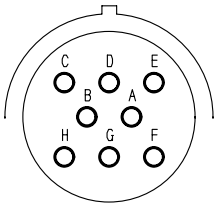
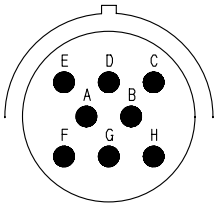
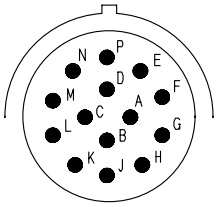
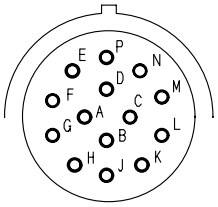
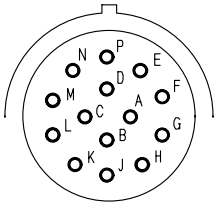
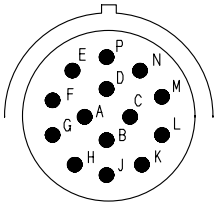
No. of pins	Connector for relay (Socket type)		
	Male (female housing)	Female (male housing)	T-adapter Part No.
5			799-601-7360
	—	—	
6			799-601-7370
	—	—	

9JS04902

No. of pins	F type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
4	 BWP03905	 BWP03906	—
	—	—	

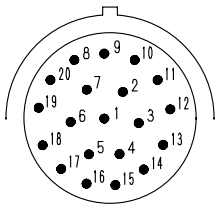
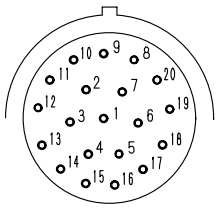
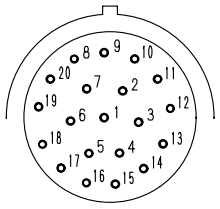
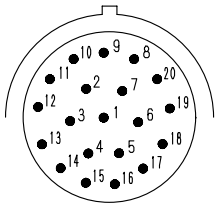
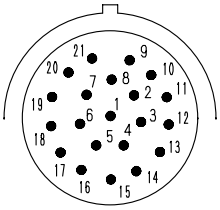
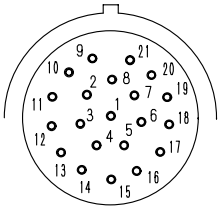
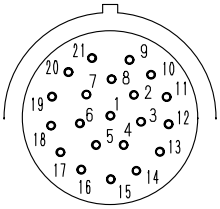
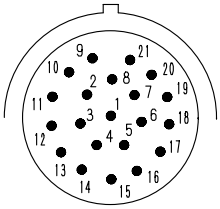
9JS04903

[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)	Socket (female terminal)	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	
	Socket (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)	Socket (female terminal)	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	
	Socket (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	

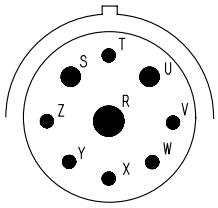
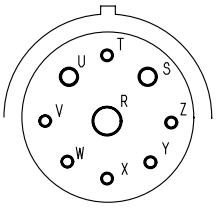
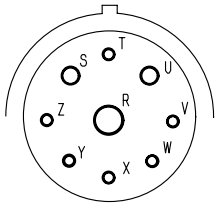
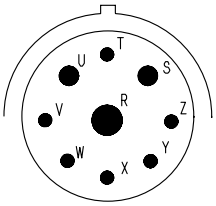
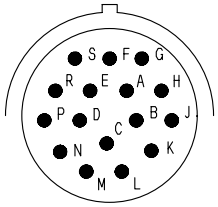
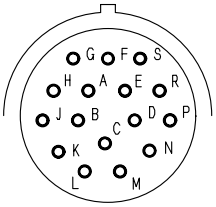
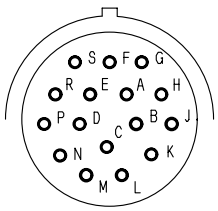
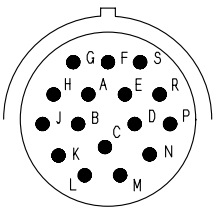
9JS04904

[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)	Socket (female terminal)	799-601-9230
	 BWP05009	 BWP05010	
	Part No. :08191-31201, 08191-31202	Part No. :08191-34101, 08191-34102	
	Socket (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)	Socket (female terminal)	799-601-9240
	 BWP05013	 BWP05014	
	Part No. :08191-41201, 08191-42202	Part No. :08191-44101, 08191-44102	
	Socket (female terminal)	Pin (male termial)	799-601-9240
	 BWP05015	 BWP05016	
	Part No. :08191-42201, 08191-42202	Part No. :08191-43101, 08191-43102	

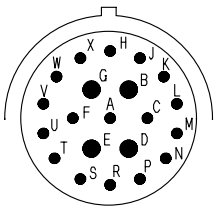
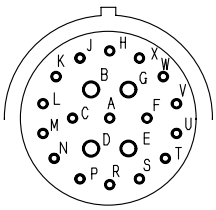
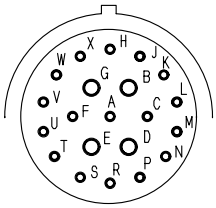
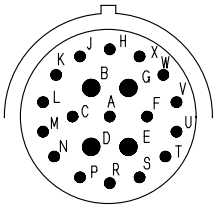
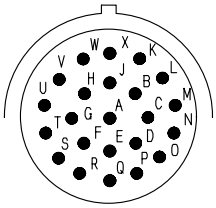
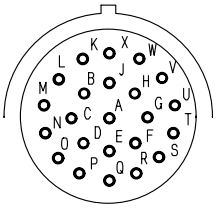
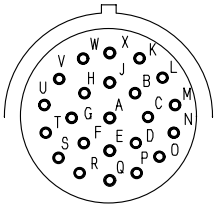
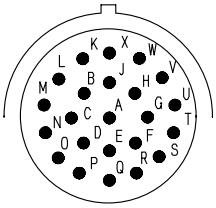
9JS04905

[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)	Socket (female terminal)	799-601-9250
	 BWP05017	 BWP05018	
	Part No. :08191-51201, 08191-51202	Part No. :08191-54101, 08191-54102	
	Socket (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)	Socket (female terminal)	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	
	Socket (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	

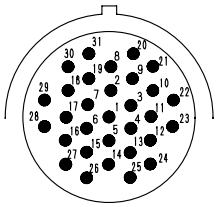
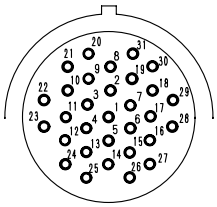
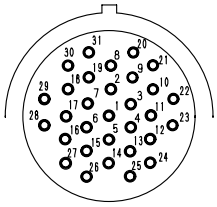
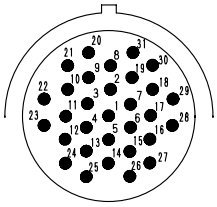
9JS04906

[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)	Socket (female terminal)	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	
	Socket (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)	Socket (female terminal)	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	
	Socket (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	

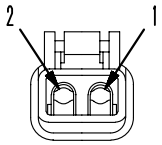
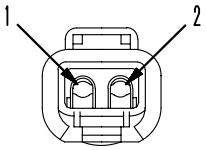
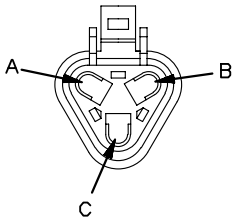
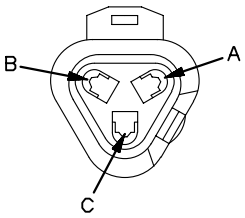
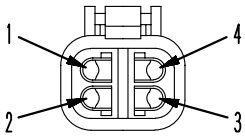
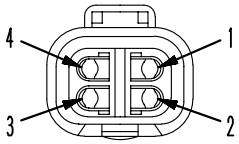
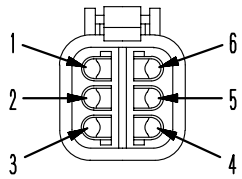
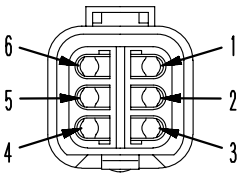
9JS04907

[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)	Socket (female terminal)	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	
	Socket (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	

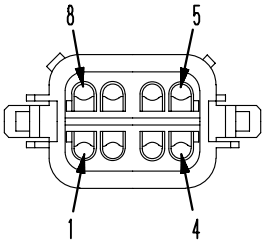
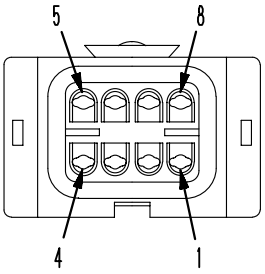
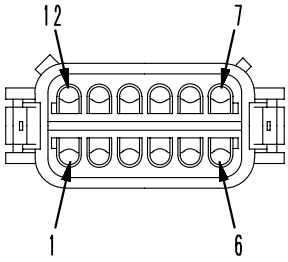
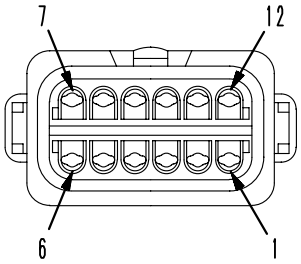
9JS04908

[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)	

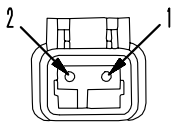
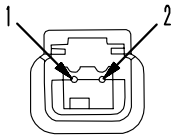
9JS04909

[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)	

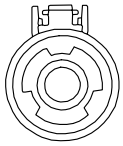
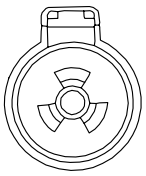
9JS04910

[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	

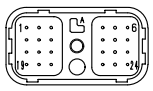
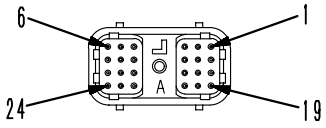
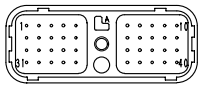
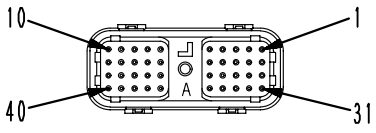
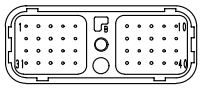
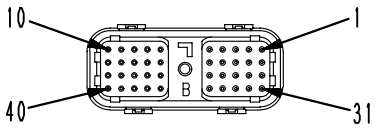
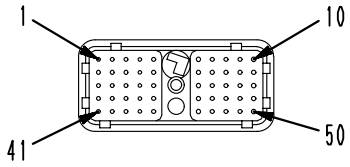
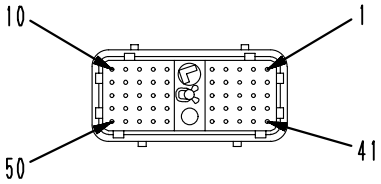
9JS04911

[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	ECONO2P	●	●																
799-601-2760	Adapter for ECONO	3	ECONO3P	●	●																
799-601-2770	Adapter for ECONO	4	ECONO4P	●	●																
799-601-2780	Adapter for ECONO	8	ECONO8P	●	●																
799-601-2790	Adapter for ECONO	12	ECONO12P	●	●																
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	ECONO12P	●	●									●							
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									●	●	●		●					
799-601-7050	Adapter for SWP	6	SW6P									●	●	●							
799-601-7060	Adapter for SWP	8	SW8P									●	●	●							
799-601-7310	Adapter for SWP	12	SW12P																		●

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	
799-601-7070	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														●		●		
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														●	●			

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	
799-601-9230	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																		●
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																		●

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 1

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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
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
2F00MA	Parking brake	Malfunction	MON	E03	Electrical system
2G43ZG	Accumulator	Low oil pressure	MON	E03	Mechanical system
AA1ANX	Air cleaner	Clogging	MON	E01	Mechanical system
AB00L6	Alternator	Signal does not match engine running or stopped state	MON	E03	Electrical system
AB00MA	Alternator	Malfunction	MON	E03	Mechanical system
B@BAZG	Derating of speed by engine oil pressure reduction	—	ENG	E03	Mechanical system
B@BAZK	Engine oil	Low oil pressure	MON	E01	Mechanical system
B@BCNS	Coolant	Overheating	ENG	E02	Mechanical system
B@BCZK	Coolant	Low oil pressure	MON	E01	Mechanical system
B@C7NS	Brake oil	Overheating	MON	E02	Mechanical system
b@CENS	Torque converter oil	Overheating	MON	E02	Mechanical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
B@CENS	Torque converter oil	Overheating	MON	E02	Mechanical system
B@HANS	Hydraulic oil	Overheating	MON	E02	Mechanical system
CA111	Engine controller internal failure	—	ENG	E03	Electrical system
CA115	Abnormality in engine Ne, Bkup speed sensor	—	ENG	E03	Electrical system
CA122	Abnormally high level in charge pressure sensor	—	ENG	E03	Electrical system
CA123	Abnormally low level in charge pressure sensor	—	ENG	E03	Electrical system
CA131	Abnormally high level in throttle sensor	—	ENG	E03	Electrical system
CA132	Abnormally low level in throttle sensor	—	ENG	E03	Electrical system
CA144	Abnormally high level in coolant temperature sensor	—	ENG	E01	Electrical system
CA145	Abnormally low level in coolant temperature sensor	—	ENG	E01	Electrical system
CA153	Abnormally high level in charge temperature sensor	—	ENG	E01	Electrical system
CA154	Abnormally low level in charge temperature sensor	—	ENG	E01	Electrical system
CA155	Derating of speed by abnormally high charge temperature	—	ENG	E03	Electrical system
CA187	Sensor power supply 2 voltage low error	—	ENG	E03	Electrical system
CA221	Ambient pressure sensor high error	—	ENG	E01	Electrical system
CA222	Ambient pressure sensor low error	—	ENG	E01	Electrical system
CA227	Sensor power supply 2 voltage high error	—	ENG	E03	Electrical system
CA234	Engine overspeed	—	ENG	E02	Mechanical system
CA238	Ne speed sensor supply power voltage error	—	ENG	E03	Electrical system
CA271	Short circuit in PCV1	—	ENG	E03	Electrical system
CA272	Disconnection in PCV1	—	ENG	E03	Electrical system
CA322	Disconnection or short circuit in injector #1 (L/B #1) system	—	ENG	E03	Electrical system
CA323	Disconnection or short circuit in injector #5 (L/B #5) system	—	ENG	E03	Electrical system
CA324	Disconnection or short circuit in injector #3 (L/B #3) system	—	ENG	E03	Electrical system
CA325	Disconnection or short circuit in injector #6 (L/B #6) system	—	ENG	E03	Electrical system
CA331	Disconnection or short circuit in injector #2 (L/B #2) system	—	ENG	E03	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
CA332	Disconnection or short circuit in injector #4 (L/B #4) system	—	ENG	E03	Electrical system
CA342	Engine control data 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
CA428	Abnormally high level in water sensor	—	ENG	E01	Electrical system
CA429	Abnormally low level in water sensor	—	ENG	E01	Electrical system
CA431	Abnormality in idle validation switch	—	ENG	E01	Electrical system
CA432	Abnormality in processing of idle validation	—	ENG	E03	Electrical system
CA435	Engine oil pressure switch error	—	ENG	E01	Electrical system
CA441	Abnormally low power supply voltage	—	ENG	E03	Electrical system
CA442	Abnormally high power supply voltage	—	ENG	E03	Electrical system
CA449	Abnormally high common rail pressure 2	—	ENG	E03	Electrical system
CA451	Abnormally high level in common rail pressure sensor	—	ENG	E03	Electrical system
CA452	Abnormally low level in common rail pressure sensor	—	ENG	E03	Electrical system
CA488	Derating of torque by abnormally high charge temperature	—	ENG	E03	Electrical system
CA553	Abnormally high common rail pressure 1	—	ENG	E03	Electrical system
CA559	Supply pump pressure very low error 1	—	ENG	E03	Electrical system
CA689	Abnormality in engine Ne speed sensor	—	ENG	E03	Electrical system
CA731	Abnormality in engine Bkup speed sensor phase	—	ENG	E03	Electrical system
CA757	Loss of all data in engine controller	—	ENG	E03	Electrical system
CA778	Abnormality in engine Bkup speed sensor	—	ENG	E03	Electrical system
CA1117	Abnormality in engine Bkup speed sensor	—	ENG	E03	Electrical system
CA1633	Abnormality in KOMNET	—	ENG	E03	Electrical system
CA2185	Throttle sensor power supply voltage high error	—	ENG	E03	Electrical system
CA2186	Throttle sensor power supply voltage low error	—	ENG	E03	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
CA2249	Supply pump pressure very low error 2	—	ENG	E03	Electrical system
CA2311	Abnormality in IMV solenoid	—	ENG	E03	Electrical system
CA2555	Disconnection in intake air heater relay	—	ENG	E01	Electrical system
CA2556	Short circuit in intake air heater relay	—	ENG	E01	Electrical system
D150KA	Emergency steering relay	Disconnection	TM	E03	Electrical system
D150KB	Emergency steering relay	Short-circuit	TM	E03	Electrical system
D150KY	Emergency steering relay	Power supply line short	TM	E03	Electrical system
D160KA	Backup lamp relay	Disconnection	TM	E01	Electrical system
D160KB	Backup lamp relay	Disconnection or short circuit	TM	E01	Electrical system
D191KA	Joystick steering neural safety relay	Disconnection	TM	E01	Electrical system
D191KB	Joystick steering neural safety relay	Short-circuit	TM	E01	Electrical system
D191KY	Joystick steering neural safety relay	Power supply line short	TM	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
D5ZHKA	Terminal C signal	Disconnection	TM	E01	Electrical system
D5ZHKB	Terminal C signal	Short-circuit	TM	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	Hydraulic oil temperature	Low source voltage (input)	MON	E03	Electrical system
DAF5KP	Hydraulic oil temperature	Low output voltage	MON	E01	Electrical system
DAFRKR	CAN communication with machine monitor	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	Disagreement of model selection signals	MON	E03	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
DAQRKR	CAN communication with transmission controller	Defective communication (Abnormality in target component system)	MON	E03	Electrical system
DAQRMA	Transmission controller option setting	Malfunction	MON	E03	Electrical system
DB2RKR	CAN communication with engine controller	Defective communication (Abnormality in target component system)	MON	E03	Electrical system
DB99KQ	Work equipment controller model selection	Disagreement of model selection signals	MON	E03	Electrical system
DB9RKR	CAN communication with work equipment controller	Defective communication (Abnormality in target component system)	TM	E03	Electrical system
DB9RMA	Work equipment controller option setting	Malfunction	MON	E03	Electrical system
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
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
DD1HLD	Load meter display selector switch	Switch is kept pressed for long time	MON	E01	Electrical system
DD1NLD	Fan reverse switch	Switch is kept pressed for long time	TM	E01	Electrical system
DD1NL4	Fan automatic reverse switch	Switch is kept pressed for long time	TM	E01	Electrical system
DDB6L4	Parking brake switch (Neutralizer)	ON/OFF signals disagree	TM	E03	Electrical system
DDK3KA	Right FNR switch	Disconnection	TM	E03	Electrical system
DDK6KA	FNR lever switch	Disconnection	TM	E03	Electrical system
DDK6KB	FNR lever switch	Short-circuit	TM	E03	Electrical system
DDS5KA	Steering pressure switch	Disconnection	TM	E01	Electrical system
DDS5KB	Steering pressure switch	Short-circuit	TM	E01	Electrical system
DDT0L4	Shift mode selector switch	ON/OFF signals disagree	TM	E01	Electrical system
DDT4LD	Transmission cut-off set switch	Switch is kept pressed for long time	TM	E01	Electrical system
DDW9LD	Kickdown 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

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
DDY0LD	Load meter cancel switch	Switch is kept pressed for long time	MON	E01	Electrical system
DF10KA	Transmission shift lever switch	Disconnection	TM	E01	Electrical system
DF10KB	Transmission shift lever switch	Short-circuit	TM	E01	Electrical system
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
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
DGT1KX	Torque converter oil temperature sensor	Out of input signal range	MON	E01	Electrical system
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
DHT1KX	Left brake pressure sensor	Out of input signal range	TM	E01	Electrical system
DHT8KA	Steering pump pressure sensor	Disconnection	TM	E01	Electrical system
DHT8KB	Steering pump pressure sensor	Short-circuit	TM	E01	Electrical system
DLT3KA	Transmission output shaft speed sensor	Short-circuit	TM	E03	Electrical system
DLT3LC	Transmission output shaft speed sensor	Out of input signal range	TM	E03	Electrical system
DT20KB	Transmission cut-off indicator lamp	Short-circuit	TM	E01	Electrical system
DV00KB	Warning buzzer	Short-circuit	MON	E01	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	Power supply line short	TM	E01	Electrical system
DX16KA	Fan pump EPC	Disconnection	TM	E01	Electrical system
DX16KB	Fan pump EPC	Short-circuit	TM	E01	Electrical system
DX16KY	Fan pump EPC	Power supply line short	TM	E01	Electrical system
DXH1KA	Lockup ECMV solenoid	Disconnection	TM	E01	Electrical system
DXH1KB	Lockup ECMV solenoid	Short-circuit	TM	E01	Electrical system

Failure code	Troubled part	Trouble	Controller	Action code	Category of record
DXH1KY	Lockup ECMV solenoid	Power supply line short	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	Power supply line short	TM	E03	Electrical system
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	Power supply line short	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	Power supply line short	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	Power supply line short	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	Power supply line short	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	Power supply line short	TM	E03	Electrical system
DY30MA	Electrical emergency steering pump	Malfunction	TM	E01	Electrical system
DY30MC	Electrical emergency steering pump	Defective operation	TM	E03	Electrical system

★ 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.

Before carrying out troubleshooting for electrical system

Connection table of fuse box and slow blow fuse

★ This connection table indicates the devices to which the power of the fuse box and slow blow fuse 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 slow blow fuse to see if the power is supplied normally.

Fuse box A

Type of power supply	Fuse No.	Capacity of fuse	Destination of power
Switch power supply head lamp relay	1	10 A	Headlamp (left) circuit
	2	10 A	Headlamp (right) circuit
Switch power supply lamp switch	3	10 A	Clearance lamp (left) circuit
	4	10 A	Clearance lamp (right) circuit
Switch power supply slow-blow fuse (50 A)	5	20 A	Main lamp circuit
	6	10 A	Machine monitor (B) circuit Load meter printer (if equipped) circuit
	7	5 A	Air conditioner (B) circuit
	8	20 A	Air conditioner (A) circuit
	9	20 A	Wiper and washer circuit
	10	20 A	Rear lamp and brake lamp circuit
	11	10 A	Work equipment positioner circuit Work equipment controller (A) circuit (if equipped)
	12	5 A	Emergency steering circuit (if equipped)
	13	5 A	Parking brake circuit
	14	10 A	Transmission controller (A) circuit
	15	10 A	Horn circuit

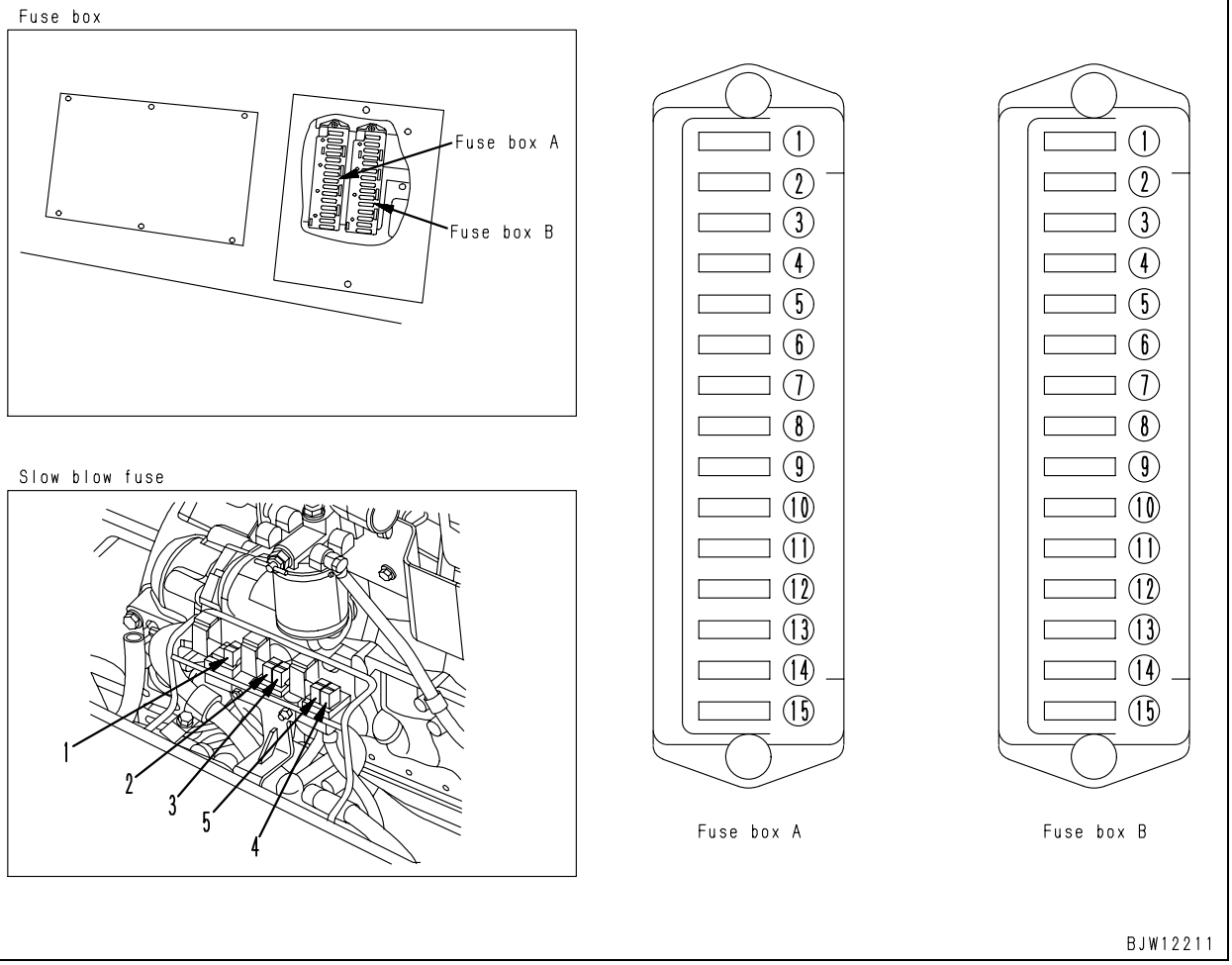
Fuse box B

Type of power supply	Fuse No.	Capacity of fuse	Destination of power
Switch power supply starting switch ACC	1	5 A	Engine controller (B) circuit
Switch power supply slow-blow fuse (50 A)	2	20 A	Rear glass heater circuit
	3	10 A	Air suspension seat
	4	20 A	Yellow rotary lamp circuit (if equipped)
	5	10 A	Turn signal lamp circuit
	6	20 A	Car radio circuit and 12 V converter circuit
	7	10 A	Rear working lamp circuit
	8	10 A	Front working lamp circuit
Constant power supply slow-blow fuse (50 A)	9	20 A	Spare 1
	10	30 A	Engine controller (A) circuit
	11	5 A	Transmission controller (B) circuit Work equipment controller (B) circuit (if equipped)
	12	10 A	Room lamp circuit
	13	10 A	Machine monitor (B) circuit KOMTRAX circuit (if equipped)
	14	10 A	Hazard lamp circuit
	15	20 A	Starting switch circuit

Slow blow fuse

Type of power supply	Slow-blow fuse No.	Capacity of fuse	Destination of power
Constant power supply	1	50 A	Spare 1, engine controller (A) circuit, transmission controller (B) circuit, work equipment controller (B) circuit (if equipped), room lamp circuit, machine monitor (B) circuit, KOMTRAX (B) circuit (if equipped), hazard lamp circuit and starting switch circuit
Switch power supply	2	50 A	Main lamp circuit, machine monitor (B) circuit, load meter printer (if equipped) circuit, air conditioner (B) circuit, air conditioner (A) circuit, wiper and washer circuit, back-up lamp and brake lamp circuit, work equipment positioner circuit, work equipment controller (A) circuit (if equipped), emergency steering circuit (if equipped), parking brake circuit, transmission controller (A) circuit and horn circuit
	3	50 A	Rear glass heater circuit, air suspension seat, yellow rotary lamp circuit (if equipped), turn signal lamp circuit, car radio circuit, 12 V converter circuit, rear working lamp circuit and front working lamp circuit
	4	120 A	Heater relay circuit
	5	120 A	Charging circuit

Locations and numbers of fuse boxes and slow blow fuse



Information contained 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)
E03	**1500LO**		
Contents of trouble	• A combination for double meshing is input as a fill signal.		
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 transmission may be broken. • The machine does not travel.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

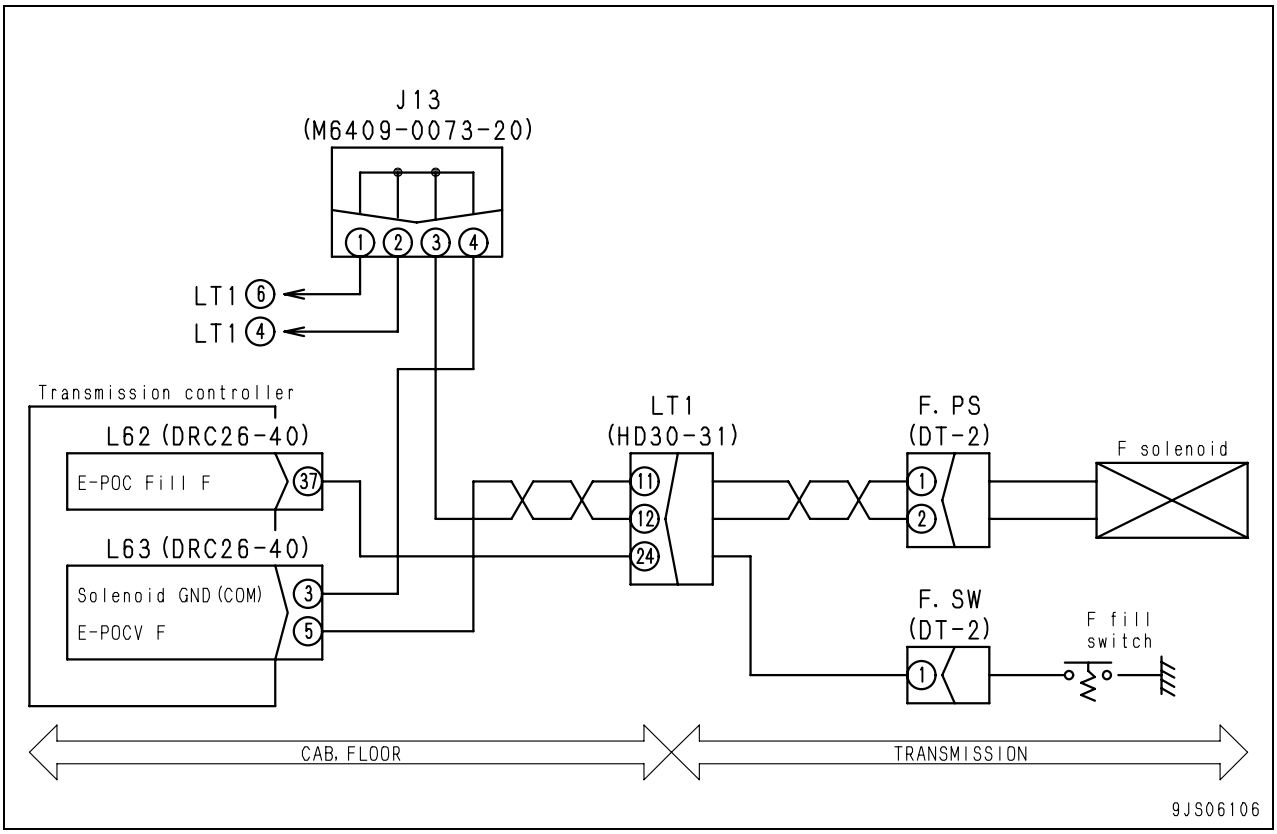
Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting
	1	See failure codes [15SAL1], [15SBL1], [15SEL1], [15SFL1], [15SGL1], and [15SHL1].	

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)
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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) 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 value) 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-24). • Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	F clutch oil pressure error	When there is no residual pressure other than the F clutch oil pressure, the failure code is displayed. (See Troubleshooting of hydraulic and mechanical system (H-mode)			
	2	Defective F ECMV fill switch (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			F.SW (male)	FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch	Resistance	
			Between (1) and chassis ground	F (Forward)	Max. 1 Ω	
				Other than above	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 L62 (female) (37) – F.SW (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	4	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			L62	FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch	Voltage	
			Between (37) and chassis ground	F (Forward)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission F clutch

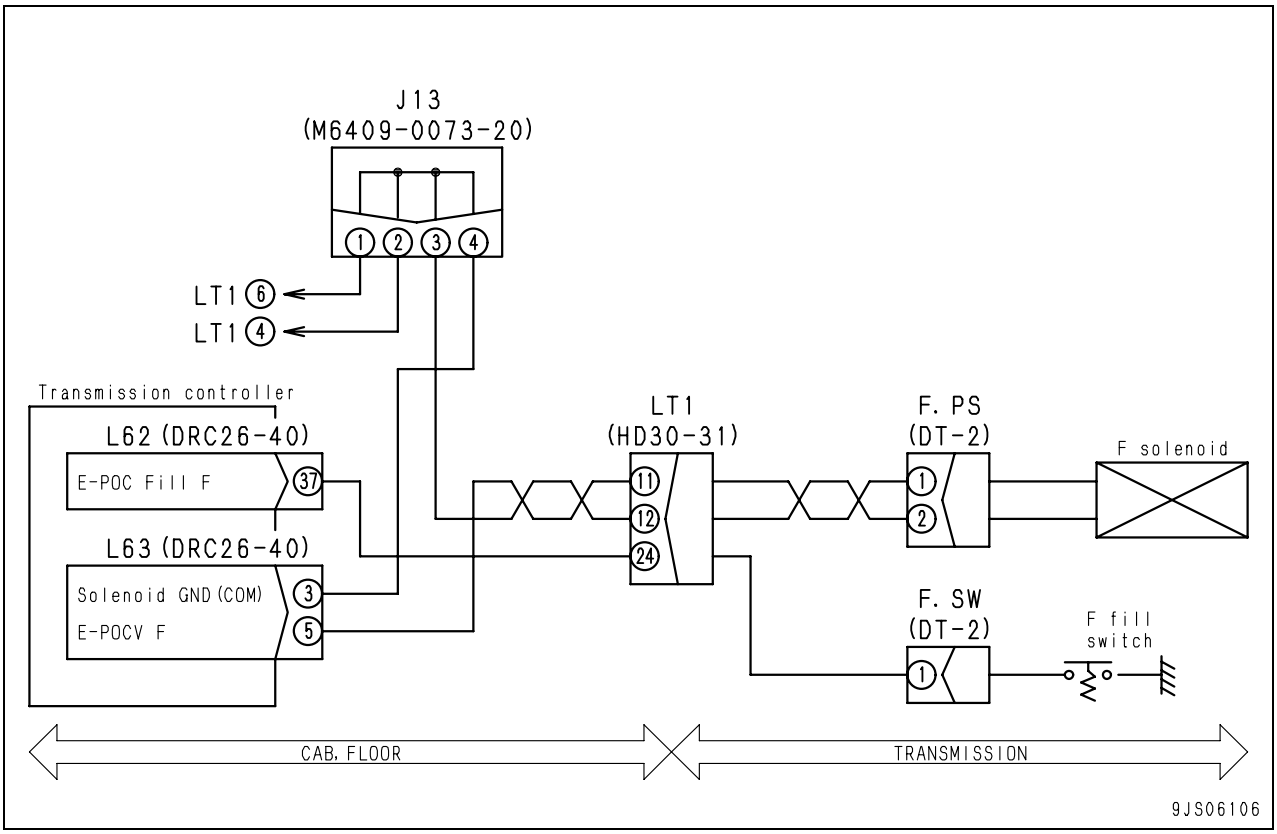


Failure code [15SALH] (ECMV F clutch: When command current is ON, fill signal is OFF)

Action code	Failure code	Trouble	ECMV F clutch: When command current is ON, fill signal is OFF (Transmission controller)
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 problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• When the travel direction is changed, a shock or a time lag may be made.		
Related information	• This failure code may also be displayed immensely after replacement of the transmission oil. • The output state (current value) 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-24). • Method of reproducing failure code: Start engine and then set FNR (directional) lever, joystick steering FNR (directional) switch, or right FNR (directional) switch to F (forward).		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	F clutch oil pressure error	This failure code is displayed if there was no F clutch oil pressure when F ECMV solenoid output is turned ON. (See Troubleshooting of hydraulic and mechanical system (H-mode)			
	2	Defective F ECMV fill switch (Internal disconnection)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			F.SW (male)	FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch	Resistance	
			Between (1) and chassis ground	F (Forward)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harnesses between L62 (female) (37) – F.SW (female) (1)		Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			L62	FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch	Voltage	
			Between (37) and chassis ground	F (Forward)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission F clutch

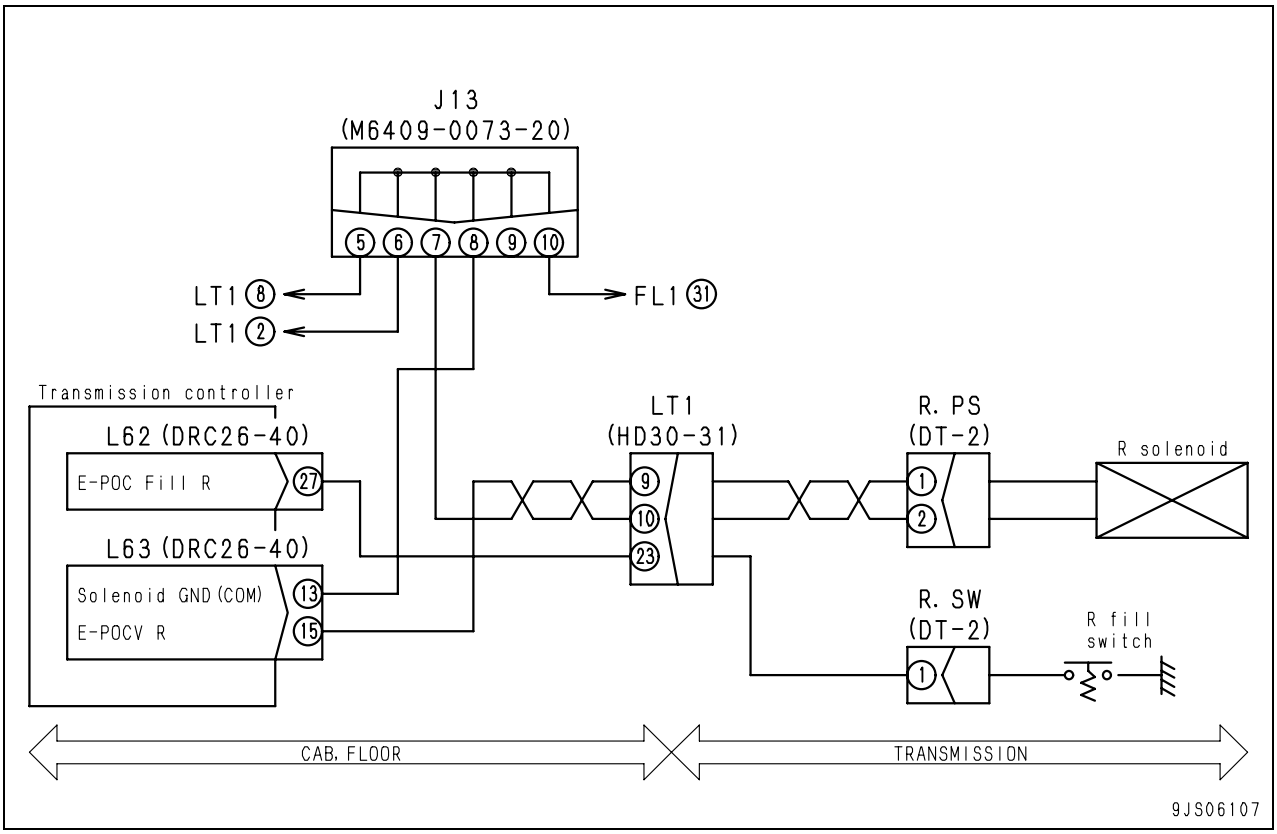


Failure code [15SBL1] (ECMV R clutch: When command current is OFF, fill signal is ON)

Action code	Failure code	Trouble	ECMV R clutch: When command current is OFF, fill signal is ON (Transmission controller)
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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) 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 value) 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-25). • Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	F clutch oil pressure error	When there is no residual pressure other than the F clutch oil pressure, the failure code is displayed. (See Troubleshooting of hydraulic and mechanical system (H-mode)			
	2	Defective R ECMV fill switch (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			R.SW (male)	FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch	Resistance	
			Between (1) and chassis ground	R (Reverse)	Max. 1 Ω	
				Other than above	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 L62 (female) (27) – R.SW (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	4	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			L62	FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch	Voltage	
			Between (27) and chassis ground	R (Reverse)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission R clutch

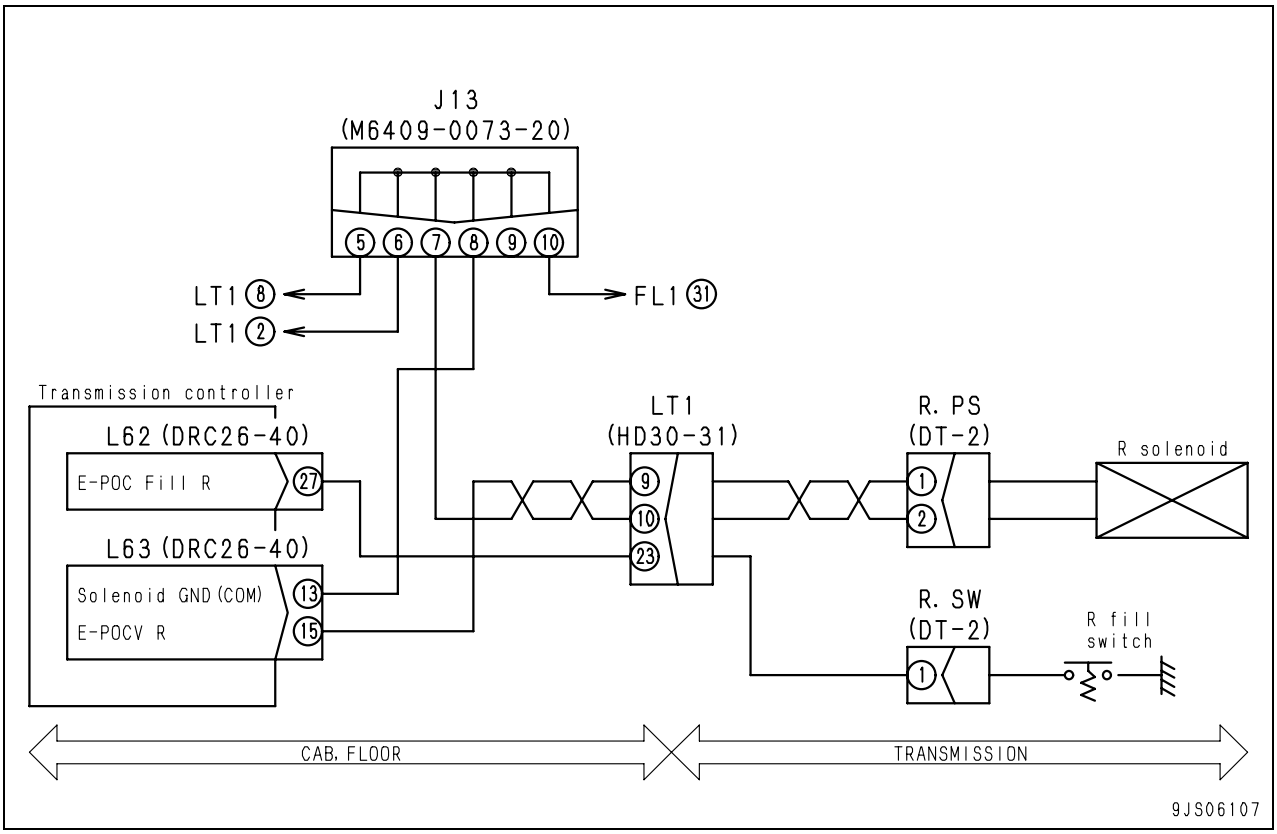


Failure code [15SBLH] (ECMV R clutch: When command current is ON, fill signal is OFF)

Action code	Failure code	Trouble	ECMV R clutch: When command current is ON, fill signal is OFF (Transmission controller)
E01	**15SBLH**		
Contents of trouble	• When R ECMV solenoid output is turned ON, clutch does not mesh because R ECMV fill switch ON signal is not input and the condition requires to set the engine speed at 500 rpm or below.		
Action of controller	• Judges that the R ECMV fill switch signal is turned OFF. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• When the travel direction is changed, a shock or a time lag may be made.		
Related information	• This failure code may also be displayed immensely after replacement of the transmission oil. • The output state (current value) 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-25). • Method of reproducing failure code: Start engine, then set FNR (directional) lever, joystick steering FNR (directional) switch, or right FNR (directional) switch to R (reverse).		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	F (forward) clutch oil pressure error	This failure code is displayed if there was no F clutch oil pressure when F ECMV solenoid output is turned ON. (See Troubleshooting of hydraulic and mechanical system (H-mode)			
	2	Defective R ECMV fill switch (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			R.SW (male)	FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch	Resistance	
			Between (1) and chassis ground	R (Reverse)	Max. 1 Ω	
				Other than above	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harnesses between L62 (female) (27) – R.SW (female) (1)		Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • Turn parking brake switch OFF. • Keep pressing brake pedal to prevent machine from traveling.			
			L62	FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch	Voltage	
			Between (27) and chassis ground	R (Reverse)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission R clutch

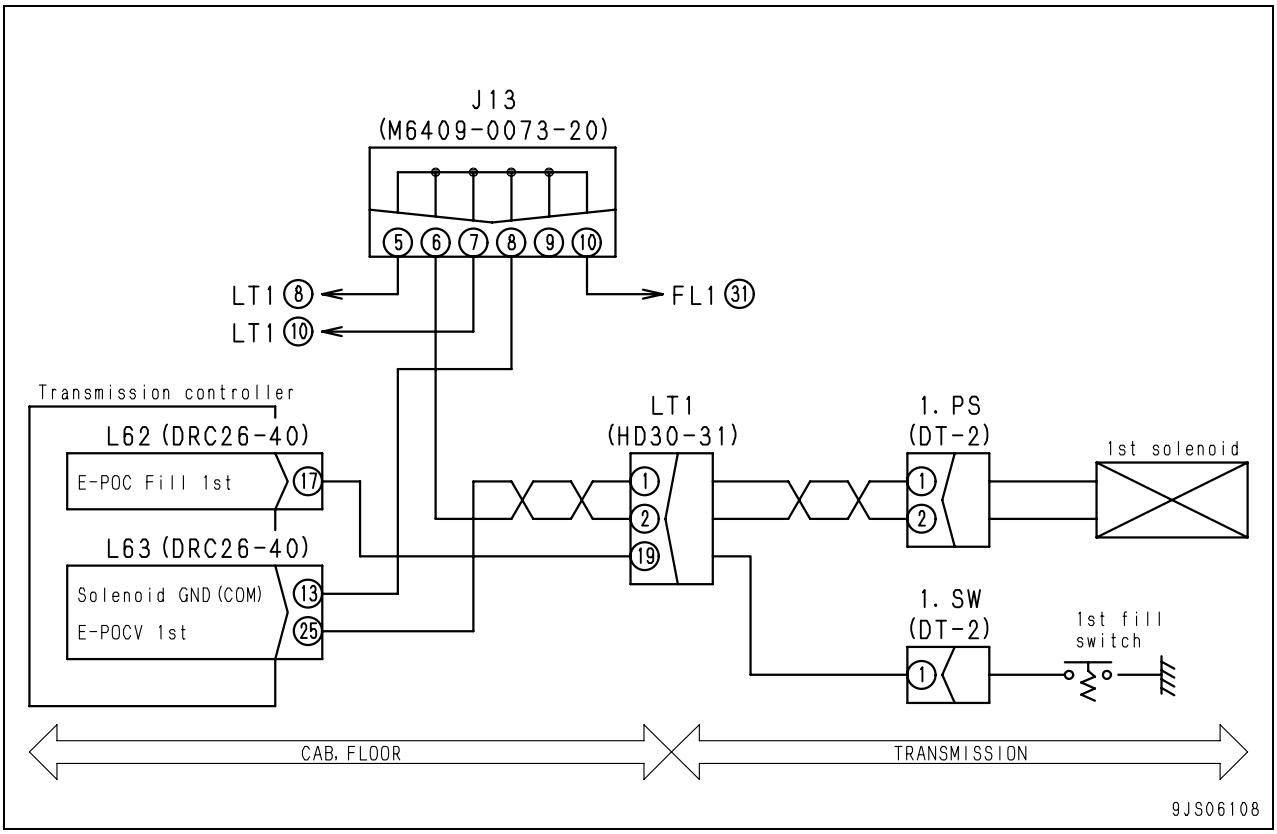


Failure code [15SEL1] (ECMV 1st clutch: When command current is OFF, fill signal is ON)

Action code	Failure code	Trouble	ECMV 1st clutch: When command current is OFF, fill signal is ON (Transmission controller)
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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) 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 value) 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-26). • Method of reproducing failure code: Start engine		

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>1st clutch oil pressure error</td><td colspan="4">When there is not residual pressure other than the 1st clutch oil pressure, the failure code is displayed.
(See Troubleshooting of hydraulic and mechanical system (H-mode)</td></tr>
<tr><td rowspan="4">2</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 transmission cut-off switch OFF.
• 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">3</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 L62 (female) (17) – 1.SW (female) (1) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective transmission controller</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.
• Turn transmission cut-off switch OFF.
• 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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to the F (forward) or R (reverse) position.</td></tr>
<tr><td>L62</td><td>Shift lever</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (17) 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

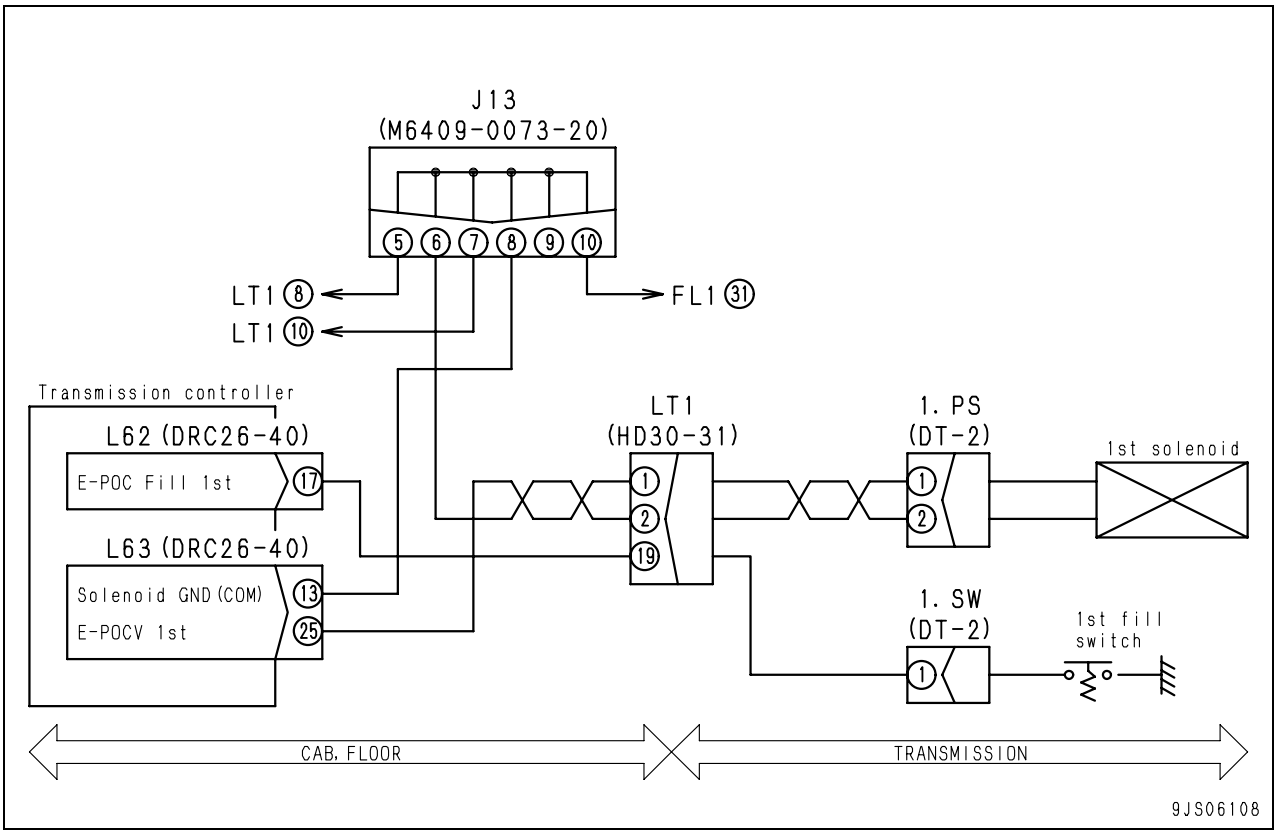


Failure code [15SELH] (ECMV 1st clutch: When command current is ON, fill signal is OFF)

Action code	Failure code	Trouble	ECMV 1st clutch: When command current is ON, fill signal is OFF (Transmission controller)
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 problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The machine may not travel at 1st speed. • When the 1st gear speed is changed, a shock or a time lag may be made.		
Related information	• This failure code may also be displayed immensely after replacement of the transmission oil. • The output state (current value) 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-26). • Method of reproducing failure code: Start the engine, set the manual/auto shift selector switch in the MANUAL position, set FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to the F (forward) or R (reverse), then set shift lever to 1st speed position.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	1st clutch oil pressure error	This code failure is displayed if 1st clutch oil pressure were absent when 1st ECMV solenoid output is turned ON. (See Troubleshooting of hydraulic and mechanical system (H-mode)			
	2	Defective 1st ECMV fill switch (Internal disconnection)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • 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	
	3	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harnesses between L62 (female) (17) – 1.SW (female) (1)		Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • 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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to the F (forward) or R (reverse) position.			
			L62	Shift lever	Voltage	
			Between (17) and chassis ground	1st (1st speed)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission 1st clutch

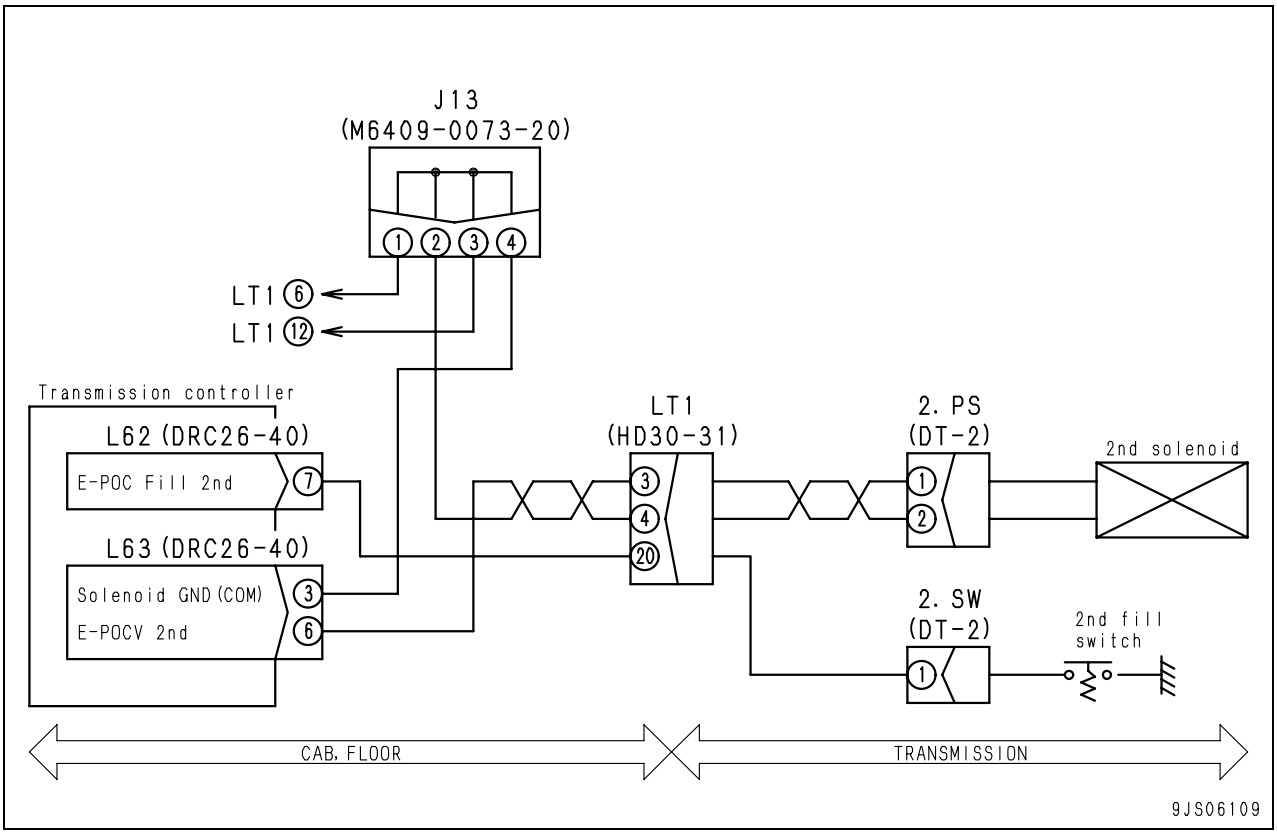


Failure code [15SFL1] (ECMV 2nd clutch: When command current is OFF, fill signal is ON)

Action code	Failure code	Trouble	ECMV 2nd clutch: When command current is OFF, fill signal is ON (Transmission controller)
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	• Judges that the 2nd ECMV fill switch signal is turned ON. • Holds 1st, 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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) 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 value) 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-27). • Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	2nd clutch oil pressure error	When there is no residual pressure other than the 2nd clutch oil pressure, the failure code is displayed. (See Troubleshooting of hydraulic and mechanical system (H-mode)			
	2	Defective 2nd ECMV fill switch (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • 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	
	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 L62 (female) (7) – 2.SW (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	4	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • 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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to the F (forward) or R (reverse) position.			
			L62	Shift lever	Voltage	
			Between (7) and chassis ground	2nd (2nd speed)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission 2nd clutch

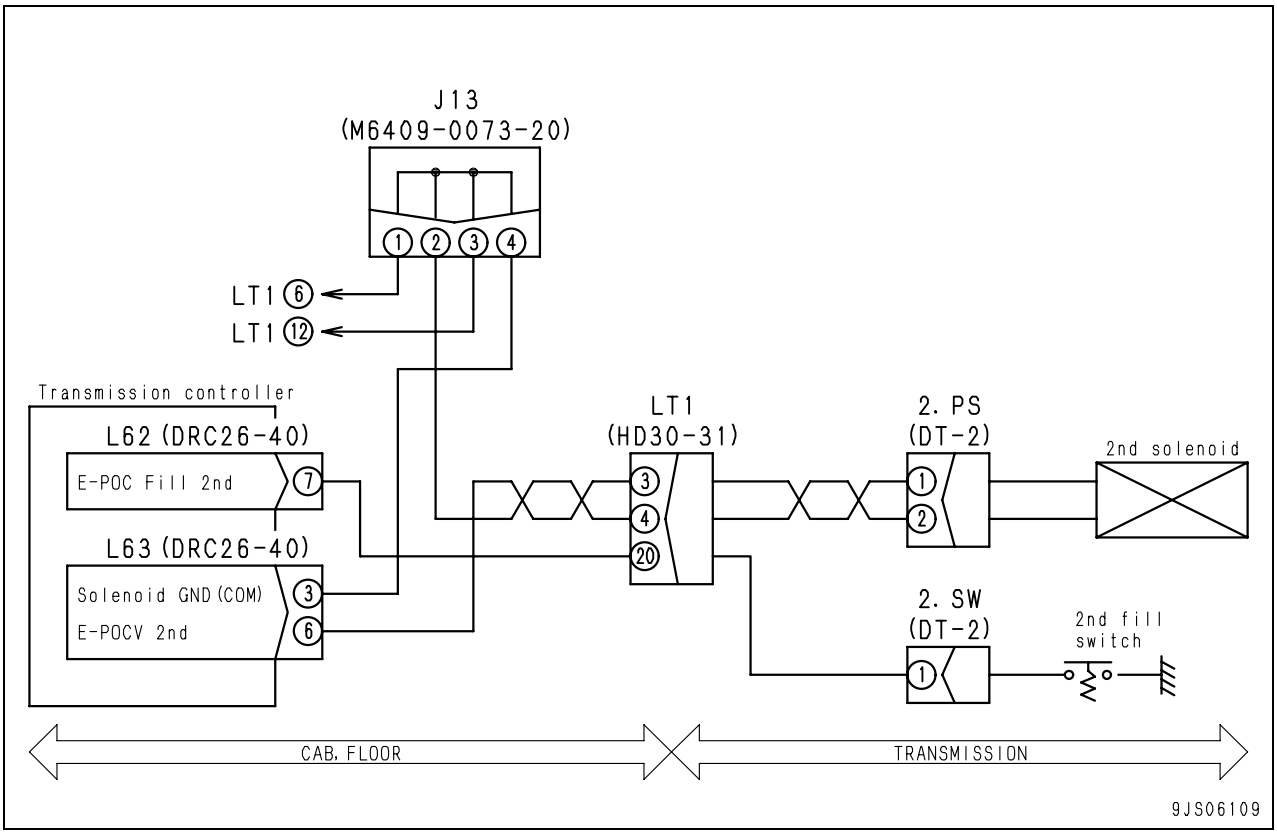


Failure code [15SFLH] (ECMV 2nd clutch: When command current is ON, fill signal is OFF)

Action code	Failure code	Trouble	ECMV 2nd clutch: When command current is ON, fill signal is OFF (Transmission controller)
E01	**15SFLH**		
Contents of trouble	• When 2nd ECMV solenoid output 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 problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The machine may not travel at 2nd speed. • When the 2nd gear speed is changed, a shock or a time lag may be made.		
Related information	• This failure code may also be displayed immensely after replacement of the transmission oil. • The output state (current value) 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-27). • Method of reproducing failure code: Start engine, set the manual/auto shift selector switch in the MANUAL position, set FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to the F (forward), R (reverse), then set shift lever to 2nd speed position.		

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>2nd clutch oil pressure error</td><td colspan="4">This failure code is displayed if 2nd clutch oil pressure were absent when 2nd ECMV solenoid output is turned ON.
(See Troubleshooting of hydraulic and mechanical system (H-mode)</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective 2nd ECMV fill switch (Internal disconnection)</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.
• Turn transmission cut-off switch OFF.
• Turn parking brake switch OFF.
• Keep pressing brake pedal to prevent machine from traveling.</td></tr>
<tr><td>2.SW (male)</td><td>Shift lever</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) and chassis ground</td><td>2nd (2nd 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>3</td><td>Disconnection in wiring harness
(Disconnection or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.
Wiring harnesses between L62 (female) (7) – 2.SW (female) (1) and chassis ground | Resistance | Max. 1 Ω</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Defective transmission controller</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.
• Turn transmission cut-off switch OFF.
• 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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to the F (forward) or R (reverse) position.</td></tr>
<tr><td>L62</td><td>Shift lever</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (7) and chassis ground</td><td>2nd (2nd 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 2nd clutch

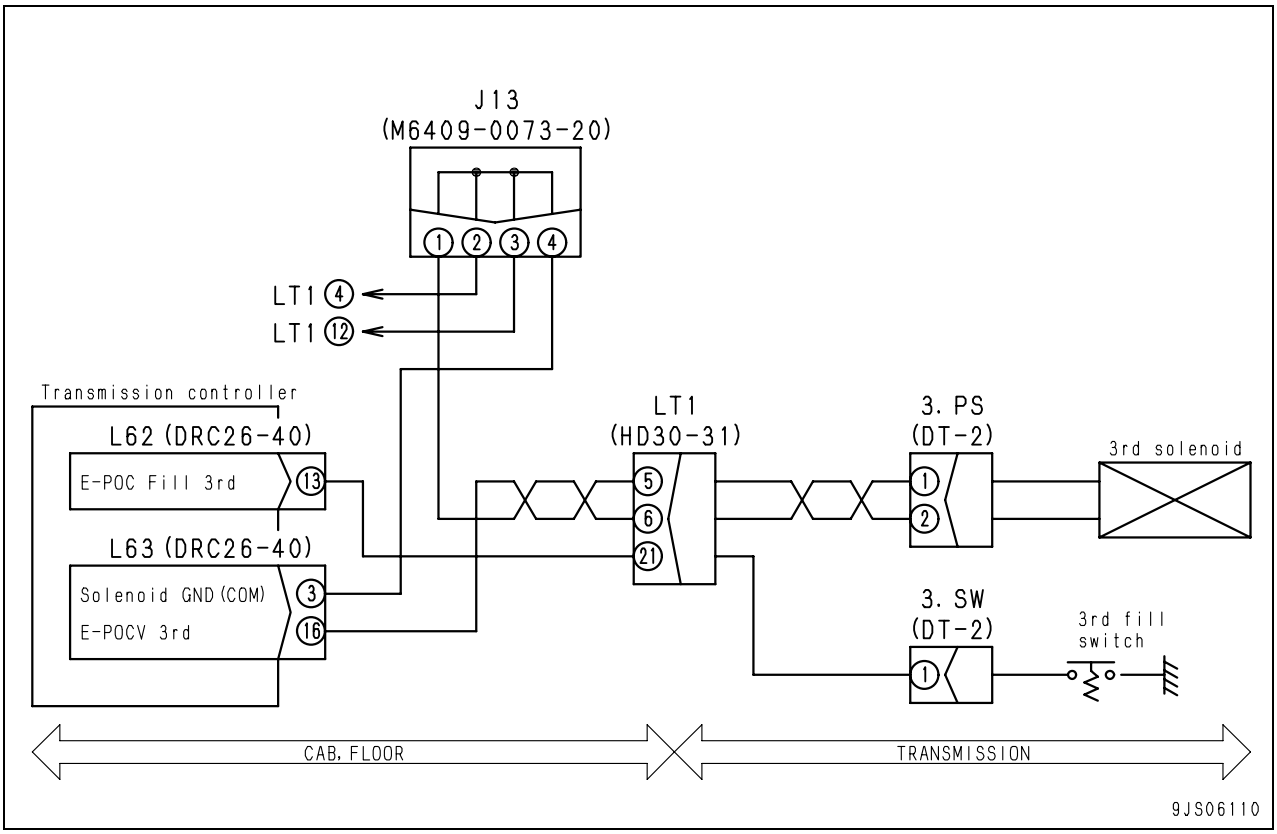


Failure code [15SGL1] (ECMV 3rd clutch: When command current is OFF, fill signal is ON)

Action code	Failure code	Trouble	ECMV 3rd clutch: When command current is OFF, fill signal is ON (Transmission controller)
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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) 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 value) 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-28). • Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	3rd clutch oil pressure error	When there is no residual pressure other than the 3rd clutch oil pressure, the failure code is displayed. (See Troubleshooting of hydraulic and mechanical system (H-mode)			
	2	Defective 3rd ECMV fill switch (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • 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	
	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 L62 (female) (13) – 3.SW (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	4	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • 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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to the F (forward) or R (reverse) position.			
			L62	Shift lever	Voltage	
			Between (13) and chassis ground	3rd (3rd speed)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission 3rd clutch

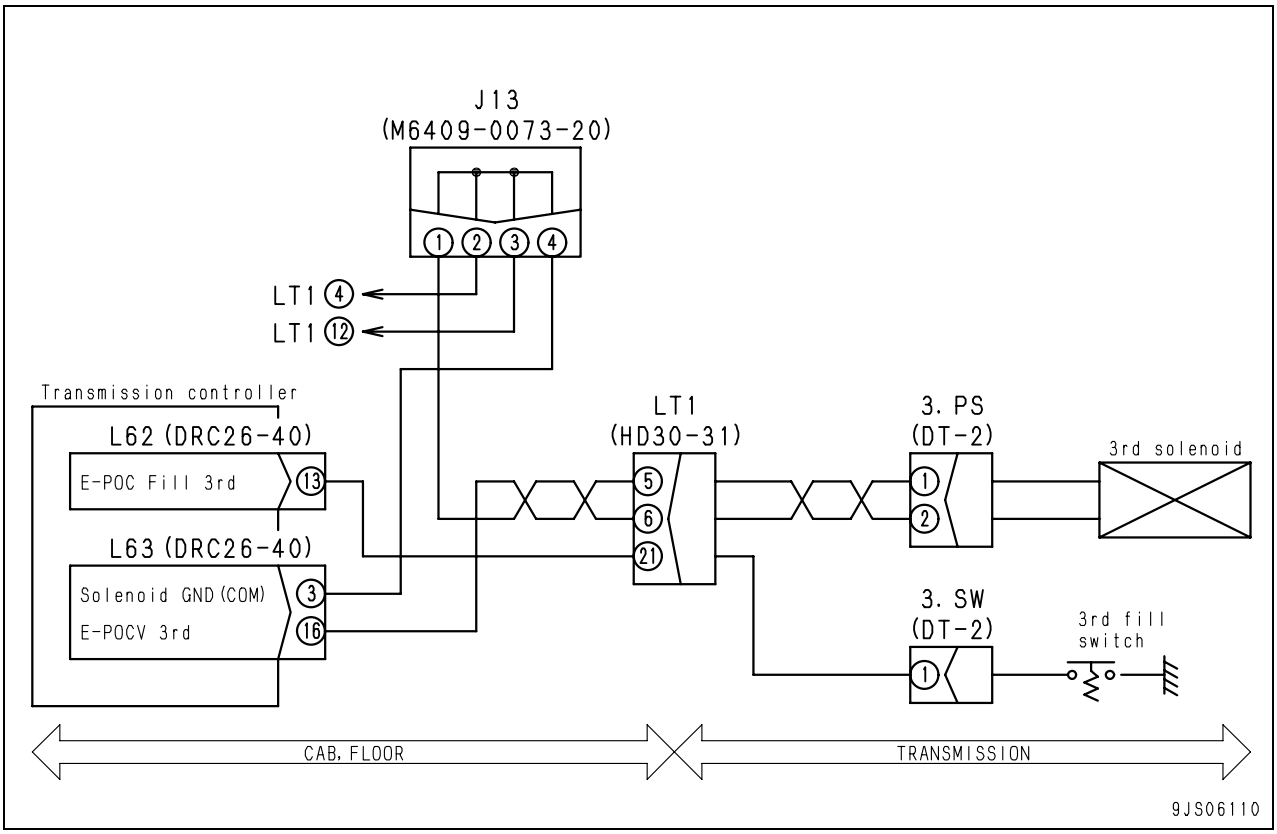


Failure code [15SGLH] (ECMV 3rd clutch: When command current is ON, fill signal is OFF)

Action code	Failure code	Trouble	ECMV 3rd clutch: When command current is ON, fill signal is OFF (Transmission controller)
E01	**15SGLH**		
Contents of trouble	• When 3rd ECMV solenoid output is turned ON, clutch does not mesh because 3rd ECMV fill switch ON signal is not input and the condition requires to set the engine speed at 500 rpm or below.		
Action of controller	• Judges that the 3rd ECMV fill switch signal is turned OFF. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The machine may not travel at 3rd speed. • When the 3rd gear speed is changed, a shock or a time lag may be made.		
Related information	• This code may also be displayed immensely after replacement of the transmission oil. • The output state (current value) 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-28). • Method of reproducing failure code: Start engine, set the manual/auto shift selector switch in the MANUAL position, set FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to the F (forward), R (reverse), and then set shift lever to 3rd speed position.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	3rd clutch oil pressure error	This failure code is displayed if 3rd clutch oil pressure were absent when 3rd ECMV solenoid output is turned ON. (See Troubleshooting of hydraulic and mechanical system (H-mode)			
	2	Defective 3rd ECMV fill switch (Internal disconnection)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • 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	
	3	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harnesses between L62 (female) (13) – 3.SW (female) (1)		Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • 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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to the F (forward) or R (reverse) position.			
			L62	Shift lever	Voltage	
			Between (13) and chassis ground	3rd (3rd speed)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission 3rd clutch

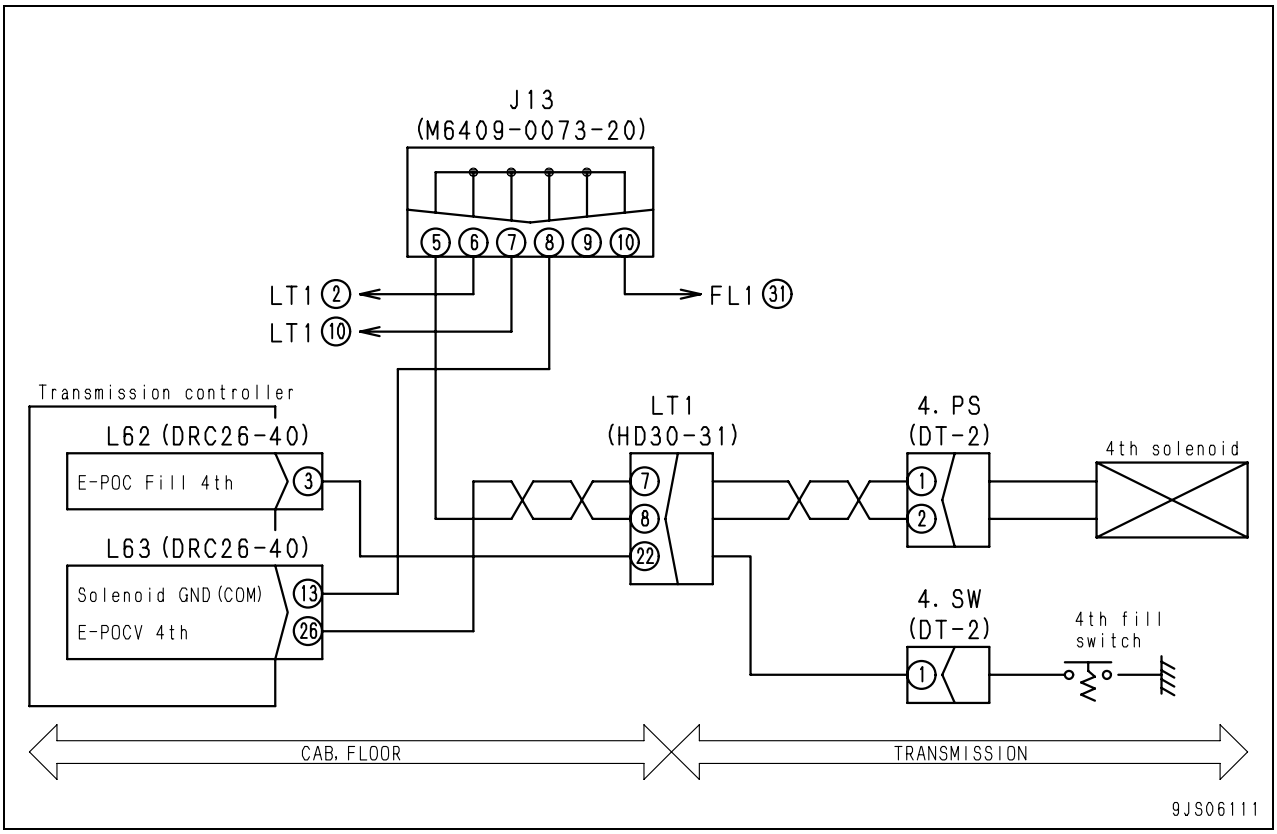


Failure code [15SHL1] (ECMV 4th clutch: When command current is OFF, fill signal is ON)

Action code	Failure code	Trouble	ECMV 4th clutch: When command current is OFF, fill signal is ON (Transmission controller)
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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) 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-29). • Method of reproducing failure code: Start engine		

		Causes	Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	4th clutch oil pressure error	When there is no residual pressure other than the 4th clutch oil pressure, the failure code is displayed. (See Troubleshooting of hydraulic and mechanical system (H-mode)			
	2	Defective 4th ECMV fill switch (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • 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	
	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 L62 (female) (3) – 4.SW (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	4	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • 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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to the F (forward) or R (reverse) position.			
			L62	Shift lever	Voltage	
			Between (3) and chassis ground	4th (4th speed)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission 4th clutch

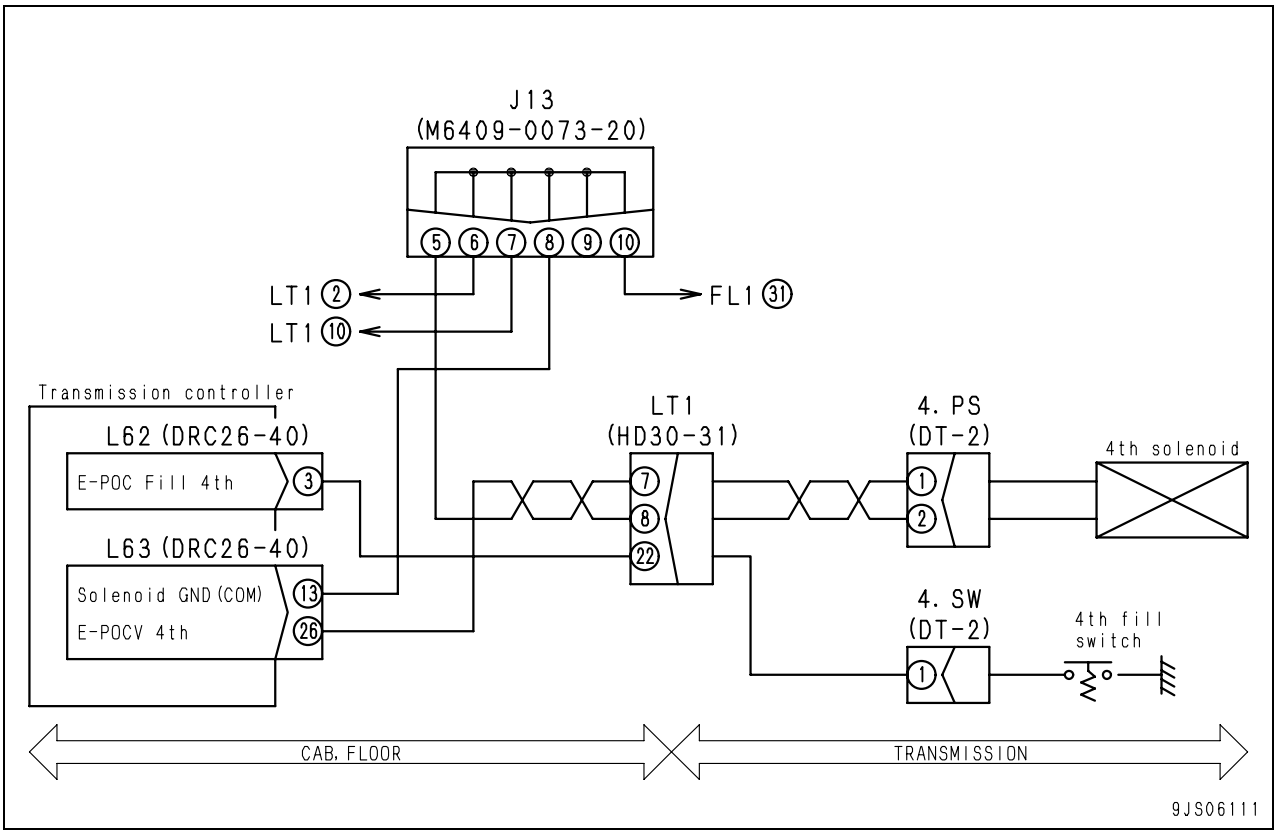


Failure code [15SHLH] (ECMV 4th clutch: When command current is ON, fill signal is OFF)

Action code	Failure code	Trouble	ECMV 4th clutch: When command current is ON, fill signal is OFF (Transmission controller)
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 problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The machine may not travel at 4th speed. • When the 4th gear speed is changed, a shock or a time lag may be made.		
Related information	• This code may also be displayed immensely after replacement of the transmission oil. • The output state (current value) 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-29). • Method of reproducing failure code: Start engine, set the manual/auto shift selector switch in the MANUAL position, set FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to the F (forward), R (reverse), then set shift lever to 4th speed position.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	4th clutch oil pressure error	This failure code is displayed if 4th clutch oil pressure were absent when 4th ECMV solenoid is turned ON. (See Troubleshooting of hydraulic and mechanical system (H-mode)			
	2	Defective 4th ECMV fill switch (Internal disconnection)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • 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	
	3	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harnesses between L62 (female) (3) – 4.SW (female) (1)		Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. • Turn transmission cut-off switch OFF. • 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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to the F (forward) or R (reverse) position.			
			L62	Shift lever	Voltage	
			Between (3) and chassis ground	4th (4th speed)	Max. 1 V	
				Other than above	8 – 10 V	

Circuit diagram related to transmission 4th clutch

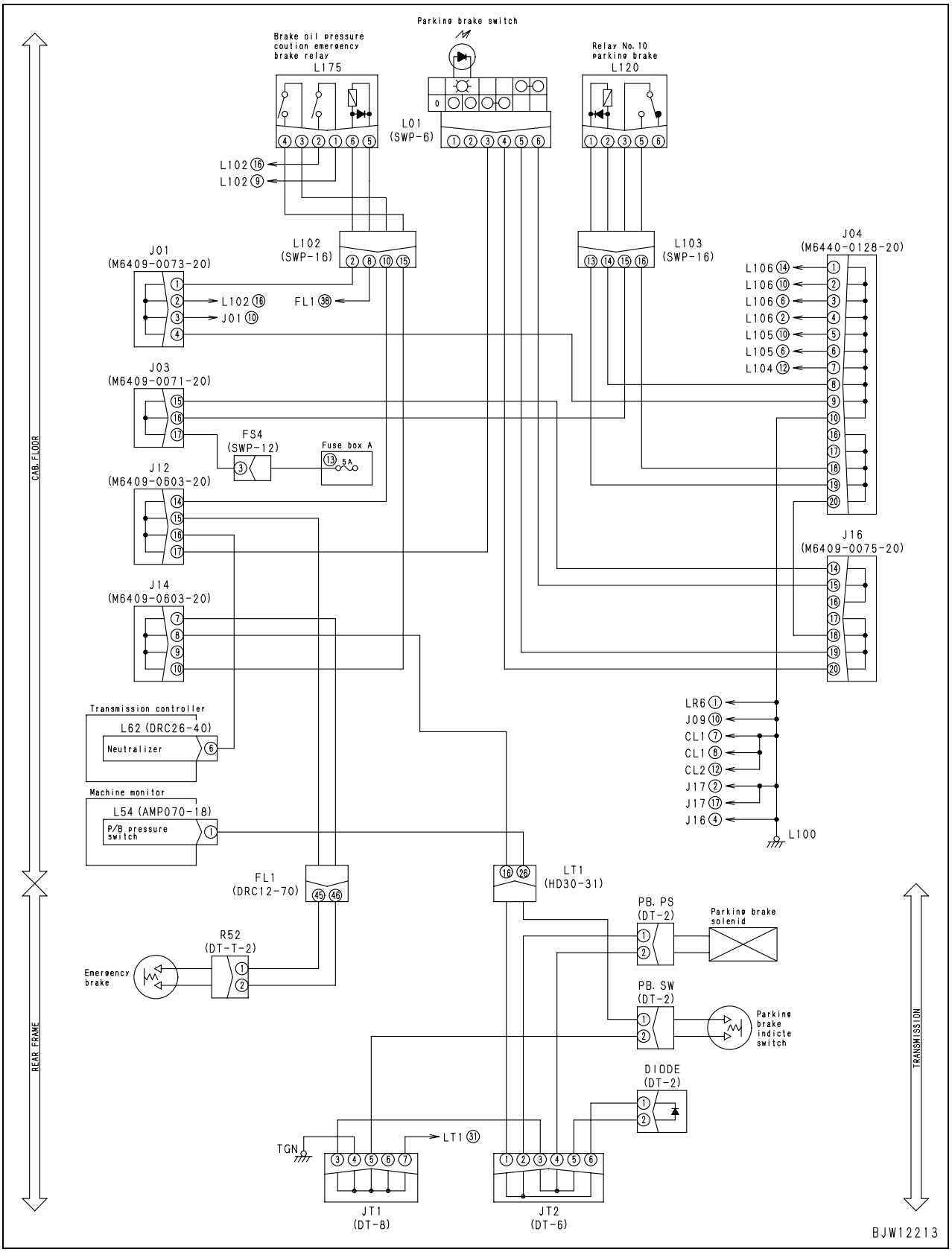


Failure code [2F00MA] (Parking brake: Malfunction)

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 remains OPEN.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• Although the parking brake lamp is turned on, a gear speed other than neutral is actually selected.		
Related information	• This code may also be displayed if engine stalls or the emergency brake is operated while the machine is traveling. • The input state (ON/OFF) from the brake 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.		

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting			
	1	Defective parking brake indicator switch (Internal disconnection)	★ Prepare with starting switch OFF, disconnect PB.SW connector and then start the engine to carry out troubleshooting.			
			PB.SW (male)	Parking brake	Resistance	
			Between (1) and (4)	Released	Max. 1 Ω	
				Operating	Min. 1 MΩ	
	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 L54 (female) (1) – PB.SW (female) (1)		Resistance	Max. 1 Ω
	3	Defective machine monitor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L54	Parking brake oil pressure	Voltage	
			Between (1) and chassis ground	Released	Max. 1 V	
				Operating	20 – 30 V	

Circuit diagram related to parking brake



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 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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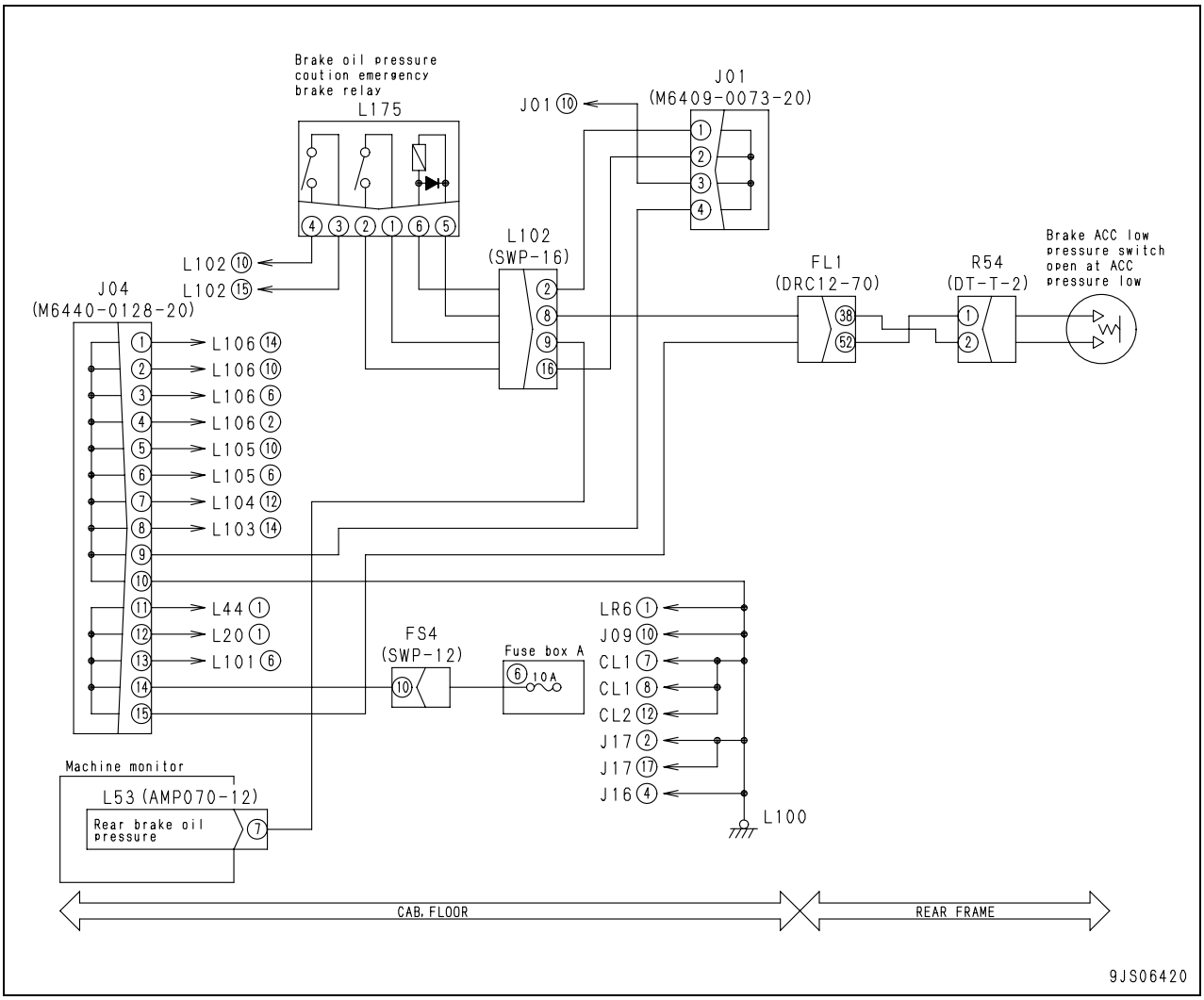
Troubleshooting by failure code (Display of code), Part 2

Failure code [2G43ZG] (Accumulator: Low oil pressure)

Action code	Failure code	Trouble	Accumulator: Low oil pressure (Machine monitor system)
E03	**2G43ZG**		
Contents of trouble	• After the engine is started, the brake accumulator pressure sensor circuit once reaches the specified pressure, then the circuit conditions turns to OPEN.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• Low brake accumulator oil pressure • The brake may not work.		
Related information	• The input state (ON/OFF) from the 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.		

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Low brake accumulator oil pressure</td><td colspan="4">Check the brake accumulator oil pressure.
(See Testing and adjusting.)</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective brake oil pressure sensor
(Internal disconnection)</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.</td></tr>
<tr><td>R54 (Male)</td><td>Brake accumulator oil pressure</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>Pressure normal
Min. 5.88 MPa
Min. {60 kg/cm^2}</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Low pressure
Max. 3.92 MPa
Max. {40 kg/cm^2}</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">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 from L53 (female) (7) to R54 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness from R54 (female) (2) to chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective machine monitor</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L53 (female)</td><td>Brake accumulator oil pressure</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Wiring harnesses between (7) – chassis ground</td><td>Pressure normal
Min. 5.88 MPa
Min. {60 kg/cm^2}</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Low pressure
Max. 3.92 MPa
Max. {40 kg/cm^2}</td><td colspan="2">Min. 1 MΩ</td></tr>
</table>

Circuit diagram related to brake accumulator

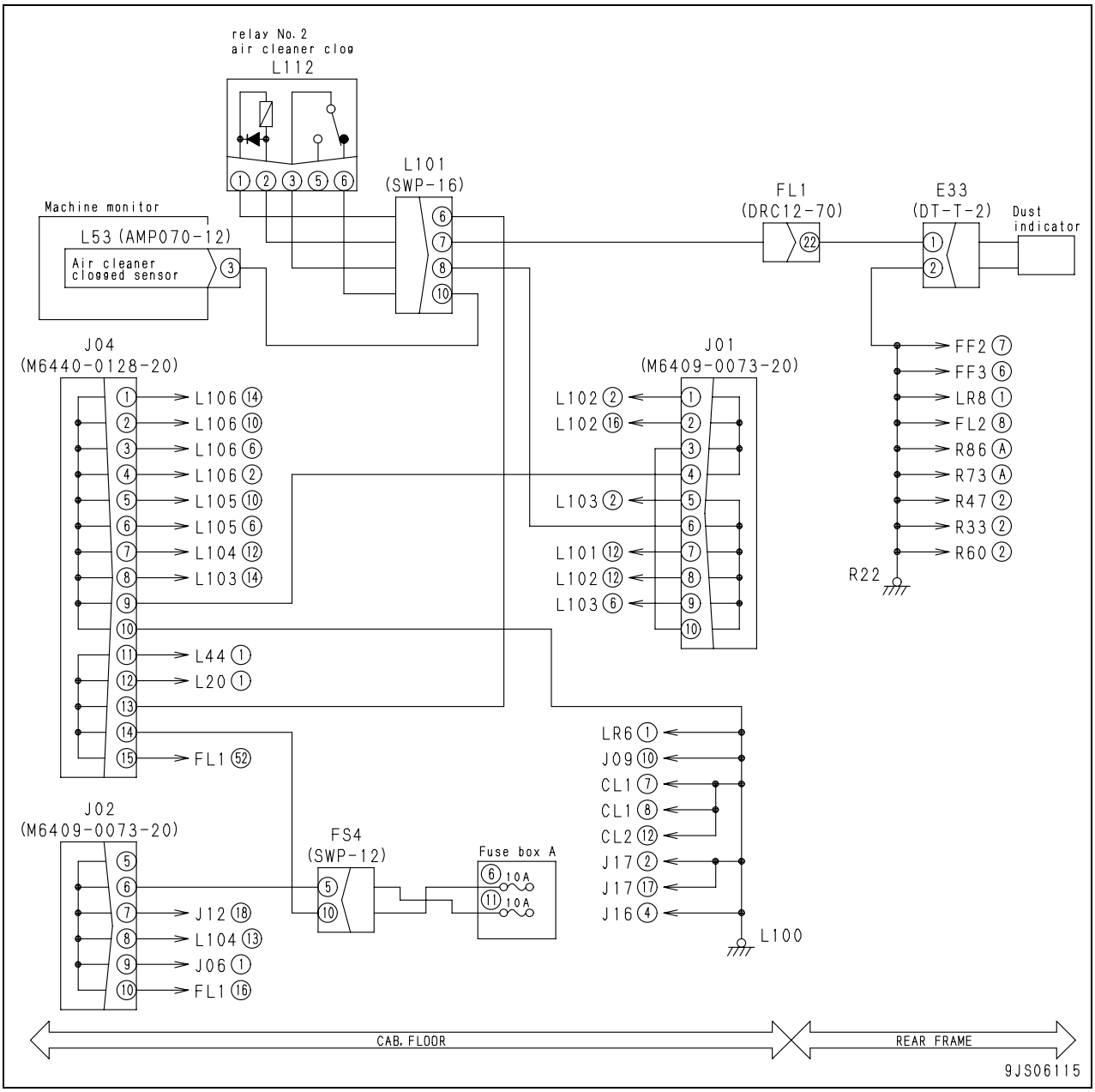


Failure code [AA1ANX] (Air cleaner: Clogging)

Action code	Failure code	Trouble	Air cleaner: Clogging (Machine monitor system)
E01	**AA1ANX**		
Contents of trouble	• When the engine is started, the air cleaner clogging sensor circuit is OPEN.		
Action of controller	• Turns the air cleaner clogging caution lamp ON. • If problem is removed, system is returned to normal operating state.		
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		

	Causes		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 short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			Replace the dust indicator	If the condition becomes normal, the trouble is attributable to defective indicator.		
	3	Defective dust indicator relay (L112) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L112 (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 (L112) 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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harnesses between L112 (female) (2) – E33 (female) (1)		Resistance	Max. 1 Ω
			Wiring harnesses between E33 (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 L112 (female) (2) – E33 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	6	Defective machine monitor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L53	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

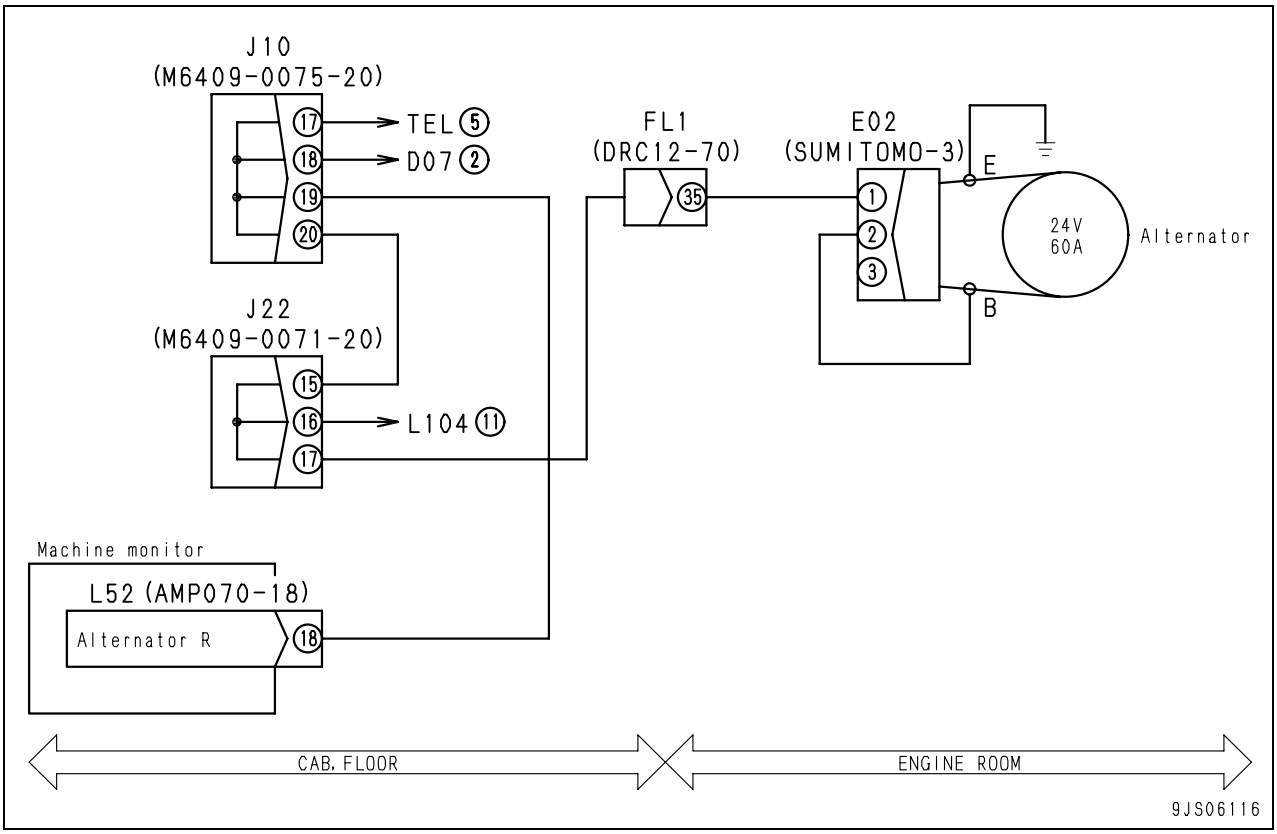


Failure code [AB00L6] (Alternator: Signal disagrees with operating state of engine)

Action code	Failure code	Trouble	Alternator: Signal disagrees with operating state 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 charge circuit error caution lamp ON. • Turns the centralized warning lamp and alarm buzzer ON. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• After the engine is started, just turning on the starting switch runs the service meter.		
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: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective alternator (Internal trouble)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			Alternator	Engine	Voltage	
			Wiring harness between E02 (female) (1) – chassis ground	Running (Throttle: Above 1/2)	27.5 – 29.5 V	
				Holds in position	Max. 1 V	
	2	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harnesses between E02 (female) (1) – L52 (female) (18), – circuit branch end		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L52	Engine	Voltage	
			Between (18) and chassis ground	Running (Throttle: Above 1/2)	27.5 – 29.5 V	
				Holds in position	Max. 1 V	

Circuit diagram related to alternator

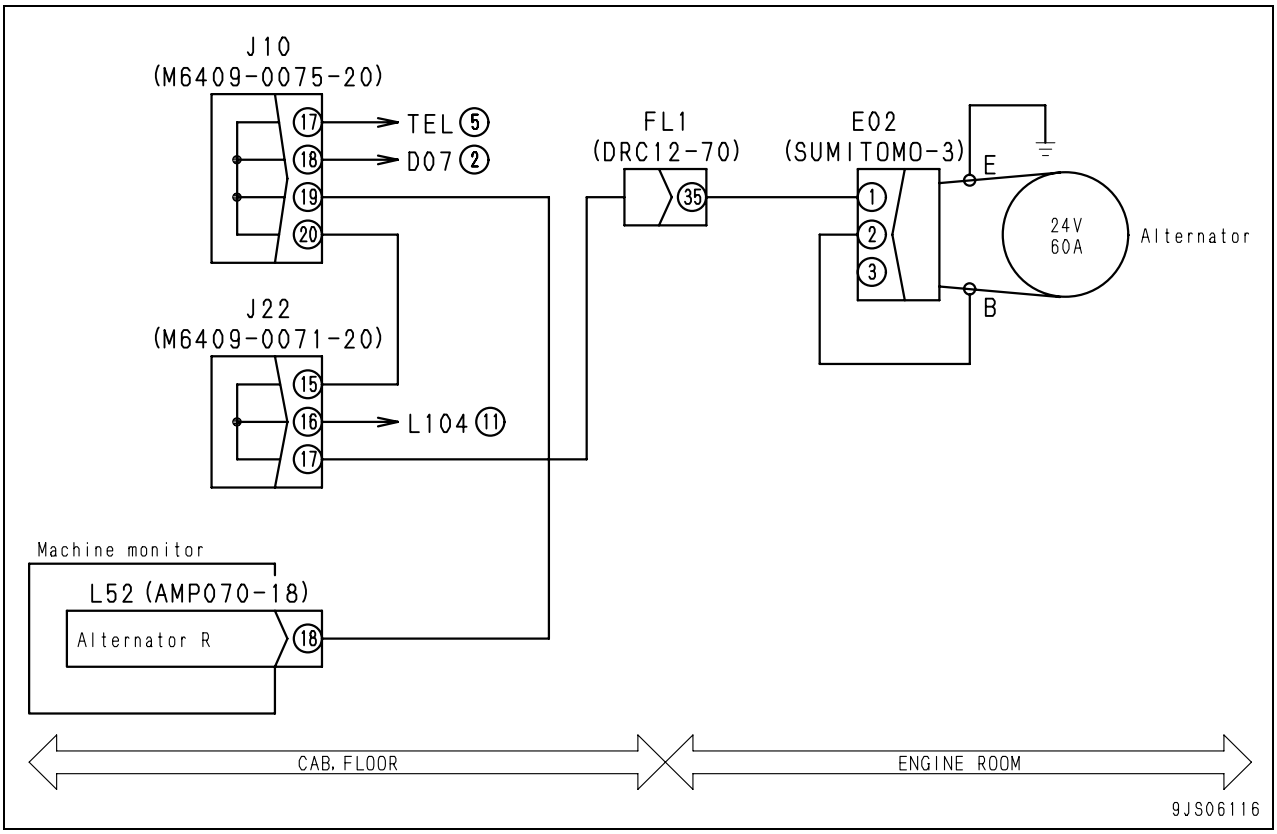


Failure code [AB00MA] (Alternator: Malfunction)

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 charge circuit failure caution lamp ON. • Turns the centralized warning lamp and alarm buzzer ON. • If problem is removed (min. 1 V), system is returned to normal operating state.		
Problem that appears on machine	• Deterioration of battery or insufficient charging		
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		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	The battery is deteriorated.	The battery may be deteriorated. Check it directly.			
	2	Defective alternator (Internal trouble)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			Alternator	Engine	Voltage	
			Wiring harness between E02 (female) (1) – chassis ground	Running (Throttle: Above 1/2)	27.5 – 29.5 V	
				Holds in position	Max. 1 V	
	3	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harnesses between E02 (female) (1) – L52 (female) (18)		Resistance	Max. 1 Ω
	4	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare by turning starting switch OFF and then start engine to carry out troubleshooting.			
			Wiring harness between E02 (female) (1) – L52 (female) (18) – circuit branch end and chassis ground		Resistance	Min. 1 MΩ
	5	Defective machine monitor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L52	Engine	Voltage	
			Between (18) and chassis ground	Running (Throttle: Above 1/2)	27.5 – 29.5 V	
				Holds in position	Max. 1 V	

Circuit diagram related to alternator

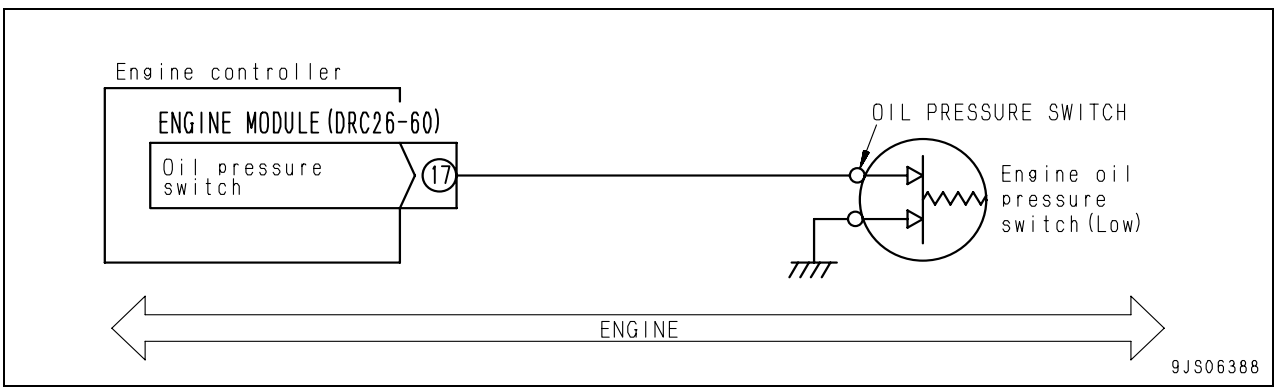


Failure code [B@BAZG] (Rotation derating by low engine oil pressure)

Action code	Failure code	Trouble	Rotation derating by low engine oil pressure (Engine controller system)
E03	**B@BAZG**		
Contents of trouble	• While engine is run, engine oil pressure became lower than operating range.		
Action of controller	• Limits output and continues operation (Limits fuel injection rate and engine speed). • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output lowers.		
Related information	• The input state (oil pressure) from the engine oil pressure sensor can be checked with the monitoring function (Code: 37200, ENG OIL PRESS). • The input state (voltage) from the engine oil pressure sensor can be checked with the monitoring function (Code: 37201, ENG OIL PRESS). • If failure code [CA435] (engine oil pressure switch error) is indicated, carry out troubleshooting for it first. • Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Low engine oil pressure (When the system is normal)	Engine oil has potentially gone low. Check the pressure and if it is below the specified level, locate and eliminate the cause.		
	2	Defective engine oil pressure switch (Internal trouble)	Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			OIL PRESSURE SWITCH	Resistance	
			Between (1) and (2)	Max. 10 Ω	
	3	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harnesses between ENGINE MODULE (female) (17) – OIL PRESSURE SWITCH	Resistance	Max. 1 Ω
			Wiring harnesses between OIL PRESSURE SWITCH – chassis ground	Resistance	Max. 1 Ω
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ENGINE MODULE	Resistance	
			Between (17) and chassis ground	Max. 10 Ω	

Circuit diagram related to engine oil pressure switch

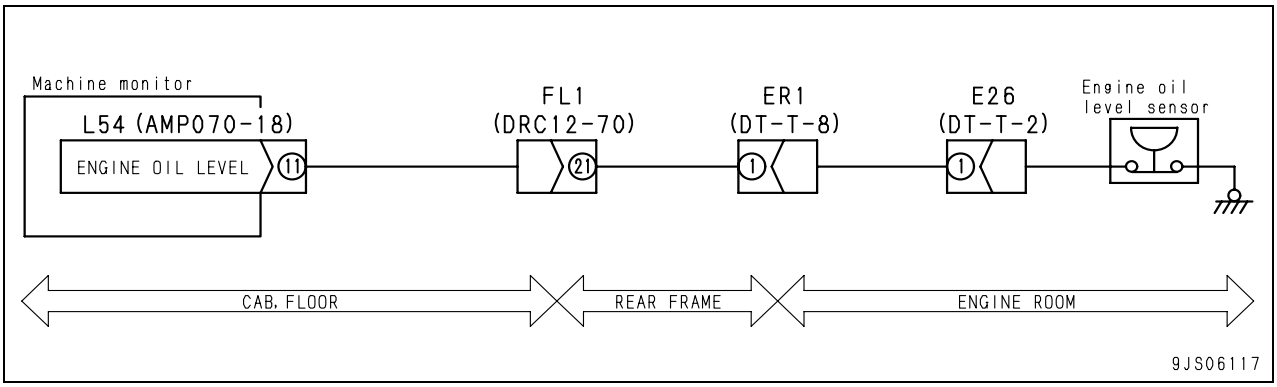


Failure code [B@BAZK] (Engine oil: Low level)

Action code	Failure code	Trouble	Engine oil: Low level (Machine monitor system)
E01	**B@BAZK**		
Contents of trouble	• While engine is stopped, the engine oil level sensor circuit was detected to have remained in OPEN condition for more than 2 seconds. (This error, however, is not detected for 5 minutes from the engine stop) • An error being detected at stopping the engine remains as the error after the engine is started again until the normal condition is recovered.		
Action of controller	• Turns the engine oil level caution lamp ON. • If problem is removed, system is returned to normal operating state.		
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 level sensor can be checked with the monitoring function (Code: 40903, D-IN-29). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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.			
			E26 (male)	Engine oil level	Resistance	
			Between (1) and chassis ground	Oil level is normal	Max. 1 Ω	
				Oil level is insufficient (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 harnesses between L54 (female) (11) – E26 (female) (1)		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L54 (female)	Engine oil level	Resistance	
			Wiring harness between (11) – chassis ground	Oil level is normal	Max. 1 Ω	
				Oil level is insufficient (low level)	Min. 1 MΩ	

Circuit diagram related to engine oil level sensor

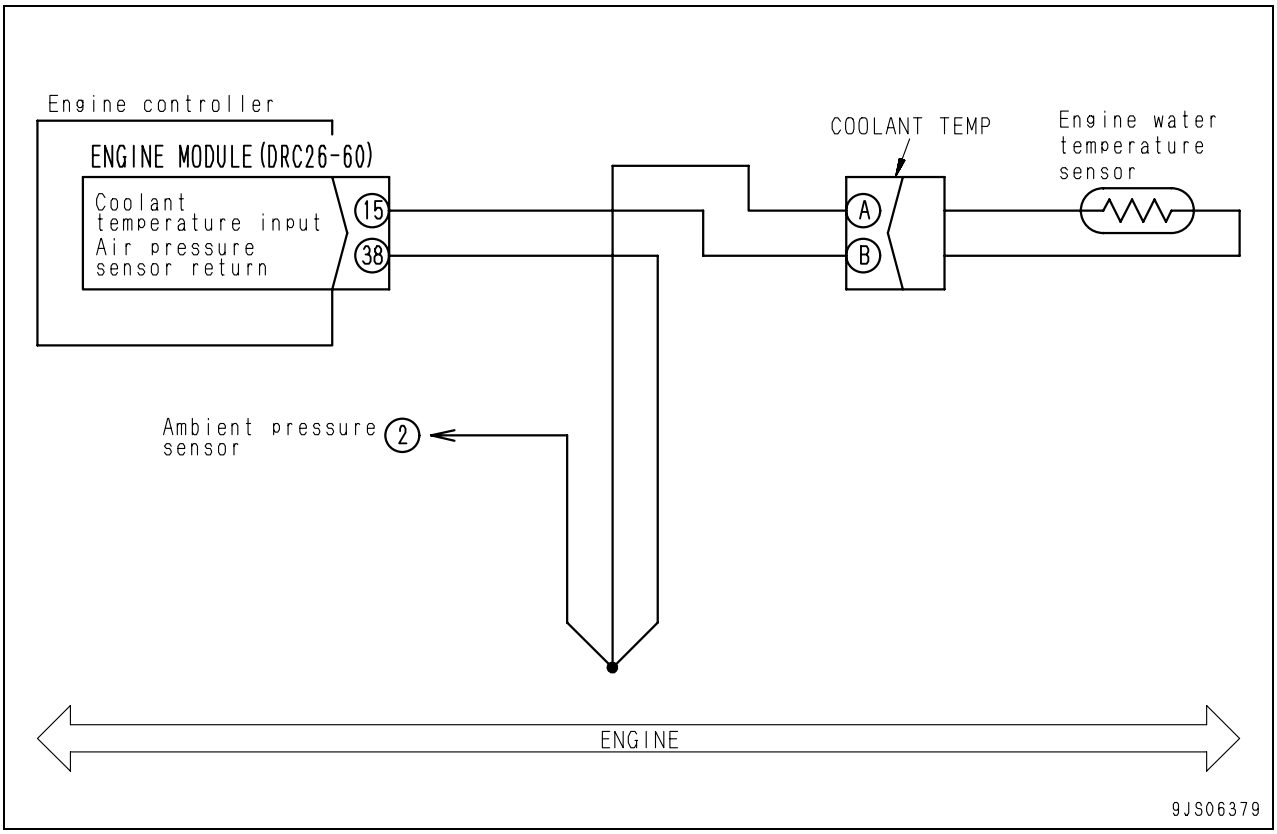


Failure code [B@BCNS] (Coolant: Overheating)

Action code	Failure code	Trouble	Coolant: Overheating (Engine controller system)
E02	**B@BCNS**		
Contents of trouble	• While the engine is run, the engine coolant temperature exceeded the 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 lowers.		
Related information	• The input state (temperature) from the engine coolant temperature sensor can be checked with the monitoring function (Code: 04104, COOLANT TEMP). • The input state (voltage) from the engine coolant temperature sensor can be checked with the monitoring function (Code: 04105, COOLANT TEMP). • if failure code [CA144] (Engine coolant temperature sensor high error) or [CA145] (Engine coolant temperature sensor high error) is indicated, carry out troubleshooting for it first. • Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Engine coolant overheat (When the system is normal)	Overheating of engine coolant can be suspected. Check the temperature to locate and eliminate the cause.			
	2	Defective coolant temperature sensor (Internal trouble)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			COOLANT TEMP (male)	Resistance		
			Between (A) and (B)	0.18 – 160 kΩ		
	3	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENGINE MODULE (female) (15) – COOLANT TEMP (female) (B)	Resistance	Max. 1 Ω	
			Wiring harness between COOLANT TEMP (female) (A) – ENGINE MODULE (female) (38)	Resistance	Max. 1 Ω	
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENGINE MODULE (male)	Resistance		
			Between (15) and chassis ground	0.18 – 160 kΩ		

Circuit diagram related to coolant temperature sensor

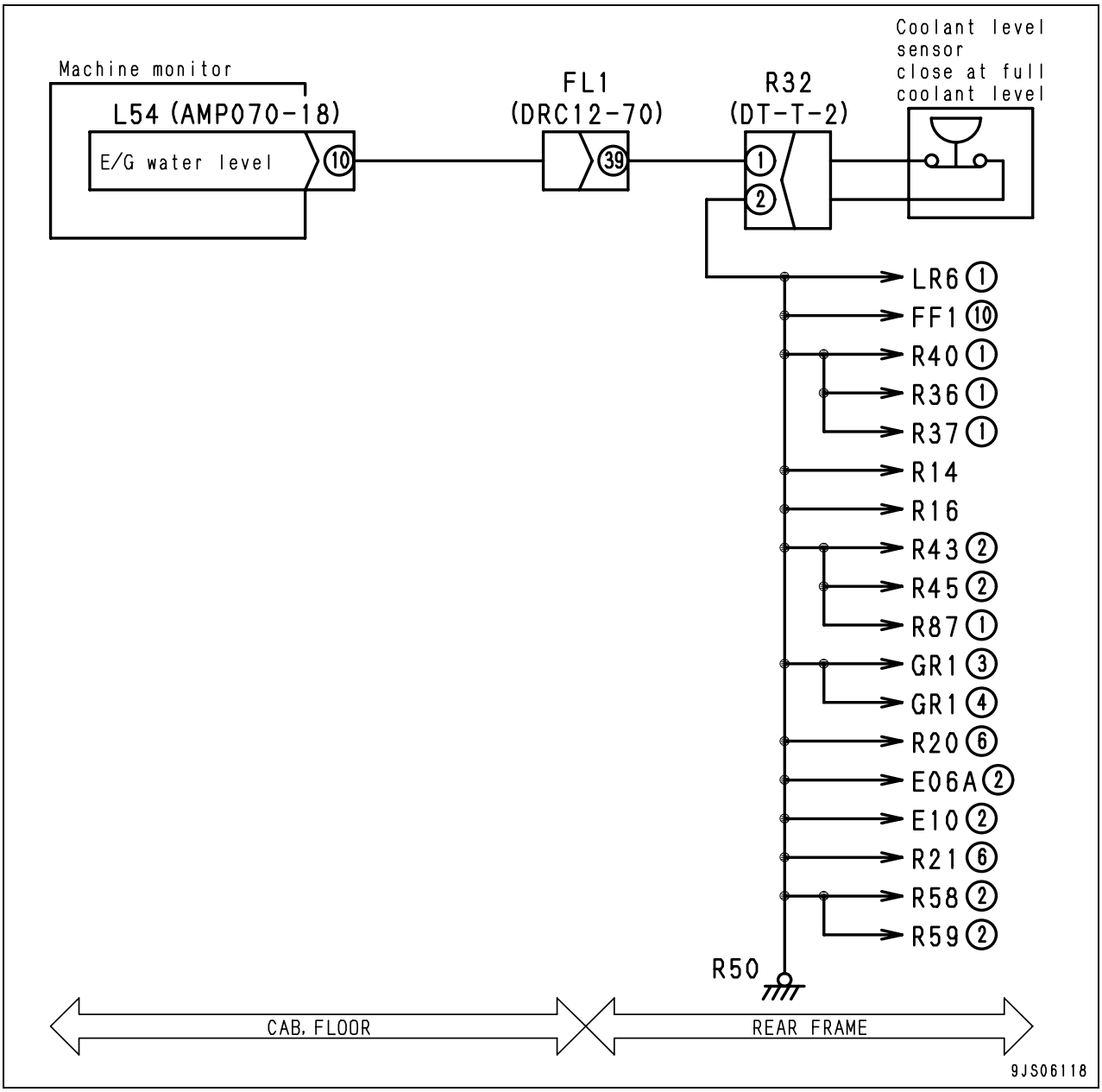


Failure code [B@BCZK] (Coolant: Low level)

Action code	Failure code	Trouble	Coolant: Low level (Machine monitor system)
E01	**B@BCZK**		
Contents of trouble	• The coolant level sensor circuit is OPEN (circuit was in this condition for 30 seconds)		
Action of controller	• Turns the coolant level caution lamp ON. • If problem is removed, system is returned to normal operating state.		
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.		

	Causes		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 short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R32 (Male)	Sub-tank	Resistance	
			Between (1) and (2)	Below LOW level (Abnormal)	Max. 1 Ω	
				Above LOW level (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 L54 (female) (10) – R32 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness from R32 (female) (2) and chassis ground		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L54 (female)	Sub-tank	Resistance	
			Wiring harness between (10) – chassis ground	Below LOW level (Abnormal)	Max. 1 Ω	
				Above LOW level (Normal)	Min. 1 MΩ	

Circuit diagram related to coolant level sensor

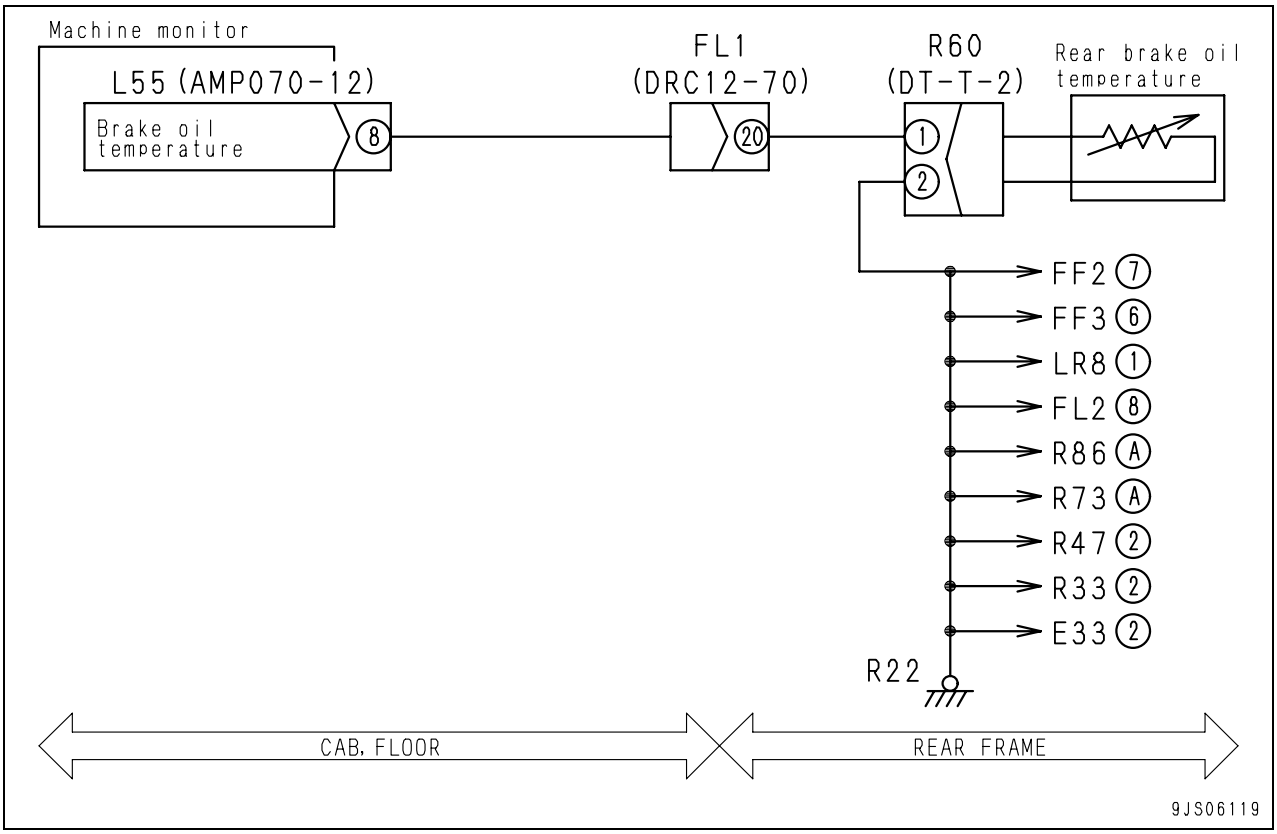


Failure code [B@C7NS] (Brake oil: Overheating)

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 problem is removed, system is returned to normal operating state.		
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.		

	Causes		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 the correct way of operating the brake.		
	2	Defective rear brake oil temperature sensor (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R60 (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.		
			L55 (female)	Rear brake oil temperature	Voltage
			Wiring harnesses between (8) – chassis ground	25°C (Normal temperature)	4.4 – 4.6 V
				100°C	2.1 – 2.3 V

Circuit diagram related to rear brake oil temperature sensor

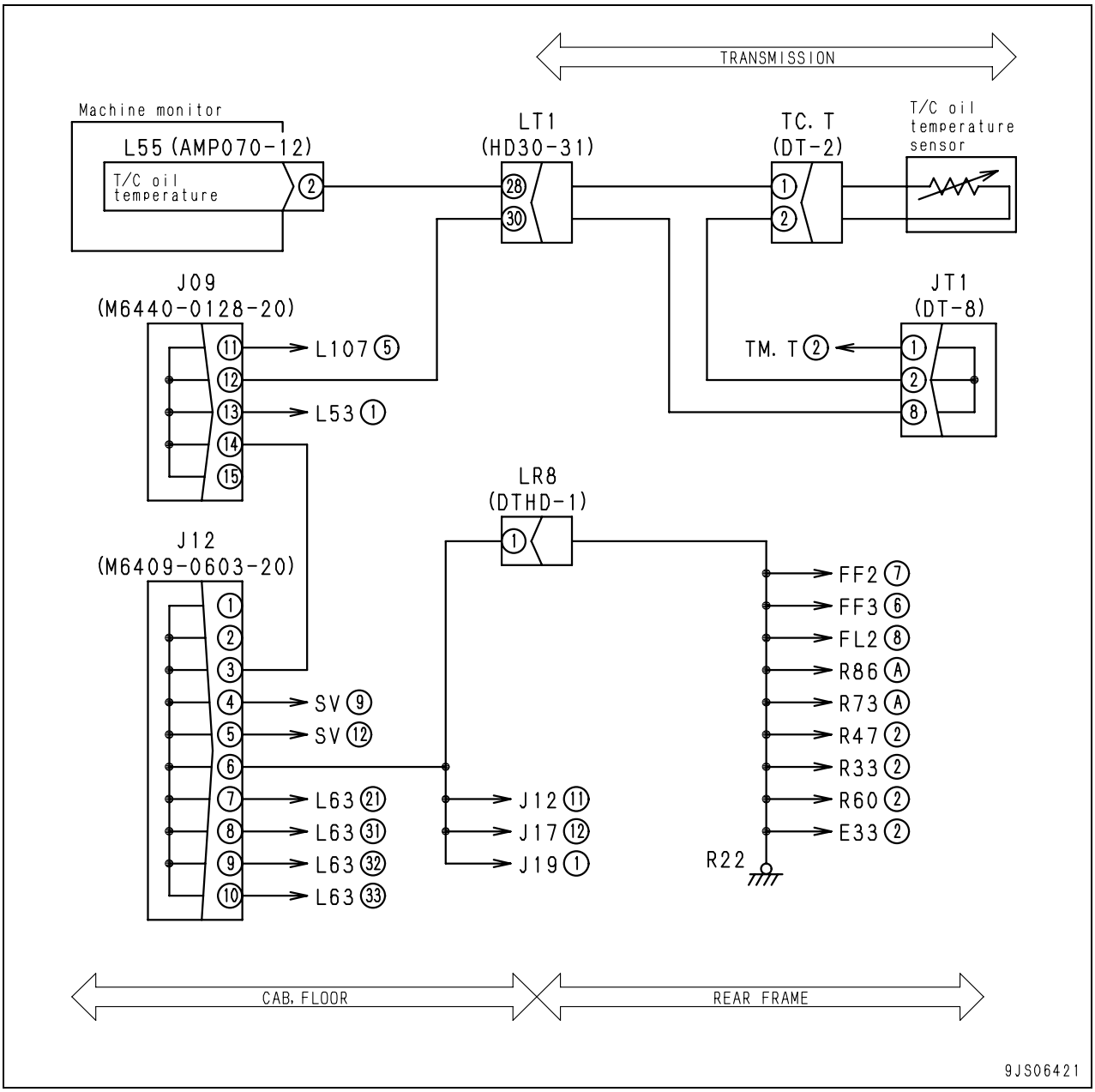


Failure code [b@CENS] (Torque converter oil: Overheating)

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 120°C.		
Action of controller	• If cause of failure disappears, system resets itself. (120°C and below was detected continuously for 1 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.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	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.		
			TC.T (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	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L55 (female)	Torque converter oil temperature	Voltage
			Between (2) and chassis ground	25°C (Normal temperature)	4.4 – 4.6 V
				100°C	2.1 – 2.3V

Circuit diagram related to torque converter oil temperature sensor

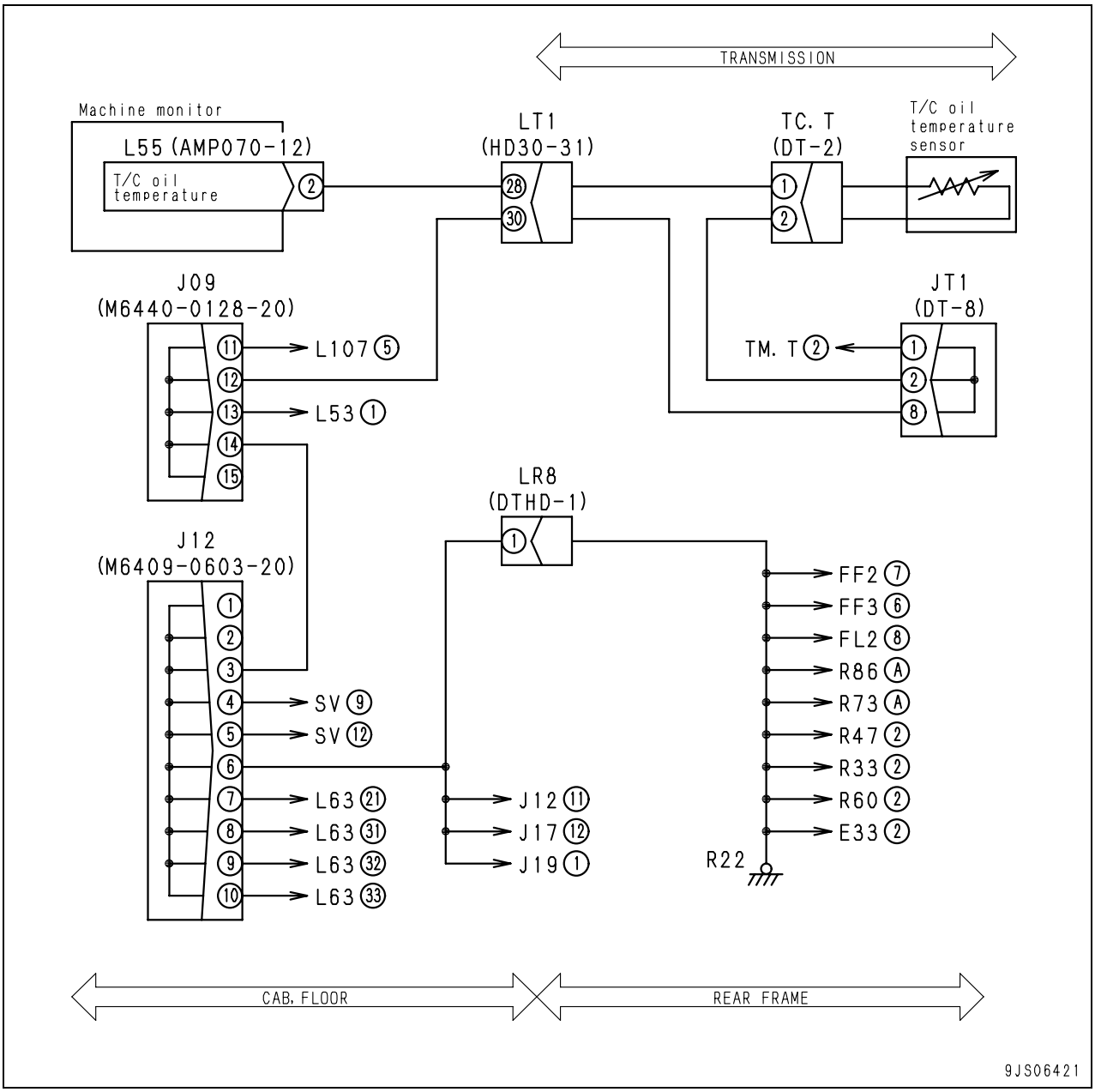


Failure code [B@CENS] (Torque converter oil: Overheating)

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. (130°C and below was detected continuously for 1 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.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	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.		
			TC.T (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	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L55 (female)	Torque converter oil temperature	Voltage
			Between (2) and chassis ground	25°C (Normal temperature)	4.4 – 4.6 V
				100°C	2.1 – 2.3 V

Circuit diagram related to torque converter oil temperature sensor

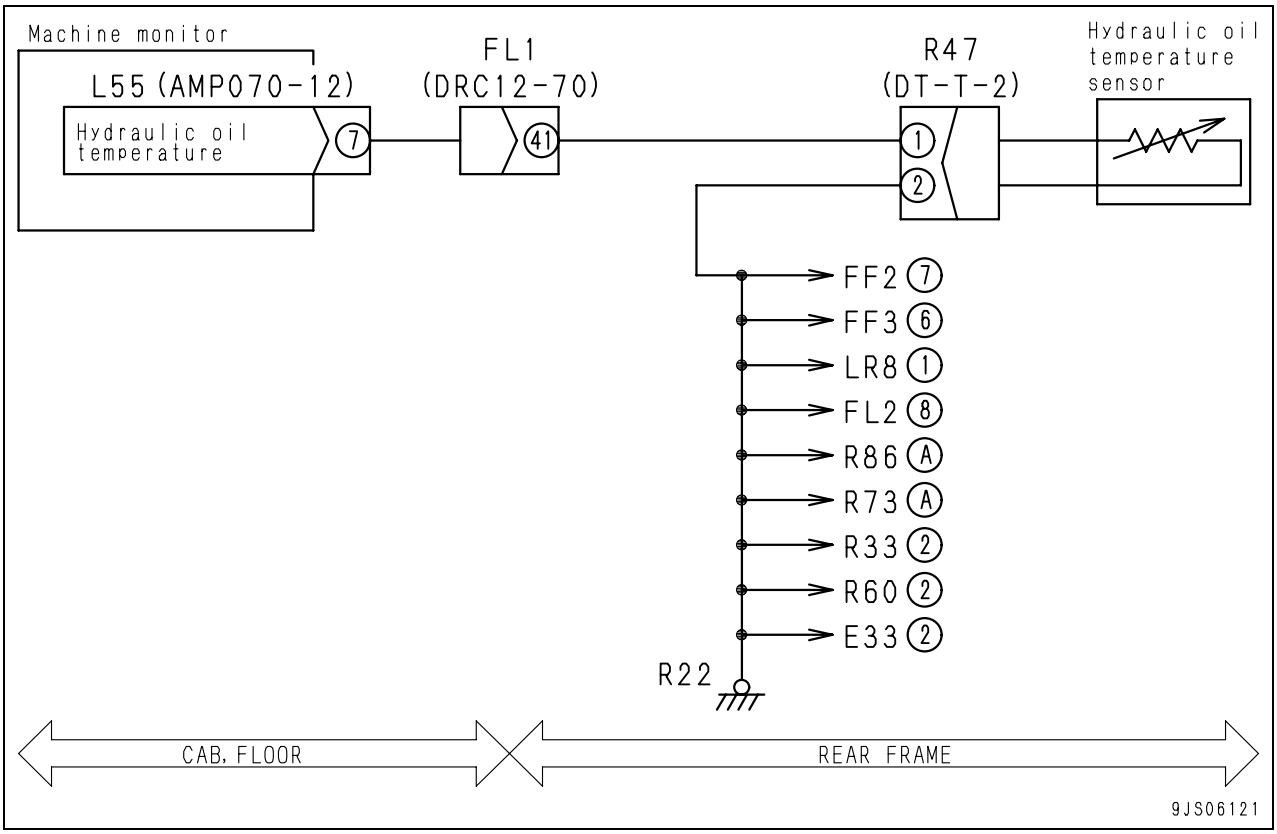


Failure code [B@HANS] (Hydraulic oil: Overheating)

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 (this level was detected for 10 seconds)		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If problem is removed, system is returned to normal operating state.		
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.		

	Causes		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 trouble)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R47 (Male)	Hydraulic 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.		
			L55 (female)	Hydraulic oil temperature	Voltage
			Wiring harnesses between (7) – chassis ground	25°C (Normal temperature)	4.4 – 4.6 V
				100°C	2.1 – 2.3 V

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	• Abnormality occurred in memory of engine controller or power supply circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• The engine does not start.		
Related information	• Method of reproducing failure code: Start engine		

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting
	1	Defective engine controller	Possible defect in engine controller (Troubleshooting cannot be carried out.)

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 signals of engine Ne speed sensor and engine Bkup speed sensor circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine stops • The engine does not start.		
Related information	• Method of reproducing failure code: Start engine		

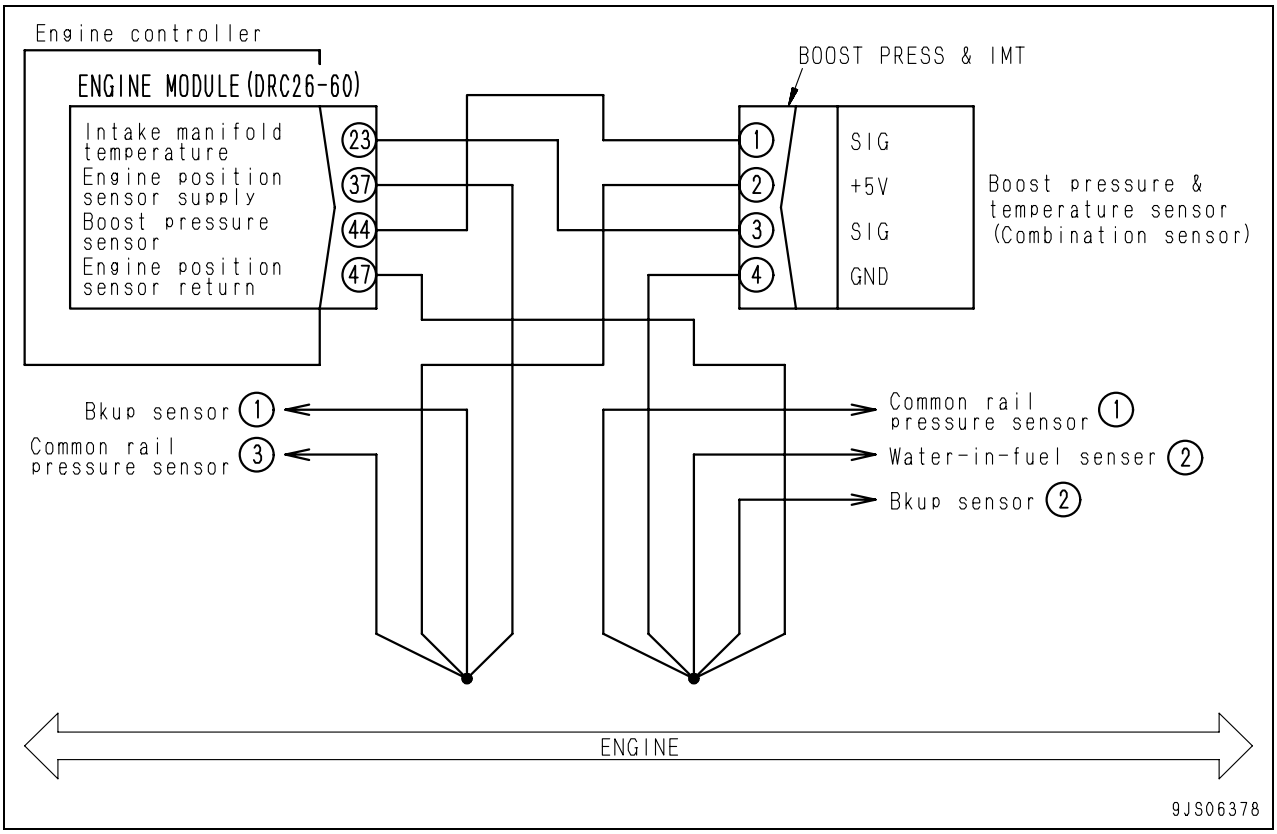
Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting
	1	Defective connection of sensor connector	Check Ne speed sensor and Bkup speed sensor directly for defective connection (wrong connection).

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	• High voltage is detected in pressure signal circuit of boost pressure sensor and temperature sensor.		
Action of controller	• Fixes charge pressure (boost pressure) 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 (boost pressure) from the charge pressure sensor (boost pressure sensor) can be checked with the monitoring function (Code: 36500, CHG PRESS-A). • The input state (voltage) from the charge pressure sensor (boost pressure sensor) can be checked with the monitoring function (Code: 36502, CHG PRESS-A). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power supply 2 system	If failure code [**CA227**] is indicated simultaneously, carry out troubleshooting for it first.			
	2	Defective boost pressure sensor and temperature sensors [pressure signal system] (Internal trouble)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			BOOST PRESS & IMT		Voltage	
			Between (2) and (4)	Voltage	4.75 – 5.25 V	
			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	Hot short (Short circuit with 5V, 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between ENGINE MODULE (female) (44) – BOOST PRESS & IMT (female) (1) and chassis ground	Voltage	Max. 1 V	
	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 harnesses between ENGINE MODULE (female) (44) – BOOST PRESS & IMT (female) (1), ENGINE MODULE (female) (47) – BOOST PRESS & IMT (female) (4).	Resistance	Min. 100 kΩ	
	5	Defective wiring harness connector	Connecting parts among boost pressure sensor/temperature sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock and, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			ENGINE MODULE		Voltage	
			Between (37) and (47)	Power supply	4.75 – 5.25V	

Circuit diagram related to boost pressure and temperature sensors

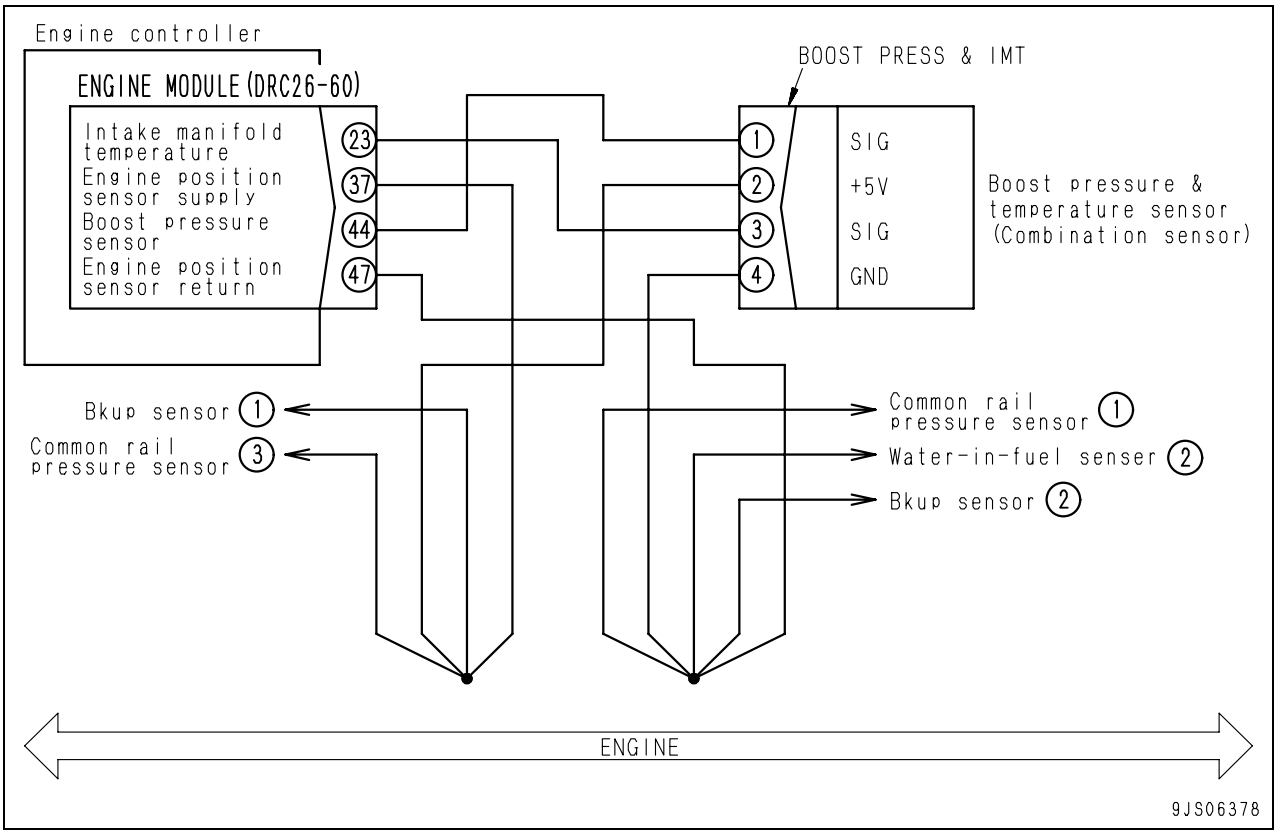


Failure code [CA123] (Charge pressure sensor low error)

Action code	Failure code	Trouble	Charge pressure sensor low error (Engine controller system)
E03	**CA123**		
Contents of trouble	• Low voltage is detected in pressure signal circuit of boost pressure sensor and temperature sensor.		
Action of controller	• Fixes charge pressure (boost pressure) 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 (boost pressure) from the charge pressure sensor (boost pressure sensor) can be checked with the monitoring function (Code: 36500, CHG PRESS-A). • The input state (voltage) from the charge pressure sensor (boost pressure sensor) can be checked with the monitoring function (Code: 36502, CHG PRESS-A). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power supply 2 system	If failure code [**CA187**] is indicated simultaneously, carry out troubleshooting for it first.			
	2	Defective boost pressure sensor or temperature sensor [pressure signal circuit] (Internal trouble)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			BOOST PRESS & IMT		Voltage	
			Between (2) and (4)	Power supply	4.75 – 5.25 V	
			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	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 ENGINE MODULE (female) (44) – BOOST PRESS & IMT (female) (1) and chassis ground		Resistance	Min. 100 kΩ
	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 harnesses between ENGINE MODULE (female) (44) – BOOST PRESS & IMT (female) (1), ENGINE MODULE (female) (47) – BOOST PRESS & IMT (female) (4)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts among boost pressure sensor/temperature sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			ENGINE MODULE		Voltage	
			Between (37) and (47)	Power supply	4.75 – 5.25 V	

Circuit diagram related to boost pressure and temperature sensors

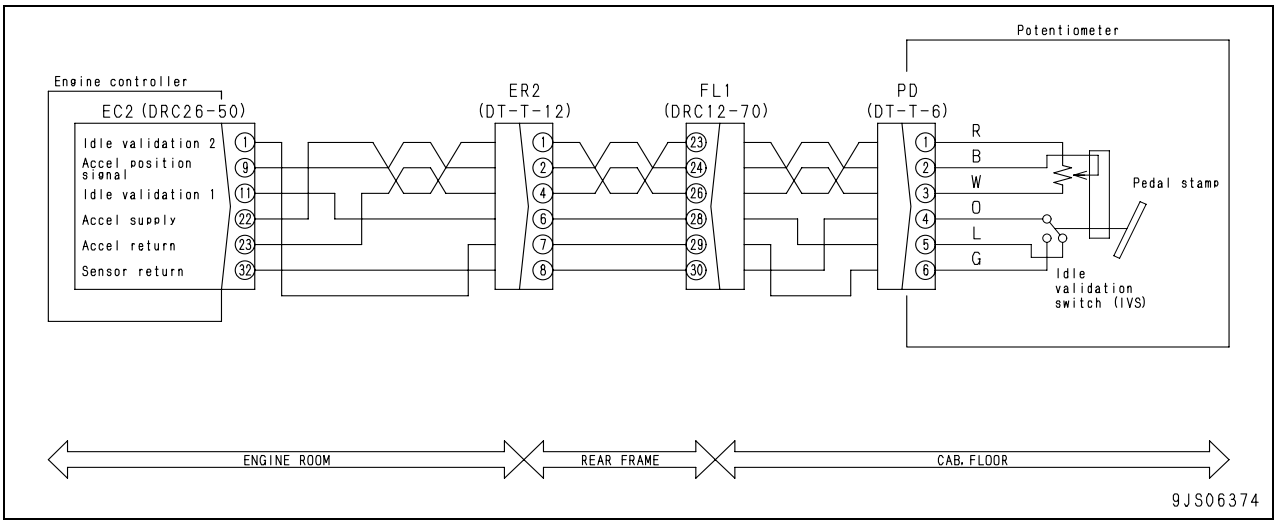


Failure code [CA131] (Throttle sensor high error)

Action code	Failure code	Trouble	Throttle sensor high error (Engine controller system)
E03	**CA131**		
Contents of trouble	• High voltage was detected in the throttle sensor signal circuit.		
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	• The input state (accelerator pedal opening ratio) from the throttle sensor can be checked with the monitoring function (Code: 31701, THROTTLE POS). • The input state (voltage) from the throttle sensor can be checked with the monitoring function (Code: 31707, THROTTLE POS). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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**] is indicated simultaneously, carry out troubleshooting for it first.			
	2	Defective accelerator pedal (Internal trouble)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			PD	Accelerator pedal	Voltage	
			Between (1) and (3)	All range (Power supply)	4.75 – 5.25 V	
			Between (2) and (3)	When released	0.50 – 0.80 V	
				When pressed	3.70 – 4.00 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	Hot short (Short circuit with 5V, 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between EC2 (female) (9) – PD (female) (2) and chassis ground		Voltage	Max. 1 V
	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 EC2 (female) (9) – PD (female) (2), EC2 (female) (22) – PD (female) (1)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts among fuel control dial, engine unit wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			EC2	Accelerator pedal	Voltage	
			Between (22) and (23)	All range (Power supply)	4.75 – 5.25 V	
			Between (9) and (23)	When released	0.50 – 0.80 V	
				When pressed	3.70 – 4.00 V	

Circuit diagram related to throttle sensor

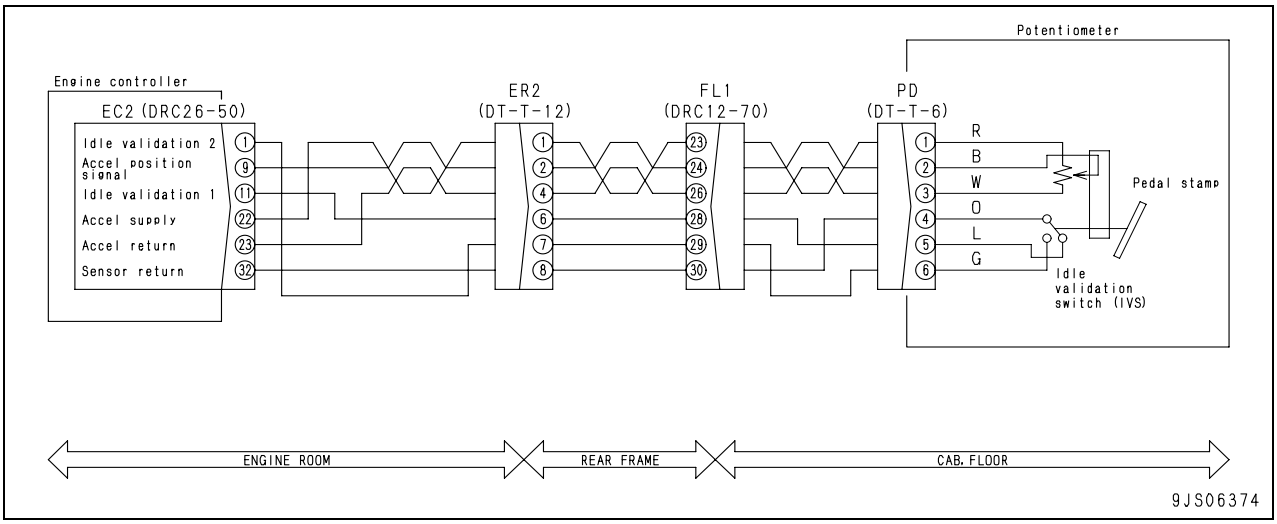


Failure code [CA132] (Throttle sensor low error)

Action code	Failure code	Trouble	Throttle sensor low error (Engine controller system)
E03	**CA132**		
Contents of trouble	• Low voltage was detected in the throttle sensor signal circuit.		
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	• The input state (accelerator pedal opening ratio) from the throttle sensor can be checked with the monitoring function (Code: 31701, THROTTLE POS). • The input state (voltage) from the throttle sensor can be checked with the monitoring function (Code: 31707, THROTTLE POS). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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 [**CA2186**] is indicated simultaneously, carry out troubleshooting for it first.			
	2	Defective accelerator pedal (Internal trouble)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			PD	Accelerator pedal	Voltage	
			Between (1) and (3)	All range (Power supply)	4.75 – 5.25 V	
			Between (2) and (3)	When released	0.50 – 0.80 V	
				When pressed	3.70 – 4.00 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	Ground fault in wiring harness (Short circuit with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between EC2 (female) (9) – PD (female) (2) and chassis ground		Resistance	Min. 100 kΩ
	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 EC2 (female) (9) – PD (female) (2), PD (female) (23) – PD (female) (3)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts among fuel control dial, engine unit wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			EC2	Accelerator pedal	Voltage	
			Between (22) and (23)	All range (Power supply)	4.75 – 5.25 V	
			Between (9) and (23)	When released	0.50 – 0.80 V	
				When pressed	3.70 – 4.00 V	

Circuit diagram related to throttle sensor

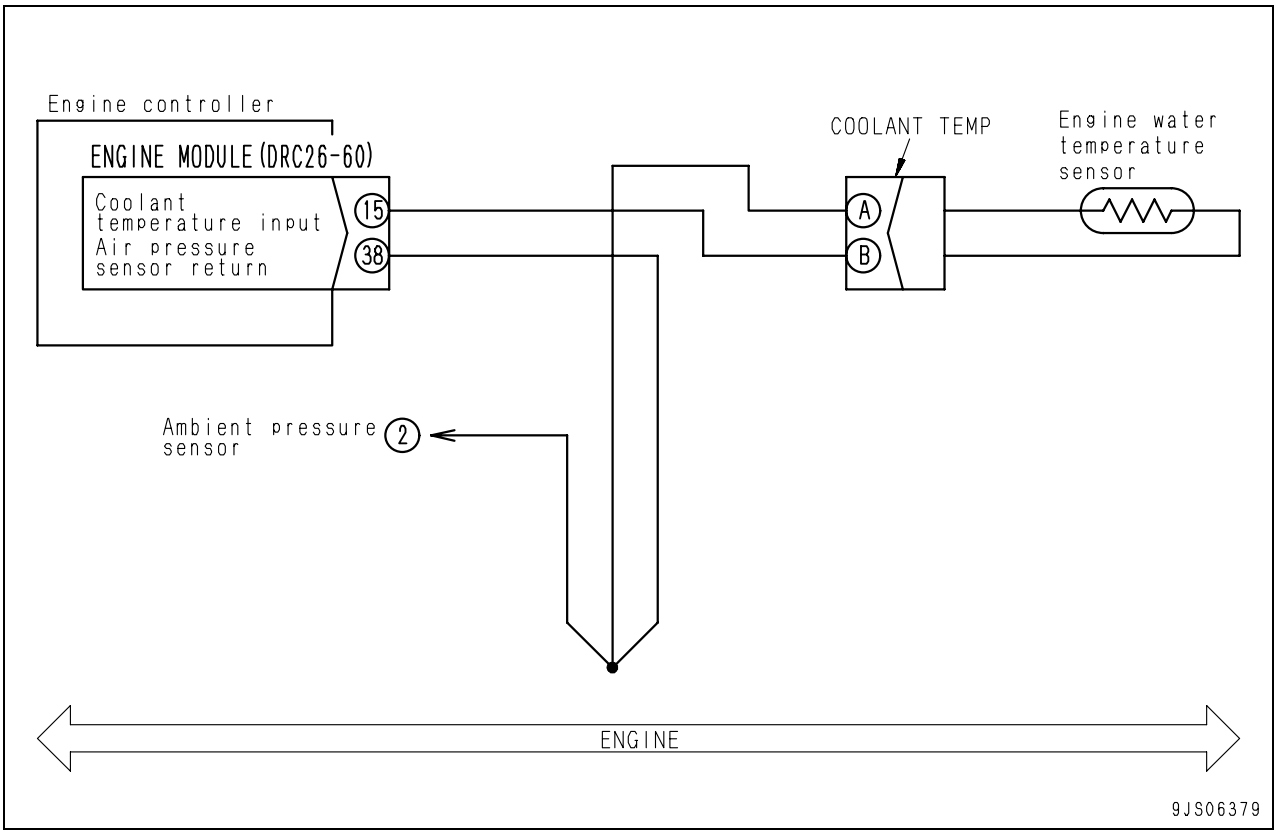


Failure code [CA144] (Coolant sensor high error)

Action code	Failure code	Trouble	Coolant sensor high error (Engine controller system)
E01	**CA144**		
Contents of trouble	• High voltage is detected in coolant temperature sensor signal circuit.		
Action of controller	• Fixes engine coolant temperature and continues operation.		
Problem that appears on machine	• Exhaust smoke becomes white • Overheat prevention function does not function.		
Related information	• The input state (temperature) from the engine coolant temperature sensor can be checked with the monitoring function (Code: 04104, COOLANT TEMP). • The input state (voltage) from the engine coolant temperature sensor can be checked with the monitoring function (Code: 04105, COOLANT TEMP). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective coolant temperature sensor (Internal trouble)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			COOLANT TEMP (male)	Resistance		
			Between (A) and (B)	0.18 – 160 kΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENGINE MODULE (female) (15) – COOLANT TEMP (female) (B)	Resistance	Max. 10Ω	
			Wiring harness between ENGINE MODULE (female) (38) – COOLANT TEMP (female) (A)	Resistance	Max. 10Ω	
	3	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 among all pins between ENGINE MODULE (female) (15) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ	
	4	Defective wiring harness connector	Connecting parts among coolant temperature sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENGINE MODULE (female)	Resistance		
			Between (15) and (38)	0.18 – 160 kΩ		

Circuit diagram related to coolant temperature sensor

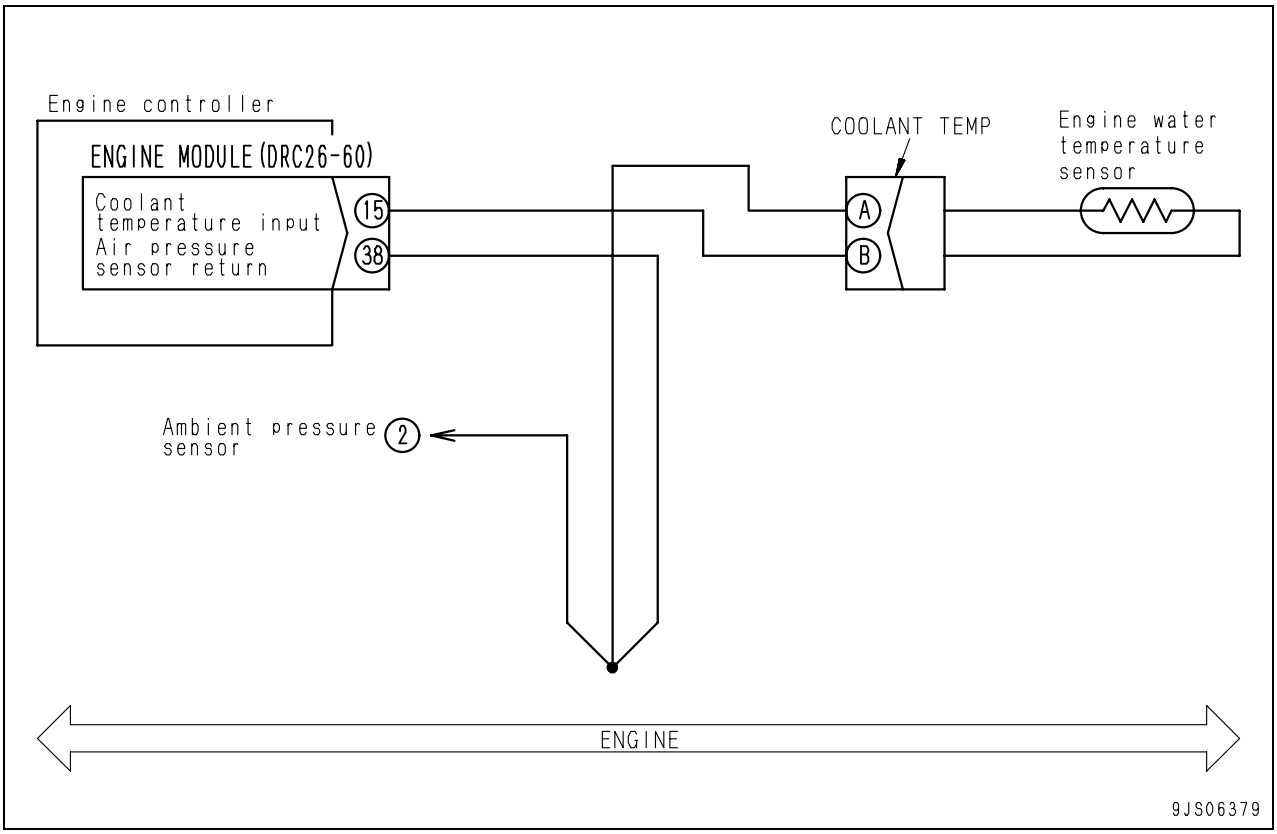


Failure code [CA145] (Coolant sensor low error)

Action code	Failure code	Trouble	Coolant sensor low error (Engine controller system)
E01	**CA145**		
Contents of trouble	• Low voltage is detected in coolant temperature sensor signal circuit.		
Action of controller	• Fixes engine coolant temperature and continues operation.		
Problem that appears on machine	• Exhaust smoke becomes white • Overheat prevention function does not function.		
Related information	• The input state (temperature) from the engine coolant temperature sensor can be checked with the monitoring function (Code: 04104, COOLANT TEMP). • The input state (voltage) from the engine coolant temperature sensor can be checked with the monitoring function (Code: 04105, COOLANT TEMP). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective coolant temperature sensor (Internal trouble)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			COOLANT TEMP (male)	Resistance	
			Between (A) and (B)	0.18 – 160 kΩ	
			Between (B) and chassis ground	Min. 100 kΩ	
	2	Ground fault in wiring harness (Short circuit with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENGINE MODULE (female) (15) – COOLANT TEMP (female) (B) and chassis ground	Resistance	Min. 100 kΩ
	3	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 among all pins between ENGINE MODULE (female) (15) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts among coolant temperature sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ENGINE MODULE (female)	Resistance	
			Between (15) and (38)	0.18 – 160 kΩ	
			Between (15) and chassis ground	Min. 100 kΩ	

Circuit diagram related to coolant temperature sensor

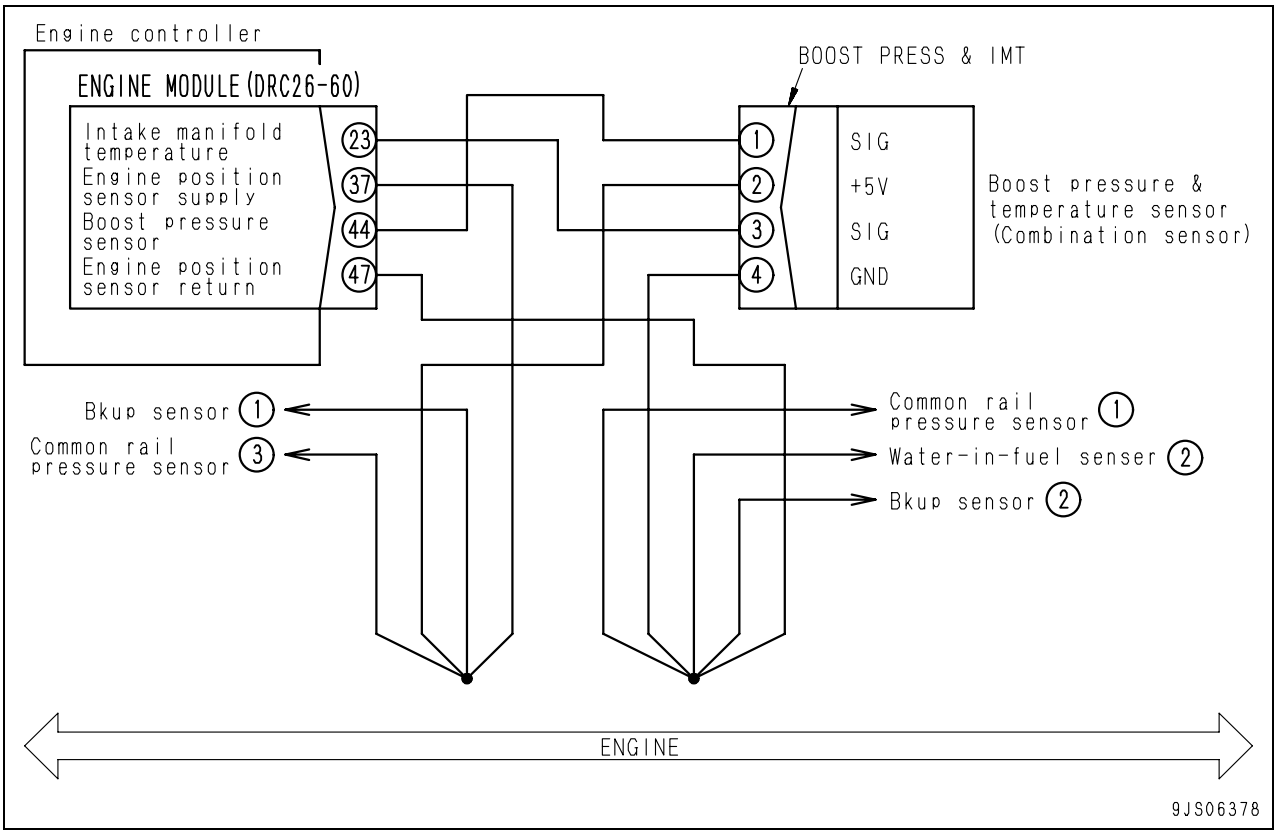


Failure code [CA153] (Charge temperature sensor high error)

Action code	Failure code	Trouble	Charge temperature sensor high error (Engine controller system)
E01	**CA153**		
Contents of trouble	• High voltage is detected in temperature signal circuit of boost pressure sensor and temperature sensor.		
Action of controller	• Fixes charge temperature and continues operation.		
Problem that appears on machine	• Exhaust smoke becomes white • Boost temperature-based engine protection function does not function.		
Related information	• The input state (temperature) from the charge temperature sensor (boost temperature sensor) can be checked with the monitoring function (Code: 18500, CHG TEMP). • The input state (voltage) from the charge temperature sensor (boost temperature sensor) can be checked with the monitoring function (Code: 18501, CHG TEMP). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective [temperature signal circuit] of boost pressure sensor, temperature sensor (Internal trouble)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			BOOST PRESS & IMT (male)	Resistance		
			Between (3) and (4)	0.18 – 160 kΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENGINE MODULE (female) (23) – BOOST PRESS & IMT (female) (3)	Resistance	Max. 10Ω	
			Wiring harness between ENGINE MODULE (female) (47) – BOOST PRESS & IMT (female) (4)	Resistance	Max. 10Ω	
	3	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 among all pins between ENGINE MODULE (female) (23) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ	
	4	Defective wiring harness connector	Connecting parts among boost pressure sensor/temperature sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENGINE MODULE (female)	Resistance		
			Between (23) and (47)	0.18 – 160 kΩ		

Circuit diagram related to boost pressure and temperature sensors

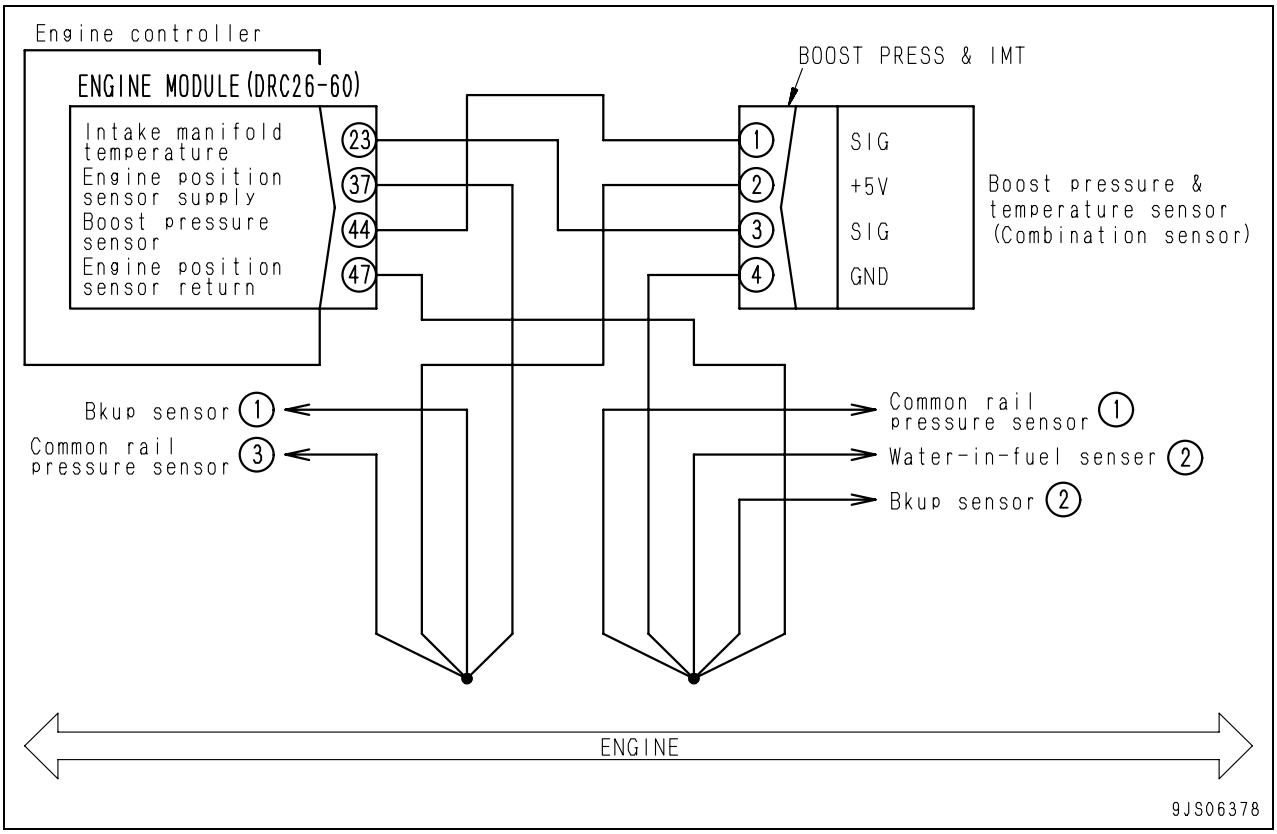


Failure code [CA154] (Charge temperature sensor low error)

Action code	Failure code	Trouble	Charge temperature sensor low error (Engine controller system)
E01	**CA154**		
Contents of trouble	• Low voltage is detected in temperature signal circuit of boost pressure sensor and temperature sensor.		
Action of controller	• Fixes charge temperature and continues operation.		
Problem that appears on machine	• Exhaust smoke becomes white • Boost temperature-based engine protection function does not function.		
Related information	• The input state (temperature) from the charge temperature sensor (boost temperature sensor) can be checked with the monitoring function (Code: 18500, CHG TEMP). • The input state (voltage) from the charge temperature sensor (boost temperature sensor) can be checked with the monitoring function (Code: 18501, CHG TEMP). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective [temperature signal circuit] of boost pressure sensor, temperature sensor (Internal trouble)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			BOOST PRESS & IMT (male)	Resistance		
			Between (2) and (1)	0.18 – 160 kΩ		
			Between (2) and chassis ground	Min. 100 kΩ		
	2	Ground fault in wiring harness (Short circuit with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENGINE MODULE (female) (23) – BOOST PRESS & IMT (female) (3) and chassis ground	Resistance	Min. 100 kΩ	
	3	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 among all pins between ENGINE MODULE (female) (23) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ	
	4	Defective wiring harness connector	Connecting parts among boost pressure sensor/temperature sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENGINE MODULE (female)	Resistance		
			Between (23) and (47)	0.18 – 160 kΩ		
			Between (23) and chassis ground	Min. 100 kΩ		

Circuit diagram related to boost pressure and temperature sensors



Failure code [CA155] (Derating of speed by abnormally high charge temperature)

Action code	Failure code	Trouble	Derating of speed by abnormally high charge temperature (Engine controller system)
E03	**CA155**		
Contents of trouble	• Temperature signal of boost pressure sensor and temperature sensor is above upper control limit.		
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. • Engine stops		
Related information	• The input state (temperature) from the charge temperature sensor (boost temperature sensor) can be checked with the monitoring function (Code: 18500, CHG TEMP). • The input state (voltage) from the charge temperature sensor (boost temperature sensor) can be checked with the monitoring function (Code: 18501, CHG TEMP). • Method of reproducing failure code: Start engine		

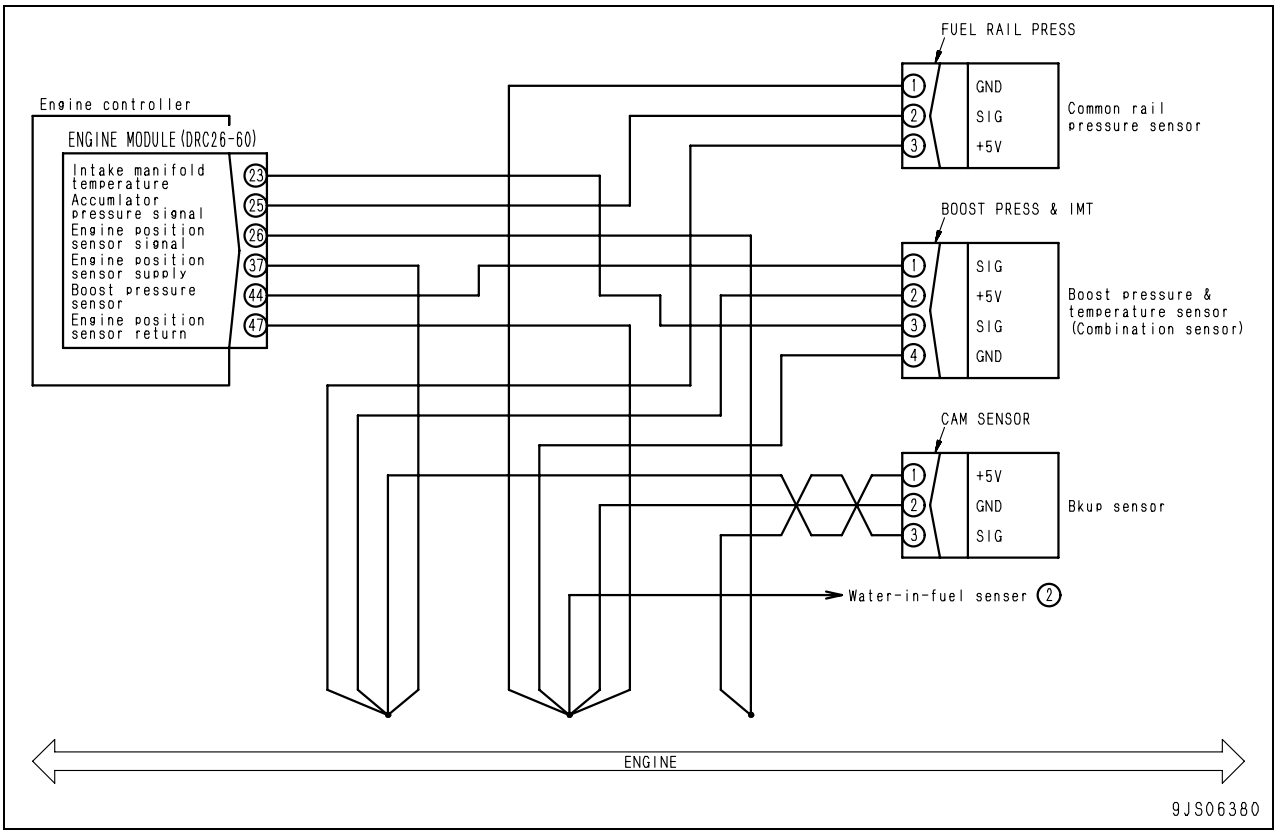
	Causes		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Drop in cooling performance of aftercooler	Cooling performance deterioration of the after cooler is suspected. Inspect the following points directly. • Loose, broken fan belt • Lack of cooling air • Clogged aftercooler fin
	2	Abnormally high temperature at turbocharger outlet	Inspect related parts directly.
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

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	• Low voltage is detected in sensor power supply 2 circuit.		
Action of controller	• Fixes boost pressure and continues operation. • Fixes charge temperature and continues operation. • Limits output and continues operation. • 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.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor or wiring harness	★ Disconnect connector with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Disconnect devices at right in order. If mark E of failure code disappears after reproduction operation is conducted, that device or wiring harness has a defect in it.	Boost pressure, temperature sensor	BOOST PRESS & IMT
				Common rail pressure sensor	FUEL RAIL PRESS
				Bkup sensor	CAM SENSOR
				Engine wiring harness	ENGINE MODULE
	2	Defective wiring harness connector	Connecting parts among each sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to sensor power supply 2

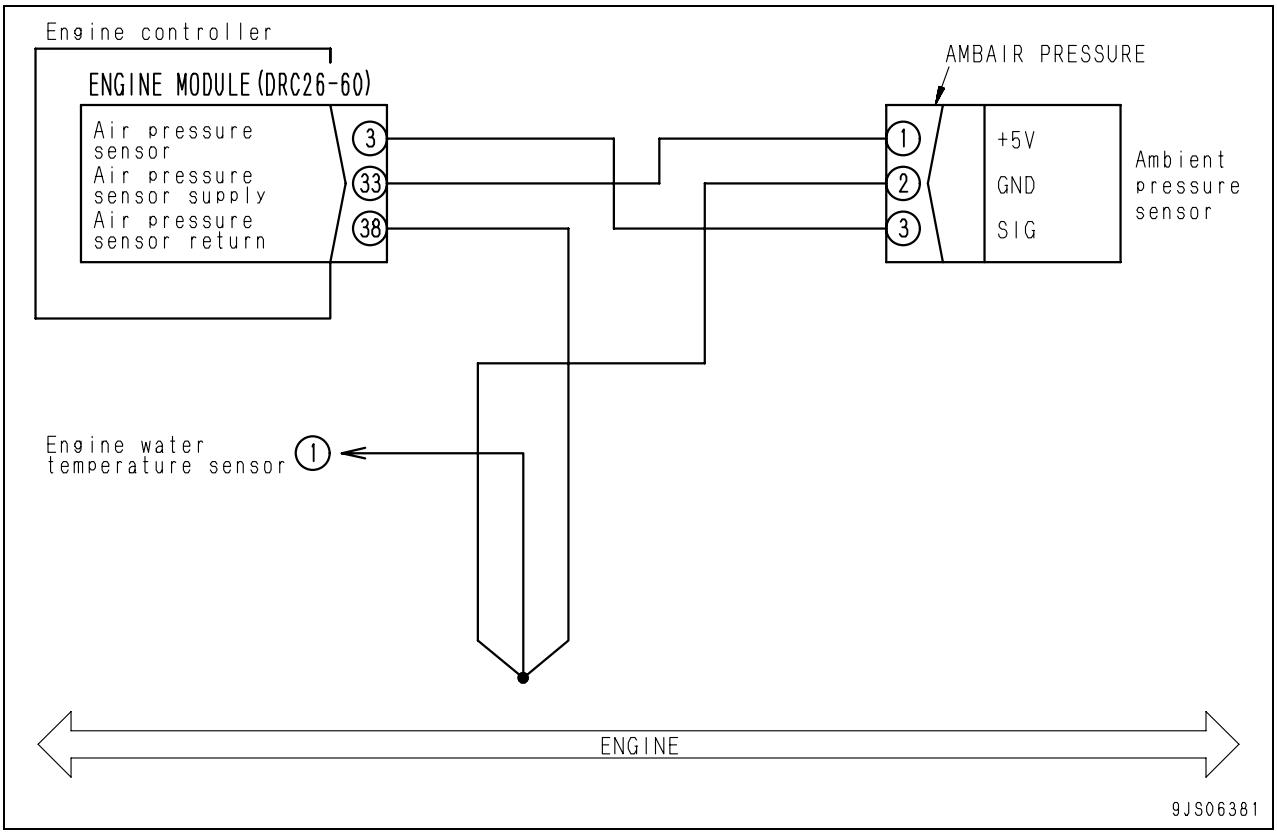


Failure code [CA221] (Atmospheric pressure sensor high error)

Action code	Failure code	Trouble	Ambient pressure sensor high error (Engine controller system)
E01	**CA221**		
Contents of trouble	• High voltage is detected in atmospheric pressure sensor		
Action of controller	• Fixes atmospheric pressure and continues operation.		
Problem that appears on machine	• Engine does not start easily. • Engine output drops.		
Related information	• The input state (atmospheric pressure) from the atmospheric pressure sensor can be checked with the monitoring function (Code: 37400, AMBIENT PRESS). • The input state (voltage) from the atmospheric pressure sensor can be checked with the monitoring function (Code: 37402, AMBIENT PRESS). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power supply 1 system	If failure code [**CA386**] is indicated simultaneously, carry out troubleshooting for it first.			
	2	Defective atmospheric pressure sensor (Internal trouble)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			AMBAIR PRESURE		Voltage	
			Between (1) and (2)	Power supply	4.75 – 5.25 V	
			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	Hot short (Short circuit with 5V, 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between ENGINE MODULE (female) (3) – AMBAIR PRESURE (female) (3) and chassis ground		Voltage	Max. 1 V
	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 ENGINE MODULE (female) (3) – AMBAIR PRESURE (female) (3), ENGINE MODULE (female) (33) – AMBAIR PRESURE (female) (1)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts among atmospheric pressure sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			ENGINE MODULE		Voltage	
			Between (33) and (38)	Power supply	4.75 – 5.25 V	

Circuit diagram related to atmospheric pressure sensor

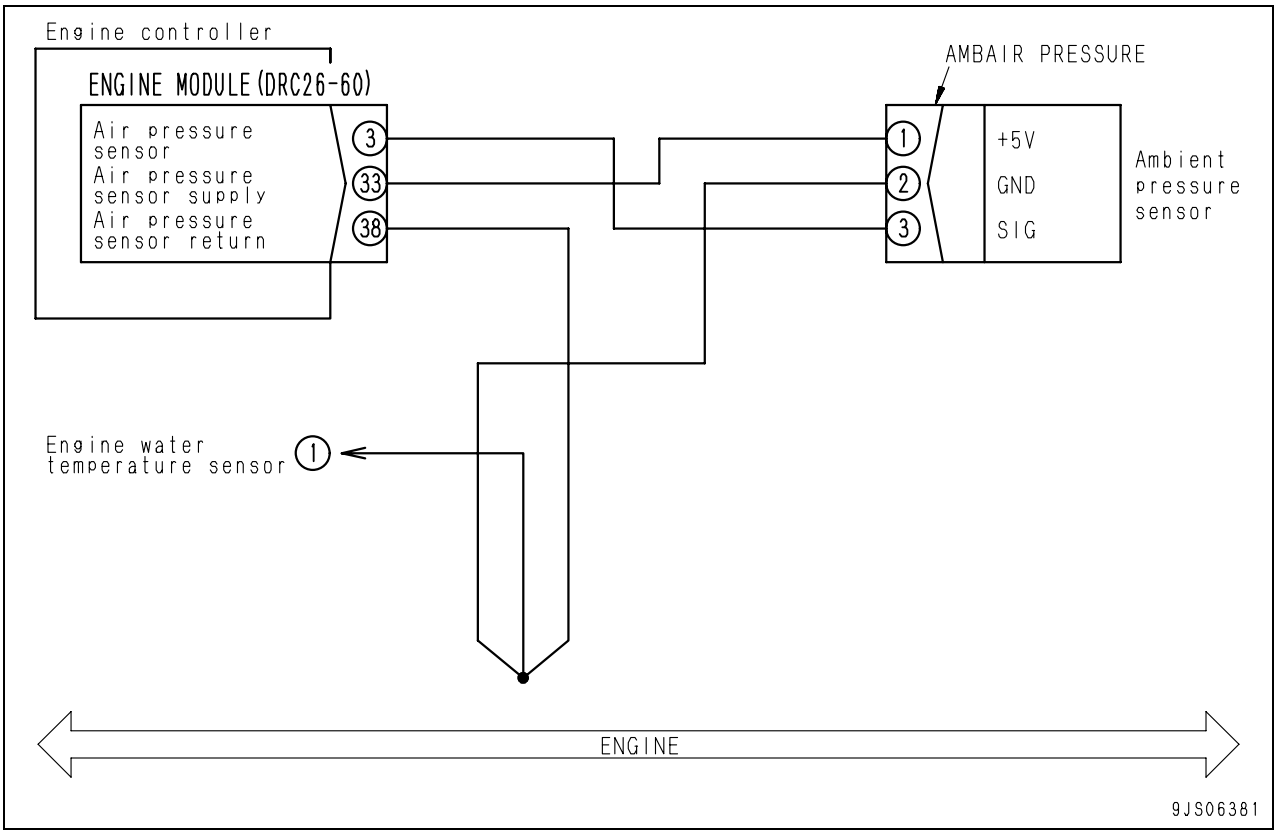


Failure code [CA222] (Atmospheric sensor low error)

Action code	Failure code	Trouble	Atmospheric sensor low error (Engine controller system)
E01	**CA222**		
Contents of trouble	• Low voltage is detected in atmospheric pressure sensor		
Action of controller	• Fixes atmospheric pressure and continues operation.		
Problem that appears on machine	• Engine does not start easily. • Engine output drops.		
Related information	• The input state (atmospheric pressure) from the atmospheric pressure sensor can be checked with the monitoring function (Code: 37400, AMBIENT PRESS). • The input state (voltage) from the atmospheric pressure sensor can be checked with the monitoring function (Code: 37402, AMBIENT PRESS). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power supply 1 system	If failure code [**CA352**] is indicated simultaneously, carry out troubleshooting for it first.			
	2	Defective atmospheric pressure sensor (Internal trouble)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			AMBAIR PRESURE		Voltage	
			Between (1) and (2)	Power supply	4.75 – 5.25 V	
			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	Ground fault in wiring harness (Short circuit with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENGINE MODULE (female) (3) – AMBAIR PRESURE (female) (3) and chassis ground		Resistance	Min. 100 kΩ
	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 ENGINE MODULE (female) (3) – AMBAIR PRESURE (female) (3), ENGINE MODULE (female) (38) – AMBAIR PRESURE (female) (2)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts among atmospheric pressure sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			ENGINE MODULE		Voltage	
			Between (33) and (38)	Power supply	4.75 – 5.25 V	

Circuit diagram related to atmospheric pressure sensor

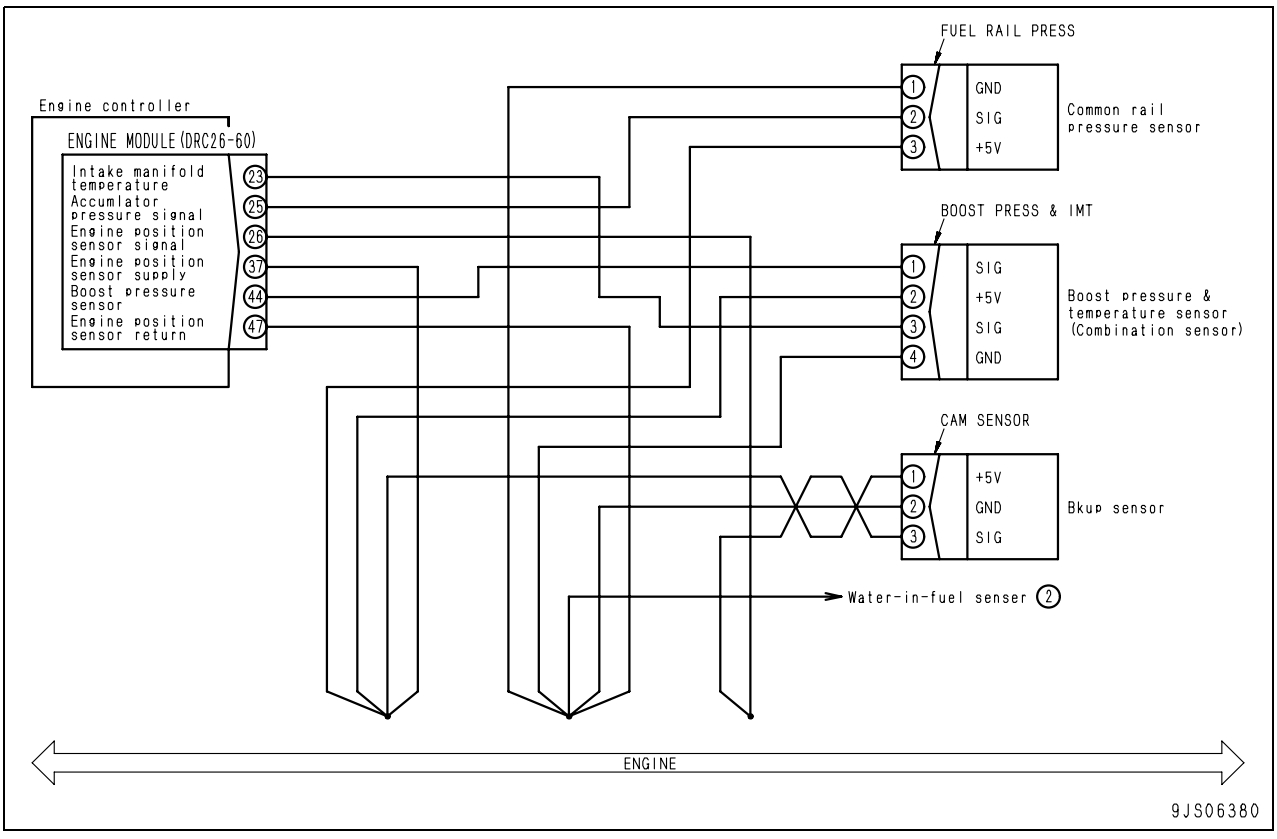


Failure code [CA227] (Sensor power supply 2 high error)

Action code	Failure code	Trouble	Sensor power supply 2 high error (Engine controller system)
E03	**CA227**		
Contents of trouble	• High voltage is detected in sensor power supply 2 circuit.		
Action of controller	• Fixes boost pressure and continues operation. • Fixes charge temperature and continues operation. • Limits output and continues operation. • 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.		

	Causes		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective wiring harness connector	Connecting parts among each sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation
	2	Defective engine controller	If cause 1 is not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Circuit diagram related to sensor power supply 2



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 3

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Failure code [CA238] (Ne speed sensor power supply error) 4
Failure code [CA271] (PCV1 Short circuit) 5
Failure code [CA272] (PCV1 Disconnection) 6
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Failure code [CA342] (Calibration code inconsistency) 20
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Failure code [CA778] (Engine Bkup speed sensor error)..... 54
Failure code [CA1117] (Partial engine controller data loss error)..... 56
Failure code [CA1633] (KOMNET datalink timeout error) 59

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 is above upper control limit.		
Action of controller	• Stops injection of injector until engine speed drops to normal level. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine speed fluctuates.		
Related information	• Engine speed can be checked by monitoring function (Code: 01001, ENG SPEED, Code: 01002, ENG SPEED). • Method of reproducing failure code: Start engine and running at high idle.		

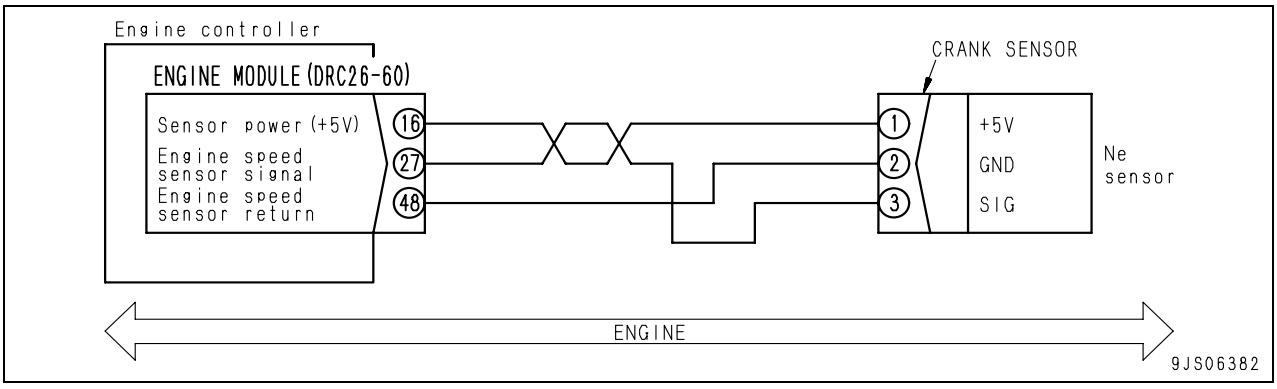
	Causes		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Use of improper fuel	Check fuel used directly.
	2	Improper way of use	Way of use may be improper. Teach proper way of use to operator.
	3	Defective engine controller	If causes 1 and 2 are not detected, 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 supply power error (Engine controller system)
E03	**CA238**		
Contents of trouble	• Low voltage is detected in engine Ne speed sensor power supply circuit.		
Action of controller	• Controls Ne speed sensor with signals of Bkup speed sensor. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Starting performance is poor • There is hunting from engine.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state			★ Disconnect connector with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
	1	Defective sensor or wiring harness	Disconnect devices at right in order. If failure code disappears after reproduction operation is conducted, that device or wiring harness has a defect in it.	Ne speed sensor	CRANK SENSOR
				Engine wiring harness	ENGINE MODULE
	2	Defective wiring harness connector	Connecting parts among each sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		

Circuit diagram related to engine Ne speed sensor

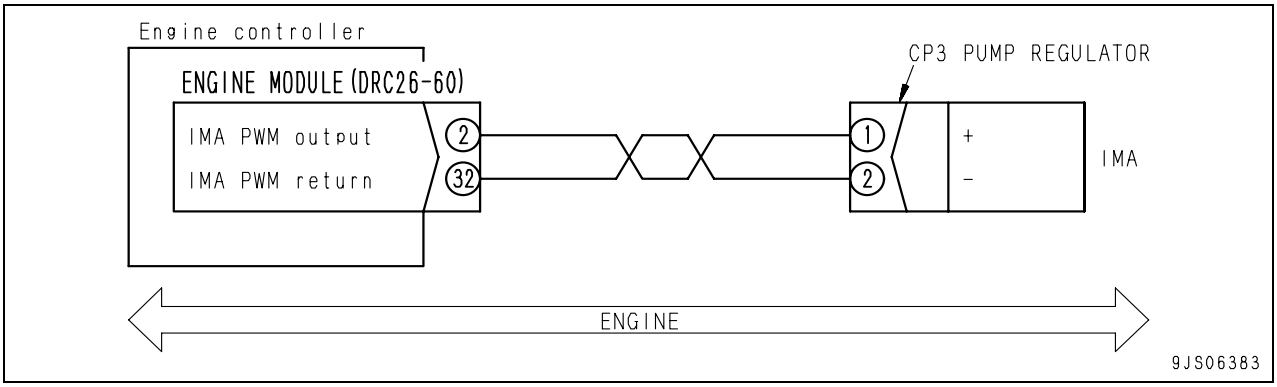


Failure code [CA271] (PCV1 Short circuit)

Action code	Failure code	Trouble	IMV/PCV1 Short circuit (Engine controller system)
E03	**CA271**		
Contents of trouble	• There is short circuit in supply pump actuator drive circuit.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine speed does not rise from low idle. • Engine output drops. • Common rail fuel pressure is above command value.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective supply pump actuator	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CP3 PUMP REGULATOR (male)	Resistance	
			Between (1) and chassis ground	Min. 100 kΩ	
	2	Ground fault in wiring harness (Short circuit with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENGINR MODULE (female) (2) – CP3 PUMP REGULATOR (female) (1) and chassis ground	Resistance	Min. 100 kΩ
	3	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 among all pins between ENGINE MODULE (female) (2) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts among supply pump actuator, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ENGINR MODULE (female)	Resistance	
			Between (2) and chassis ground	Min. 100 kΩ	

Circuit diagram related to supply pump actuator (metering unit)

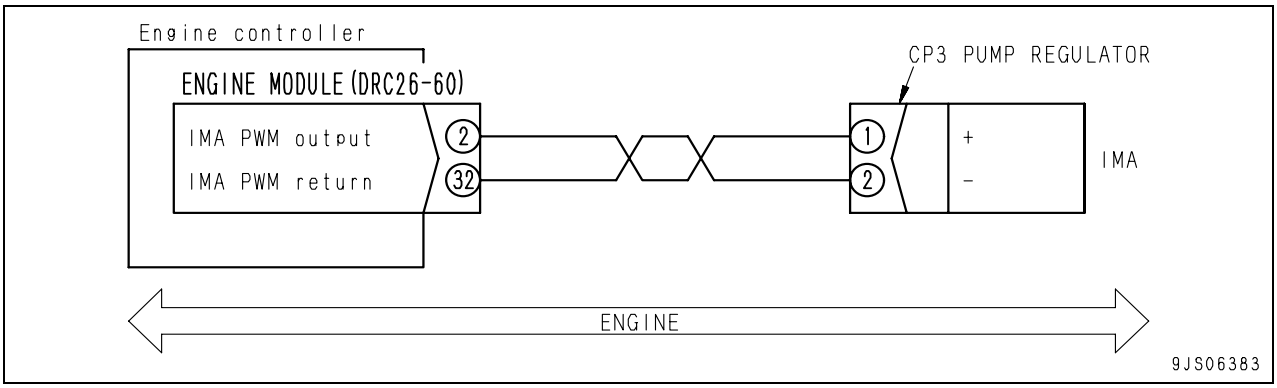


Failure code [CA272] (PCV1 Disconnection)

Action code	Failure code	Trouble	IMV/PCV1 Disconnection (Engine controller system)
E03	**CA272**		
Contents of trouble	• There is disconnection in supply pump actuator drive circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine speed runs, but in unstable condition. • Common rail fuel pressure is above command value.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective supply pump actuator	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CP3 PUMP REGULATOR (male)	Resistance	
			Between (1) and (2)	Max. 5 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENGINE MODULE (female) (2) – CP3PUMP REGULATOR (female) (1)	Resistance	Max. 10 Ω
			Wiring harness between ENGINE MODULE (female) (32) – CP3 PUMP REGULATOR (female) (2)	Resistance	Max. 10 Ω
	3	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 ENGINE MODULE (female) (2) – CP3 PUMP REGULATOR (female) (1) and chassis ground	Voltage	Max. 3 V
	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 among all pins between ENGINE MODULE (female) (2) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts among supply pump actuator, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	6	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ENGINE MODULE (female)	Resistance	
			Between (2) and (32)	Max. 5 Ω	

Circuit diagram related to supply pump actuator (metering unit)

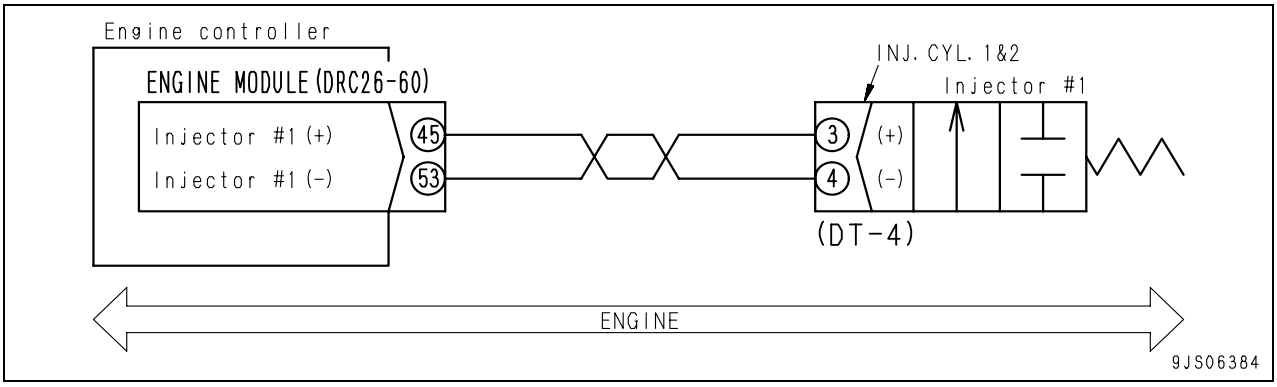


Failure code [CA322] (Injector #1 (L/B #1) open/short error)

Action code	Failure code	Trouble	Injector #1 (L/B #1) open/short error (Engine controller system)
E03	**CA322**		
Contents of trouble	• There is disconnection or short circuit in drive circuit of injector No. 1.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• There is irregular combustion or hunting. • Engine output drops.		
Related information	• Method of reproducing failure code: Start engine		

<table>
<tr><td rowspan="19">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective injector No. 1</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">INJ CYL 1 & 2 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (3) and (4)</td><td colspan="2">Max. 2 Ω</td></tr>
<tr><td colspan="2">Between (3) and chassis ground</td><td colspan="2">Min. 100 kΩ</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Disconnection in wiring harness (Disconnection or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>Wiring harness between ENGINE MODULE (female) (45) – INJ CYL 1 & 2 (female) (3)</td><td>Resistance</td><td>Max. 2 Ω</td></tr>
<tr><td>Wiring harness between ENGINE MODULE (female) (53) – INJ CYL 1 & 2 (female) (4)</td><td>Resistance</td><td>Max. 2 Ω</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Ground 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>Wiring harness between ENGINE MODULE (female) (45) – INJ CYL 1 & 2 (female) (3) and chassis ground</td><td>Resistance</td><td>Max. 2 Ω</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Short circuit in wiring harness (with another wiring harness)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>Wiring harness among all pins between ENGINE MODULE (female) (45) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)</td><td>Resistance</td><td>Min. 100 kΩ</td></tr>
<tr><td>Wiring harness among all pins between ENGINE MODULE (female) (53) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)</td><td>Resistance</td><td>Min. 100 kΩ</td></tr>
<tr><td>5</td><td>Defective wiring harness connector</td><td colspan="4">Connecting parts among injector No. 1, engine wiring harness, and engine controller are suspected. Inspect them directly.
• Loose connector, broken lock, broken seal
• Corrosive, bent, broken, forced-in, or extended pin
• Humidity in connector, entry of dirt or dust, poor insulation</td></tr>
<tr><td>6</td><td>Defective other cylinder injector or harness</td><td colspan="4">If other failure codes are indicated simultaneously, carry out troubleshooting for them.</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Defective engine controller</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">ENGINE MODULE (female)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (45) and (53)</td><td colspan="2">Max. 2 Ω</td></tr>
<tr><td colspan="2">Between (45) and chassis ground</td><td colspan="2">Min. 100 kΩ</td></tr>
</table>

Circuit diagram related to injector No. 1

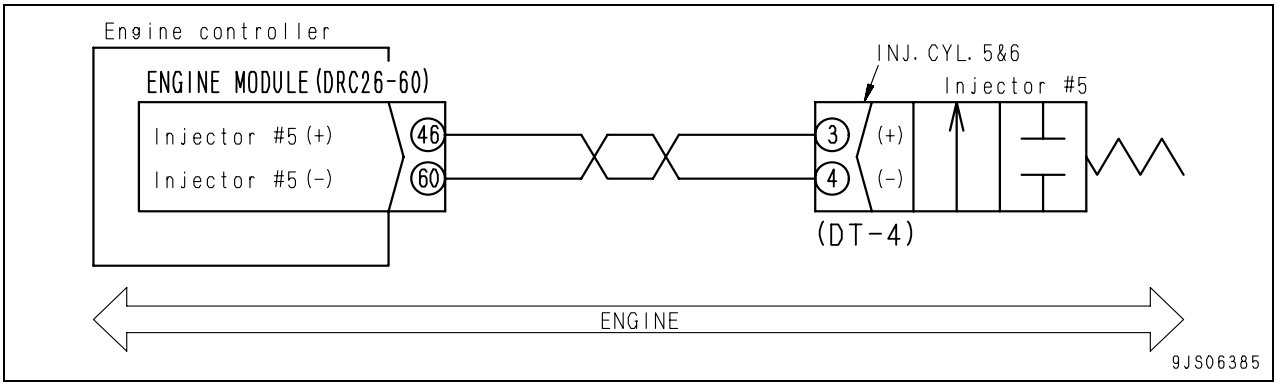


Failure code [CA323] (Injector #5 (L/B #5) open/short error)

Action code	Failure code	Trouble	Injector #5 (L/B #5) open/short error (Engine controller system)
E03	**CA323**		
Contents of trouble	• There is disconnection or short circuit in drive circuit of injector No. 5.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• There is irregular combustion or hunting. • Engine output drops.		
Related information	• Method of reproducing failure code: Start engine		

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective injector No. 5</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">INJ CYL 5 & 6 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (3) and (4)</td><td colspan="2">Max. 2 Ω</td></tr>
<tr><td colspan="2">Between (3) and chassis ground</td><td colspan="2">Min. 100 kΩ</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Disconnection in wiring harness (Disconnection or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>Wiring harness between ENGINE MODULE (female) (46) – INJ CYL 5 & 6 (female) (3)</td><td>Resistance</td><td>Max. 2 Ω</td></tr>
<tr><td>Wiring harness between ENGINE MODULE (female) (60) – INJ CYL 5 & 6 (female) (4)</td><td>Resistance</td><td>Max. 2 Ω</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Ground 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>Wiring harness between ENGINE MODULE (female) (46) – INJ CYL 5 & 6 (female) (3) and chassis ground</td><td>Resistance</td><td>Max. 2 Ω</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Short circuit in wiring harness (with another wiring harness)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>Wiring harness among all pins between ENGINE MODULE (female) (46) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)</td><td>Resistance</td><td>Min. 100 kΩ</td></tr>
<tr><td>Wiring harness among all pins between ENGINE MODULE (female) (60) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)</td><td>Resistance</td><td>Min. 100 kΩ</td></tr>
<tr><td>5</td><td>Defective wiring harness connector</td><td colspan="4">Connecting parts among injector No. 5, engine wiring harness, and engine controller are suspected. Inspect them directly.
• Loose connector, broken lock, broken seal
• Corrosive, bent, broken, forced-in, or extended pin
• Humidity in connector, entry of dirt or dust, poor insulation</td></tr>
<tr><td>6</td><td>Defective other cylinder injector or harness</td><td colspan="4">If other failure codes are indicated simultaneously, carry out troubleshooting for them.</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Defective engine controller</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">ENGINE MODULE (female)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (46) and (60)</td><td colspan="2">Max. 2 Ω</td></tr>
<tr><td colspan="2">Between (46) and chassis ground</td><td colspan="2">Min. 100 kΩ</td></tr>
</table>

Circuit diagram related to injector No. 5

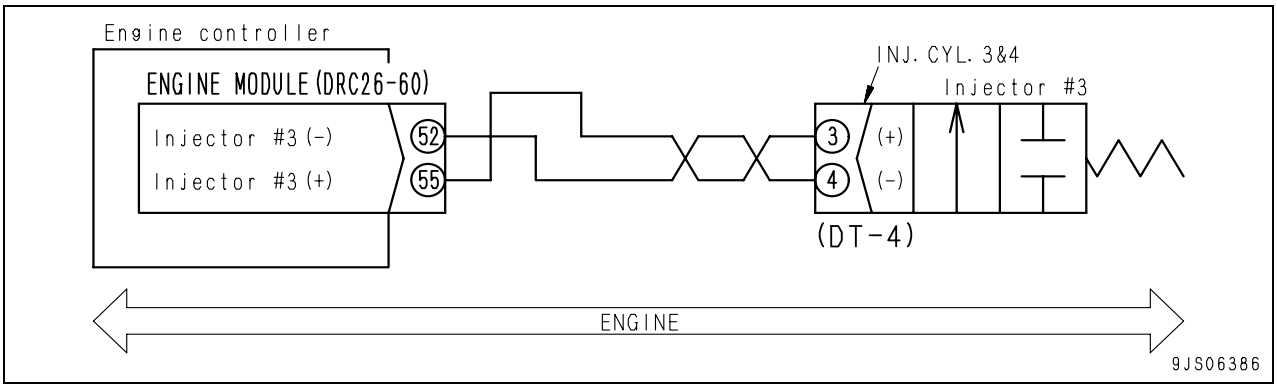


Failure code [CA324] (Injector #3 (L/B #3) open/short error)

Action code	Failure code	Trouble	Injector #3 (L/B #3) open/short error (Engine controller system)
E03	**CA324**		
Contents of trouble	• There is disconnection or short circuit in drive circuit of injector No. 3.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• There is irregular combustion or hunting. • Engine output drops.		
Related information	• Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state						
	1	Defective injector No. 3	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ CYL 3 & 4 (male)	Resistance		
			Between (3) and (4)	Max. 2 Ω		
			Between (3) and chassis ground	Min. 100 kΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENGINE MODULE (female) (52) – INJ CYL 3 (female) (4)	Resistance	Max. 2 Ω	
			Wiring harness between ENGINE MODULE (female) (55) – INJ CYL 3 & 4 (female) (3)	Resistance	Max. 2 Ω	
	3	Ground 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 ENGINE MODULE (female) (55) – INJ CYL 3 & 4 (female) (3) and chassis ground	Resistance	Max. 2 Ω	
	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 among all pins between ENGINE MODULE (female) (55) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ	
			Wiring harness among all pins between ENGINE MODULE (female) (52) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ	
	5	Defective wiring harness connector	Connecting parts among injector No. 3, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective other cylinder injector or harness	If other failure codes are indicated simultaneously, carry out troubleshooting for them.			
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENGINE MODULE (female)	Resistance		
			Between (55) and (52)	Max. 2 Ω		
			Between (55) and chassis ground	Min. 100 kΩ		

Circuit diagram related to injector No. 3

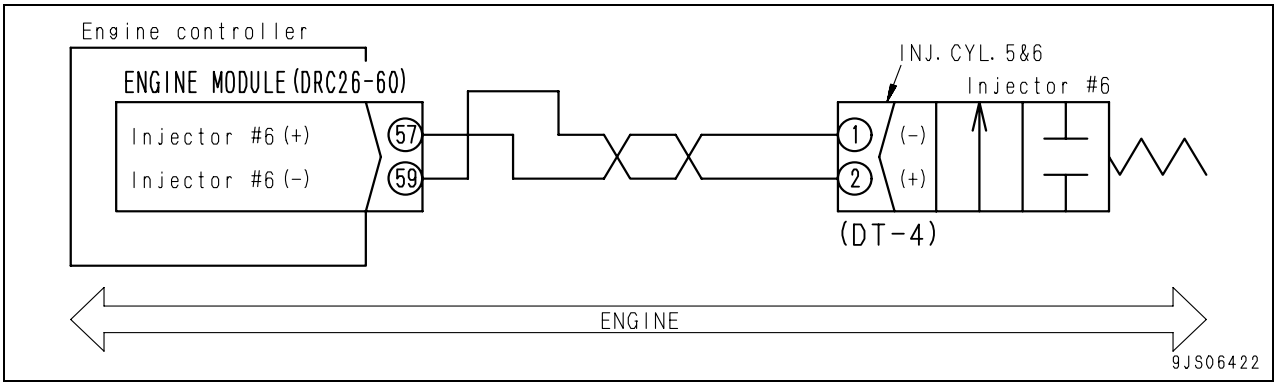


Failure code [CA325] (Injector #6 (L/B #6) open/short error)

Action code	Failure code	Trouble	Injector #6 (L/B #6) open/short error (Engine controller system)
E03	**CA325**		
Contents of trouble	• There is disconnection or short circuit in drive circuit of injector No. 6.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• There is irregular combustion or hunting. • Engine output drops.		
Related information	• Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector No. 6	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ CYL 5 & 6 (male)	Resistance		
			Between (1) and (2)	Max. 2 Ω		
			Between (1) and chassis ground	Min. 100 kΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENGINE MODULE (female) (57) – INJ CYL 5 & 6 (female) (2)	Resistance	Max. 2 Ω	
			Wiring harness between ENGINE MODULE (female) (59) – INJ CYL 5 & 6 (female) (1)	Resistance	Max. 2 Ω	
	3	Ground 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 ENGINE MODULE (female) (57) – INJ CYL 5 & 6 (female) (2) and chassis ground	Resistance	Max. 2 Ω	
	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 among all pins between ENGINE MODULE (female) (57) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ	
			Wiring harness among all pins between ENGINE MODULE (female) (59) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ	
	5	Defective wiring harness connector	Connecting parts among injector No. 6, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective other cylinder injector or harness	If other failure codes are indicated simultaneously, carry out troubleshooting for them.			
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENGINE MODULE (female)	Resistance		
			Between (57) and (59)	Max. 2 Ω		
			Between (57) and chassis ground	Min. 100 kΩ		

Circuit diagram related to injector No. 6

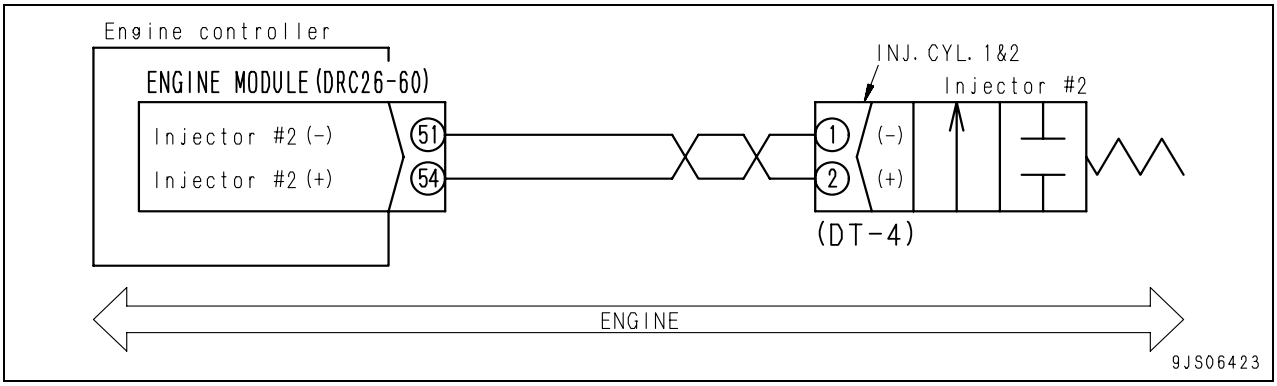


Failure code [CA331] (Injector #2 (L/B #2) open/short error)

Action code	Failure code	Trouble	Injector #2 (L/B #2) open/short error (Engine controller system)
E03	**CA331**		
Contents of trouble	• There is disconnection or short circuit in drive circuit of injector No. 2.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• There is irregular combustion or hunting. • Engine output drops.		
Related information	• Method of reproducing failure code: Start engine		

<table>
<tr><td rowspan="16">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective injector No. 2</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">INJ CYL 1 & 2 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td colspan="2">Max. 2 Ω</td></tr>
<tr><td colspan="2">Between (1) and chassis ground</td><td colspan="2">Min. 100 kΩ</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Disconnection in wiring harness (Disconnection or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>Wiring harness between ENGINE MODULE (female) (54) – INJ CYL 1 & 2 (female) (2)</td><td>Resistance</td><td>Max. 2 Ω</td></tr>
<tr><td>Wiring harness between ENGINE MODULE (female) (51) – INJ CYL 2 (female) (1)</td><td>Resistance</td><td>Max. 2 Ω</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Ground 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>Wiring harness between ENGINE MODULE (female) (54) – INJ CYL 1 & 2 (female) (2) and chassis ground</td><td>Resistance</td><td>Max. 2 Ω</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Short circuit in wiring harness (with another wiring harness)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>Wiring harness among all pins between ENGINE MODULE (female) (54) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)</td><td>Resistance</td><td>Min. 100 kΩ</td></tr>
<tr><td>Wiring harness among all pins between ENGINE MODULE (female) (51) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)</td><td>Resistance</td><td>Min. 100 kΩ</td></tr>
<tr><td>5</td><td>Defective wiring harness connector</td><td colspan="4">Connecting parts among injector No. 2, engine wiring harness, and engine controller are suspected. Inspect them directly.
• Loose connector, broken lock, broken seal
• Corrosive, bent, broken, forced-in, or extended pin
• Humidity in connector, entry of dirt or dust, poor insulation</td></tr>
<tr><td>6</td><td>Defective other cylinder injector or harness</td><td colspan="4">If other failure codes are indicated simultaneously, carry out troubleshooting for them.</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Defective engine controller</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">ENGINE MODULE (female)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (54) and (51)</td><td colspan="2">Max. 2 Ω</td></tr>
<tr><td colspan="2">Between (54) and chassis ground</td><td colspan="2">Min. 100 kΩ</td></tr>
</table>

Circuit diagram related to injector No. 2

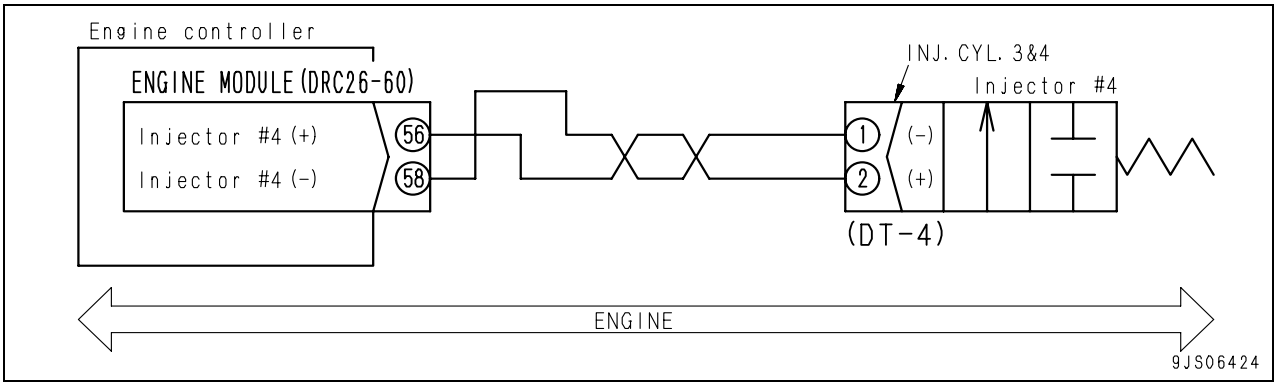


Failure code [CA332] (Injector #4 (L/B #4) open/short error)

Action code	Failure code	Trouble	Injector #4 (L/B #4) open/short error (Engine controller system)
E03	**CA332**		
Contents of trouble	• There is disconnection or short circuit in drive circuit of injector No. 4.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• There is irregular combustion or hunting. • Engine output drops.		
Related information	• Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector No. 4	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ CYL 3&4 (male)	Resistance		
			Between (1) and (2)	Max. 2 Ω		
			Between (1) and chassis ground	Min. 100 kΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ENGINE MODULE (female) (56) – INJ CYL 3 & 4 (female) (2)	Resistance	Max. 2 Ω	
			Wiring harness between ENGINE MODULE (female) (58) – INJ CYL 3 & 4 (female) (1)	Resistance	Max. 2 Ω	
	3	Ground 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 ENGINE MODULE (female) (56) – INJ CYL 3 & 4 (female) (2) and chassis ground	Resistance	Max. 2 Ω	
	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 among all pins between ENGINE MODULE (female) (56) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ	
			Wiring harness among all pins between ENGINE MODULE (female) (58) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ	
	5	Defective wiring harness connector	Connecting parts among injector No. 4, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective other cylinder injector or harness	If other failure codes are indicated simultaneously, carry out troubleshooting for them.			
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ENGINE MODULE (female)	Resistance		
			Between (56) and (58)	Max. 2 Ω		
			Between (56) and chassis ground	Min. 100 kΩ		

Circuit diagram related to injector No. 4



Failure code [CA342] (Calibration code inconsistency)

Action code	Failure code	Trouble	Calibration code inconsistency (Engine controller system)
E03	**CA342**		
Contents of trouble	• Matching error occurred in engine controller data.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Continues the normal operation. • Engine stops or does not start.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

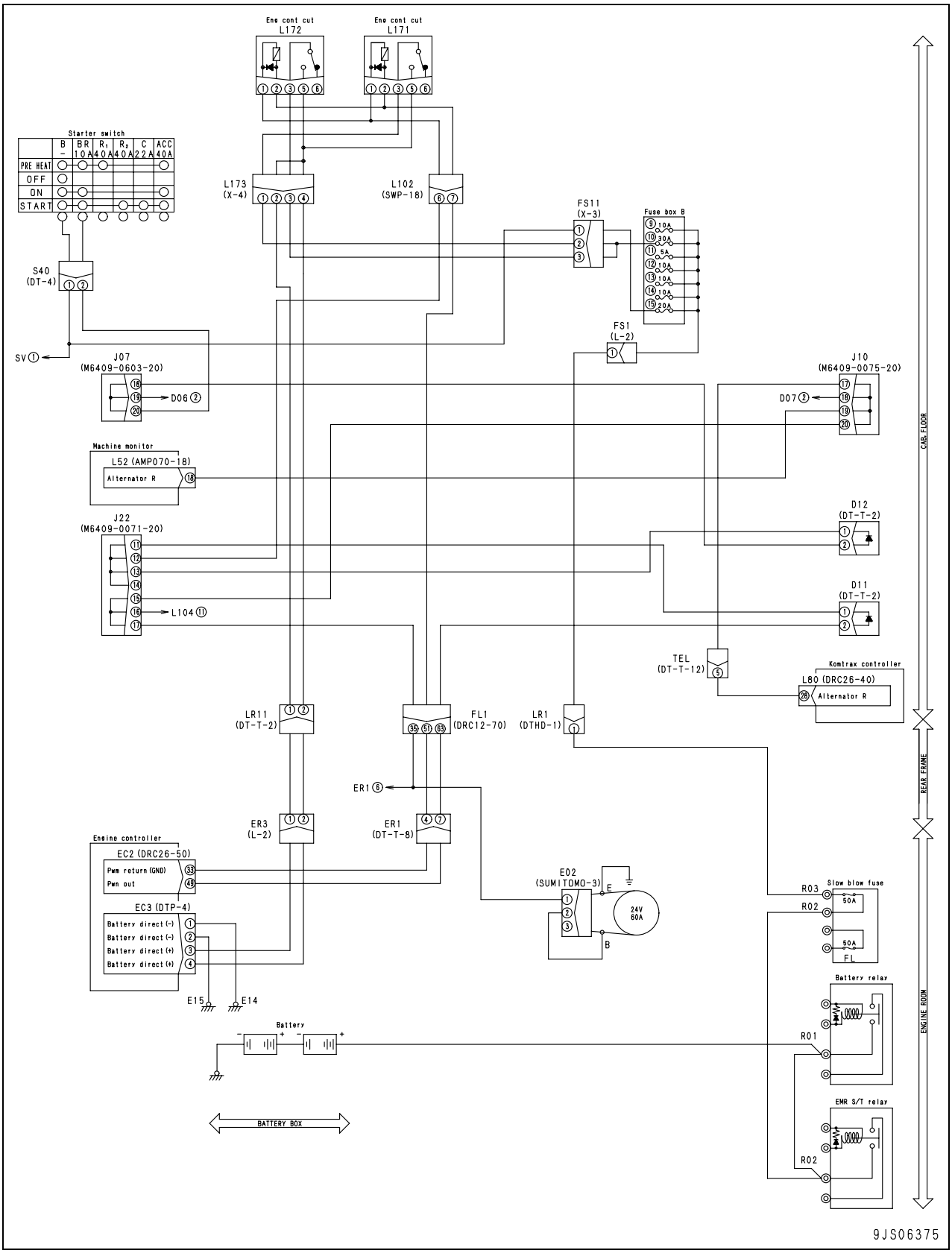
Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting
	1	Defect in related system	If another code is displayed, carry out troubleshooting for it.
	2	Defective engine controller	Possible defect in engine controller (Troubleshooting cannot be carried out.)

Failure code [CA351] (Injectors drive circuit error)

Action code	Failure code	Trouble	Injectors drive circuit error (Engine controller system)
E03	**CA351**		
Contents of trouble	• Abnormality occurred in injector drive power supply 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	• Exhaust smoke is black. • There is irregular combustion. • Engine output drops. • The engine does not start.		
Related information	• Method of reproducing failure code: Start engine		

	Causes		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 fuse No. 10 of fuse box B	If the fuse is broken, the circuit probably has a grounding fault, etc.		
	3	Defective engine control cut-out relay (L171) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L171 (Male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			When engine control cut-out relay (L171) is replaced with a relay of the same type, if the condition becomes normal, the engine control cut-out relay 1 is defective.		
	4	Defective engine control cut-out relay (L172) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L172 (male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			When engine control cut-out relay (L172) is replaced with a relay of the same type, if the condition becomes normal, the engine control cut-out relay 2 is defective.		
	5	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 10 of fuse box B – L171, L172 (female) (3)	Resistance	Max. 0.5 Ω
			Wiring harness between L171 (female) (5), L172 (female) (5) – EC3 (female) (3), (4)	Resistance	Max. 0.5 Ω
			Wiring harness between EC3 (female) (1), (2) – chassis ground	Resistance	Max. 10 Ω
	6	Defective engine controller	If causes 1 – 5 are not detected, engine controller may be defective. (Since trouble is in the system, troubleshooting cannot be carried out.)		

Circuit diagram related to engine controller power supply

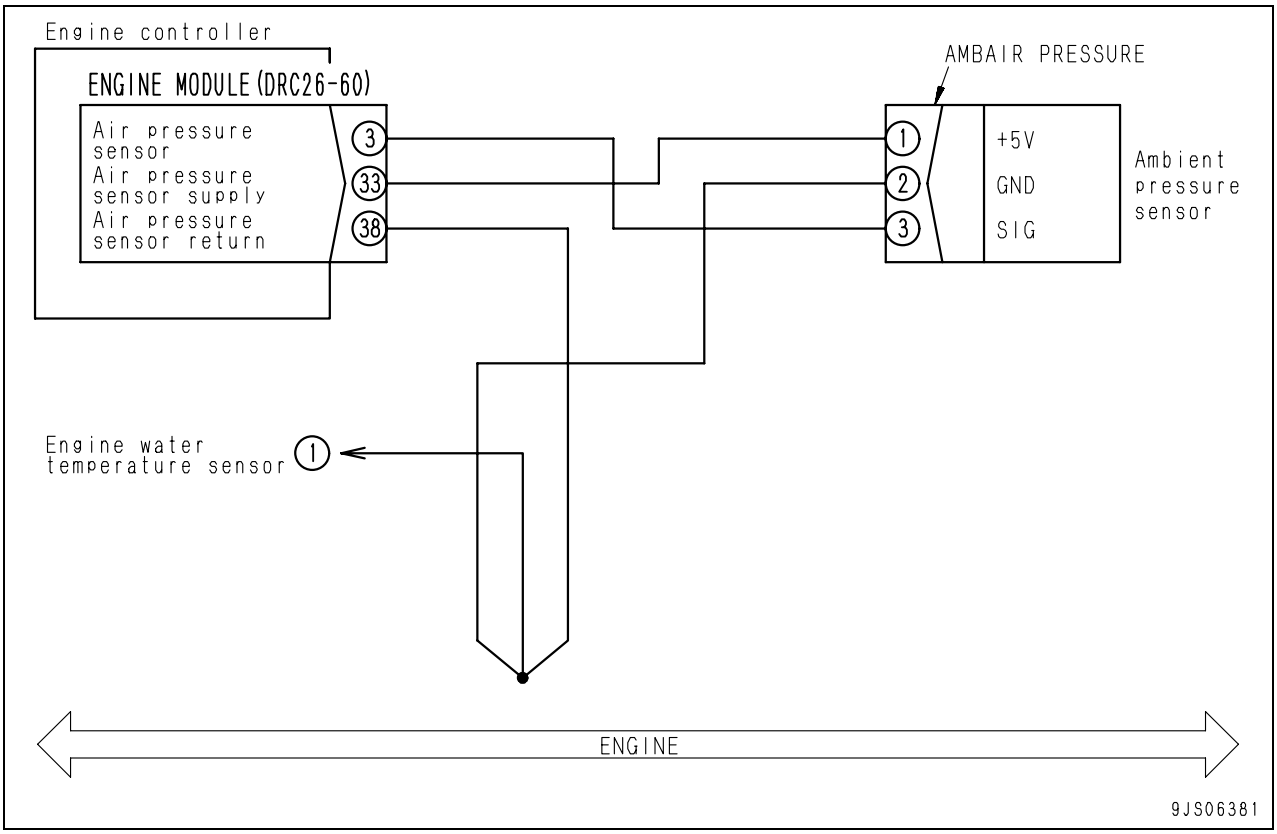


Failure code [CA352] (Sensor power supply 1 low error)

Action code	Failure code	Trouble	Sensor power supply 1 low error (Engine controller system)
E03	**CA352**		
Contents of trouble	• Low voltage is detected in sensor power supply 1 (5V) circuit.		
Action of controller	• Fixes atmospheric pressure and continues operation. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Starting performance is poor. • Engine output drops.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

<table>
<tr><td rowspan="4">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Defective sensor or wiring harness</td><td colspan="3">★ Disconnect connector with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td rowspan="2">Disconnect devices at right in order. If failure code disappears after reproduction operation is conducted, that device or wiring harness has a defect in it.</td><td>Atmospheric pressure sensor</td><td>AMBAIR PRESURE</td></tr>
<tr><td>Engine wiring harness</td><td>ENGINE MODULE</td></tr>
<tr><td>2</td><td>Defective wiring harness connector</td><td colspan="3">Connecting parts among atmospheric pressure sensor, engine wiring harness, and engine controller are suspected. Inspect them directly.
• Loose connector, broken lock, broken seal
• Corrosive, bent, broken, forced-in, or extended pin
• Humidity in connector, entry of dirt or dust, poor insulation</td></tr>
<tr><td>3</td><td>Defective engine controller</td><td colspan="3">If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)</td></tr>
</table>

Circuit diagram related to sensor power supply 1

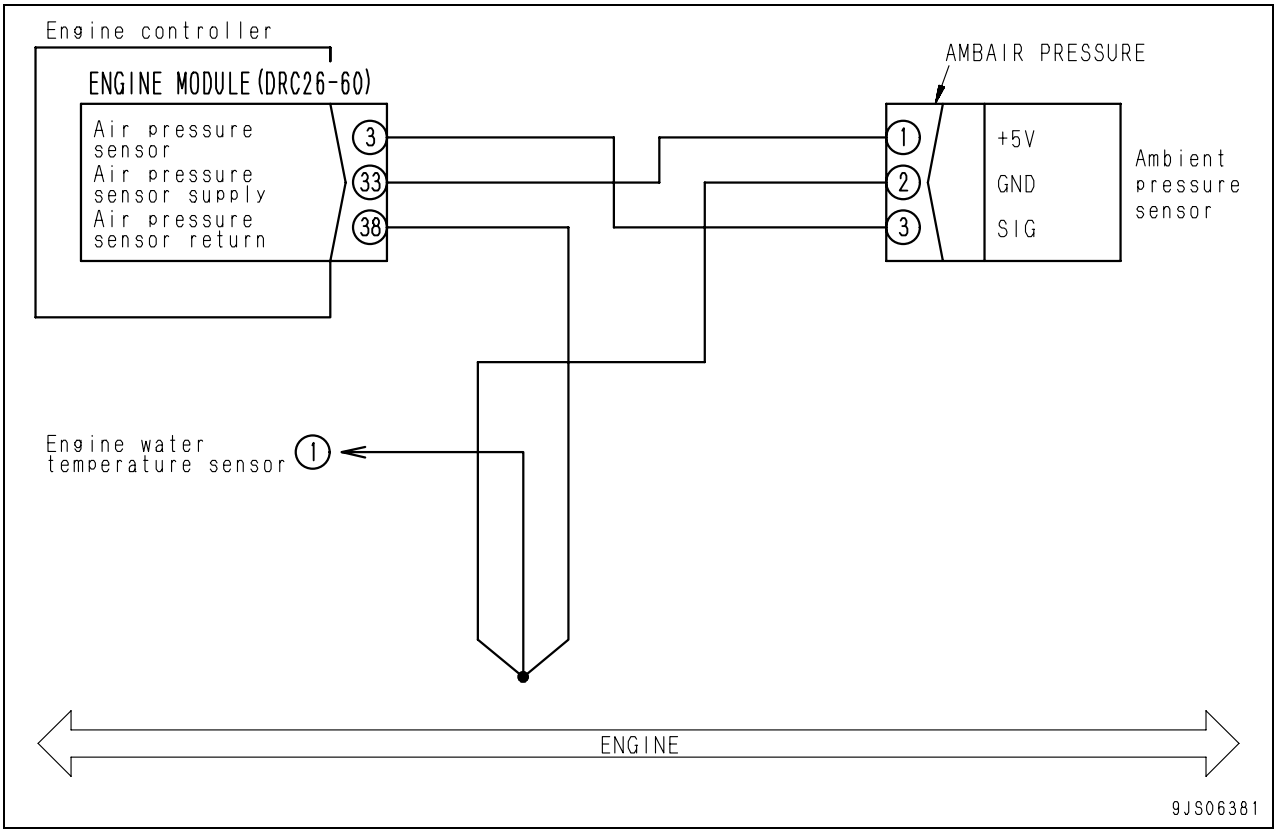


Failure code [CA386] (Sensor power supply 1 high error)

Action code	Failure code	Trouble	Sensor power supply 1 high error (Engine controller system)
E03	**CA386**		
Contents of trouble	• High voltage is detected in sensor power supply 1 (5V) circuit.		
Action of controller	• Fixes atmospheric pressure and continues operation. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Starting performance is poor. • Engine output drops.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective wiring harness connector	Connecting parts among atmospheric pressure sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation
	2	Defective engine controller	If cause 1 is not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Circuit diagram related to sensor power supply 1

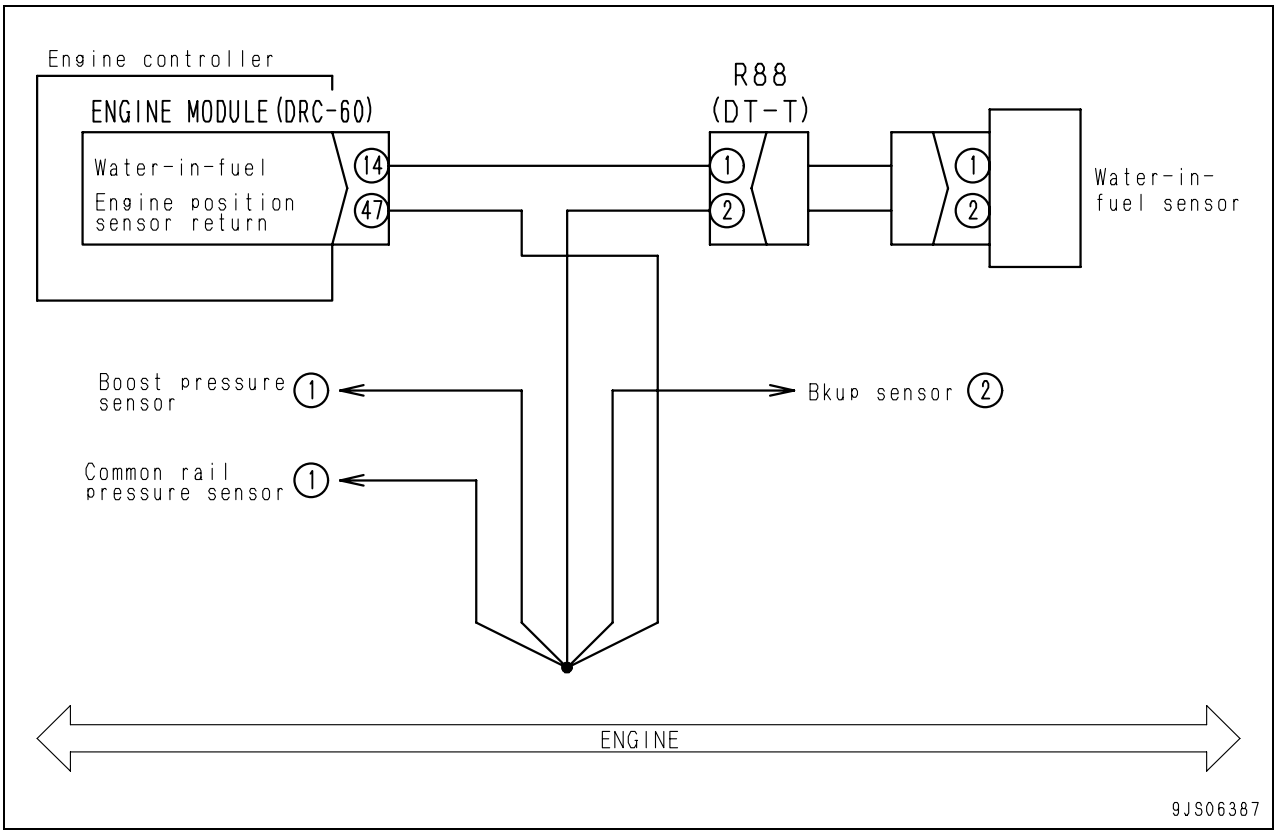


Failure code [CA428] (Abnormally high level in water sensor)

Action code	Failure code	Trouble	Abnormally high level in water sensor (Engine controller system)
E01	**CA428**		
Contents of trouble	• High voltage occurred in fuel water sensor		
Action of controller	• None in particular.		
Problem that appears on machine	• Water separator monitor does not indicate normally.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuel water sensor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R88 (female)	Resistance	
			Between (1) and (2)	Max. 10 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENGINE MODULE (female) (14) – R88 (male) (1)	Resistance	Max. 10 Ω
			Wiring harness between ENGINE MODULE (female) (47) – R88 (male) (2)	Resistance	Max. 10 Ω
	3	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 among all pins between ENGINE MODULE (female) (14) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts among fuel water sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ENGINE MODULE (female)	Resistance	
			Between (14) and (47)	Max. 10 Ω	

Circuit diagram related to fuel water sensor

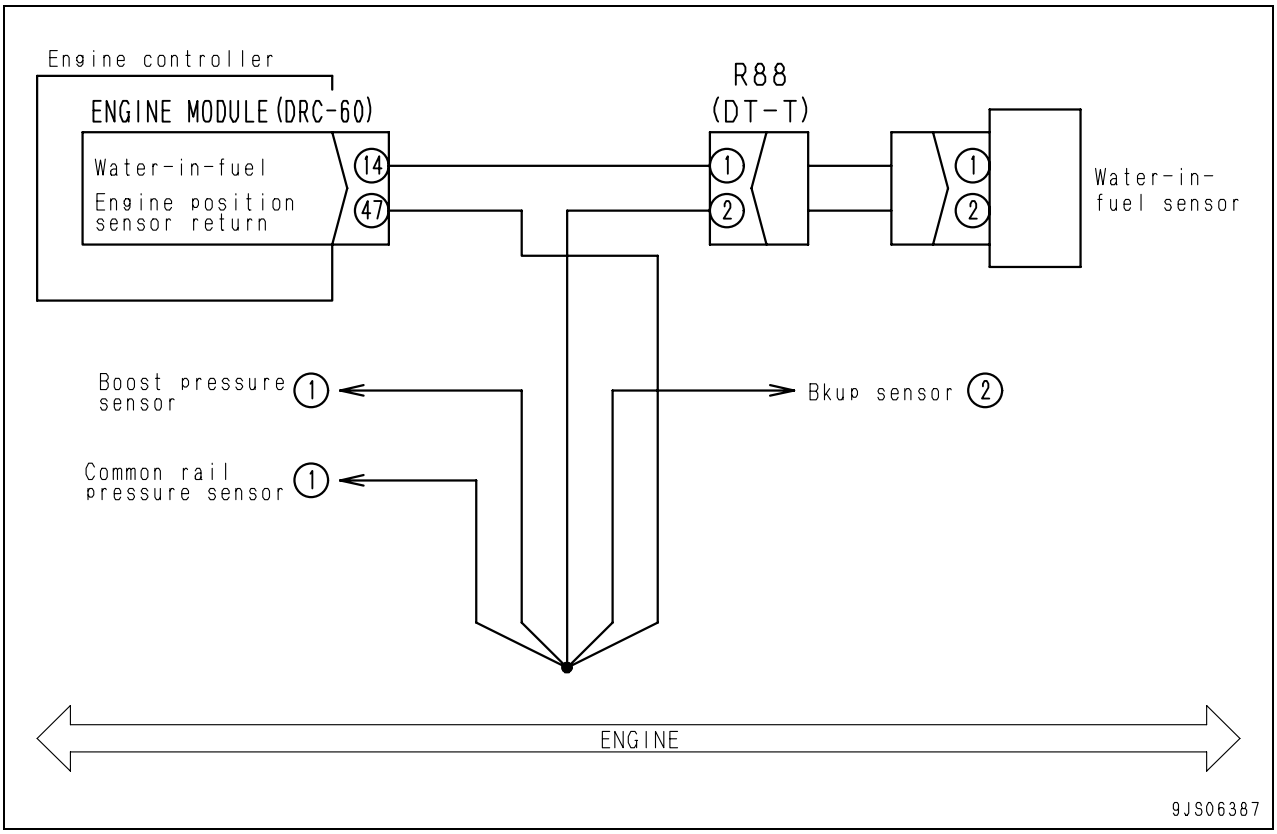


Failure code [CA429] (Abnormally low level in water sensor)

Action code	Failure code	Trouble	Abnormally low level in water sensor (Engine controller system)
E01	**CA429**		
Contents of trouble	• Low voltage occurred in fuel water sensor		
Action of controller	• None in particular.		
Problem that appears on machine	• Water separator monitor does not indicate normally.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuel water sensor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R88 (female)	Resistance	
			Between (1) and (2)	Max. 10 Ω	
			Between (1) and chassis ground	Min. 100 kΩ	
	2	Ground 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 ENGINE MODULE (female) (14) – R88 (male) (1) and chassis ground	Resistance	Min. 100 kΩ
	3	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 among all pins between ENGINE MODULE (female) (14) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts among fuel water sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ENGINE MODULE (female)	Resistance	
			Between (14) and (47)	Max. 10 Ω	
			Between (14) and chassis ground	Min. 100 kΩ	

Circuit diagram related to fuel water sensor



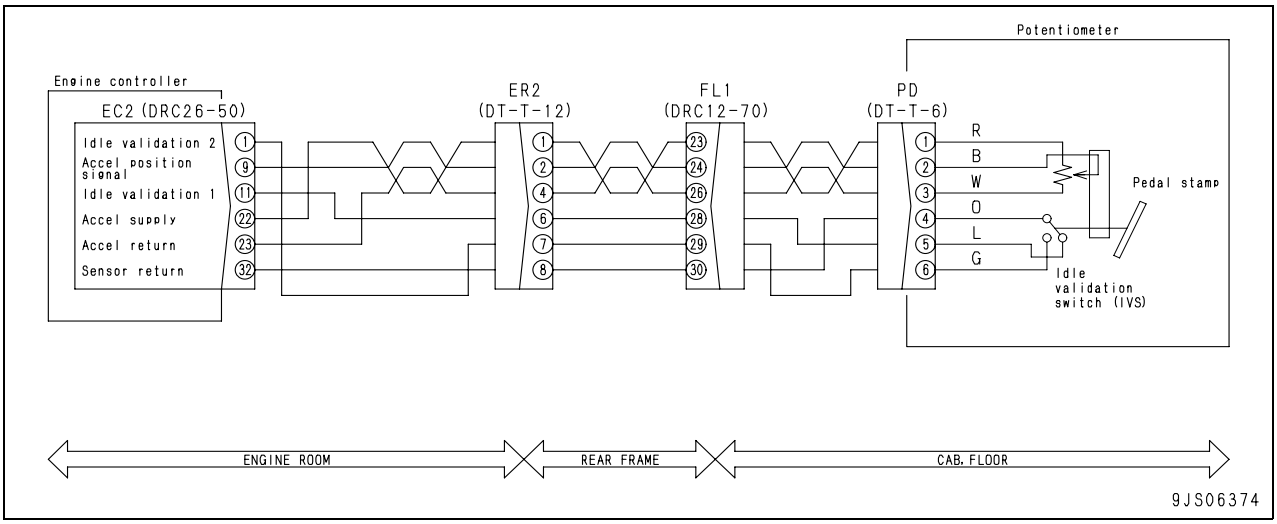
Failure code [CA431] (Idle validation switch error)

Action code	Failure code	Trouble	Idle validation switch error (Engine controller system)
E01	**CA431**		
Contents of trouble	• Abnormality occurred 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, IVS 1). • The input state (ON/OFF) from the idle validation switch 2 can be checked with the monitoring function (Code: 18301, IVS 2). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective accelerator pedal (Internal trouble)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			PD	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 for another cause of trouble before judgment			
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between EC2 (female) (11) – PD (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between EC2 (female) (1) – PD (female) (6)		Resistance	Max. 1 Ω
			Wiring harness between EC2 (female) (32) – PD (female) (4)		Resistance	Max. 1 Ω
	3	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 among all pins between EC2 (female) (11) – EC2 (female) (PD, too, is disconnected.)		Resistance	Min. 100 kΩ
			Wiring harness among all pins between EC2 (female) (1) – EC2 (female) (PD, too, is disconnected.)		Resistance	Min. 100 kΩ
			Between EC2 (female) (11) – EC3 (female) (3) (PD, too, is disconnected.)		Resistance	Min. 100 kΩ
			Between EC2 (female) (1) – EC3 (female) (3) (PD, too, is disconnected.)		Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts among accelerator pedal, engine unit wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			EC2 (female)	Signal name	Voltage
			Between (11) and (32)	Signal 1	See Fig. 1
			Between (1) and (32)	Signal 2	

Circuit diagram related to accelerator pedal



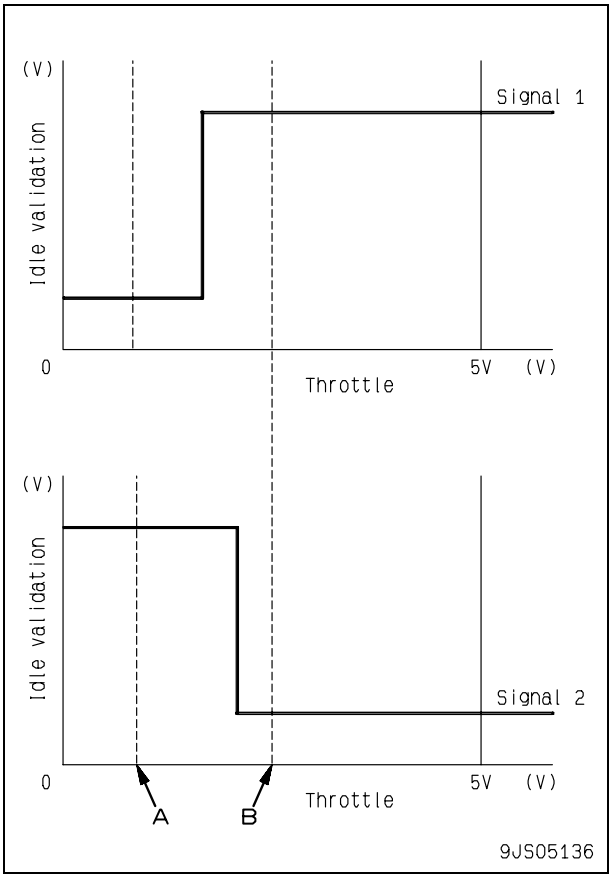


Fig. 1
Throttle: Throttle sensor signal voltage
Idle validation: Idle validation switch signal voltage
A: Voltage when pedal opened + 0.03 x (Voltage when pedal pressed – Voltage when pedal opened)
B: Voltage when pedal opened + 0.1 x (Voltage when pedal pressed – Voltage when pedal opened)

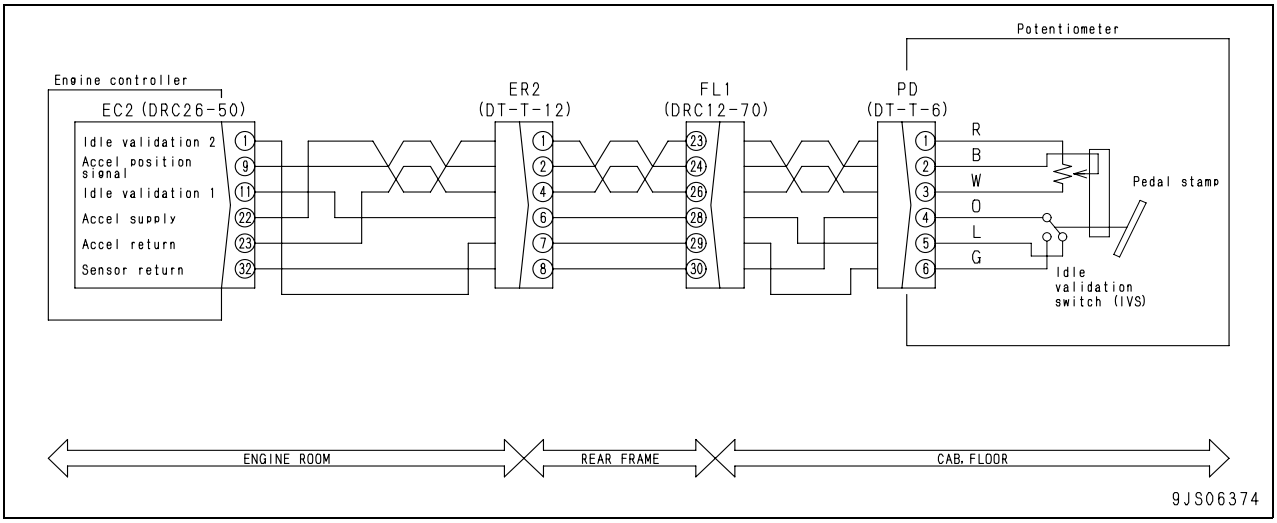
Failure code [CA432] (Idle validation action error)

Action code	Failure code	Trouble	Idle validation action error (Engine controller system)
E03	**CA432**		
Contents of trouble	• Signals from the idle validation switch and throttle sensor do not agree (they are contradictory)		
Action of controller	1. When the idle validation switch recognized the accelerator pedal is OFF and the throttle sensor, on the contrary, recognized the accelerator pedal is ON: Control the opening ratio of the throttle to 0% after the accelerator pedal is OFF and then control the opening ratio of the throttle to 50% while after the accelerator pedal is ON. 2. When the idle validation switch recognized the accelerator pedal is ON and the throttle sensor, on the contrary, recognized the accelerator pedal is OFF: Control the opening ratio of the throttle to 0% (fix to the low idling). • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine speed does not rise from low idle.		
Related information	• The input state (ON/OFF) from the idle validation switch 1 can be checked with the monitoring function (Code: 18300, IVS 1). • The input state (ON/OFF) from the idle validation switch 2 can be checked with the monitoring function (Code: 18301, IVS 2). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective accelerator pedal	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			PD	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 for another cause of trouble before judgment			
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between EC2 (female) (22) – PD (female) (1)		Resistance	Max. 10 Ω
			Wiring harness between EC2 (female) (9) – PD (female) (2)		Resistance	Max. 10 Ω
	3	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 among all pins between EC2 (female) (22) – EC2 (female) (PD, too, is disconnected.)		Resistance	Min. 100 kΩ
			Wiring harness among all pins between EC2 (female) (9) – EC2 (female) (PD, too, is disconnected.)		Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts among accelerator pedal, engine unit wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			EC2 (female)	Accelelator pedal	Voltage
			Between (11) and (32)	Signal 1	See Fig. 1
			Between (1) and (32)	Signal 2	

Circuit diagram related to accelerator pedal



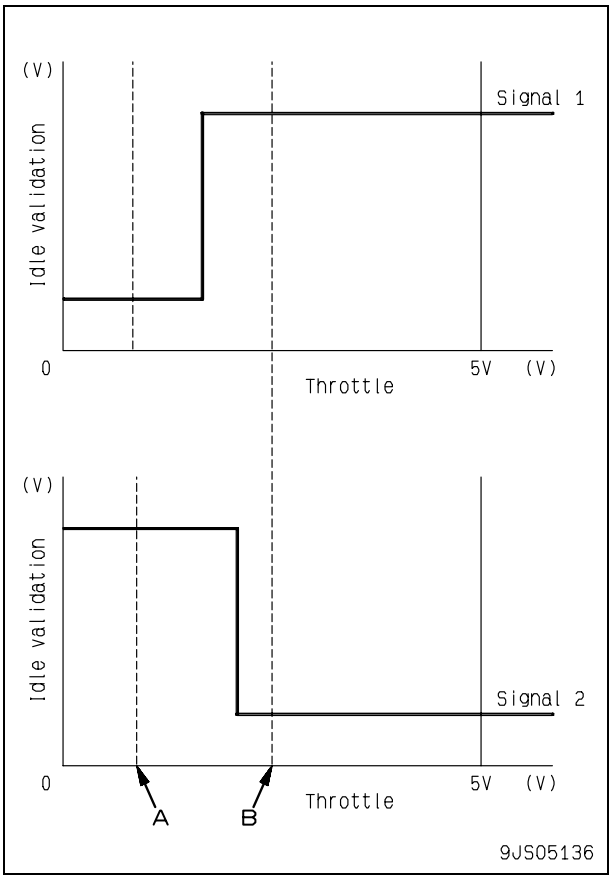


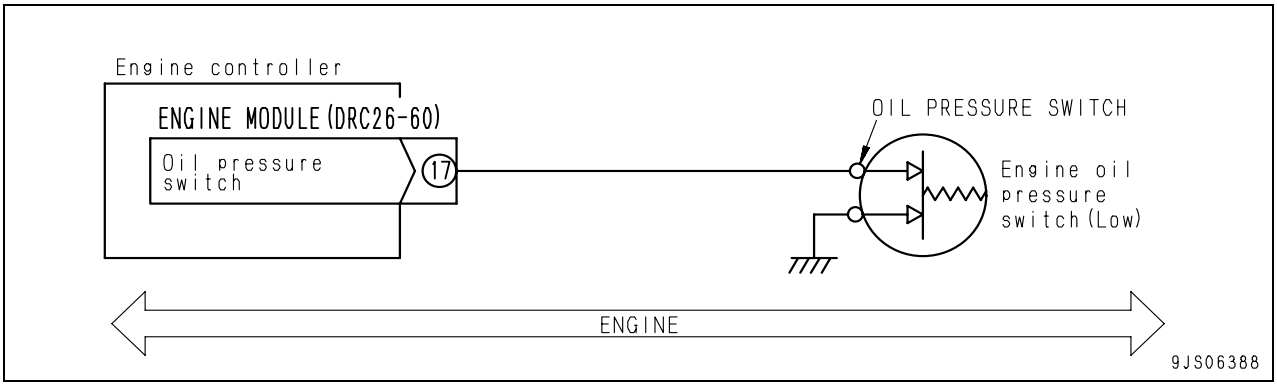
Fig. 1
Throttle: Throttle sensor signal voltage
Idle validation: Idle validation switch signal voltage
A: Voltage when pedal opened + 0.03 x (Voltage when pedal pressed – Voltage when pedal opened)
B: Voltage when pedal opened + 0.1 x (Voltage when pedal pressed – Voltage when pedal opened)

Failure code [CA435] (Engine oil pressure switch error)

Action code	Failure code	Trouble	Engine oil pressure switch error (Engine controller system)
E01	**CA435**		
Contents of trouble	• Abnormality occurred in engine oil pressure switch signal circuit.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine oil switch-based engine protection function does not function. • Engine oil pressure monitor does not indicate normally.		
Related information	• Method of reproducing failure code: Starting switch ON or start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective engine oil pressure switch	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			OIL PRESURE SWITCH (male)	Resistance	
			Between (1) and body	Max. 10 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENGINE MODULE (female) (17) – OIL PRESURE SWITCH (female) (1)	Resistance	Max. 10 Ω
	3	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 among all pins between ENGINE MODULE (female) (17) – ENGINE MODULE (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts among engine oil pressure switch, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ENGINE MODULE (female)	Resistance	
			Between (17) and chassis ground	Max. 10 Ω	

Circuit diagram related to engine oil pressure switch



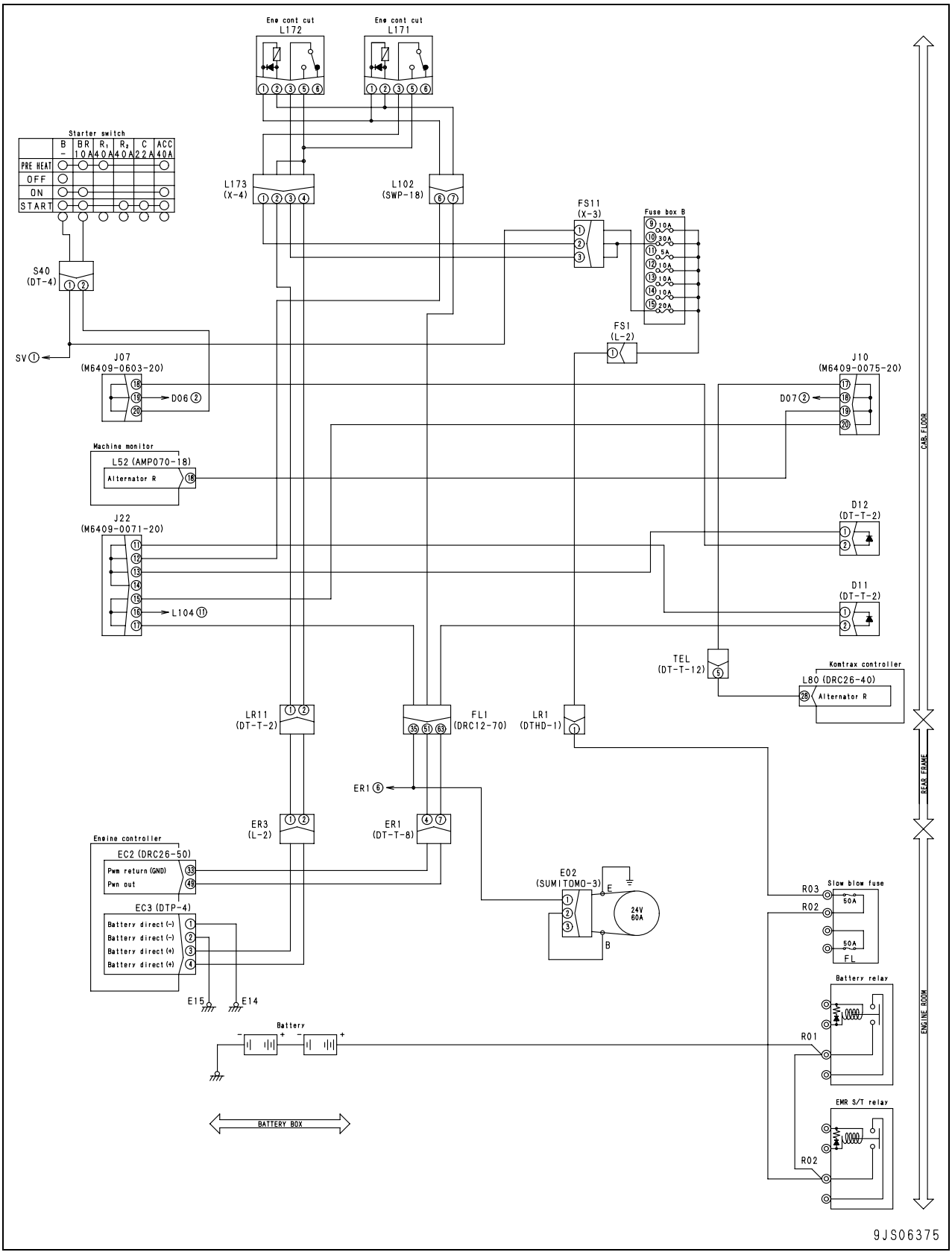
Failure code [CA441] (Battery voltage low error)

Action code	Failure code	Trouble	Battery voltage low error (Engine controller system)
E03	**CA441**		
Contents of trouble	• Low voltage (Max. 6 V) occurred in controller power supply voltage circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine stops • Starting performance is poor		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Loose, corroded battery terminal	Inspect battery terminal directly for loose and corrosion.		
	2	Defective battery voltage	★ Prepare with starting switch OFF, then turn starting switch OFF and START and carry out troubleshooting.		
			Battery (1 piece)	Starting switch	Voltage
			Between (+) and (–) terminals	OFF	Min. 12 V
				START	Min. 6.2 V
	3	Defective fuse No. 10 of fuse box B	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 6.)		
	4	Defective engine control cut-out relay (L171) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L171 (Male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			When engine control cut-out relay (L171) is replaced with a relay of the same type, if the condition becomes normal, the engine control cut-out relay (L171) is defective.		
	5	Defective engine control cut-out relay (L172) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L172 (Male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			When engine control cut-out relay (L172) is replaced with a relay of the same type, if the condition becomes normal, the engine control cut-out relay (L172) is defective.		
	6	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 10 of fuse box B – L171 or L172 (female) (3)	Resistance	Max. 10 Ω
			Wiring harness between L171 (female) (5), L172 (female) (5) – EC3 (female) (3), (4)	Resistance	Max. 10 Ω
			Wiring harness between EC3 (female) (1), (2) – chassis ground	Resistance	Max. 10 Ω

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">7</td><td rowspan="3">Ground 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. 10 of fuse box B – L171, L172 (female) (3) and chassis ground</td><td>Resistance</td><td>Min. 100 kΩ</td></tr>
<tr><td colspan="2">Wiring harness between L171 (female) (5), L172 (female) (5) – EC (3), (4) and chassis ground</td><td>Resistance</td><td>Max. 10Ω</td></tr>
<tr><td rowspan="4">8</td><td rowspan="4">Short circuit in wiring harness
(with another wiring harness)</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 among pins between EC3 (female) (3), (4) – EC3 (female) (1), (2)
(With battery terminal disconnected)</td><td>Resistance</td><td>Min. 100 kΩ</td></tr>
<tr><td colspan="2">Wiring harness among all pins between EC3 (female) (3), (4) – EC2 (female)
(With battery terminal disconnected)</td><td>Resistance</td><td>Min. 100 kΩ</td></tr>
<tr><td colspan="2">Wiring harness among all pins between EC3 (female) (1), (2) – EC2 (female)
(With battery terminal disconnected)</td><td>Resistance</td><td>Min. 100 kΩ</td></tr>
<tr><td>9</td><td>Defective wiring harness connector</td><td colspan="4">Connecting parts among fuse No. 10 of fuse box B, engine unit wiring harness, and engine controller are suspected. Inspect them directly.
• Loose connector, broken lock, broken seal
• Corrosive, bent, broken, forced-in, or extended pin
• Humidity in connector, entry of dirt or dust, poor insulation</td></tr>
<tr><td rowspan="3">10</td><td rowspan="3">Defective engine controller</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>EC3 (female)</td><td>Starting switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (3), (4) and (1), (2)</td><td>ON</td><td colspan="2">Min. 24 V</td></tr>
<tr><td>START</td><td colspan="2">Min. 12 V</td></tr>
</table>

Circuit diagram related to engine controller power supply

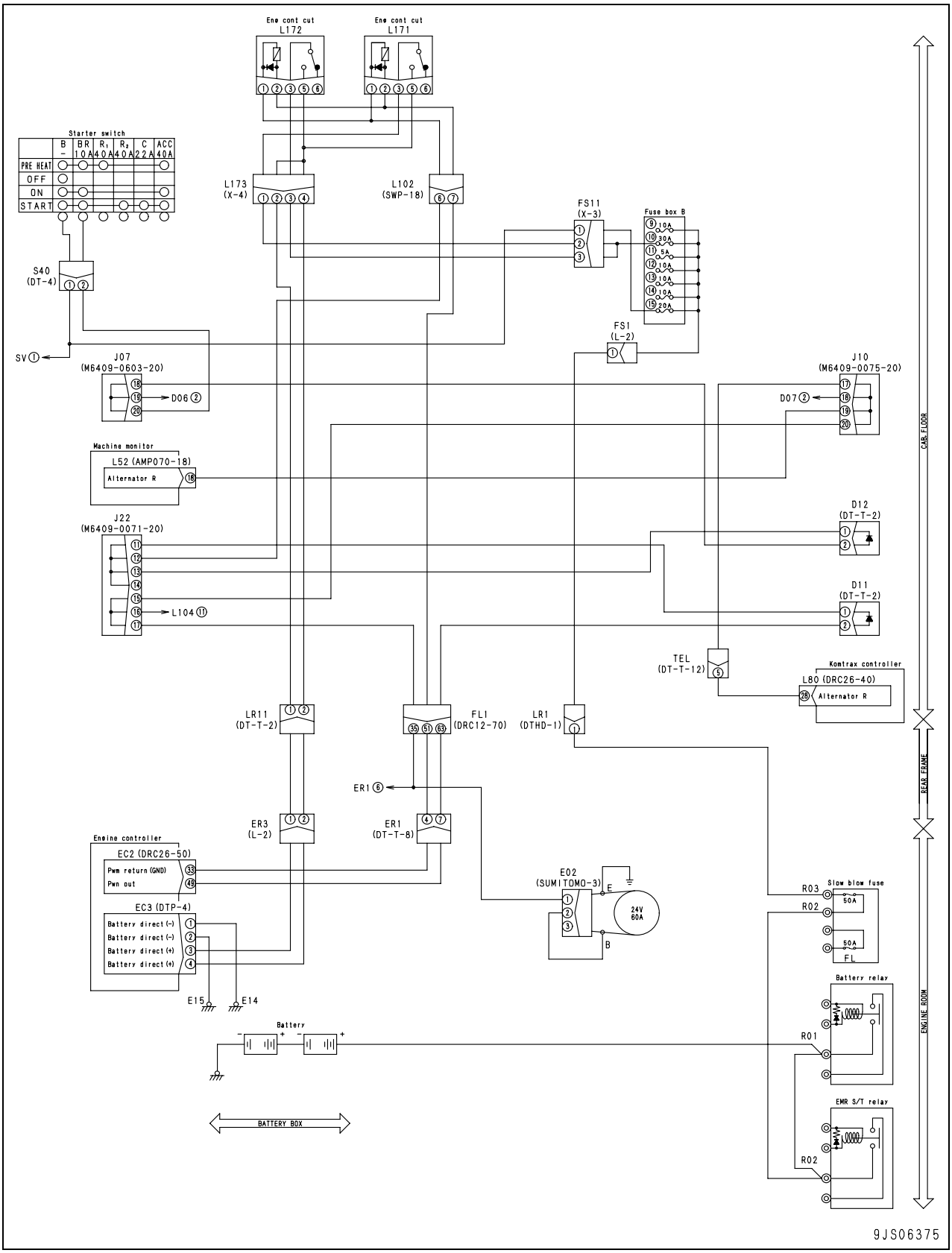


Failure code [CA442] (Battery voltage high error)

Action code	Failure code	Trouble	Battery voltage high error (Engine controller system)
E03	**CA442**		
Contents of trouble	• High voltage (min. 36V) occurred in controller power supply voltage circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine may stop.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective battery voltage	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Battery	Voltage	
			Between (+) and (–) terminals	Less than 32 V	
	2	Defective alternator	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			E02 (male)	Engine speed	Voltage
			Between (1) and chassis ground	Min. medium speed	27.5 – 29.5 V
	3	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			EC3 (female)	Voltage	
			Between (3), (4) and (1), (2)	Less than 32 V	

Circuit diagram related to engine controller power supply



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	• Voltage (2) in common rail circuit is abnormally high.		
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 sound becomes larger under no load or light load. • 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, RAIL PRESS). • The input state (voltage) from the common rail pressure sensor can be checked with the monitoring function (Code: 36402, RAIL PRESS). • Method of reproducing failure code: Start engine		

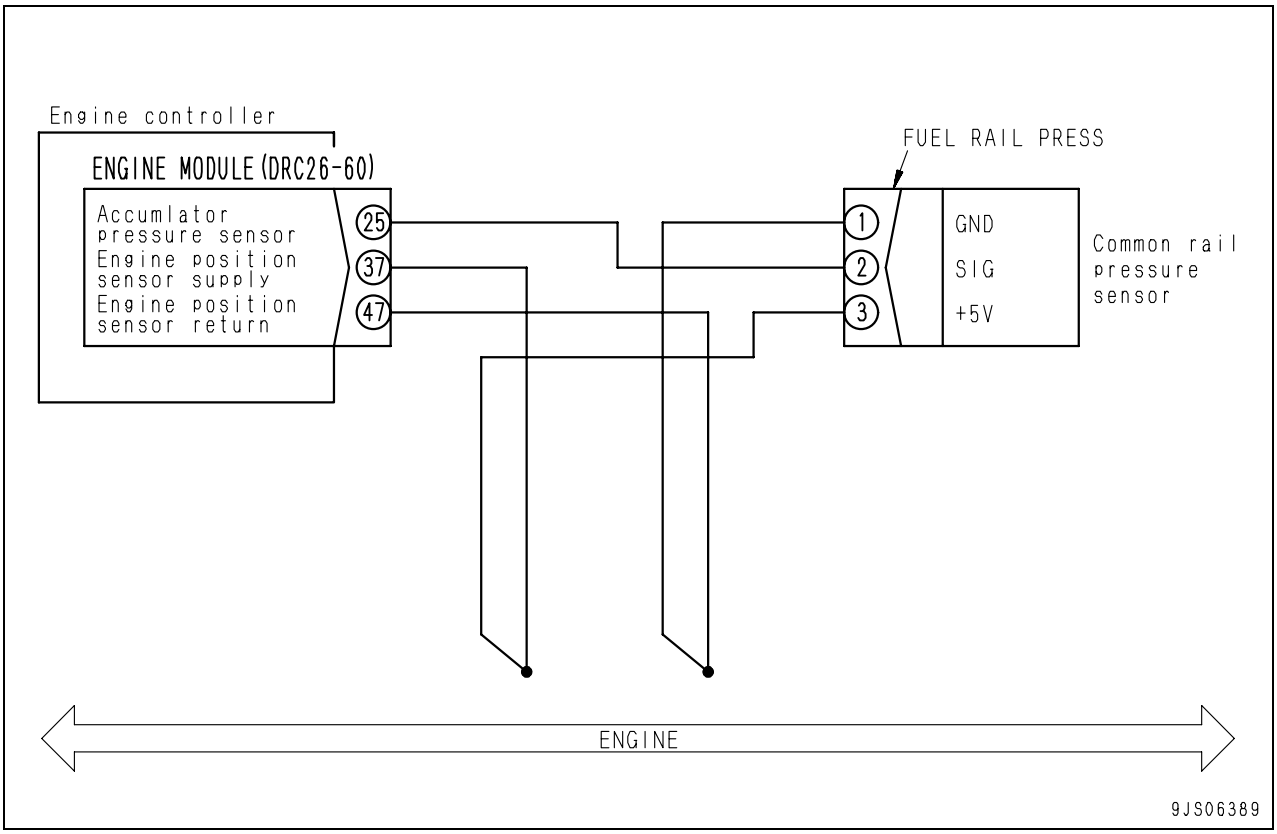
	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defect in related system	• If another code is displayed, carry out troubleshooting for it.		
	2	Air in low-pressure circuit	Commingling of air with the low pressure circuit is suspected. Inspect the circuit directly in the following procedure. 1) Remove the pressure pickup plug (outlet side) of the fuel main filter. 2) Operate the feed pump of the fuel pre-filter. 3) Inspect leakage of fuel and air from the pressure pickup plug.		
	3	Defective fuel return circuit device	★ For check of pressure in fuel return circuit, see Testing and adjusting, Testing fuel pressure.		
			Fuel circuit pressure	At low idle or cranking	Max. 0.02 MPa {Max. 0.19 kg/cm^2}
	4	Defective common rail pressure sensor	★ Prepare with starting switch ON, then carry out troubleshooting without turning starting switch OFF.		
			Monitoring code (Machine monitor)	Monitoring information	
			Code: 36400, RAIL PRESS	Condition when engine stopped	0 – 0.39 MPa {0 – 4 kg/cm^2}
	5	Defective pressure limiter	For testing of leakage from pressure limiter, see Testing and adjusting, Testing leakage-from pressure limiter and return rate from injector.		
			Leakage from pressure limiter	At low idle	0 cc (No leakage)
	6	Defective supply pump	If causes 1 – 5 are not detected, supply pump may be defective.		

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	• High voltage occurred in common rail pressure sensor.		
Action of controller	• Limits output and continues operation. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• The engine does not start. • Engine speed or 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, RAIL PRESS). • The input state (voltage) from the common rail pressure sensor can be checked with the monitoring function (Code: 36402, RAIL PRESS). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power supply 2 system	If failure code [**CA227**] is indicated simultaneously, carry out troubleshooting for it first.		
	2	Defective common rail pressure sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			FUEL RAIL PRESS		Voltage
			Between (3) and (1)	Power supply	4.75 – 5.25 V
			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	Hot short (Short circuit with 5V, 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between ENGINE MODULE (female) (25) – FUEL RAIL PRESS (female) (2) and chassis ground	Voltage	Max. 1 V
	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 ENGINE MODULE (female) (25) – FUEL RAIL PRESS (female) (2), ENGINE MODULE (female) (37) – FUEL RAIL PRESS (female) (3)	Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts among common rail pressure sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			ENGINE MODULE		Voltage
			Between (37) and (47)	Power supply	4.75 – 5.25 V

Circuit diagram related to common rail pressure sensor

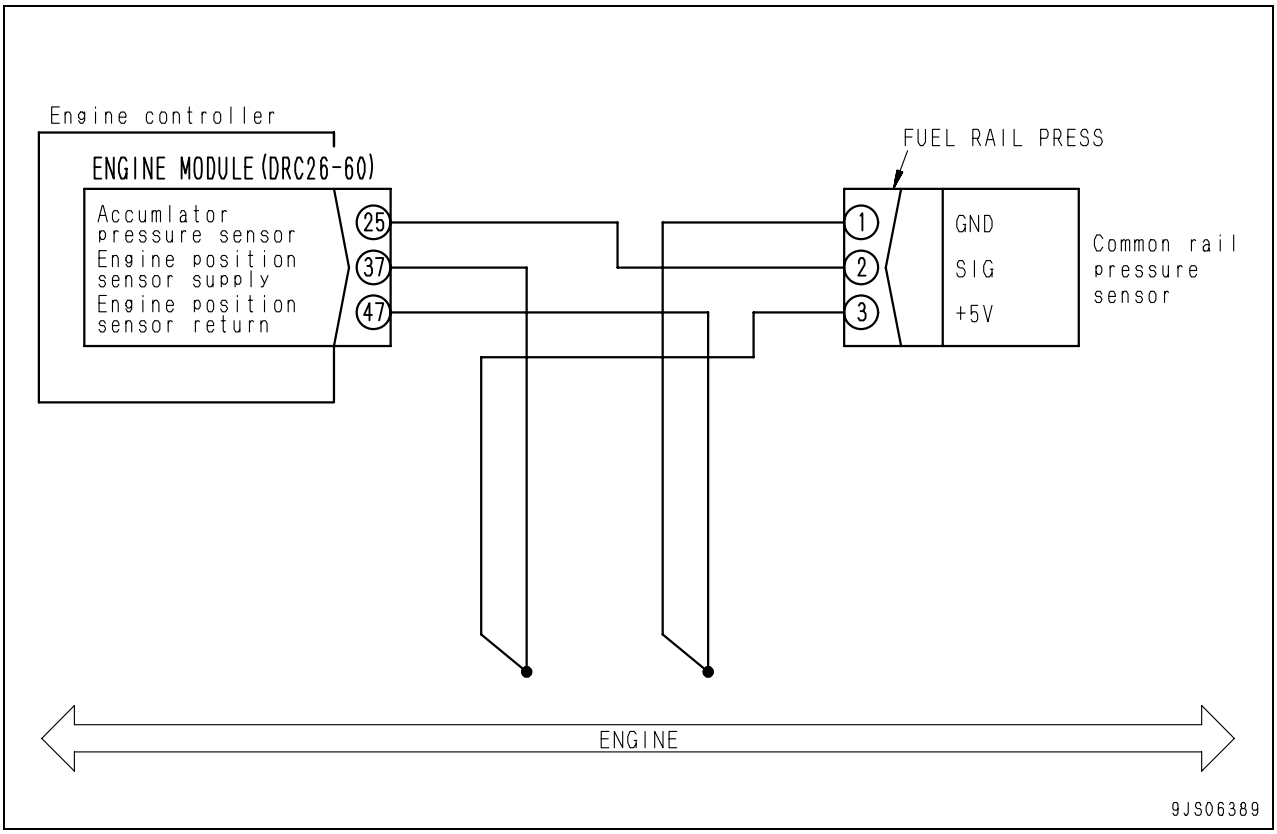


Failure code [CA452] (Common rail pressure sensor low error)

Action code	Failure code	Trouble	Common rail pressure sensor low error (Engine controller system)
E03	**CA452**		
Contents of trouble	• Low voltage occurred in common rail pressure sensor.		
Action of controller	• Limits output and continues operation. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• The engine does not start. • Engine speed or 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, RAIL PRESS). • The input state (voltage) from the common rail pressure sensor can be checked with the monitoring function (Code: 36402, RAIL PRESS). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power supply 2 system	If failure code [**CA187**] is indicated simultaneously, carry out troubleshooting for it first.			
	2	Defective common rail pressure sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			FUEL RAIL PRESS		Voltage	
			Between (3) and (1)	Power supply	4.75 – 5.25 V	
			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	Ground 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 ENGINE MODULE (female) (25) – FUEL RAIL PRESS (female) (2) and chassis ground		Resistance	Min. 100 kΩ
	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 ENGINE MODULE (female) (25) – FUEL RAIL PRESS (female) (2), ENGINE MODULE (female) (47) – FUEL RAIL PRESS (female) (3)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts among common rail pressure sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			ENGINE MODULE		Voltage	
			Between (37) and (47)	Power supply	4.75 – 5.25 V	

Circuit diagram related to common rail pressure sensor



Failure code [CA488] (Derating of torque by abnormally high charge temperature)

Action code	Failure code	Trouble	Derating of torque by abnormally high charge temperature (Engine controller system)
E03	**CA488**		
Contents of trouble	• Temperature signal of boost pressure sensor and temperature sensor is above upper control limit.		
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 (boost temperature) from the boost pressure and temperature sensors can be checked with the monitoring function (Code: 18500, CHG TEMP). • The input state (boost temperature sensor voltage) from the boost pressure and temperature sensors can be checked with the monitoring function (Code: 18501, CHG TEMP). • Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Drop in cooling performance of aftercooler	Inspect following directly. • Loose, broken fan belt • Insufficient cooling air • Clogged aftercooler fin
	2	Abnormally high temperature at turbocharger outlet	Inspect related parts directly.
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

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	• Voltage (1) in common rail circuit is abnormally high.		
Action of controller	• None in particular. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine sound becomes larger under no load or light load. • 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, RAIL PRESS). • The input state (voltage) from the common rail pressure sensor can be checked with the monitoring function (Code: 36402, RAIL PRESS). • Method of reproducing failure code: Start engine		

	Causes		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 connection of ground terminal	Inspect following directly for connection of ground terminal. • Ground terminal (battery (-)) of machine main unit. • Ground terminal of engine • Ground terminal of engine controller • Ground terminal of starting motor
	3	Broken O-ring of supply pump actuator	Inspect O-ring directly for breakage.

Failure code [CA559] (Supply pump pressure very low error)

Action code	Failure code	Trouble	Supply pump pressure very low error (Engine controller system)
E03	**CA559**		
Contents of trouble	• No-pressure feed (1) occurred in common rail circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine does not start or starting performance is poor • Exhaust smoke is black. • 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, RAIL PRESS). • The input state (voltage) from the common rail pressure sensor can be checked with the monitoring function (Code: 36402, RAIL PRESS). • Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Fuel leakage to outside	Inspect for fuel leakage directly (visual inspection at engine low idle).		
	2	Defective low-pressure circuit device	★ For check of pressure in fuel low-pressure circuit, see Testing and adjusting, Testing fuel pressure.		
			Pressure in fuel low-pressure circuit	Cranking (When starting is not available)	0.3 – 1.1 MPa {3.1 – 11.3 kg/cm^2}
				At low idle (When starting is available)	0.5 – 1.3 MPa {5.1 – 13.3 kg/cm^2}
	3	Defective pressure limiter	For testing of leakage from pressure limiter, see Testing and adjusting, Testing leakage-from pressure limiter and return rate from injector.		
			Leakage from pressure limiter	At low idle	0 cc (No leakage)
	4	Defective injector (High-pressure piping in head included)	★ For testing of return rate from injector, see Testing and adjusting, Testing leakage-from pressure limiter and return rate from injector.		
			Return rate from injector	Cranking (When starting is not available)	Max. 90 cc/min.
				At low idle (When starting is available)	Max. 180 cc/min.
	5	Defective supply pump	★ For testing of return rate from supply pump, see Testing and adjusting, Testing leakage-from pressure limiter and return rate from injector.		
			Return rate from supply pump	Cranking (When starting is not available)	Max. 140 cc/min.
				At low idle (When starting is available)	Max. 1,000 cc/min.

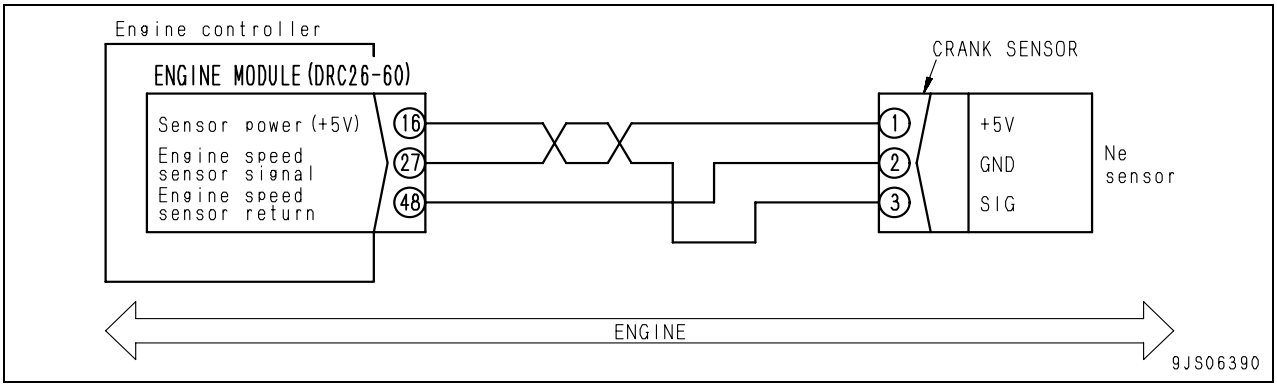
Failure code [CA689] (Engine Ne speed sensor error)

Action code	Failure code	Trouble	Engine Ne speed sensor error (Engine controller system)
E03	**CA689**		
Contents of trouble	• Abnormality occurred in signals from engine Ne speed sensor.		
Action of controller	• Controls Ne speed sensor with signals of Bkup speed sensor. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• There is hunting from engine. • Starting performance is poor • Engine output drops.		
Related information	• Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective Ne speed sensor power supply system	If failure code [**CA238**] is indicated simultaneously, carry out troubleshooting for it first.		
	2	Defective engine Ne speed sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CRANK SENSOR		Voltage
			Between (1) and (2)	Power supply	4.75 – 5.25 V
			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	Broken engine Ne speed sensor or defective clearance	Inspect engine Ne speed sensor for breakage or clearance.		
	4	Broken rotation sensing flywheel	Inspect it for breakage directly.		
	5	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENGINE MODULE (female) (27) – CRANK SENSOR (female) (3)	Resistance	Max. 10 Ω
	6	Ground 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 ENGINE MODULE (female) (27) – CRANK SENSOR (female) (3) and chassis ground	Resistance	Min. 100 kΩ
	7	Hot short (Contact with 5V, 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between ENGINE MODULE (female) (27) – CRANK SENSOR (female) (3) and chassis ground	Voltage	Max. 1 V
	8	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 ENGINE MODULE (female) (27) – CRANK SENSOR (female) (3), ENGINE MODULE (female) (16) – CRANK SENSOR (female) (1)	Resistance	Min. 100 kΩ
			Wiring harness between ENGINE MODULE (female) (27) – CRANK SENSOR (female) (3), ENGINE MODULE (female) (48) – CRANK SENSOR (female) (2)	Resistance	Min. 100 kΩ

<table>
<tr><td rowspan="4">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>9</td><td>Defective wiring harness connector</td><td colspan="3">Connecting parts among engine Ne speed sensor, engine wiring harness, and engine controller are suspected. Inspect them directly.
• Loose connector, broken lock, broken seal
• Corrosive, bent, broken, forced-in, or extended pin
• Humidity in connector, entry of dirt or dust, poor insulation</td></tr>
<tr><td rowspan="3">10</td><td rowspan="3">Defective engine controller</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2">ENGINE MODULE</td><td>Voltage</td></tr>
<tr><td>Between (16) and (48)</td><td>Power supply</td><td>4.75 – 5.25 V</td></tr>
</table>

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	• Abnormal phase is detected in signals of engine Ne speed sensor and engine Bkup speed sensor.		
Action of controller	• Controls Ne speed sensor with signals of Bkup speed sensor. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine does not start or is difficult to start. • Idle speed is unstable. • Exhaust smoke is black.		
Related information	• Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Broken engine Ne speed sensor	Inspect engine Ne speed sensor for breakage directly.
	2	Broken engine Bkup speed sensor	Inspect engine Bkup speed sensor for breakage directly.
	3	Defective/broken mount of rotation sensing flywheel on crankshaft side	Inspect it for defect or breakage according to the following procedure. 1) Set No. 1 cylinder to compression top dead center (align stamping mark). 2) If tip of Ne speed sensor is aligned with center of oblong hole of rotation sensing flywheel, it is mounted normally.
	4	Defective/broken mount of rotation sensing ring on camshaft side	Inspect it for defect or breakage according to the following procedure. 1) Set No. 1 cylinder to compression top dead center (align stamping mark). 2) Remove Bkup speed sensor. 3) If 2 grooves (1 thread) of rotation sensing ring can be seen through sensor mounting hole, it is mounted normally.
	5	Defective timing between crankshaft and camshaft	Inspect crankshaft and camshaft for timing directly.
	6	Defective connection of ground terminal	Inspect following directly for connection of ground terminal. • Ground terminal (battery (-)) of machine main unit. • Ground terminal of engine • Ground terminal of engine controller • Ground terminal of starting motor

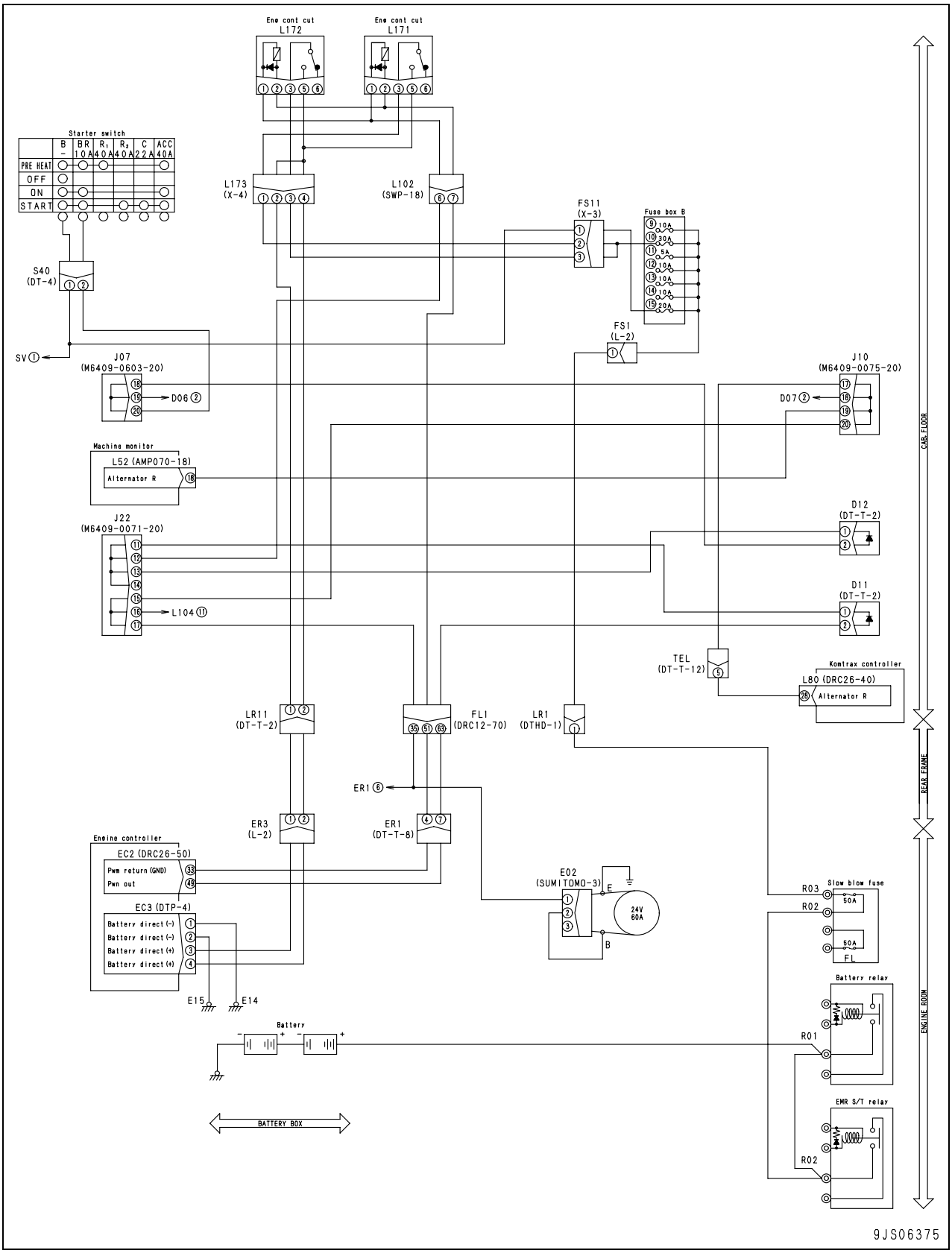
Failure code [CA757] (All continuous data lost error)

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	• Engine stops and sometimes cannot be started. • The monitoring function of the machine monitor (engine controller system) sometimes fail to work normally.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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	Loose, corroded battery terminal	Inspect battery terminal directly for loose and corrosion.		
	3	Defective battery voltage	★ Prepare with starting switch OFF, then carry out troubleshooting with starting switch OFF and START.		
			Battery (1 piece)	Starting switch	Voltage
			Between (+) – (–) terminals	OFF	Min. 12 V
				START	Min. 6.2 V
	4	Defective fuse No. 10 of fuse box B	If the fuse is broken, the circuit probably has a grounding fault, etc.		
	5	Defective engine control cut-out relay (L171) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L171 (Male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			When engine control cut-out relay (L171) is replaced with a relay of the same type, if the condition becomes normal, the engine control cut-out relay (L171) is defective.		
	6	Defective engine control cut-out relay (L172) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L172 (Male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			When engine control cut-out relay (L172) is replaced with a relay of the same type, if the condition becomes normal, the engine control cut-out relay (L172) is defective.		
	7	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 10 of fuse box B – L171 or L172 (female) (3)	Resistance	Max. 10Ω
			Wiring harness between L171 (female) (5), L172 (female) (5) – EC3 (female) (3), (4)	Resistance	Max. 10Ω
			Wiring harness between EC3 (female) (1), (2) – chassis ground	Resistance	Max. 10Ω

<table>
<tr><td rowspan="5">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>8</td><td>Defective wiring harness connector</td><td colspan="3">Connecting parts among fuse No. 10 of fuse box B, engine unit wiring harness, and engine controller are suspected. Inspect them directly.
• Loose connector, broken lock, broken seal
• Corrosive, bent, broken, forced-in, or extended pin
• Humidity in connector, entry of dirt or dust, poor insulation</td></tr>
<tr><td rowspan="4">9</td><td rowspan="4">Defective engine controller</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>EC3 (female)</td><td>Starting switch</td><td>Voltage</td></tr>
<tr><td rowspan="2">Between (3) and (1)</td><td>ON</td><td>Min. 24 V</td></tr>
<tr><td>START</td><td>Min. 12 V</td></tr>
</table>

Circuit diagram related to engine controller power supply



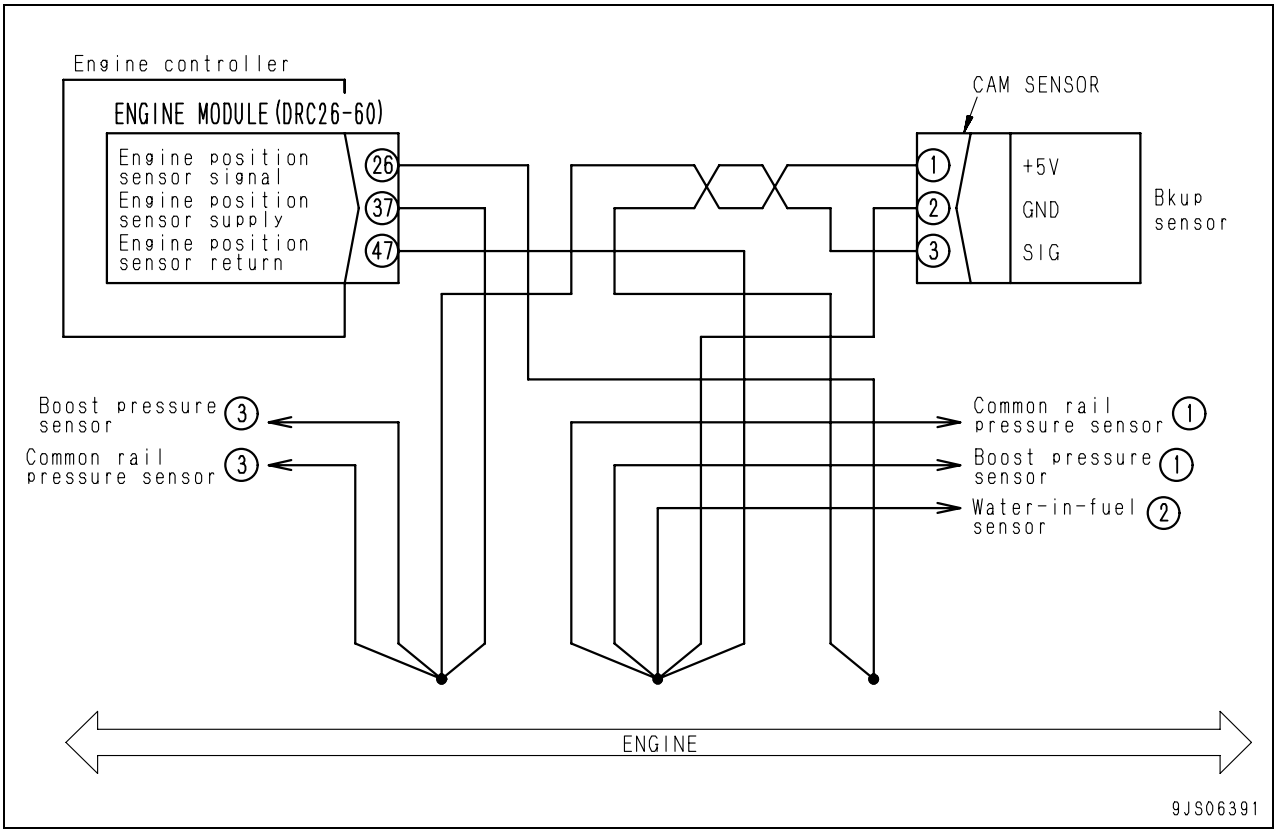
Failure code [CA778] (Engine Bkup speed sensor error)

Action code	Failure code	Trouble	Engine Bkup speed sensor error (Engine controller system)
E03	**CA778**		
Contents of trouble	• Abnormality is detected in signals of engine Bkup speed sensor.		
Action of controller	• Controls Bkup speed sensor with signals of Ne speed sensor. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Starting performance is poor • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power supply 2 system	If failure code [**CA187**] is indicated simultaneously, carry out troubleshooting for it first.		
	2	Defective engine Bkup speed sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CAM SENSOR		Voltage
			Between (1) and (2)	Power supply	4.75 – 5.25 V
			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	Broken engine Bkup speed sensor or defective clearance	Inspect engine Bkup speed sensor directly for breakage or clearance.		
	4	Broken rotation sensing ring	Inspect it for breakage directly.		
	5	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENGINE MODULE (female) (26) – CAM SENSOR (female) (3)	Resistance	Max. 10 Ω
	6	Ground 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 ENGINE MODULE (female) (26) – CAM SENSOR (female) (3) and chassis ground	Resistance	Min. 100 kΩ
	7	Hot short (Contact with 5V, 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between ENGINE MODULE (female) (26) – CAM SENSOR (female) (3) and chassis ground	Voltage	Max. 1 V
	8	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 ENGINE MODULE (female) (26) – CAM SENSOR (female) (3), ENGINE MODULE (female) (37) – CAM SENSOR (female) (1)	Resistance	Min. 100 kΩ
			Wiring harness between ENGINE MODULE (female) (26) – CAM SENSOR (female) (3), ENGINE MODULE (female) (47) – CAM SENSOR (female) (2)	Resistance	Min. 100 kΩ

<table>
<tr><td rowspan="4">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>9</td><td>Defective wiring harness connector</td><td colspan="3">Connecting parts among engine Bkup speed sensor, engine wiring harness, and engine controller are suspected. Inspect them directly.
• Loose connector, broken lock, broken seal
• Corrosive, bent, broken, forced-in, or extended pin
• Humidity in connector, entry of dirt or dust, poor insulation</td></tr>
<tr><td rowspan="3">10</td><td rowspan="3">Defective engine controller</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2">ENGINE MODULE</td><td>Voltage</td></tr>
<tr><td>Between (37) and (47)</td><td>Power supply</td><td>4.75 – 5.25 V</td></tr>
</table>

Circuit diagram related to engine Bkup speed sensor



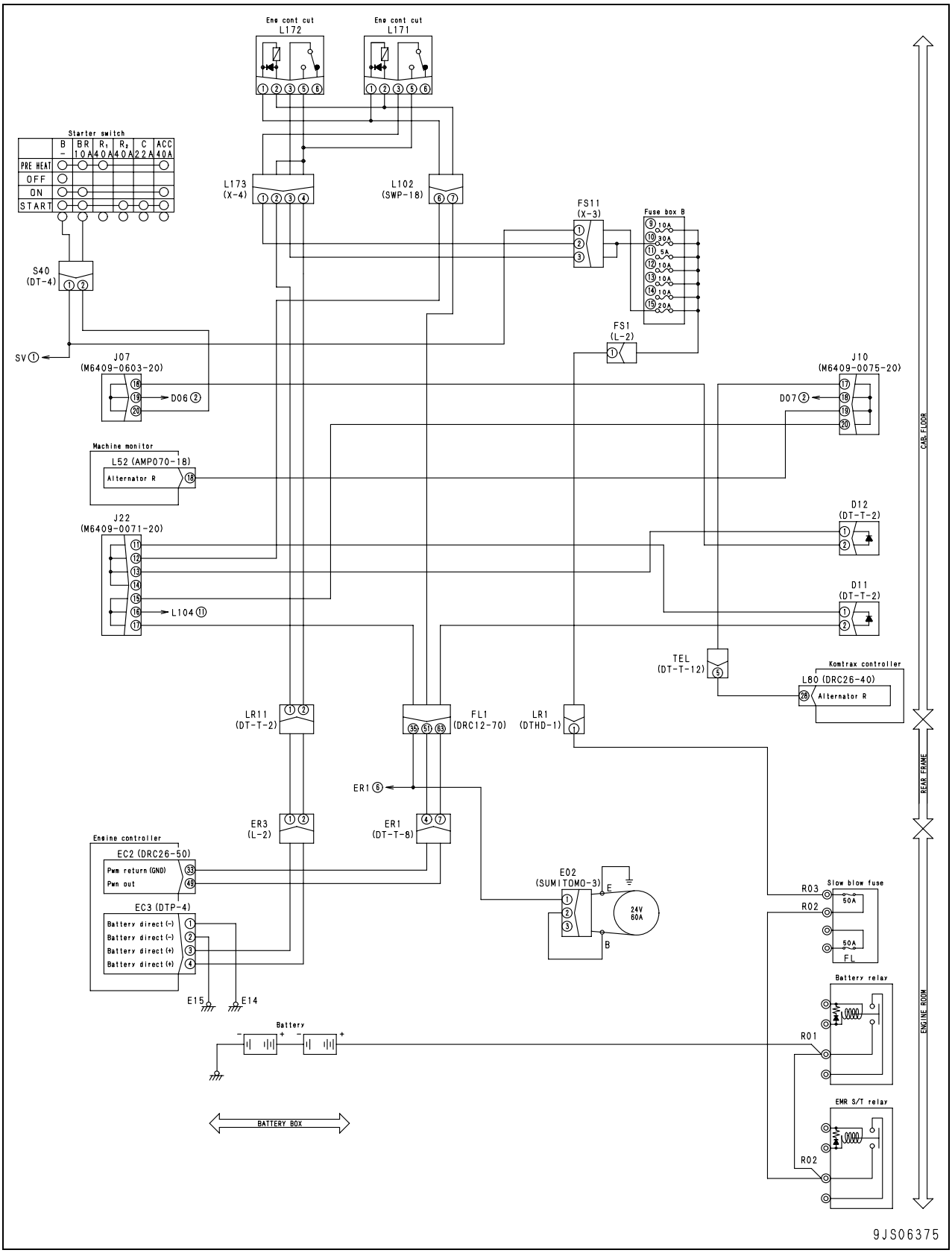
Failure code [CA1117] (Partial engine controller data loss error)

Action code	Failure code	Trouble	Partial engine controller data loss error (Engine controller system)
E03	**CA1117**		
Contents of trouble	• Engine controller data were partially lost.		
Action of controller	• Turn the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine stops and sometimes cannot be started. • The monitoring function of the machine monitor (engine controller system) does not work normally.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

		Causes	Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Loose, corroded battery terminal	Inspect battery terminal directly for loose and corrosion.		
	2	Defective battery voltage	★ Prepare with starting switch OFF, then carry out troubleshooting with starting switch OFF and START.		
			Battery (1 piece)	Starting switch	Resistance
			Between (+) – (–) terminals	OFF	Min. 12 V
				START	Min. 6.2 V
	3	Defective fuse No. 10 of fuse box B	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 6.)		
	4	Defective engine control cut-out relay (L171) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L171 (Male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			When engine control cut-out relay (L171) is replaced with a relay of the same type, if the condition becomes normal, the engine control cut-out relay (L171) is defective.		
	5	Defective engine control cut-out relay (L172) (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L172 (Male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			When engine control cut-out relay (L172) is replaced with a relay of the same type, if the condition becomes normal, the engine control cut-out relay (L172) is defective.		
	6	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 10 of fuse box B – L171, L172 (female) (3)	Resistance	Max. 10 Ω
			Wiring harness between L171 (female) (5), L172 (female) (5) – EC3 (female) (3), (4)	Resistance	Max. 10 Ω
			Wiring harness between EC3 (female) (1), (2) – chassis ground	Resistance	Max. 10 Ω

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">7</td><td rowspan="3">Ground 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 No.10 fuse of fuse box B – L171, L172 (female) (3) and chassis ground</td><td>Resistance</td><td>Min. 100 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L171 (female) (5), L172 (female) (5) – EC3 (female) (3), (4) and chassis ground</td><td>Resistance</td><td>Min. 100 Ω</td></tr>
<tr><td rowspan="4">8</td><td rowspan="4">Short circuit in wiring harness
(with another wiring harness)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Between EC3 (female) (3), (4) – EC3 (female) (1), (2) (With battery terminal disconnected)</td><td>Resistance</td><td>Min. 100 Ω</td></tr>
<tr><td colspan="2">Wiring harness among all pins between EC3 (female) (3), (4) – EC2 (female) (With battery terminal disconnected)</td><td>Resistance</td><td>Min. 100 Ω</td></tr>
<tr><td colspan="2">Wiring harness among all pins between EC3 (female) (1), (2) – EC2 (female) (With battery terminal disconnected)</td><td>Resistance</td><td>Min. 100 Ω</td></tr>
<tr><td>9</td><td>Defective wiring harness connector</td><td colspan="4">Connecting parts among fuse No. 10 of fuse box B, engine unit wiring harness, and engine controller are suspected. Inspect them directly.
• Loose connector, broken lock, broken seal
• Corrosive, bent, broken, forced-in, or extended pin
• Humidity in connector, entry of dirt or dust, poor insulation</td></tr>
<tr><td rowspan="4">10</td><td rowspan="4">Defective engine controller</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>EC3 (female)</td><td>Starting switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (3) and (1)</td><td>ON</td><td colspan="2">Min. 24 V</td></tr>
<tr><td>START</td><td colspan="2">Min. 12 V</td></tr>
</table>

Circuit diagram related to engine controller power supply



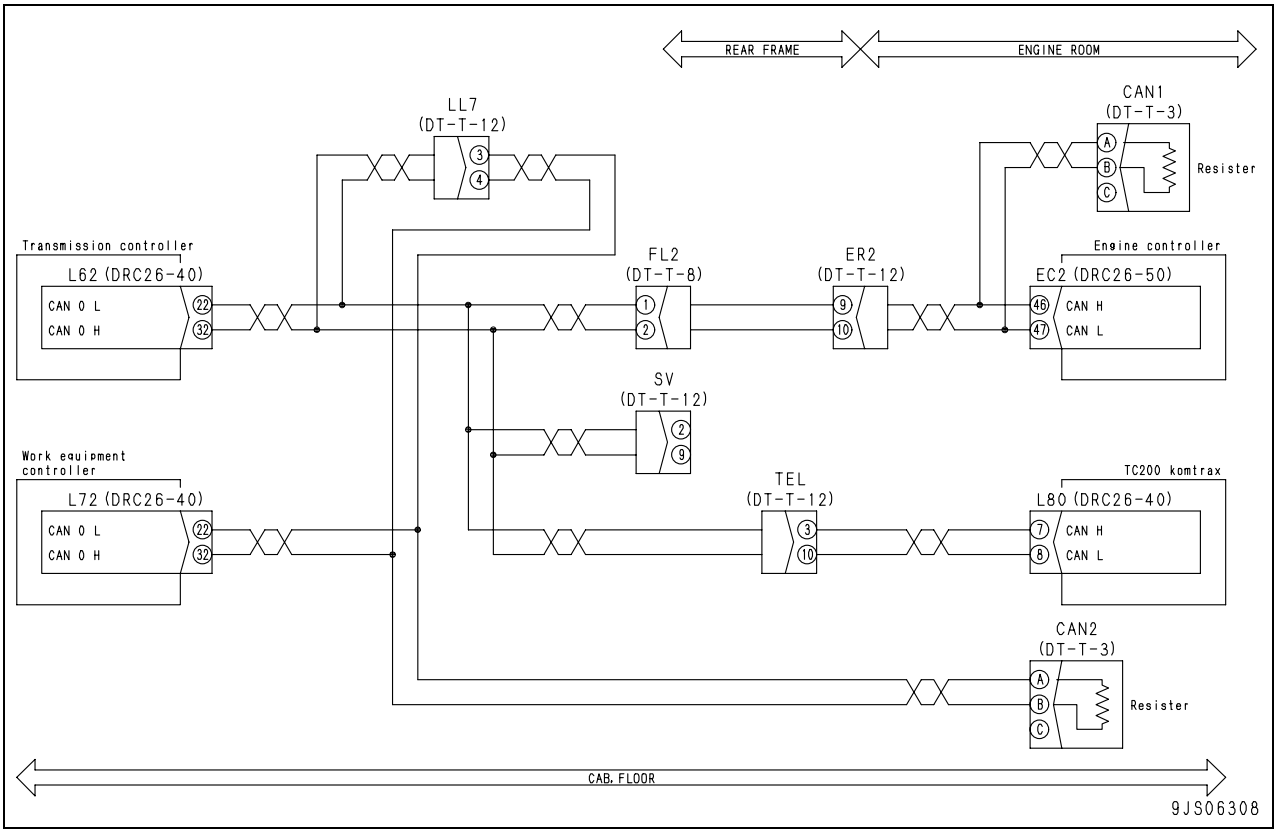
Failure code [CA1633] (KOMNET datalink timeout error)

Action code	Failure code	Trouble	KOMNET datalink timeout error (Engine controller system)
E03	**CA1633**		
Contents of trouble	• Engine controller detected a communication error in the KOMNET communication circuit used for the communication between the pump controllers and machine monitor.		
Action of controller	• Continues the operation from the default mode. • Turns the centralized warning lamp and alarm buzzer ON. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• KOMNET communication information may not be transmitted correctly to cause incorrect operation of machine. (Problem depends on failure occurrence location.)		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective CAN end point resistance	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CAN1 (male)	Resistance	
			Between (A) and (B)	110 – 140 Ω	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CAN2 (male)	Resistance	
			Between (A) and (B)	110 – 140 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between EC2 (female) (46), (47) – L62 (female) (22), (32)	Resistance	Max. 1 Ω
			Wiring harness between EC2 (female) (46), (47) – L56 (female) (3), (8)	Resistance	Max. 1 Ω
			Wiring harness between EC2 (female) (46), (47) – L72 (female) (22), (32)	Resistance	Max. 1 Ω
			Wiring harness between EC2 (female) (46), (47) – L80 (female) (7), (8)	Resistance	Max. 1 Ω
			Wiring harness between EC2 (female) (46), (47) – CAN1 (female) (A), (B)	Resistance	Max. 1 Ω
			Wiring harness between EC2 (female) (46), (47) – CAN2 (female) (A), (B)	Resistance	Max. 1 Ω

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	3	Ground fault in wiring harness (Short circuit with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between EC2 (female) (46), (47) – L62 (female) (22), (32) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between EC2 (female) (46), (47) – L56 (female) (3), (8) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between EC2 (female) (46), (47) – L72 (female) (22), (32) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between EC2 (female) (46), (47) – L80 (female) (7), (8) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between EC2 (female) (46), (47) – CAN1 (female) (A), (B) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between EC2 (female) (46), (47) – CAN2 (female) (A), (B) and chassis ground	Resistance	Min. 1 MΩ
	4	Defective machine monitor, transmission controller, work equipment controller, engine controller or KOMTRAX terminal	★ If above troubleshootings 1 – 3 have not identified the cause of the trouble, failure on the machine monitor, transmission controller, work equipment controller, engine controller or KOMTRAX terminal should be suspected. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to CAN communication



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 4

Troubleshooting by failure code (Display of code), Part 4 3
Failure code [CA2185] (Throttle sensor supply voltage high error) 3
Failure code [CA2186] (Throttle sensor power supply low error) 4
Failure code [CA2249] (Supply pump pressure very low error 2) 5
Failure code [CA2311] (Abnormality in IMV solenoid) 6
Failure code [CA2555] (Intake heater relay disconnection error) 8
Failure code [CA2556] (Intake heater relay short circuit error) 10
Failure code [D150KA] (Emergency steering relay: Disconnection) 12
Failure code [D150KB] (Emergency steering relay: Short circuit) 14
Failure code [D150KY] (Emergency steering relay: Short circuit with power supply line) 16
Failure code [D160KA] (Backup lamp relay: Disconnection) 18
Failure code [D160KB] (Backup lamp relay: Short circuit) 20
Failure code [D191KA] (Joystick steering neutral safety relay: Disconnection) 22
Failure code [D191KB] (Joystick steering neutral safety relay: Short circuit) 24

Failure code [D191KY] (Joystick steering neutral safety relay: Short circuit with power supply line). 26
Failure code [D192KA] (ECSS solenoid: Disconnection) 28
Failure code [D192KB] (ECSS solenoid: Short circuit) 29
Failure code [D192KY] (ECSS solenoid: Short circuit with power supply line) 30
Failure code [D5ZHKA] (Terminal C signal: Disconnection) 31
Failure code [D5ZHKB] (Terminal C signal: Short circuit) 35
Failure code [D5ZHL6] (Terminal C signal: Signal does not match engine running or stopped state) 39
Failure code [DA80L4] (Auto grease controller: ON/OFF signals disagree) 42
Failure code [DAF3KK] (Machine monitor: Low source voltage (input)) 44
Failure code [DAF5KP] (Machine monitor: Low output voltage) 46
Failure code [DAFRKR] (CAN communication with machine monitor:
Defective communication (Abnormality in target component system)) 49
Failure code [DAQ0KK] (Transmission controller: Low source voltage) 51
Failure code [DAQ0KT] (Transmission controller: Abnormality in controller) 53
Failure code [DAQ2KK] (Transmission controller load power supply line:
Low source voltage (input)) 54
Failure code [DAQ9KQ] (Transmission controller model selection:
Disagreement of model selection signals) 56

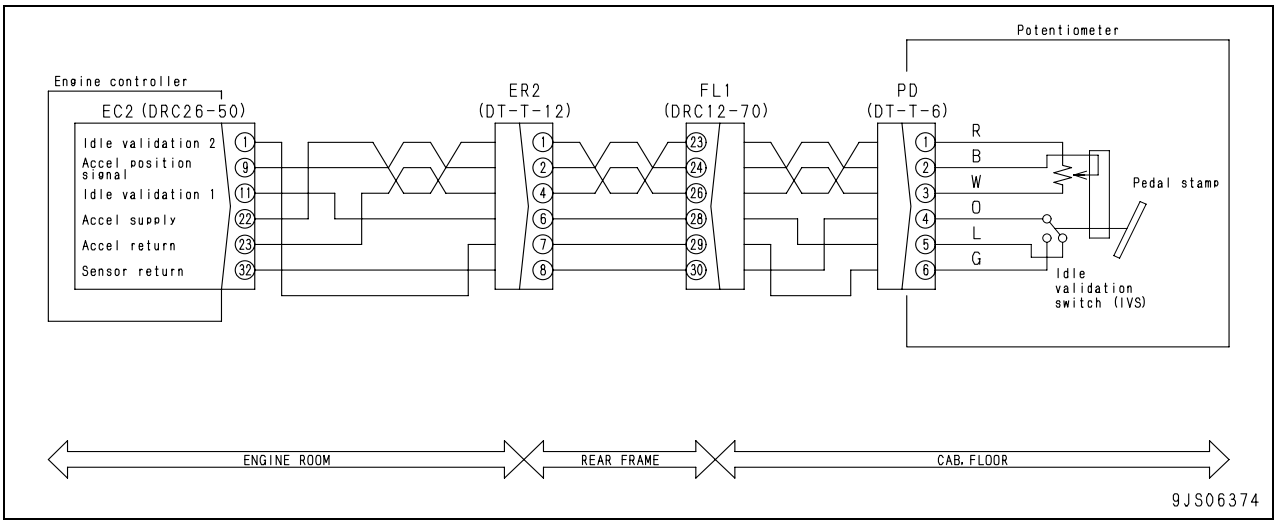
Troubleshooting by failure code (Display of code), Part 4

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	• High voltage (min. 5.25V) occurred in throttle sensor power supply circuit.		
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.		

	Causes		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.		
	1	Short circuit in wiring harness (with another wiring harness)	Wiring harness among all pins between EC2 (female) (22) – EC2 (female) (PD, too, is disconnected.)	Resistance	Min. 100 kΩ
			Between EC2 (female) (22) – EC3 (female) (3) (PD, too, is disconnected.)	Resistance	Min. 100 kΩ
	2	Defective wiring harness connector	Connecting parts among fuel control dial, engine unit wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to accelerator pedal

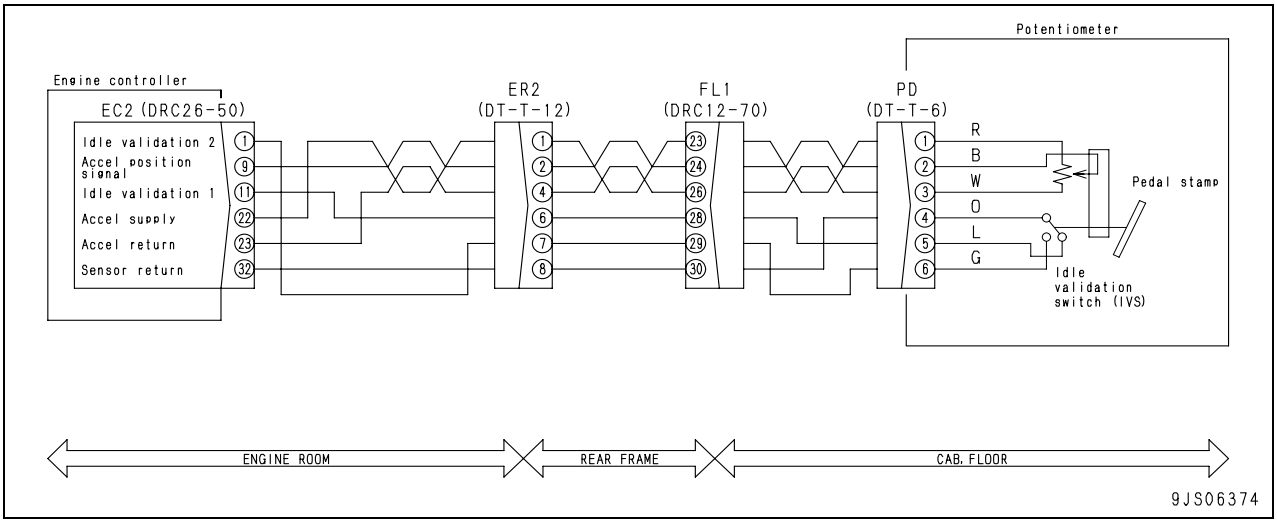


Failure code [CA2186] (Throttle sensor power supply low error)

Action code	Failure code	Trouble	Throttle sensor power supply voltage low error (Engine controller system)
E03	**CA2186**		
Contents of trouble	• Low voltage occurred in throttle sensor power supply circuit.		
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.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Ground 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 EC2 (female) (22) – PD (female) (1) and chassis ground	Resistance	Min. 100 kΩ
	2	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 among all pins between EC2 (female) (9) – EC2 (female) (PD, too, is disconnected.)	Resistance	Min. 100 kΩ
	3	Defective wiring harness connector	Connecting parts among fuel control dial, engine unit wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	4	Defective engine controller	If causes 1 – 3 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to accelerator pedal



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	• No-pressure feed (2) occurred in common rail circuit.		
Action of controller	• Limits output and continues operation. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Starting performance is poor • Exhaust smoke is black. • 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, RAIL PRESS). • The input state (voltage) from the common rail pressure sensor can be checked with the monitoring function (Code: 36402, RAIL PRESS). • Method of reproducing failure code: Start engine		

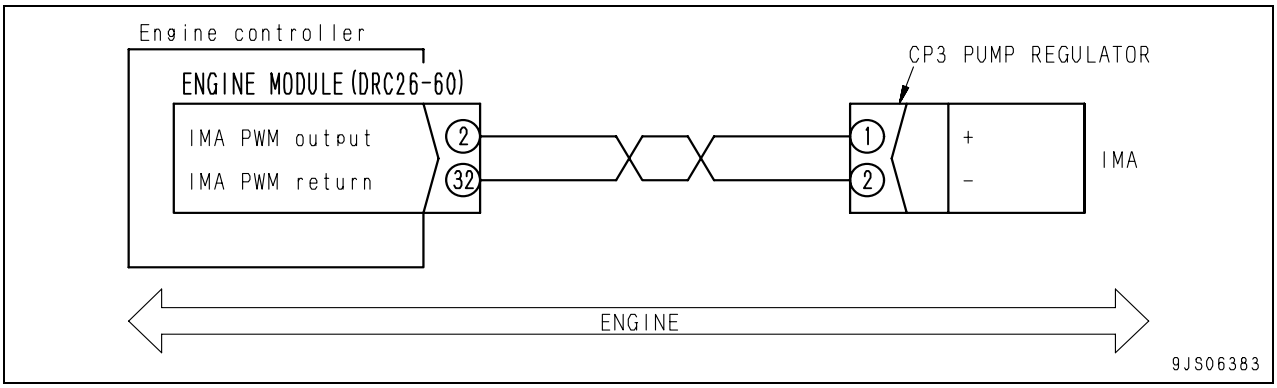
Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting
	1	Carry out troubleshooting for failure code [**CA559**].	

Failure code [CA2311] (Abnormality in IMV solenoid)

Action code	Failure code	Trouble	Abnormality in IMV solenoid (Engine controller system)
E03	**CA2311**		
Contents of trouble	• Resistance in supply pump actuator circuit is abnormally high or low.		
Action of controller	• 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		

	Causes		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 supply pump actuator	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CP3 PUMP REGULATOR (male)	Resistance	
			Between (1) and (2)	Max. 5 Ω	
			Between (1) and chassis ground	Min. 100 kΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENGINE MODULE (female) (2) – CP3 PUMP REGULATOR (female) (1)	Resistance	Max. 5 Ω
			Wiring harness between ENGINE MODULE (female) (32) – CP3 PUMP REGULATOR (female) (2)	Resistance	Max. 5 Ω
	4	Ground 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 ENGINE MODULE (female) (2) – CP3 PUMP REGULATOR (female) (1) and chassis ground	Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts among supply pump actuator, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	6	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ENGINE MODULE (female)	Resistance	
			Between (2) and (32)	Max. 5 Ω	
			Between (2) and chassis ground	Min. 100 kΩ	

Circuit diagram related to supply pump (metering unit)

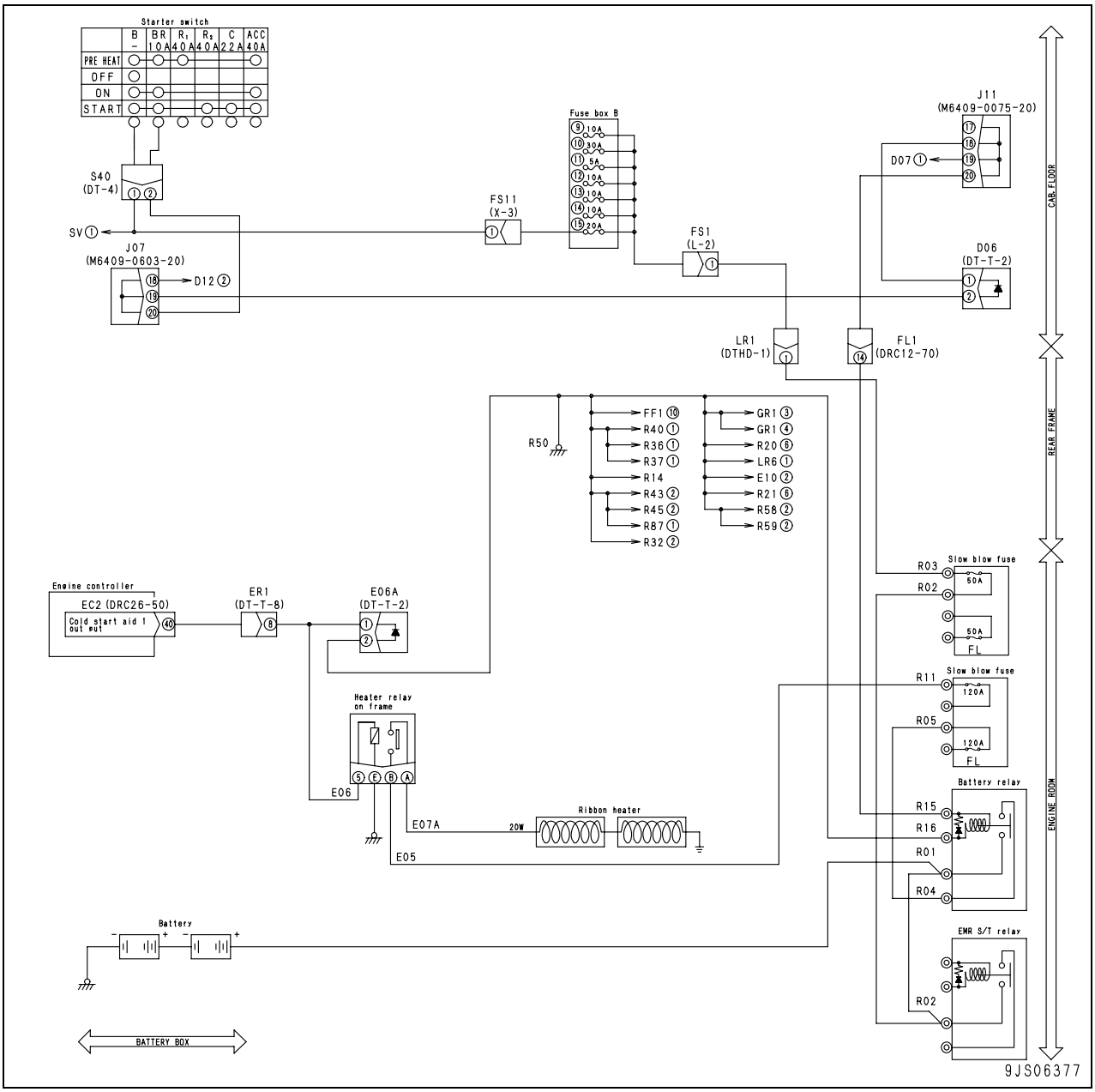


Failure code [CA2555] (Intake heater relay disconnection error)

Action code	Failure code	Trouble	Intake heater relay disconnection error (Engine controller system)
E01	**CA2555**		
Contents of trouble	• There is disconnection in intake air heater relay.		
Action of controller	• None in particular.		
Problem that appears on machine	• Intake air heater does not function. (Poor starting performance, white exhaust smoke at low temperature)		
Related information	• Method of reproducing failure code: Turn the starting switch ON when coolant temperature is –4°C or less.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective heater relay (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. (Test relay unit).		
			Between E06 and chassis ground	Resistance	
				300 – 600 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (Test by replacing relay unit.)		
			When heater relay is replaced with a relay of the same type, if the condition becomes normal, the heater relay is defective.		
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between EC2 (female) (40) – E06	Resistance	Max. 10 Ω
			Wiring harness between primary side of heater relay – chassis ground	Resistance	Max. 10 Ω
	3	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 among all pins between EC2 (female) (40) – EC2 (female) (E06, too, is disconnected.)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts among heater relay, engine unit wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			EC2 (female)	Resistance	
			Between (40) and chassis ground	300 – 600 Ω	

Circuit diagram related to intake heater relay

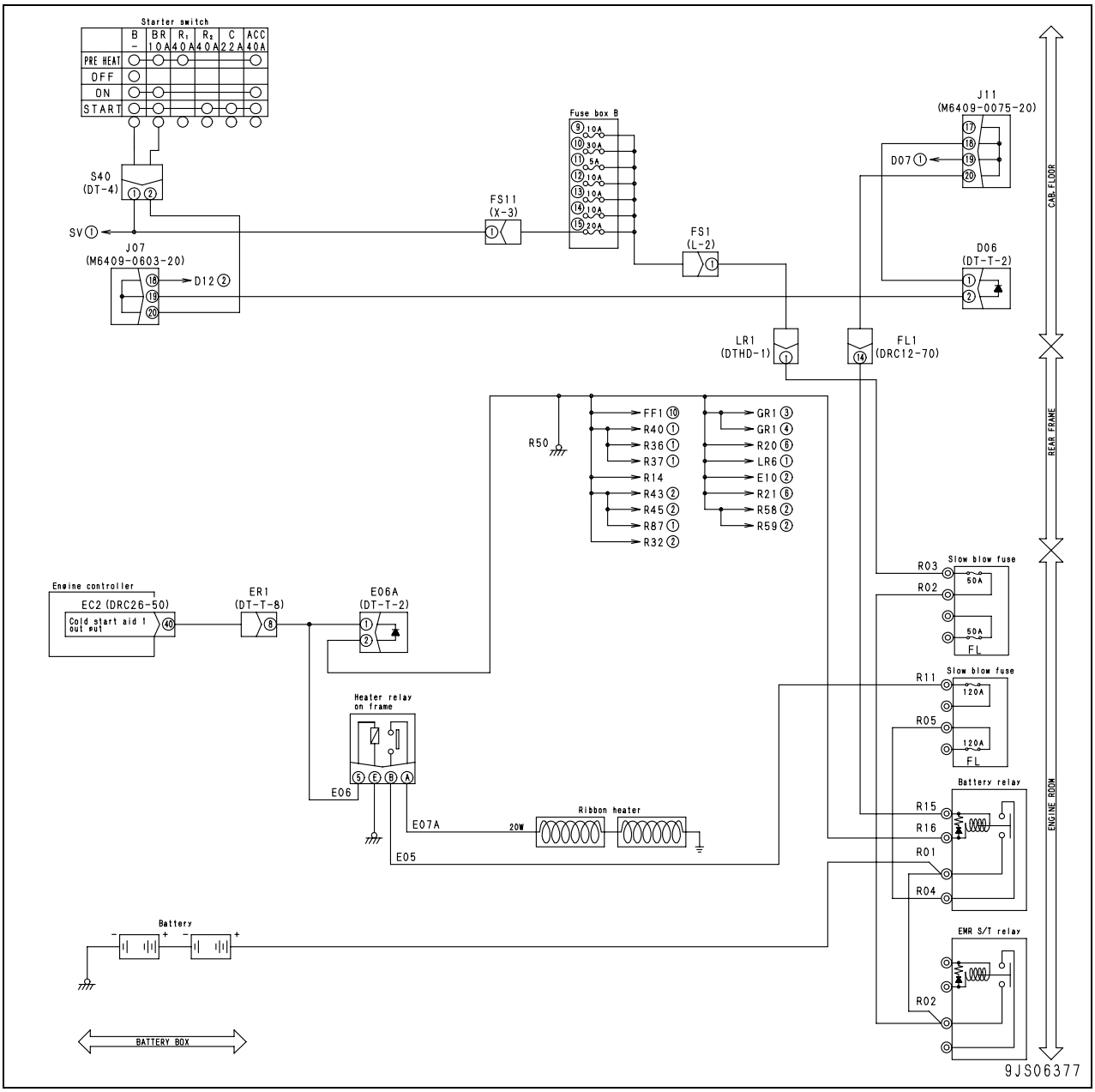


Failure code [CA2556] (Intake heater relay short circuit error)

Action code	Failure code	Trouble	Intake heater relay short circuit error (Engine controller system)
E01	**CA2556**		
Contents of trouble	• There is short circuit in intake air heater relay.		
Action of controller	• None in particular.		
Problem that appears on machine	• Intake air heater does not function. (Poor starting performance, white exhaust smoke at low temperature)		
Related information	• Method of reproducing failure code: Turn the starting switch ON when coolant temperature is –4°C or less.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective heater relay (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. (Test relay unit).			
			Between E06 and chassis ground	Resistance		
				300 – 600 Ω		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (Test by replacing relay unit.)			
			When heater relay is replaced with a relay of the same type, if the condition becomes normal, the heater relay is defective.			
	2	Ground 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 EC2 (female) (40) – E06	Resistance	Min. 100 kΩ	
	3	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 among all pins between EC2 (female) (40) – EC2 (female) (E06, too, is disconnected.)	Resistance	Min. 100 kΩ	
	4	Defective wiring harness connector	Connecting parts among heater relay, engine unit wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			EC2 (female)	Resistance		
			Between (40) and chassis ground	300 – 600 Ω		

Circuit diagram related to intake heater relay

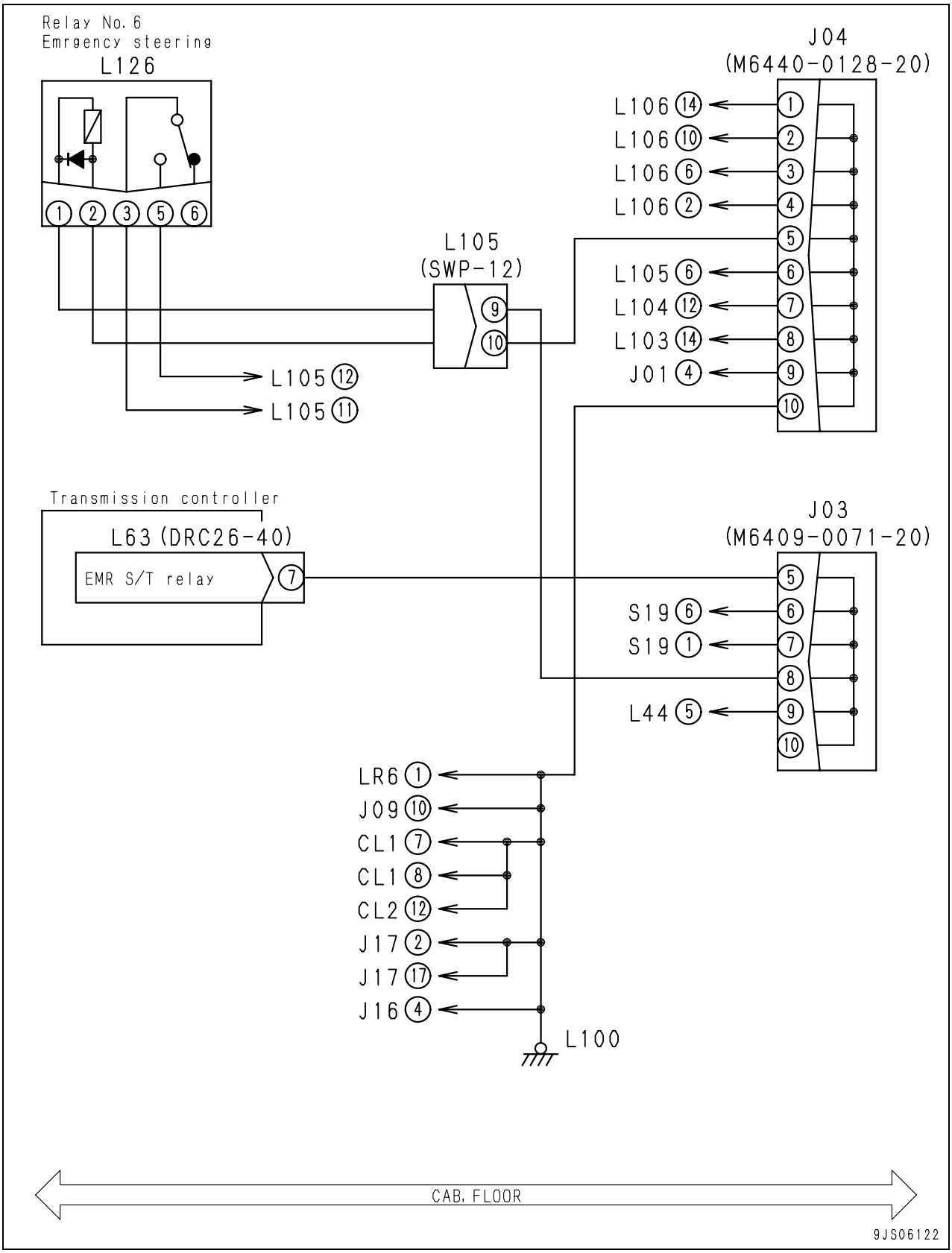


Failure code [D150KA] (Emergency steering relay: Disconnection)

Action code	Failure code	Trouble	Emergency steering relay: Disconnection (Transmission controller)
E03	**D150KA**		
Contents of trouble	• Since the emergency steering relay output system is disconnect, signals are not output to the emergency steering relay.		
Action of controller	• Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• If abnormality is detected in the steering pressure, operation of the automatic emergency steering becomes unavailable. • Self-check of the emergency steering is ended abnormally.		
Related information	• The output state (ON/OFF) to the emergency steering relay can be checked with the monitoring function (Code: 90949, D-OUT-0). • Method of reproducing failure code: Start engine, then operate the steering.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective emergency steering relay (L126) (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			When emergency steering relay (L126) is replaced with a relay of the same type, if the condition becomes normal, the emergency steering relay is defective.			
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L126 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L63 (female) (7) – L126 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between L126 (female) (2) – chassis ground	Resistance	Max. 1 Ω	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L63 (female)	Resistance		
			Between (7) and chassis ground	200 – 400 Ω		

Circuit diagram related to emergency steering relay

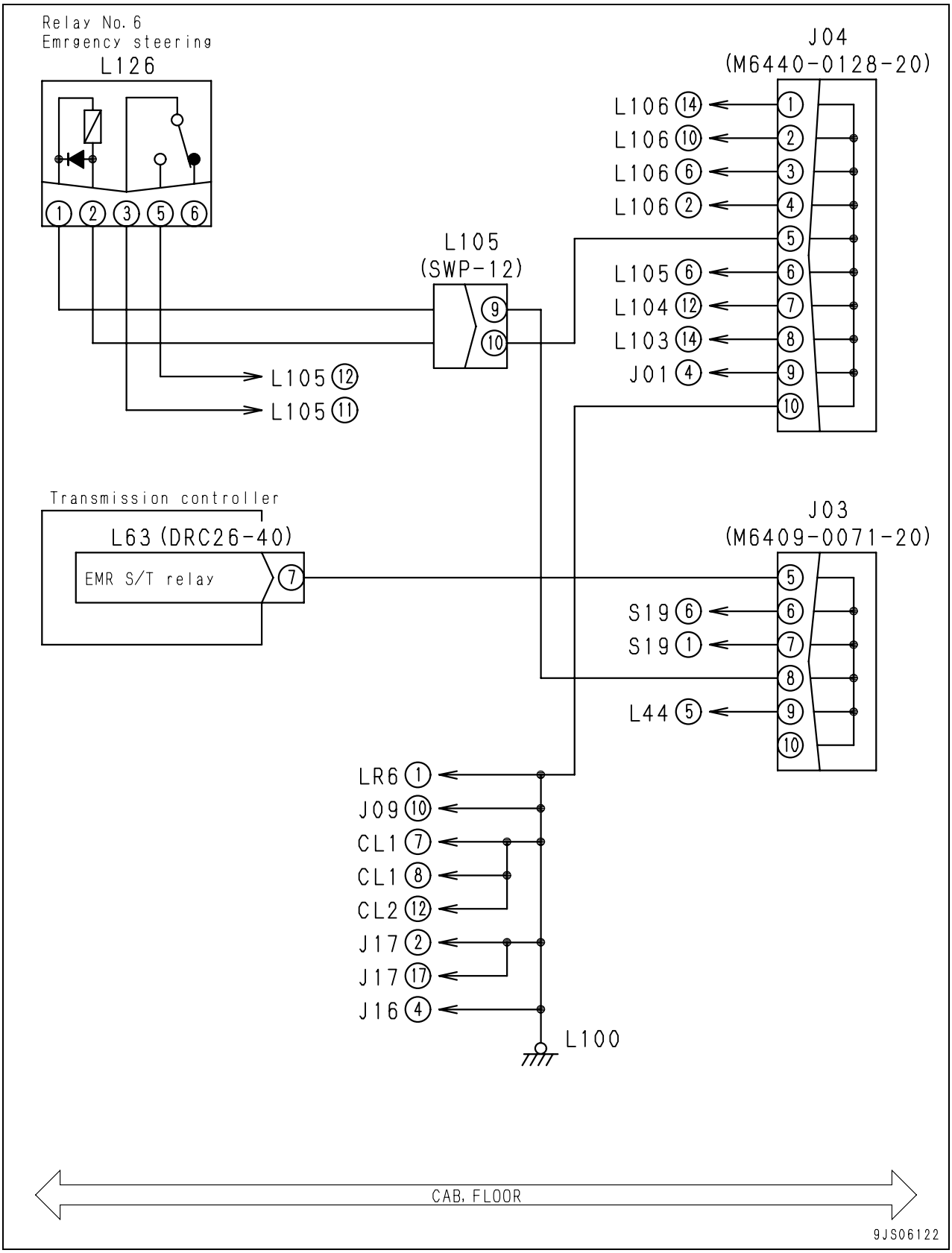


Failure code [D150KB] (Emergency steering relay: Short circuit)

Action code	Failure code	Trouble	Emergency steering relay: Short circuit (Transmission controller)
E03	**D150KB**		
Contents of trouble	• Since the emergency steering relay output system is shorted, signals are not output to the emergency steering relay.		
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	• If abnormality is detected in the steering pressure, operation of the automatic emergency steering becomes unavailable. • Self-check of the emergency steering is ended abnormally.		
Related information	• The output state (ON/OFF) to the emergency steering relay can be checked with the monitoring function (Code: 90949, D-OUT-0). • Method of reproducing failure code: Start engine and then operate the steering.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective emergency steering relay (L126) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			When emergency steering relay (L126) is replaced with a relay of the same type, if the condition becomes normal, the emergency steering relay is defective.			
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L126 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	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 L63 (female) (7) – L126 (female) (1) 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.			
			L63 (female)	Resistance		
			Between (7) and chassis ground	200 – 400 Ω		

Circuit diagram related to emergency steering relay

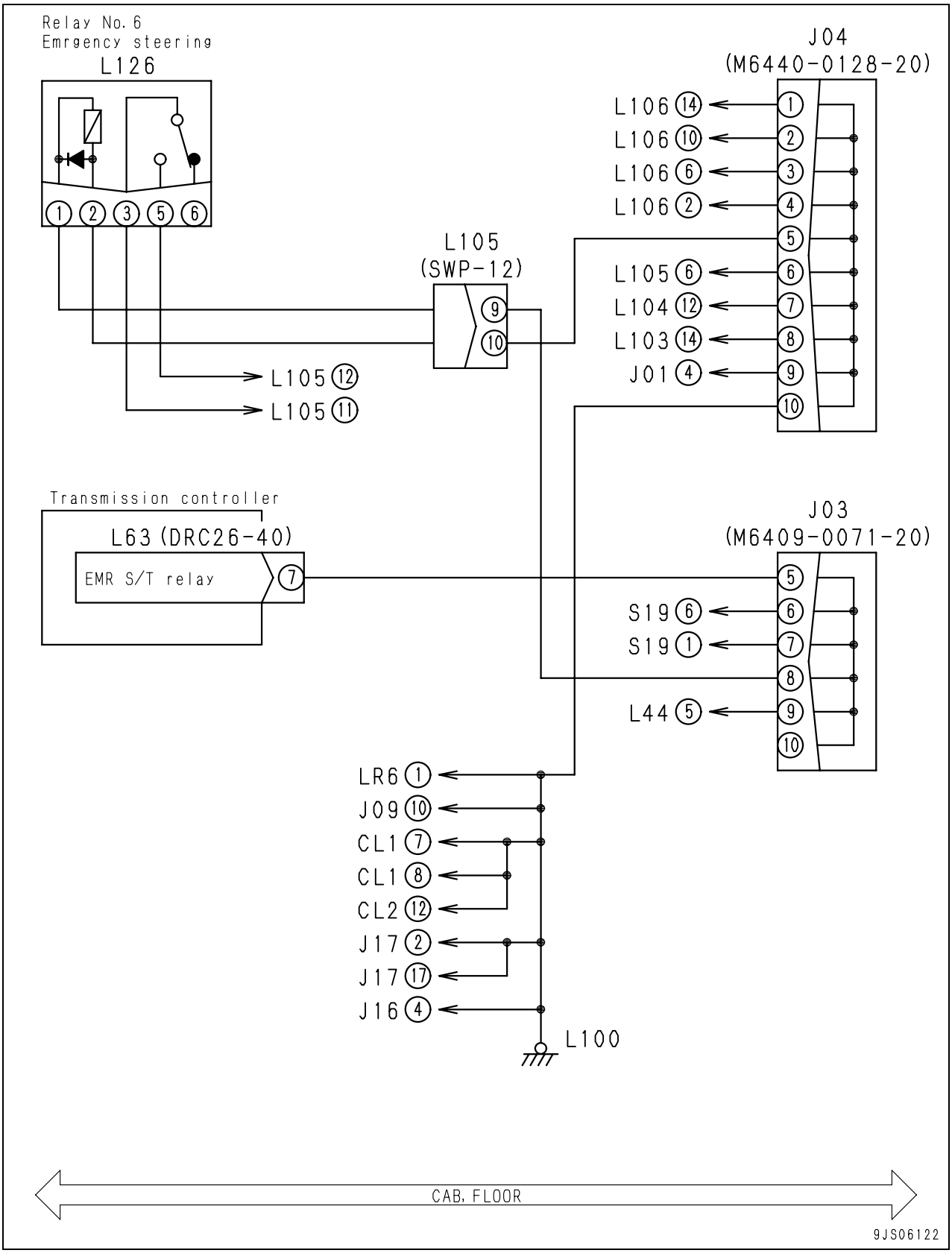


Failure code [D150KY] (Emergency steering relay: Short circuit with power supply line)

Action code	Failure code	Trouble	Emergency steering relay: Short circuit with power supply line (Transmission controller)
E03	**D150KY**		
Contents of trouble	• Since the emergency steering relay output system is shorted with the power source, signal output to the emergency steering relay is continued.		
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 emergency steering is activated during travel (resulting in seizure of the emergency steering motor).		
Related information	• The output state (ON/OFF) to the emergency steering relay can be checked with the monitoring function (Code: 90949, D-OUT-0). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective emergency steering relay (L126) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			When emergency steering relay (L126) is replaced with a relay of the same type, if the condition becomes normal, the emergency steering relay is defective.			
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L126 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L63 (female) (7) – L126 (female) (1) and chassis ground	Voltage	Max. 1 V	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L63 (female)	Resistance		
			Between (7) and chassis ground	200 – 400 Ω		

Circuit diagram related to emergency steering relay

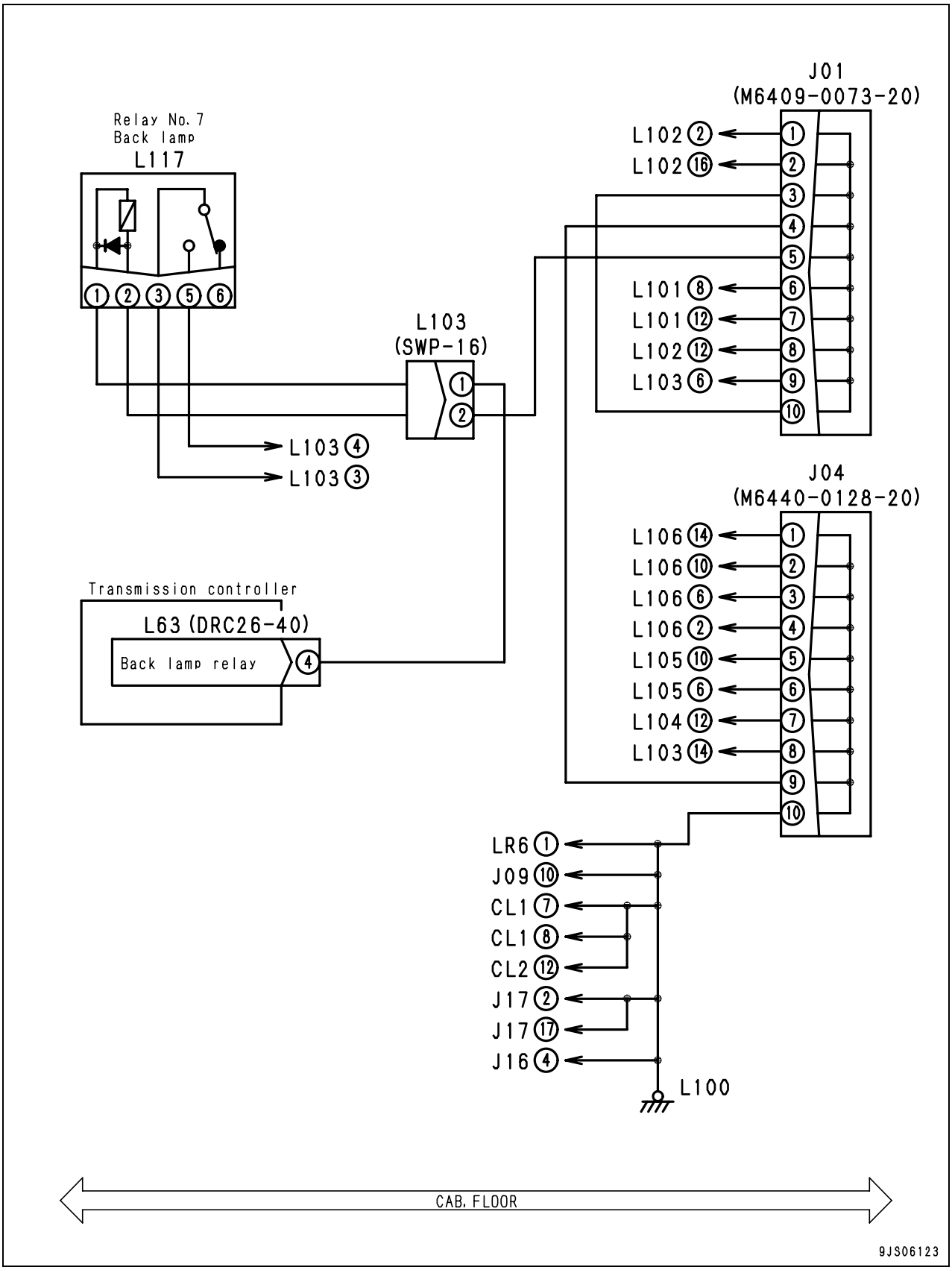


Failure code [D160KA] (Backup lamp relay: Disconnection)

Action code	Failure code	Trouble	Backup lamp relay: Disconnection (Transmission controller)
E01	**D160KA**		
Contents of trouble	• Since the backup lamp relay output system is disconnected, signals are not output to the backup lamp relay. • Since the backup lamp relay output system is shorted with the power source, signal output to the backup lamp lay is continued.		
Action of controller	• Turns the output to the backup lamp relay OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The backup lamp does not light up (disconnection). • The backup buzzer does not sound (disconnection). • The backup lamp remains turned on (hot short). • The backup buzzer sound does no stop (hot short).		
Related information	• The output state (ON/OFF) to the backup lamp relay can be checked with the monitoring function (Code: 90951, D-OUT-20). • Method of reproducing failure code: Turn the starting switch ON, and set FNR (directional) lever, joystick steering FNR (directional) switch, or right FNR (directional) switch to R (reverse).		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective backup lamp relay (L117) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			When backup lamp relay (L117) is replaced with a relay of the same type, if the condition becomes normal, the backup lamp relay is defective.			
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L117 (male)		Resistance	
			Between (1) and (2)		200 – 400 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L63 (female) (4) – L117 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L117 (female) (2) – chassis ground		Resistance	Max. 1 Ω
	3	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L63 (female) (4) – L117 (female) (1) and chassis ground		Voltage	Max. 1 V
	4	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L63	FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch	Voltage	
			Between (4) and chassis ground	R (Reverse)	20 – 30 V	
				Other than above	Max. 1 V	

Circuit diagram related to backup lamp relay

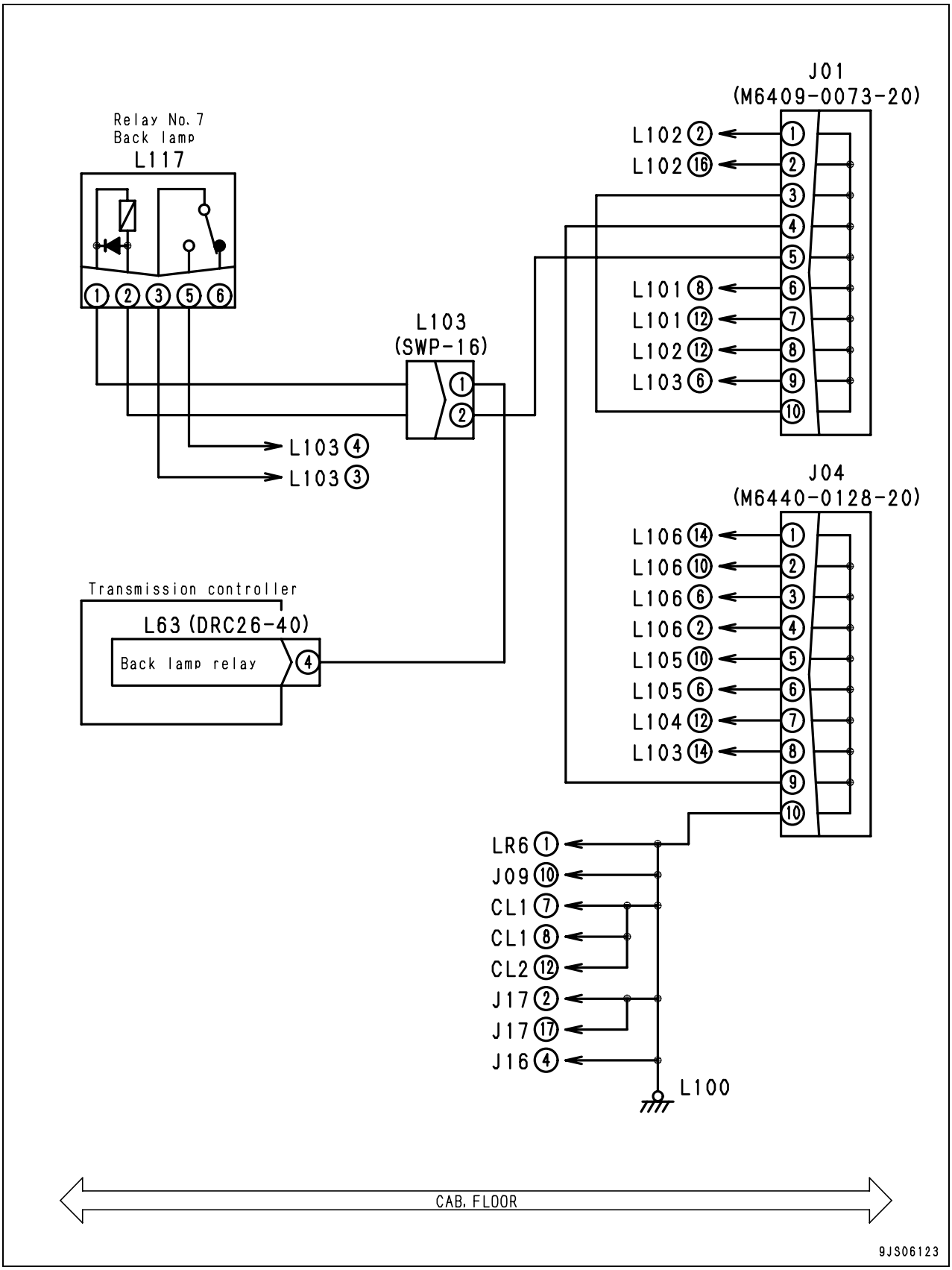


Failure code [D160KB] (Backup lamp relay: Short circuit)

Action code	Failure code	Trouble	Backup lamp relay: Short circuit (Transmission controller)
E01	**D160KB**		
Contents of trouble	• Since the backup lamp relay output system is shorted, signals are not output to the backup lamp relay.		
Action of controller	• Turns the output to the backup lamp relay OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The backup lamp does not light up. • The backup buzzer does not sound.		
Related information	• The output state (ON/OFF) to the backup lamp relay can be checked with the monitoring function (Code: 90951, D-OUT-20). • Method of reproducing failure code: Turn the starting switch ON, and set FNR (directional) lever, joystick steering FNR (directional) switch, or right FNR (directional) switch to R (reverse).		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective backup lamp relay (L101) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			When backup lamp relay (L117) is replaced with a relay of the same type, if the condition becomes normal, the backup lamp relay is defective.			
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L117 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
	2	Ground 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 L63 (female) (4) – L117 (female) (1) and chassis ground	Resistance	Min. 1 MΩ	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L63	FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch	Voltage	
			Between (4) and chassis ground	R (Reverse)	20 – 30 V	
				Other than above	Max. 1 V	

Circuit diagram related to backup lamp relay

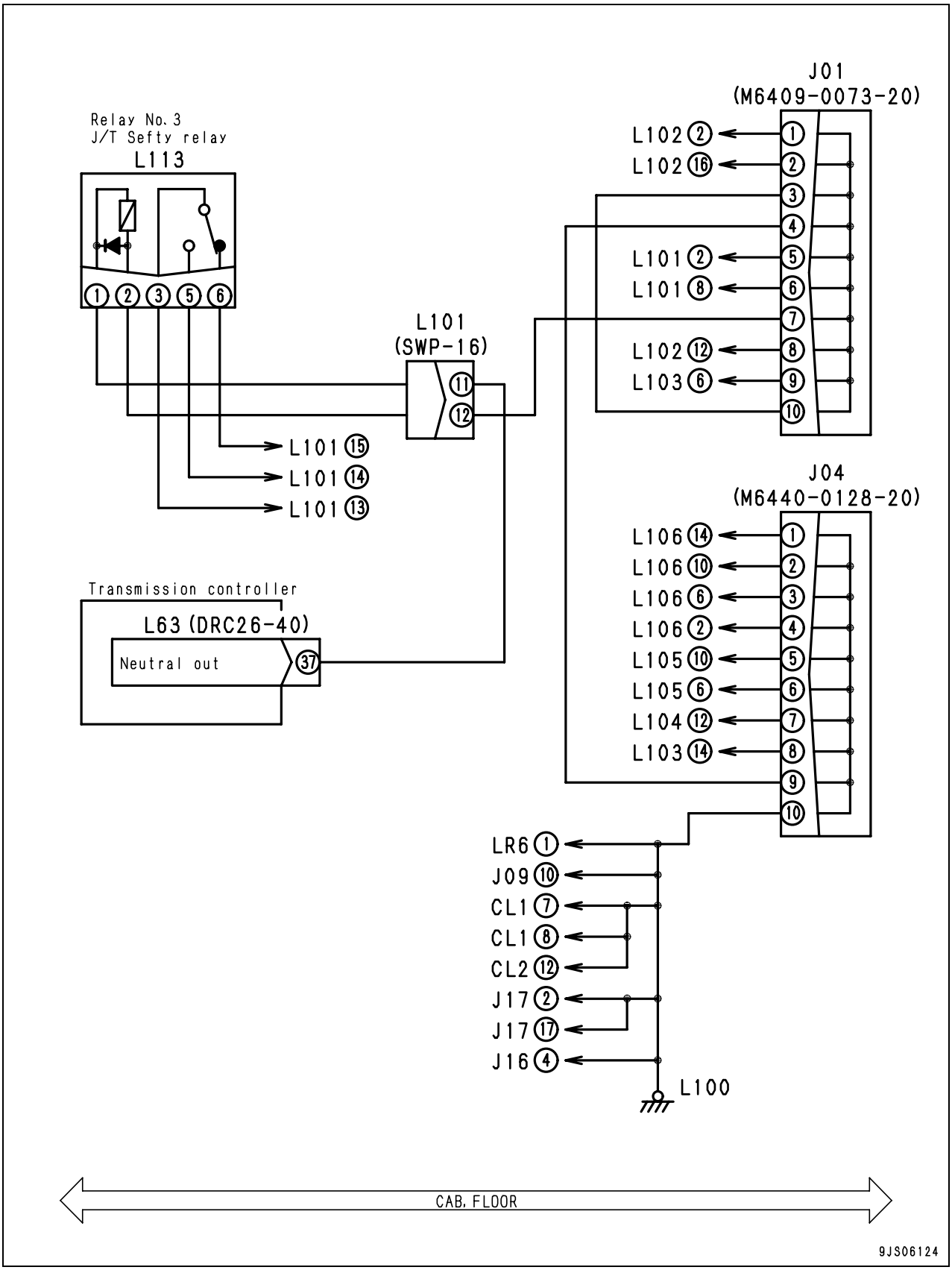


Failure code [D191KA] (Joystick steering neutral safety relay: Disconnection)

Action code	Failure code	Trouble	Joystick steering neural safety relay: Disconnection (Work equipment controller system)
E01	**D191KA**		
Contents of trouble	• Since the output system of the joystick steering neutral safety relay is disconnected, signals are not output to the neutral safety relay.		
Action of controller	• If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• While operating joystick steering, engine can be started (Steering moves immediately after engine start). • Starting of the engine is available even when the joystick steering FNR (directional) switch or right FNR (directional) switch is not set to N (neutral).		
Related information	• When the neutral position adjustment (initial setting) is not done for the joystick steering, the neutral safety relay does not work. • The output state (ON/OFF) to the neutral safety relay can be checked with the monitoring function (Code: 40954, D-OUT-20). • Only for joystick steering • Method of reproducing failure code: Turn the starting switch ON and operate the joystick steering (with the engine being stopped).		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective joystick steering neutral safety relay (L113) (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L113 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L63 (female) (37) – L113 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between L113 (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. • Operate the joystick steering lever.			
			L63	Voltage		
			Between (37) and chassis ground	20 – 30 V		

Circuit diagram related to joystick steering neutral safety relay

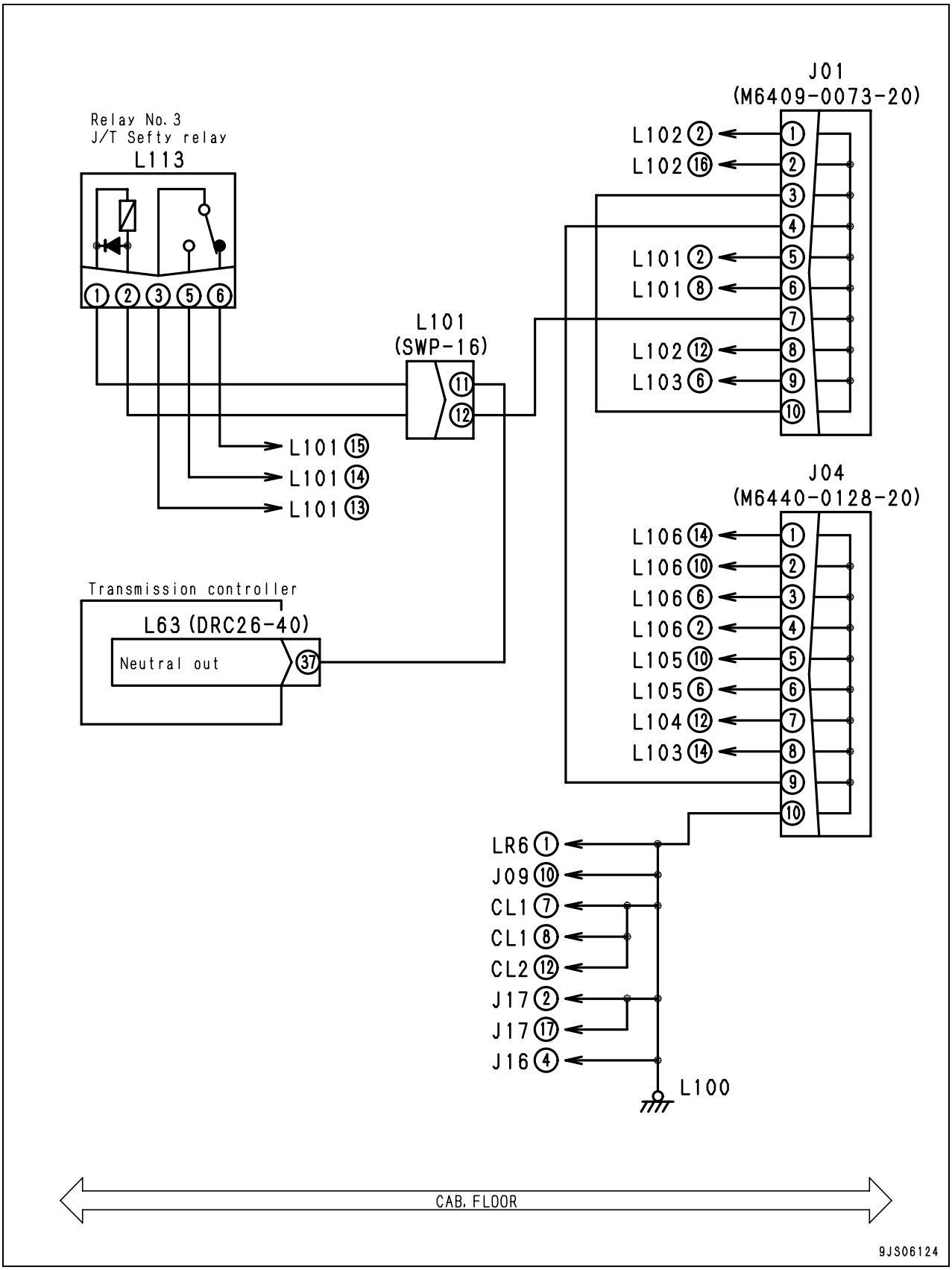


Failure code [D191KB] (Joystick steering neutral safety relay: Short circuit)

Action code	Failure code	Trouble	Joystick steering neural safety relay: Short circuit (Work equipment controller system)
E01	**D191KB**		
Contents of trouble	• Since the output system of the joystick steering neutral safety relay is shorted, signals are not output to the neutral safety relay.		
Action of controller	• Turns the output to the joystick steering 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 joystick steering, engine can be started (Steering moves immediately after engine start). • Starting of the engine is available even when the joystick steering FNR (directional) switch or right FNR (directional) switch is not set to N (neutral).		
Related information	• When the neutral position adjustment (initial setting) is not done for the joystick steering, the neutral safety relay does not work. • As long as the failure code is turned on, the work equipment controller does not output signals to the joystick steering neutral safety relay. • The output state (ON/OFF) to the neutral safety relay can be checked with the monitoring function (Code: 40954, D-OUT-20). • Only for joystick steering • Method of reproducing failure code: Turn the starting switch ON and operate the joystick steering (with the engine being stopped).		

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting			
	1	Defective joystick steering neutral safety relay (L113) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L113 (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 L63 (female) (37) – L113 (female) (1) and chassis ground	Resis-tance	Min. 1 MΩ	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. • Operate the joystick steering lever.			
			L63	Voltage		
			Between (37) and chassis ground	20 – 30 V		

Circuit diagram related to joystick steering neutral safety relay

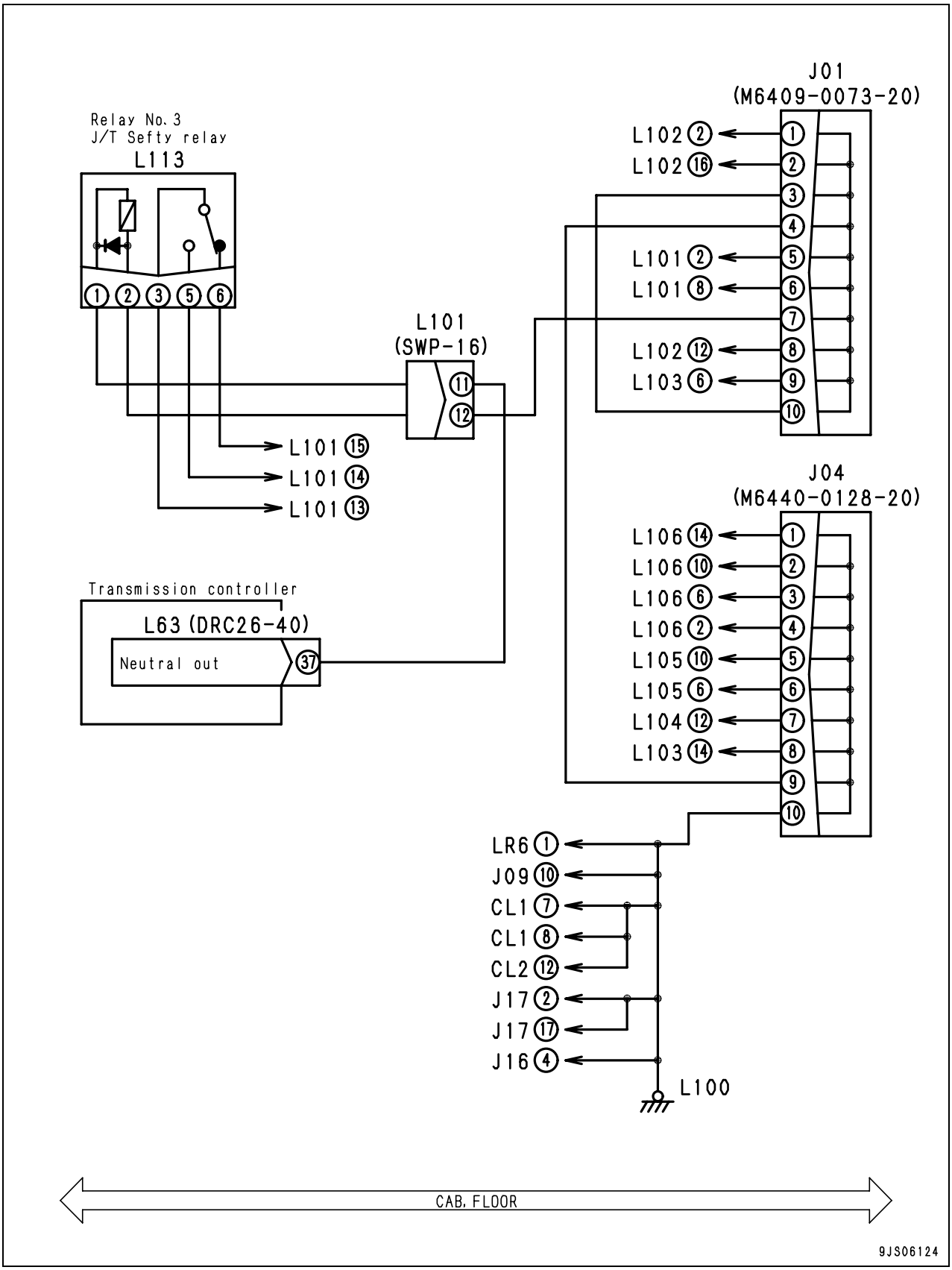


Failure code [D191KY] (Joystick steering neutral safety relay: Short circuit with power supply line)

Action code	Failure code	Trouble	Joystick steering neutral safety relay: Short circuit with power supply line (Work equipment controller system)
E01	**D191KY**		
Contents of trouble	• Since the output system of the joystick steering neutral safety relay is shorted with the power source, signals are not output to the neutral safety relay.		
Action of controller	• Turns the output to the joystick steering 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	• The engine does not start.		
Related information	• When the neutral position adjustment (initial setting) is not done for the joystick steering, the neutral safety relay does not work. • As long as the failure code is turned on, the work equipment controller does not output signals to the joystick steering neutral safety relay. • The output state (ON/OFF) to the neutral safety relay can be checked with the monitoring function (Code: 40954, D-OUT-20). • Only for joystick steering • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective joystick steering neutral safety relay (L113) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L113 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L63 (female) (37) – L113 (female) (1) and chassis ground	Voltage	Max. 1 V	
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. • Operate the joystick steering lever.			
			L63	Voltage		
			Between (37) and chassis ground	20 – 30 V		

Circuit diagram related to joystick steering neutral safety relay

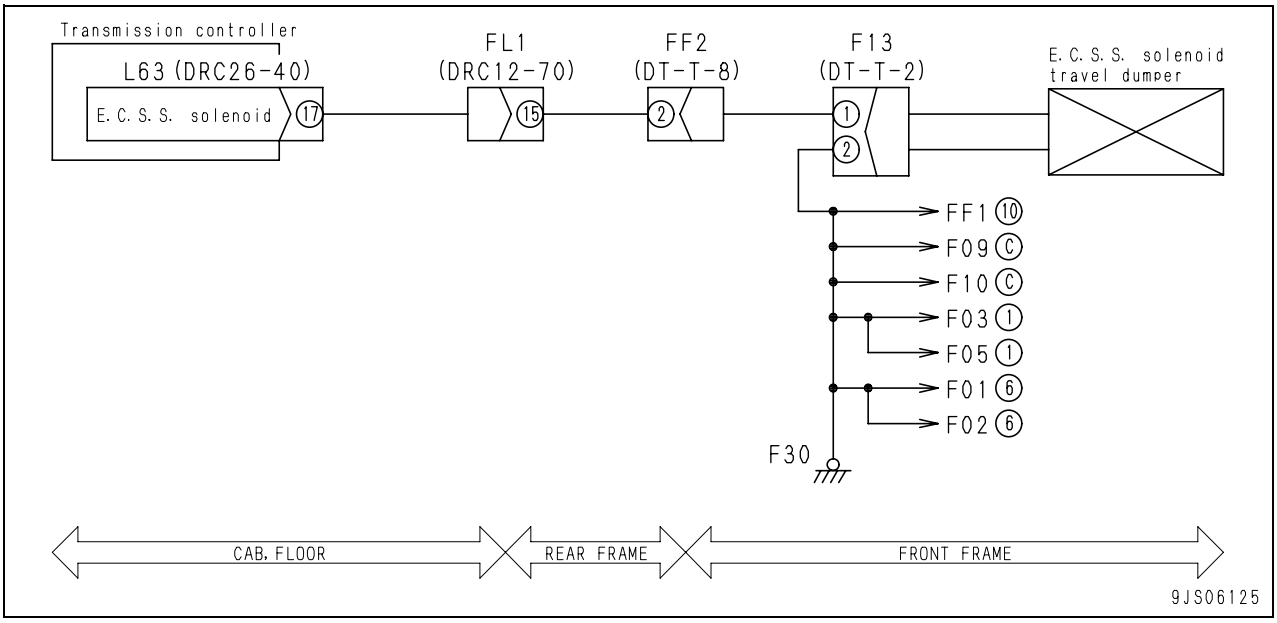


Failure code [D192KA] (ECSS solenoid: Disconnection)

Action code	Failure code	Trouble	ECSS solenoid: Disconnection (Transmission controller)
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 problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The ECSS does not operate.		
Related information	• The output state (ON/OFF) to the ECSS solenoid can be checked with the monitoring function (Code: 90949, D-OUT-1). • Applicable only to ECSS specification machines (if equipped) • Method of reproducing failure code: Turn the starting switch ON, ECSS switch ON and drive the machine at any gear speed other than 1st speed.		

	Causes		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.			
			F13 (male)	Resistance		
			Between (1) and (2)	5 – 15 Ω		
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L63 (female) (17) – F13 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between F13 (female) (2) – chassis ground	Resistance	Max. 1 Ω	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L63 (female)	Resistance		
			Wiring harness between (17) – chassis ground	5 – 15 Ω		

Circuit diagram related to ECSS solenoid

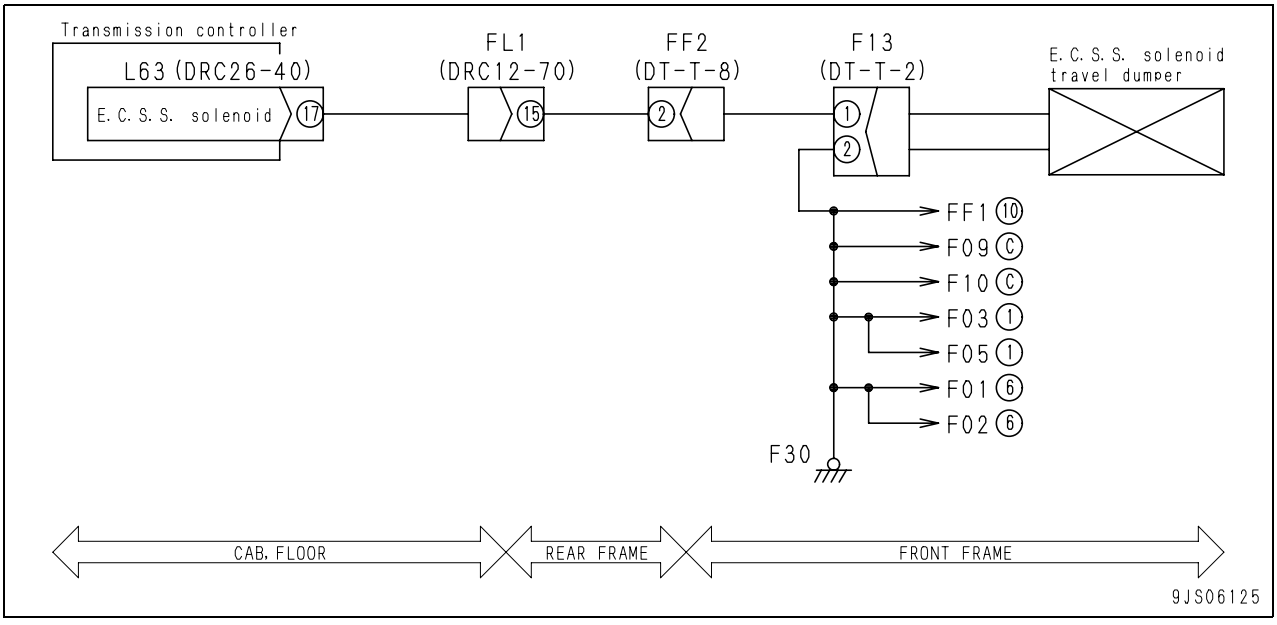


Failure code [D192KB] (ECSS solenoid: Short circuit)

Action code	Failure code	Trouble	ECSS solenoid: Short circuit (Transmission controller)
E01	**D192KB**		
Contents of trouble	• Since the ECSS solenoid system is shorted, abnormal current flowed when ECSS 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. • The wiring harness or controller may be burnt out.		
Related information	• The output state (ON/OFF) to the ECSS solenoid can be checked with the monitoring function (Code: 90949, D-OUT-1). • Applicable only to ECSS specification machines (if equipped) • Method of reproducing failure code: Turn the starting switch ON, ECSS switch ON and drive the machine at any gear speed other than 1st speed.		

	Causes		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.			
			F13 (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 L63 (female) (17) – F13 (female) (1) 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.			
			L63 (female)	Resistance		
			Wiring harness between (17) – chassis ground	5 – 15 Ω		

Circuit diagram related to ECSS solenoid

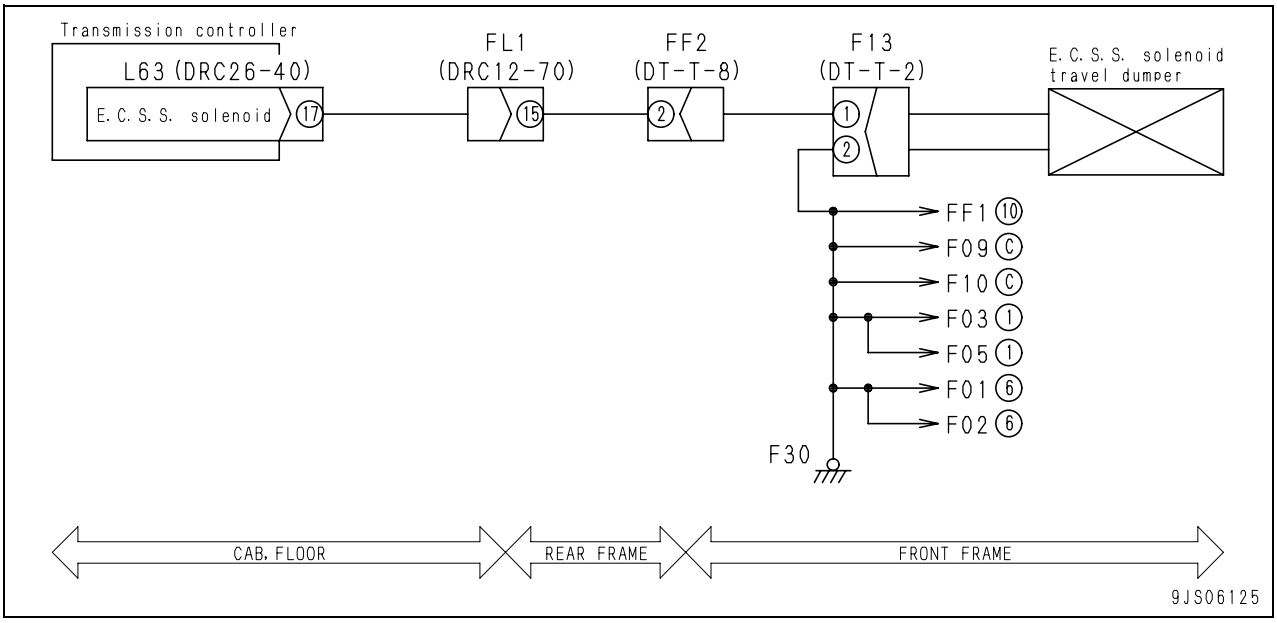


Failure code [D192KY] (ECSS solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	ECSS solenoid: Short circuit with power supply line (Transmission controller)
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 problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The ECSS keeps operating.		
Related information	• The output state (ON/OFF) to the ECSS solenoid can be checked with the monitoring function (Code: 90949, D-OUT-1). • Applicable only to ECSS specification machines (if equipped) • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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.		
			F13 (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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between L63 (female) (17) – F13 (female) (1) and chassis ground	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L63 (female)	Resistance	
			Wiring harness between (17) – chassis ground	5 – 15 Ω	

Circuit diagram related to ECSS solenoid

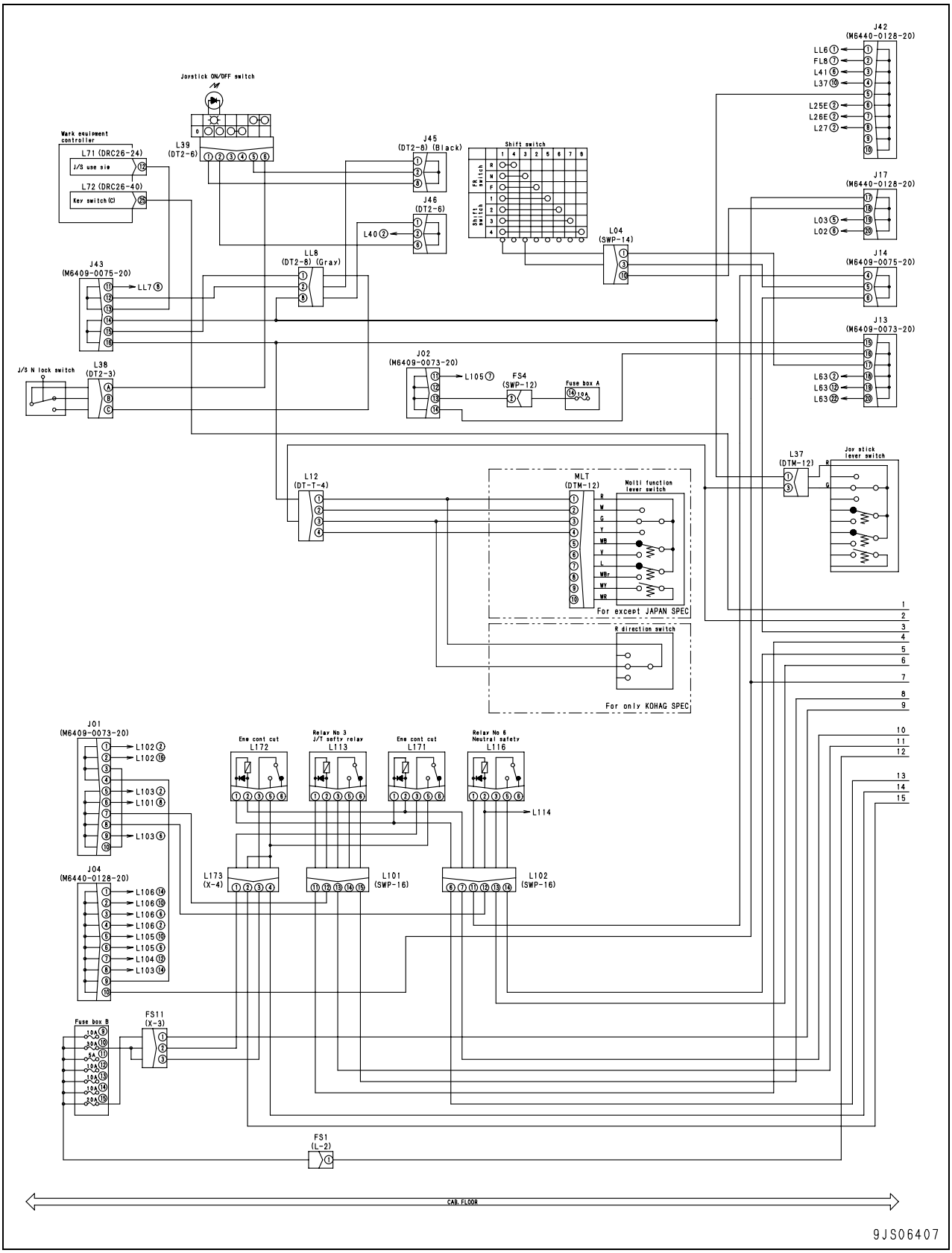


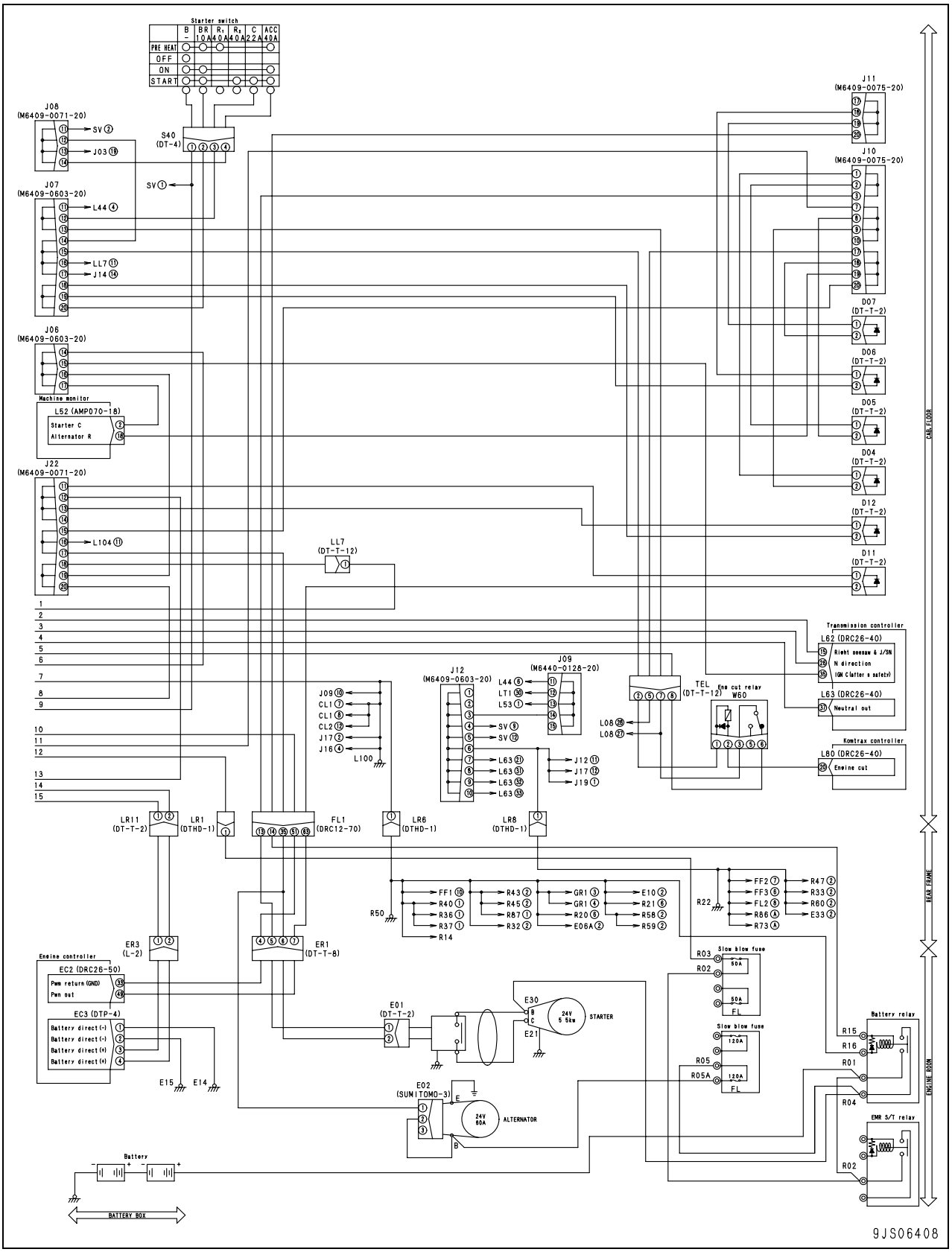
Failure code [D5ZHKA] (Terminal C signal: Disconnection)

Action code	Failure code	Trouble	Terminal C signal: Disconnection (Transmission controller)
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. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Starting performance is poor		
Related information	• The input state (ON/OFF) to the transmission controller from starting switch terminal C can be checked with the monitoring function (Code: 40907, D-IN-16). • Method of reproducing failure code: Set the starting switch to START position		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No. 15 of fuse box B	If the fuse is burn, 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			
			S40	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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between S40 (female) (3) – W60 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between W60 (female) (6) – L116 (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between L116 (female) (3) – L62 (female) (35)		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 S40 (female) (3) – W60 (female) (3), – circuit branch end and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between W60 (female) (6) – L116 (female) (5), – circuit branch end and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L116 (female) (3) – L62 (female) (35), – circuit branch end 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			
			L62	Starting switch	Voltage	
			Between (35) and chassis ground	START	20 – 30 V	
				OFF, ON	Max. 1 V	

Circuit diagram related to engine starting system (C terminal signal)



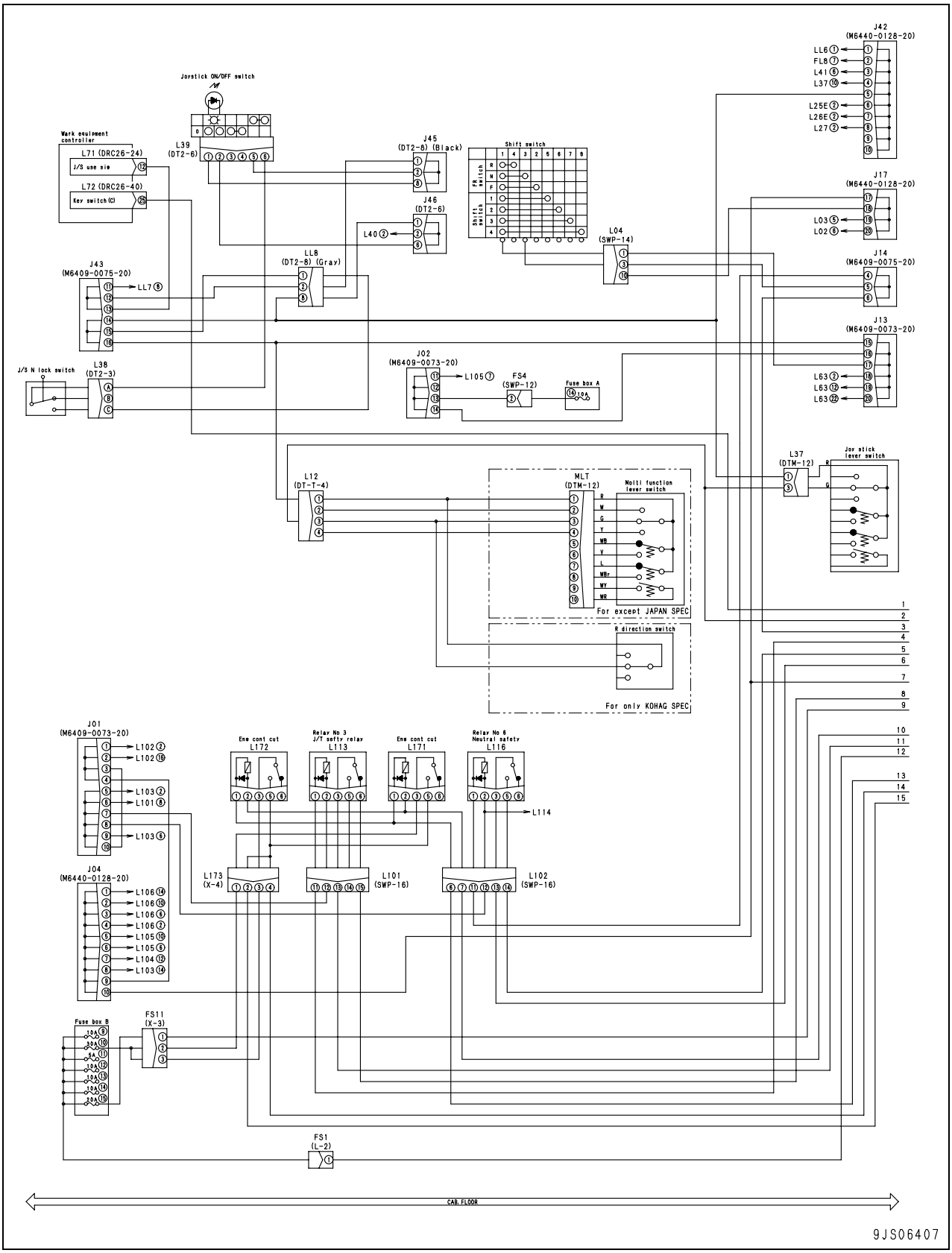

Starter switch
B BR R1 R2 C ACC
PRE HEAT
OFF
ON
START
J08 (M6409-0071-20)
J07 (M6409-0603-20)
J06 (M6409-0603-20)
J22 (M6409-0071-20)
J11 (M6409-0075-20)
J10 (M6409-0075-20)
S40 (DT-4)
SV①
J03⑲
L44④
LL7⑪
J14⑭
L104⑪
Machine monitor
L52 (AMP070-18)
Starter C
Alternator R
LL7 (DT-T-12)
D07 (DT-T-2)
D06 (DT-T-2)
D05 (DT-T-2)
D04 (DT-T-2)
D12 (DT-T-2)
D11 (DT-T-2)
Transmission controller
L62 (DRC26-40)
Right seesaw & J/SW
N direction
IGN (after s safety)
L63 (DRC26-40)
Neutral out
Komtrax controller
L80 (DRC26-40)
Engine cut
J12 (M6409-0603-20)
J09 (M6440-0128-20)
TEL (DT-T-12)
Ena cut relay W60
L08㉕
L08㉗
J09⑯
CL1⑦
CL1⑧
CL2⑮
J17②
J16④
L100
SV⑨
SV⑫
L63㉑
L63㉛
L63㉜
L63㉝
J12⑪
J17⑫
J19①
LR11 (DT-T-2)
LR1 (DTHD-1)
FL1 (DRC12-70)
LR6 (DTHD-1)
LR8 (DTHD-1)
R50
FF1⑩
R40①
R36①
R37①
R14
R43②
R45②
R87①
R32②
GR1③
GR1④
R20⑥
E06A②
E10②
R21⑥
R58②
R59②
R22
FF2⑦
FF3⑧
FL2⑧
R86Ⓐ
R73Ⓐ
R47②
R33②
R60②
E33②
ER3 (L-2)
ER1 (DT-T-8)
Engine controller
EC2 (DRC26-50)
Pwm return (GND)
Pwm out
EC3 (DTP-4)
Battery direct (-)
Battery direct (-)
Battery direct (+)
Battery direct (+)
E15
E14
E01 (DT-T-2)
E30
24V 5.5kw
STARTER
E21
E02 (SUMITOMO-3)
24V 60A
ALTERNATOR
Battery
BATTERY BOX
R03
R02
Slow blow fuse
50A
50A
FL
Slow blow fuse
120A
R05
R05A
120A
FL
Battery relay
R15
R16
R01
R04
EMR S/T relay
R02
CAB FLOOR
REAR FRAME
ENGINE ROOM
9JS06408

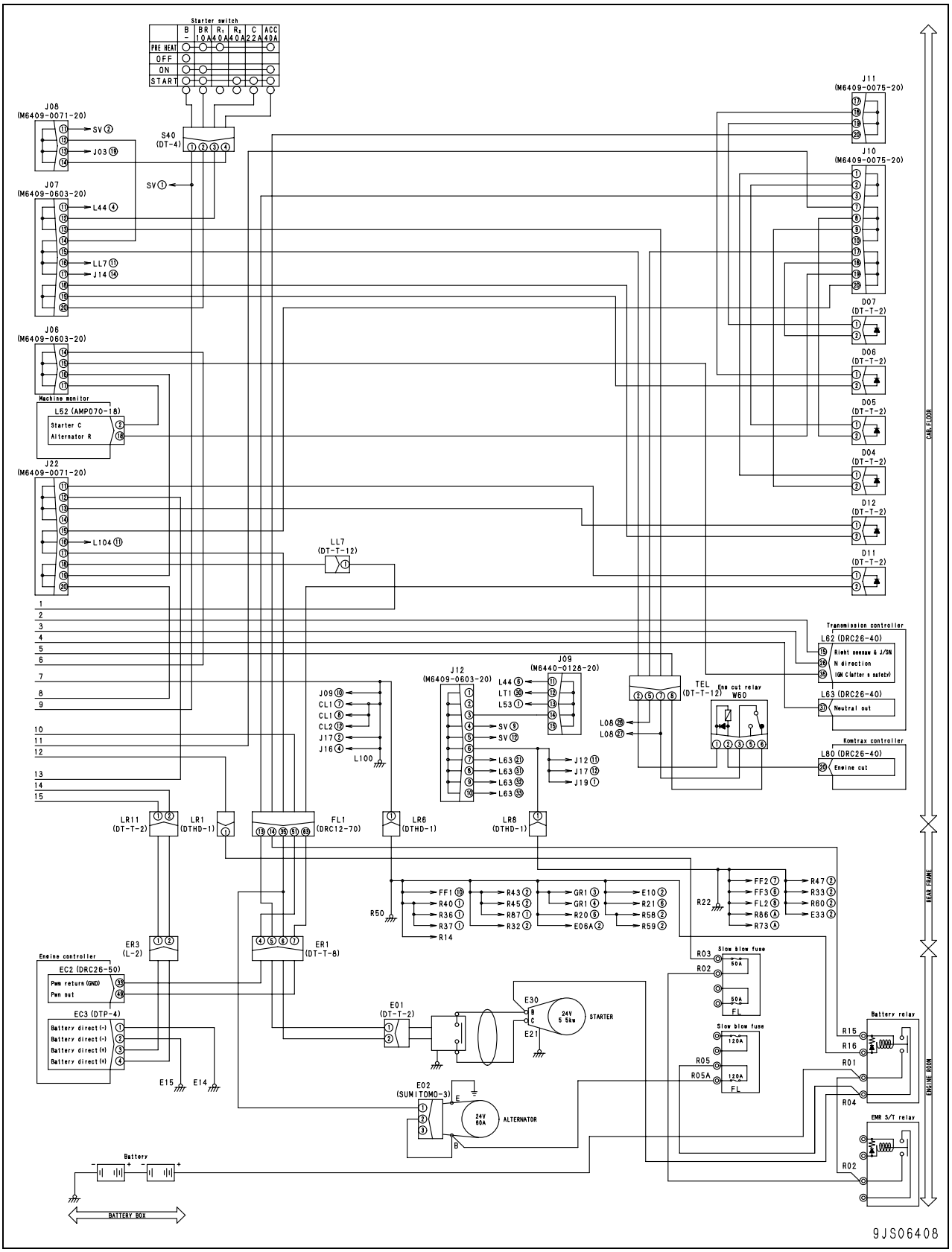
Failure code [D5ZHKB] (Terminal C signal: Short circuit)

Action code	Failure code	Trouble	Terminal C signal: Short circuit (Transmission controller)
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 problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• Starting performance is poor		
Related information	• The input state (ON/OFF) to the transmission controller from starting switch terminal C can be checked with the monitoring function (Code: 40905, D-IN-7). • Method of reproducing failure code: Start engine		

	Causes		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			
			S40	Starting switch	Resistance	
			Between (1) and (3)	START	Max. 1 Ω	
				OFF, ON	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting after engine start and during engine operation			
			Wiring harness between S40 (female) (3) – W60 (female) (3), – circuit branch end and chassis ground		Voltage	Max. 1 V
			Wiring harness between W60 (female) (6) – L116 (female) (5), – circuit branch end and chassis ground		Voltage	Max. 1 V
			Wiring harness between L116 (female) (3) – L62 (female) (35), – circuit branch end 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			
			L62	Starting switch	Voltage	
			Between (35) and chassis ground	START	20 – 30 V	
				OFF, ON	Max. 1 V	

Circuit diagram related to engine starting system (C terminal signal)



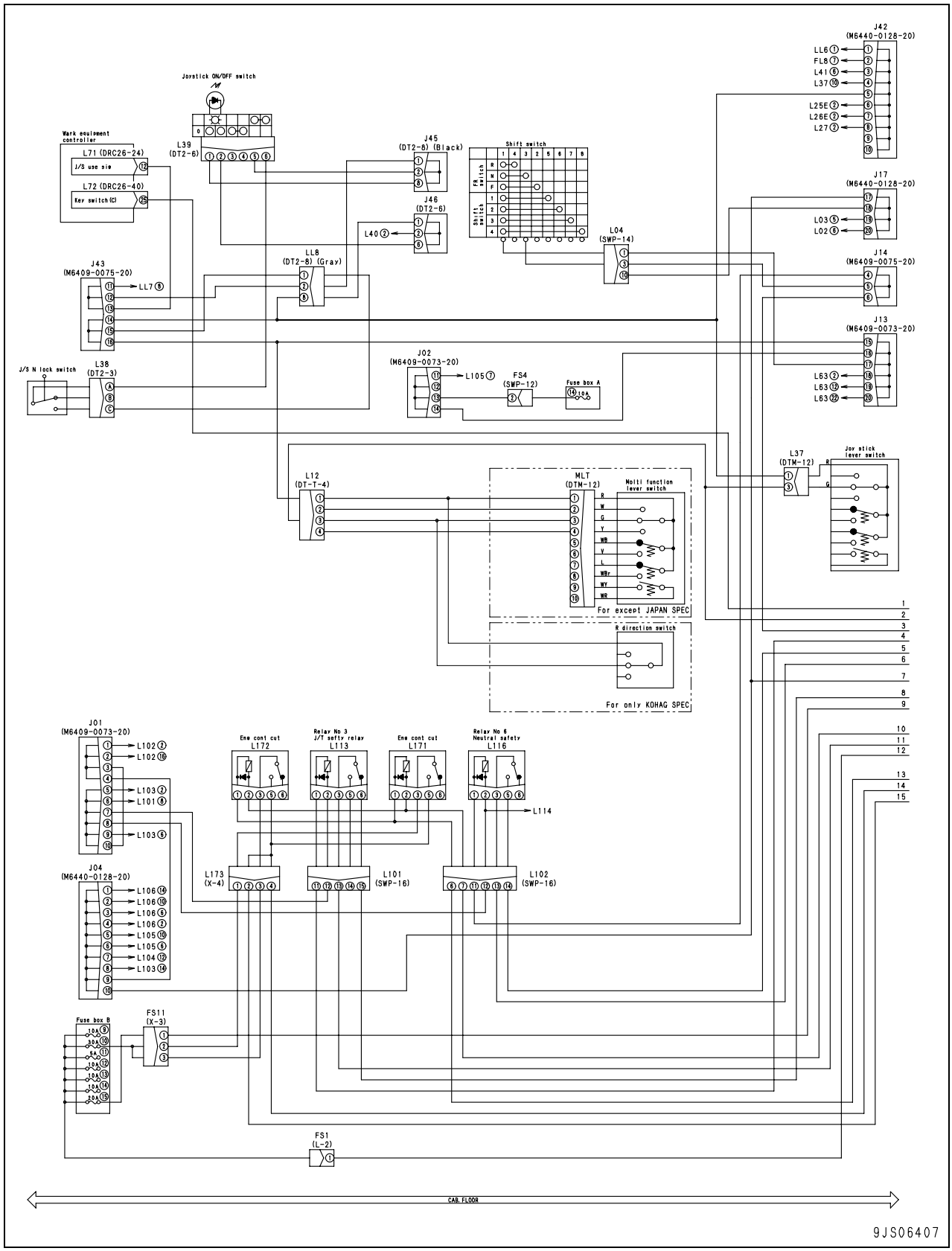

Starter switch
B BR R1 R2 C ACC
PRE HEAT
OFF
ON
START
S40 (DT-4)
J08 (M6409-0071-20)
J07 (M6409-0603-20)
J06 (M6409-0603-20)
J22 (M6409-0071-20)
J11 (M6409-0075-20)
J10 (M6409-0075-20)
D07 (DT-T-2)
D06 (DT-T-2)
D05 (DT-T-2)
D04 (DT-T-2)
D12 (DT-T-2)
D11 (DT-T-2)
Machine monitor
L52 (AMP070-18)
Starter C
Alternator R
LL7 (DT-T-12)
J12 (M6409-0603-20)
J09 (M6440-0128-20)
TEL (DT-T-12)
Ena cut relay W60
Transmission controller
L62 (DRC26-40)
Right seesaw & J/SW
N direction
IGN (after s safety)
L63 (DRC26-40)
Neutral out
Komtrax controller
L80 (DRC26-40)
Engine cut
LR11 (DT-T-2)
LR1 (DTHD-1)
FL1 (DRC12-70)
LR6 (DTHD-1)
LR8 (DTHD-1)
L100
R50
R14
R22
ER3 (L-2)
ER1 (DT-T-8)
Engine controller
EC2 (DRC26-50)
Pwm return (GND)
Pwm out
EC3 (DTP-4)
Battery direct (-)
Battery direct (-)
Battery direct (+)
Battery direct (+)
E15
E14
E01 (DT-T-2)
E30
24V 5.5kw
STARTER
E21
E02 (SUMITOMO-3)
24V 60A
ALTERNATOR
Battery
BATTERY BOX
Slow blow fuse
50A
50A
FL
Slow blow fuse
120A
120A
FL
Battery relay
EMR S/T relay
R03
R02
R15
R16
R01
R04
R05
R05A
R02
CAB FLOOR
REAR FRAME
ENGINE ROOM
9JS06408

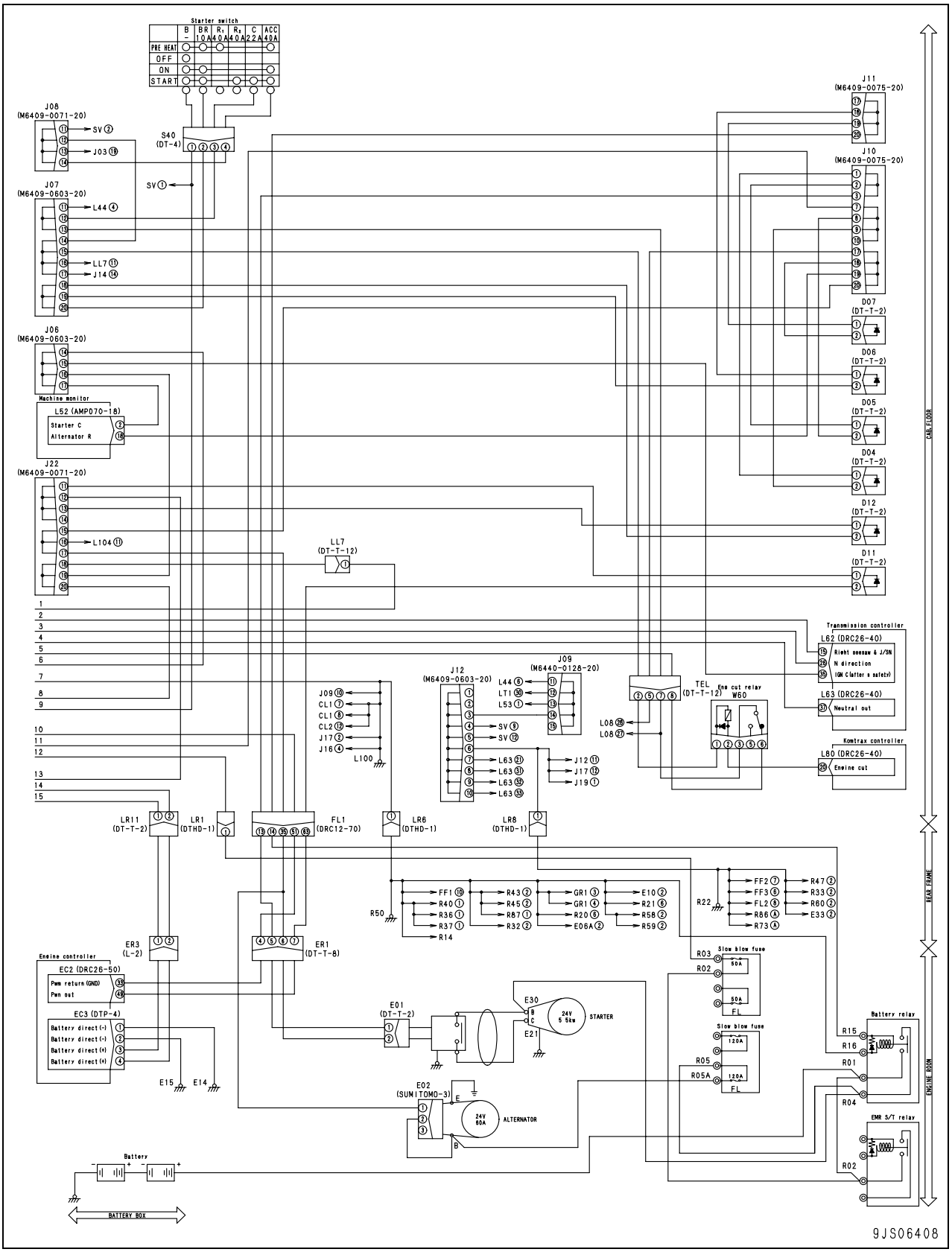
Failure code [D5ZHL6] (Terminal C signal: Signal does not match engine running or stopped state)

Action code	Failure code	Trouble	Terminal C signal: Signal does not match engine running or stopped state (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 voltage is supplied to the alternator R terminal.)		
Action of controller	• None in particular. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The engine does not start.		
Related information	• The input state (ON/OFF) to the machine monitor from the starting switch terminal C can be checked with the monitoring function (Code: 40900, D-IN-2). • Method of reproducing failure code: Set the starting switch to START position		

	Causes		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			
			S40	Starting switch	Voltage	
			Between (3) and chassis ground	START	20 – 30 V	
				OFF, ON	Max. 1 V	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between S40 (female) (3) – W60 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between W60 (female) (6) – L116 (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between L116 (female) (3) – L52 (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 S40 (female) (3) – W60 (female) (3), – circuit branch end and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between W60 (female) (6) – L116 (female) (5), – circuit branch end and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L116 (female) (3) – L52 (female) (2), – circuit branch end and chassis ground		Resistance	Min. 1 MΩ
	4	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON, OFF or START and carry out troubleshooting			
			L52	Starting switch	Voltage	
			Between (2) and chassis ground	START	20 – 30 V	
				OFF, ON	Max. 1 V	

Circuit diagram related to engine starting system (C terminal signal)



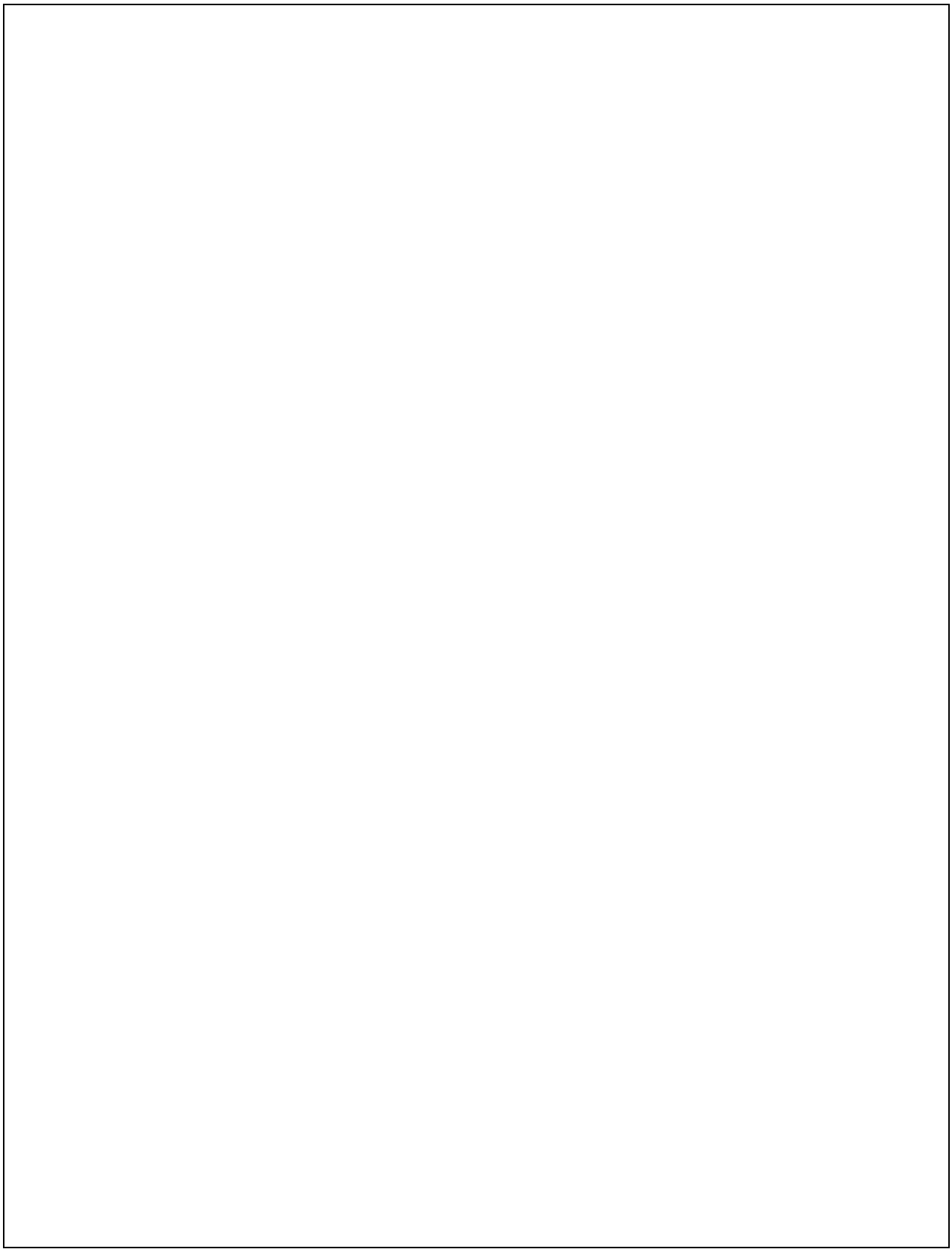

Starter switch
B
BR
R1
R2
C
ACC
PRE HEAT
OFF
ON
START
S40 (DT-4)
J08 (M6409-0071-20)
J07 (M6409-0603-20)
J06 (M6409-0603-20)
J22 (M6409-0071-20)
J11 (M6409-0075-20)
J10 (M6409-0075-20)
Machine monitor
L52 (AMP070-18)
Starter C
Alternator R
LL7 (DT-T-12)
J12 (M6409-0603-20)
J09 (M6440-0128-20)
TEL (DT-T-12)
Ena cut relay W60
Transmission controller
L62 (DRC26-40)
Right seesaw & J/SW
N direction
IGN (after s safety)
L63 (DRC26-40)
Neutral out
Komtrax controller
L80 (DRC26-40)
Engine cut
LR11 (DT-T-2)
LR1 (DTHD-1)
FL1 (DRC12-70)
LR6 (DTHD-1)
LR8 (DTHD-1)
ER3 (L-2)
ER1 (DT-T-8)
Engine controller
EC2 (DRC26-50)
Pwm return (GND)
Pwm out
EC3 (DTP-4)
Battery direct (-)
Battery direct (-)
Battery direct (+)
Battery direct (+)
E01 (DT-T-2)
E30
24V 5.5kw
STARTER
E21
E02 (SUMITOMO-3)
24V 60A
ALTERNATOR
Battery
BATTERY BOX
Slow blow fuse
50A
120A
Battery relay
EMR S/T relay
CAB FLOOR
REAR FRAME
ENGINE ROOM
9JS06408

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	• 24V signal has been input to the auto grease sensor A/B circuits at the same time.		
Action of controller	• None in particular. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• Auto grease does not work. • Auto grease lamp goes off.		
Related information	• The input state (ON/OFF) from the auto grease controller can be checked with the monitoring function (Code: 40900, D-IN-4 and 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		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L52 (female) (3) – R38 (female) (2)		Voltage	Max. 1 V
	2	Defective auto grease controller	★ Refer to and carry out troubleshooting for auto grease system.			
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L52	Auto grease	Voltage	Auto-grease lamp
			Between (3) and chassis ground	In operation	Max. 1 V	ON
				With empty tank	20 – 30 V	Flashing (1 Hz)
				When abnormal	Max. 1 V	Flashing (2 Hz)
					20 – 30 V	OFF
			Between (12) and chassis ground	In operation	20 – 30 V	ON
				With empty tank	Max. 1 V	Flashing (1 Hz)
				When abnormal	Max. 1 V	Flashing (2 Hz)
					20 – 30 V	OFF

Circuit diagram related to auto grease

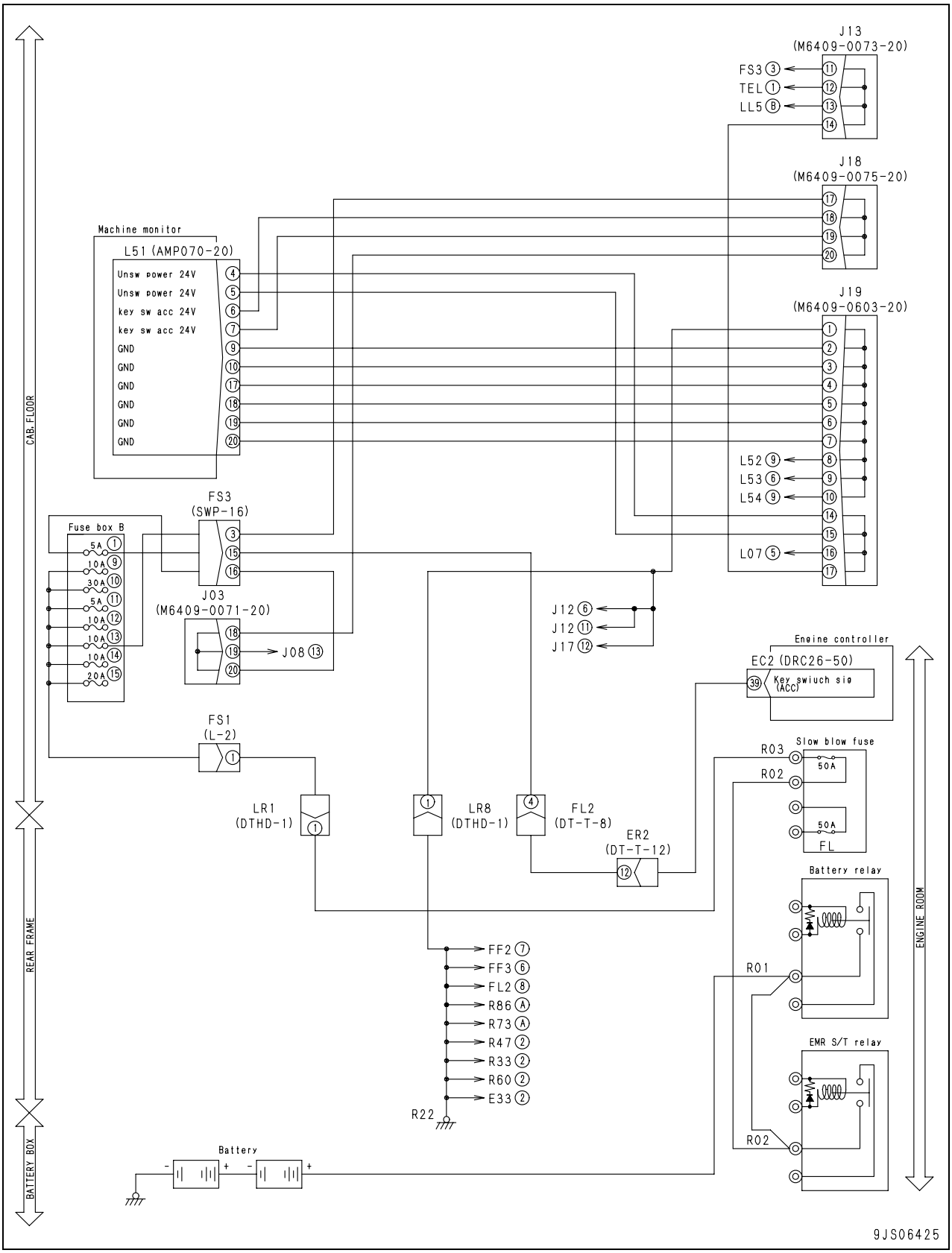


Failure code [DAF3KK] (Machine monitor: Low source voltage (input))

Action code	Failure code	Trouble	Machine monitor: Low source voltage (input) (Machine monitor system)
E03	**DAF3KK**		
Contents of trouble	• When the voltage of the switch power supply (power supply for operation) is above 17 V, the voltage of the constant power supply (power supply for the memory) is below 17 V.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The service meter reading is abnormal, the odometer does not advance and failure history data is not saved.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between FS1 (male) (1) – fuse No. 13 of fuse box B	Resistance	Max. 1 Ω
			Wiring harness between fuse No. 13 of fuse box B – L51 (female) (4), (5)	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 fuse No. 13 of fuse box B – L51 (female) (4), (5) and chassis ground	Resistance	Min. 1 MΩ
	3	Defective machine monitor	Since trouble is in system, troubleshooting cannot be carried out. (Replace the machine monitor)		

Circuit diagram related to machine monitor power supply



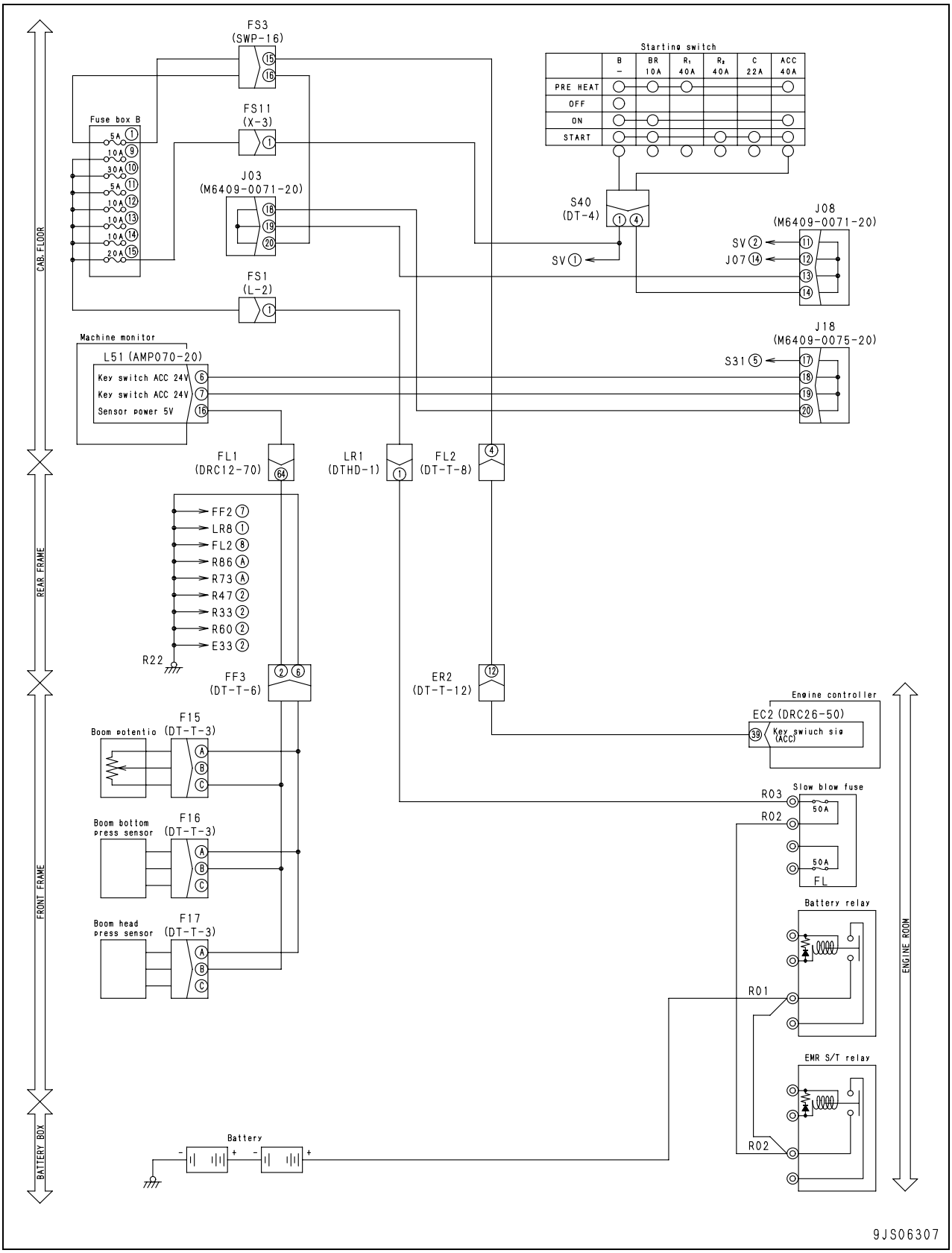
Failure code [DAF5KP] (Machine monitor: Low output voltage)

Action code	Failure code	Trouble	Machine monitor: Low output voltage (Machine monitor system)
E01	**DAF5KP**		
Contents of trouble	• When the voltage of the switch 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	• Only for load meter (if equipped) • Method of reproducing failure code: Turn the starting switch ON.		

<table>
<tr><td rowspan="16">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="8">1</td><td rowspan="8">Defective lift arm angle sensor (Internal 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">F15 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (C) and (A)</td><td>5 kΩ ± 20%</td></tr>
<tr><td colspan="2">Between (A), (B), (C) 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.</td></tr>
<tr><td>F15</td><td>Lift arm cylinder</td><td>Voltage</td></tr>
<tr><td>Between (C) and (A)</td><td>Constant</td><td>4.85 – 5.15 V</td></tr>
<tr><td rowspan="3">Between (B) and (A)</td><td>Constant</td><td>0.83 – 4.17 V</td></tr>
<tr><td>At max. length</td><td>3.50 – 4.17 V</td></tr>
<tr><td>At min. length</td><td>0.83 – 1.88 V</td></tr>
<tr><td rowspan="8">2</td><td rowspan="8">Defective lift arm bottom pressure sensor (Internal 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">F16 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (A), (B), (C) 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.</td></tr>
<tr><td>F16 (male)</td><td>Lift arm bottom pressure</td><td>Voltage</td></tr>
<tr><td>Between (C) and (B)</td><td>Constant</td><td>4.85 – 5.15 V</td></tr>
<tr><td rowspan="3">Between (C) and (A)</td><td>Constant</td><td>0.50 – 4.50 V</td></tr>
<tr><td>When released</td><td>0.50 – 0.90 V</td></tr>
<tr><td>When relieved</td><td>3.02 – 3.42 V</td></tr>
</table>

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="8">3</td><td rowspan="8">Defective lift arm head pressure sensor
(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 colspan="2">F17 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (A), (B), (C) and chassis ground</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>F17 (male)</td><td>Lift arm head pressure</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (C) and (B)</td><td>Constant</td><td colspan="2">4.85 – 5.15 V</td></tr>
<tr><td rowspan="2">Between (C) and (A)</td><td>Constant</td><td colspan="2">0.50 – 4.50 V</td></tr>
<tr><td>When released</td><td colspan="2">0.50 – 0.90 V</td></tr>
<tr><td></td><td></td><td>When relieved</td><td colspan="2">3.02 – 3.42 V</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">Between L51 (female) (16) – F15 (female) (C) wiring harness and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L51 (female) (16) – F16 (female) (B) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L51 (female) (16) – F17 (female) (B) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">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>L51</td><td>Lift arm cylinder</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (16) and chassis ground</td><td>Constant</td><td colspan="2">4.85 – 5.15 V</td></tr>
</table>

Circuit diagram related to machine monitor 5V sensor power supply



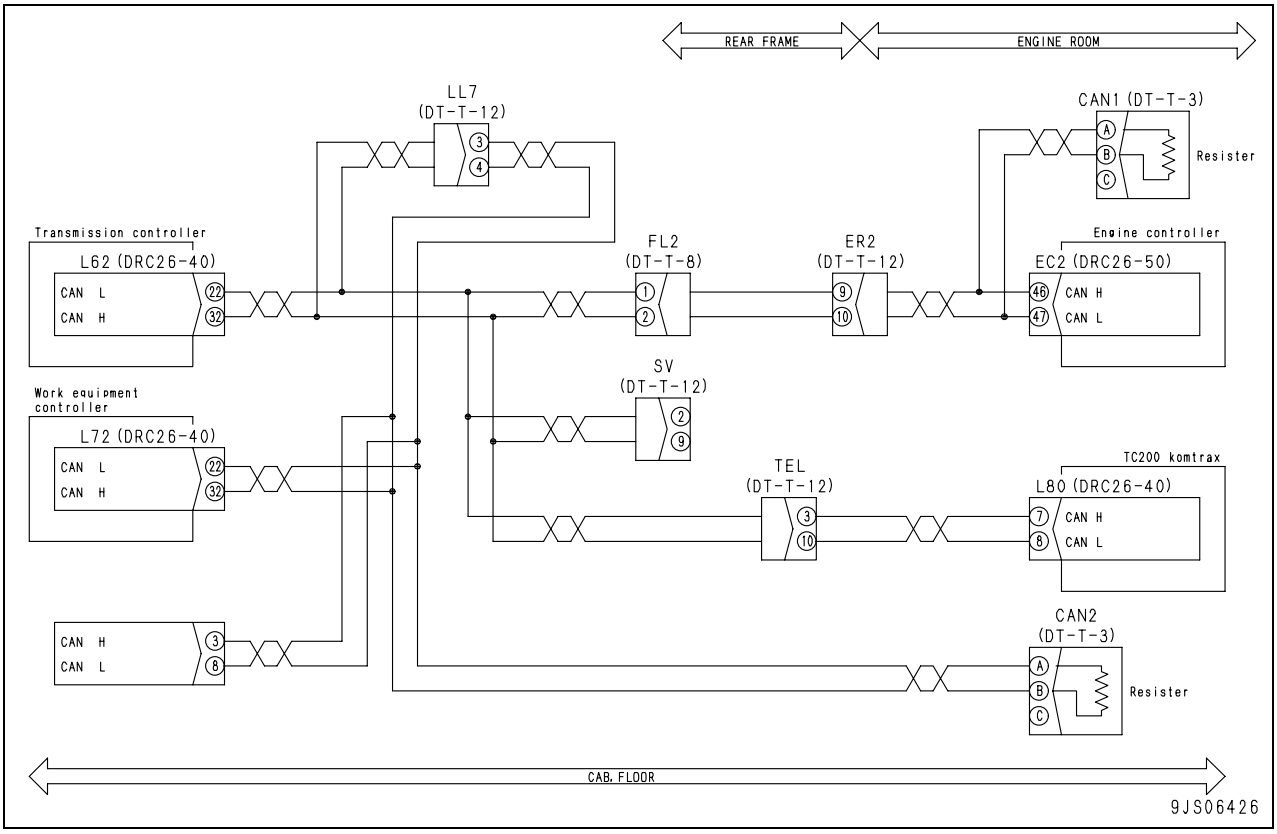
Failure code [DAFRKR] (CAN communication with machine monitor: Defective communication (Abnormality in target component system))

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	• Transmission controller cannot get information from machine monitor		
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 problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The monitor does not display normally		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective CAN end point resistance	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CAN1 (male)	Resistance	
			Between (A) and (B)	110 – 140 Ω	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CAN2 (male)	Resistance	
			Between (A) and (B)	110 – 140 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L62 (female) (22), (32) – L56 (female) (3), (8)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – L72 (female) (22), (32)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – EC2 (female) (46), (47)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – L80 (female) (7), (8)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – CAN1 (female) (A), (B)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – CAN2 (female) (A), (B)	Resistance	Max. 1 Ω

	Causes		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 L62 (female) (22), (32) – L56 (female) (3), (8) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – L72 (female) (22), (32) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – EC2 (female) (46), (47) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – L80 (female) (7), (8) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – CAN1 (female) (A), (B) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – CAN2 (female) (A), (B) and chassis ground	Resistance	Min. 1 MΩ
	4	Defective machine monitor, transmission controller, work equipment controller, engine controller or KOMTRAX terminal	★ If above troubleshootings 1 – 3 have not identified the cause of the trouble, failure on the machine monitor, transmission controller, work equipment controller, engine controller or KOMTRAX terminal should be suspected. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to CAN communication

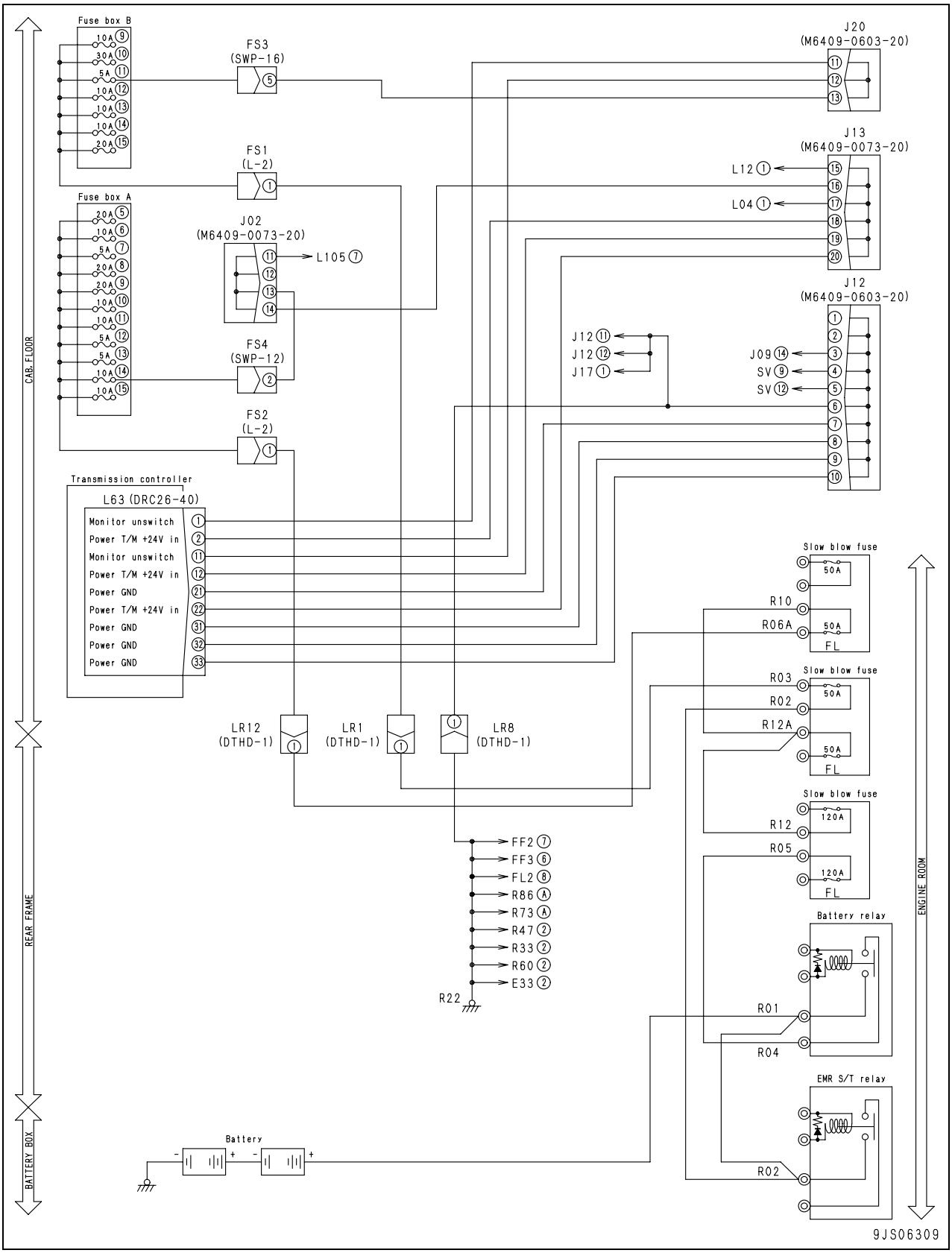


Failure code [DAQ0KK] (Transmission controller: Low source voltage)

Action code	Failure code	Trouble	Transmission controller: Low source voltage (Transmission controller)
E03	**DAQ0KK**		
Contents of trouble	• Voltage of constant power supply (battery direct power supply) of the transmission controller is low. • Voltage of constant power supply (battery direct power supply) is below 18 V and engine speed is above 500 rpm.		
Action of controller	• Cannot sense the input signals normally. • Turns the centralized warning lamp and alarm buzzer ON. • Sets all the controller output to OFF (neutral hold state). • Even if cause of failure disappears, system does not reset itself until FNR (directional) lever, joystick FNR (directional) switch or right FNR (directional) switch is set to N (Neutral).		
Problem that appears on machine	• The machine cannot move (transmission is stuck in Neutral).		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective slow-blow fuse	If the slow-blow fuse is shut down, the circuit probably has a grounding fault, etc. (See cause 4.)		
	2	Defective fuse No. 11 of fuse box B	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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between emergency steering relay R02 – slow-blow fuse R02	Resistance	Max. 1 Ω
			Wiring harness between slow-blow fuse R03 – fuse No. 11 of fuse box B	Resistance	Max. 1 Ω
			Wiring harness between fuse No. 11 of fuse box B – L63 (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 emergency steering relay R02 – slow-blow fuse R02 and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between slow-blow fuse R03 – fuse No. 11 of fuse box B and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between fuse No. 11 of fuse box B – L63 (female) (1), (11), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
	5	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			L63	Voltage	
			Between (1), (11) and (21), (31), (32), (33)	20 – 30 V	

Circuit diagram related to CAN communication



Failure code [DAQ0KT] (Transmission controller: Abnormality in controller)

Action code	Failure code	Trouble	Transmission controller: Abnormality in controller (Transmission controller)
E01	**DAQ0KT**		
Contents of trouble	• The information in the ROM (non-volatile memory) of the transmission controller is abnormal. • The battery direct power is not available immediately after the starting switch is OFF. Thus, the ending process is not normally executed.		
Action of controller	• Sets the internal adjustment values to the default values. • 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.		

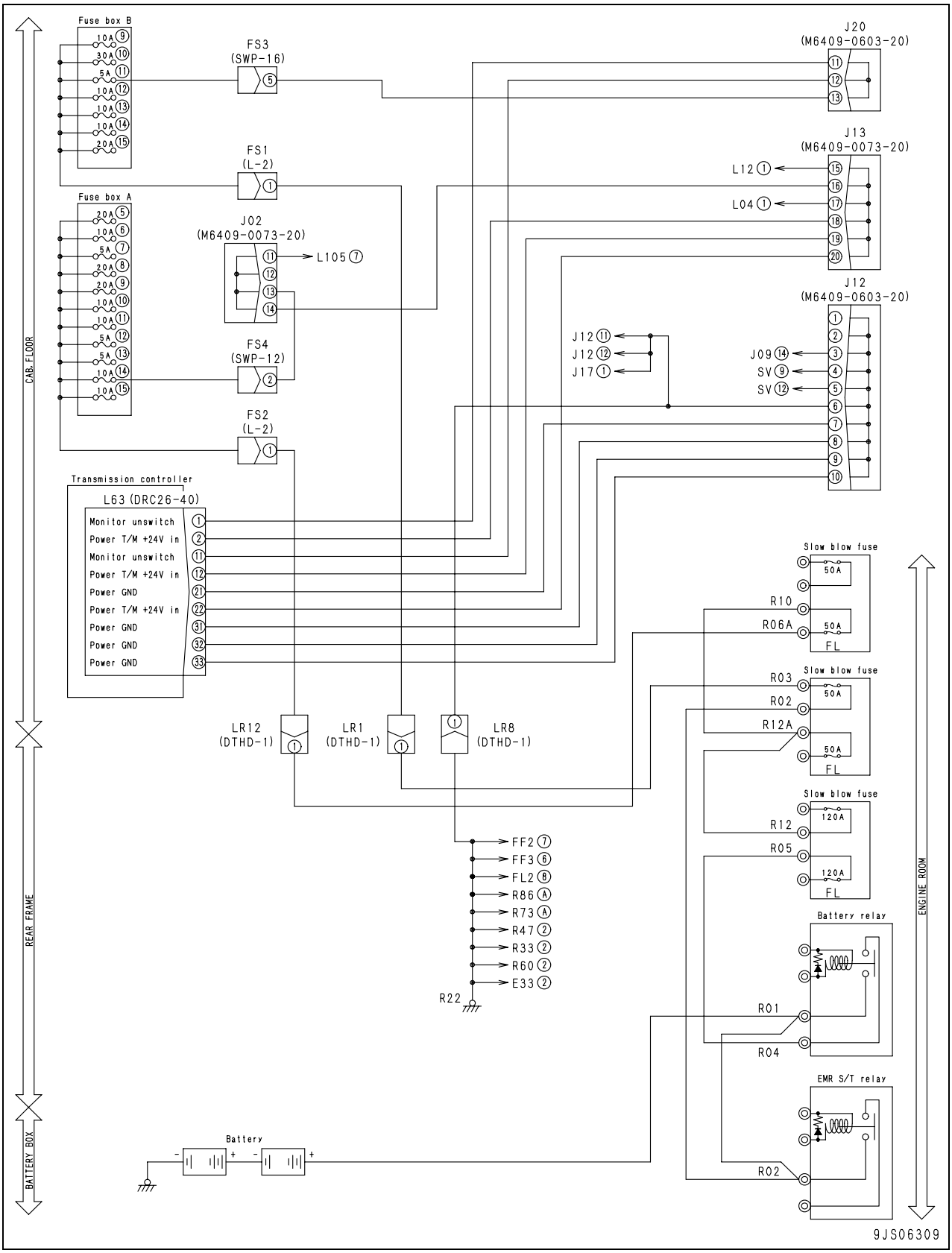
Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting
	1	Defective transmission controller	Since trouble is in system, troubleshooting cannot be carried out. (If there is no visible trouble on the machine, it is allowed to use the transmission controller without modifying the initial setting or initial adjustment.)

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, constant power supply (battery direct power supply) is above 20 V and solenoid power supply is below 18 V		
Action of controller	• Strain itself not to display failure codes that may be false detected due to low 24 V solenoid source voltage • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until directional lever, joystick steering FNR (directional) switch or directional selector switch is set to N (Neutral).		
Problem that appears on machine	• The machine cannot move (transmission is stuck in Neutral). • When the current fan rotation is reverse, its rotating direction is switched to forward.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L63(female) (2), (12), (22) – fuse No.14 of fuse box A	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 L63(female) (2), (12), (22) – fuse No.2 of fuse box A and chassis ground	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			L63	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. • Does not display failure codes which may be false detected.		
Problem that appears on machine	• Continuing the travel in this condition can damage the transmission.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Improper machine monitor model selection	Set the model using the adjustment function of the service mode of the machine monitor (See Special functions of machine monitor (EMMS) in Testing and adjusting)
	2	Transmission controller part number error	Confirm the part number of the transmission controller. It must be replaced if it is not the specified controller.

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 5

Troubleshooting by failure code (Display of code), Part 5 3
Failure code [DAQRKR] (CAN communication with transmission controller: Defective communication (Abnormality in target component system)) 3
Failure code [DAQRMA] (Transmission controller option setting: Malfunction) 5
Failure code [DB2RKR] (CAN communication with engine controller: Defective communication (Abnormality in target component system) 6
Failure code [DB99KQ] (Work equipment controller model selection: Disagreement in model selection signals) 9
Failure code [DB9RKR] CAN communication with work equipment controller: Defective communication (Abnormality in target component system)) 10
Failure code [DB9RMA] (Work equipment controller option setting: Malfunction) 12
Failure code [DD15LD] ■ switch (Panel switch 1): Switch is kept pressed for long time 14
Failure code [DD16LD] ◇ switch (Panel switch 2): Switch is kept pressed for long time 16
Failure code [DD17LD] < switch (Panel switch 3): Switch is kept pressed for long time 18

Failure code [DD18LD] > switch (Panel switch 4): Switch is kept pressed for long time 20
Failure code [DD1CLD] Load meter subtotal switch: Switch is kept pressed for long time 22
Failure code [DD1FLD] Load meter mode selector switch (A/B):
Switch is kept pressed for long time 24
Failure code [DD1GLD] Load meter mode selector switch (+/–):
Switch is kept pressed for long time 26
Failure code [DD1HLD] (Load meter display selector switch: Switch is kept pressed for long time) . 28
Failure code [DD1NLD] (Fan reverse switch: Switch is kept pressed for long time) 30
Failure code [DD1NL4] (Fan automatic reverse switch: Switch is kept pressed for long time) 32
Failure code [DDB6L4] (Parking brake switch (Neutralizer): ON/OFF signals disagree) 34

Troubleshooting by failure code (Display of code), Part 5

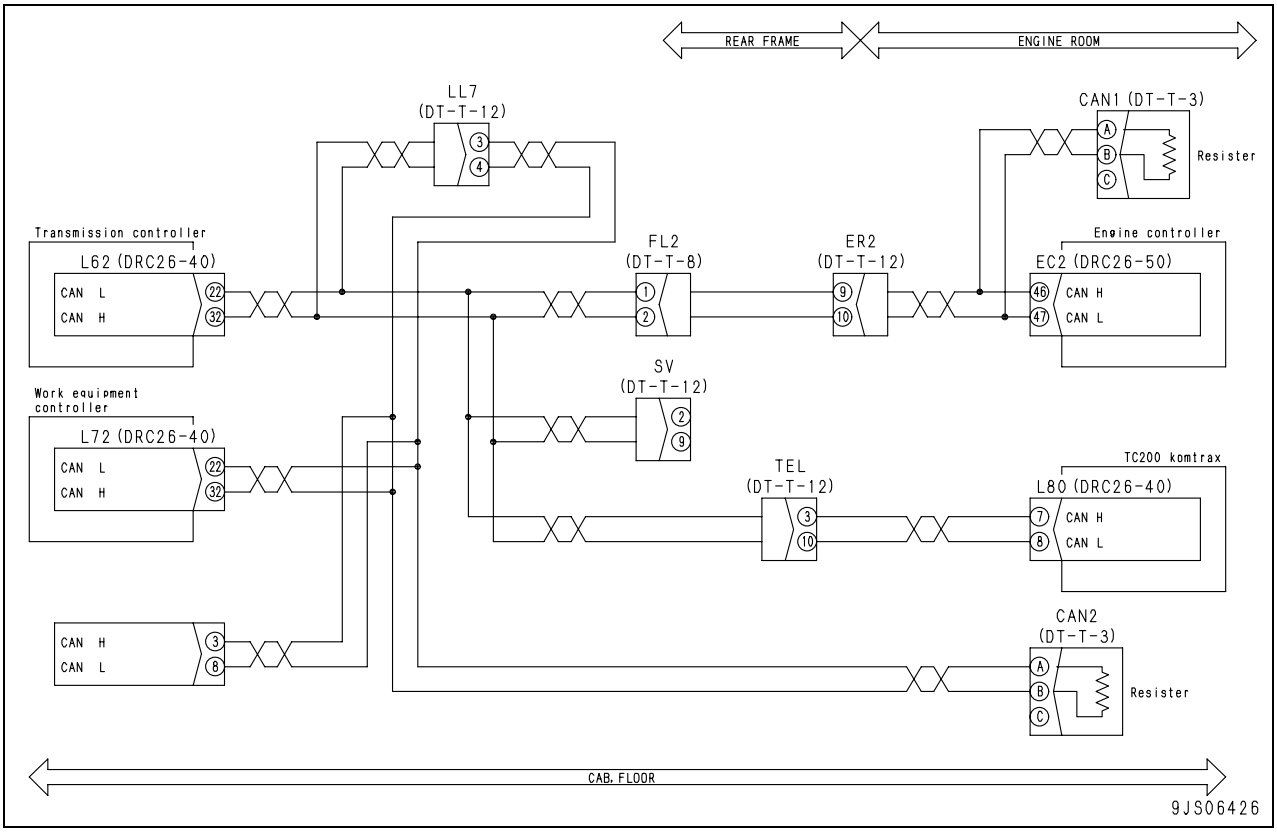
Failure code [DAQRKR] (CAN communication with transmission controller: Defective communication (Abnormality in target component system))

Action code	Failure code	Trouble	CAN communication with transmission controller: Defective communication (Abnormality in target component system) (Machine monitor system)
E03	**DAQRKR**		
Contents of trouble	• Machine monitor cannot get information from transmission controller		
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 problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The monitor does not display normally		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective CAN end point resistance	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CAN1 (male)	Resistance	
			Between (A) and (B)	110 – 140 Ω	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CAN2 (male)	Resistance	
			Between (A) and (B)	110 – 140 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L62 (female) (22), (32) – L56 (female) (3), (8)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – L72 (female) (22), (32)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – EC2 (female) (46), (47)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – L80 (female) (7), (8)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – CAN1 (female) (A), (B)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – CAN2 (female) (A), (B)	Resistance	Max. 1 Ω

	Causes		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 L62 (female) (22), (32) – L56 (female) (3), (8) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – L72 (female) (22), (32) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – EC2 (female) (46), (47) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – L80 (female) (7), (8) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – CAN1 (female) (A), (B) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – CAN2 (female) (A), (B) and chassis ground	Resistance	Min. 1 MΩ
	4	Defective power supply circuit of transmission controller	★ Power supply circuit or grounding circuit may be defective. Confirm that there is no disconnection of the circuit or defective mating of the connector.		
	5	Defective machine monitor, transmission controller, work equipment controller, engine controller or KOMTRAX terminal	★ If above troubleshootings 1 – 4 have not identified the cause of the trouble, failure on the machine monitor, transmission controller, work equipment controller, engine controller or KOMTRAX terminal should be suspected. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to CAN communication



Failure code [DAQRMA] (Transmission controller option setting: Malfunction)

Action code	Failure code	Trouble	Transmission controller option setting: Malfunction (Machine monitor system)
E03	**DAQRMA**		
Contents of trouble	• Disagreement between the option setting done by the machine monitor and the option recognition by done the transmission controller.		
Action of controller	• The transmission controller follows the option setting being recognized by itself. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• The option setting does not work normally.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective option setting	Adjust the option setting using the adjustment function of the machine monitor (See Special functions of machine monitor (EMMS) in Testing and adjusting)
	2	Defective machine monitor	The machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)
	3	Defective transmission controller	The transmission controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

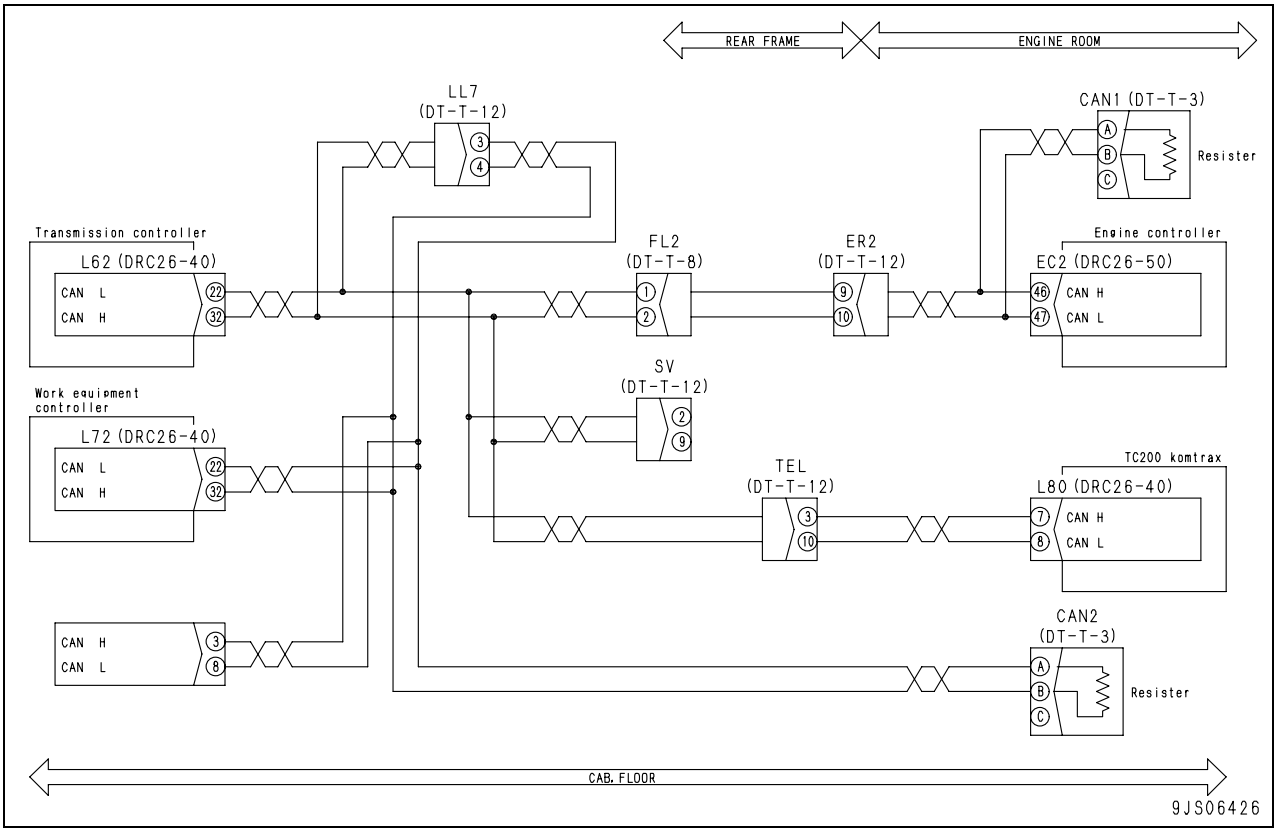
Failure code [DB2RKR] (CAN communication with engine controller: Defective communication (Abnormality in target component system)

Action code	Failure code	Trouble	CAN communication with 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	• Uses CAN information that was sent from engine controller before the occurrence of the error. • Fixes the recognition value of engine speed to 2,100 rpm. • Holds recognized position of accelerator at 80%. • Turns the centralized warning lamp and alarm buzzer ON. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The monitor does not display normally		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective CAN end point resistance	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CAN1 (male)	Resistance		
			Between (A) and (B)	110 – 140 Ω		
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CAN2 (male)	Resistance		
			Between (A) and (B)	110 – 140 Ω		
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between EC2 (female) (46), (47) – L62 (female) (22), (32)	Resistance	Max. 1 Ω	
			Wiring harness between EC2 (female) (46), (47) – L56 (female) (3), (8)	Resistance	Max. 1 Ω	
			Wiring harness between EC2 (female) (46), (47) – L72 (female) (22), (32)	Resistance	Max. 1 Ω	
			Wiring harness between EC2 (female) (46), (47) – L80 (female) (7), (8)	Resistance	Max. 1 Ω	
			Wiring harness between EC2 (female) (46), (47) – CAN1 (female) (A), (B)	Resistance	Max. 1 Ω	
			Wiring harness between EC2 (female) (46), (47) – CAN2 (female) (A), (B)	Resistance	Max. 1 Ω	

	Causes		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 EC2 (female) (46), (47) – L62 (female) (22), (32) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between EC2 (female) (46), (47) – L56 (female) (3), (8) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between EC2 (female) (46), (47) – L72 (female) (22), (32) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between EC2 (female) (46), (47) – L80 (female) (7), (8) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between EC2 (female) (46), (47) – CAN1 (female) (A), (B) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between EC2 (female) (46), (47) – CAN2 (female) (A), (B) and chassis ground	Resistance	Min. 1 MΩ
	4	Defective power supply circuit of engine controller	★ Power supply circuit or grounding circuit may be defective. Confirm that there is no disconnection of the circuit or defective mating of the connector.		
	5	Defective machine monitor, transmission controller, work equipment controller, engine controller or KOMTRAX terminal	★ If above troubleshootings 1 – 4 have not identified the cause of the trouble, failure on the machine monitor, transmission controller, work equipment controller, engine controller or KOMTRAX terminal should be suspected. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to CAN communication



Failure code [DB99KQ] (Work equipment controller model selection: Disagreement in model selection signals)

Action code	Failure code	Trouble	Work equipment controller model selection: Disagreement in 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.		
Problem that appears on machine	• Work equipment does not operate normally		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Improper machine monitor model selection	Set the model using the adjustment function of the service mode of the machine monitor (See Special functions of machine monitor (EMMS) in Testing and adjusting)
	2	Work equipment controller part number error	Confirm the part number of the work equipment controller. It must be replaced if it is not the specified controller.

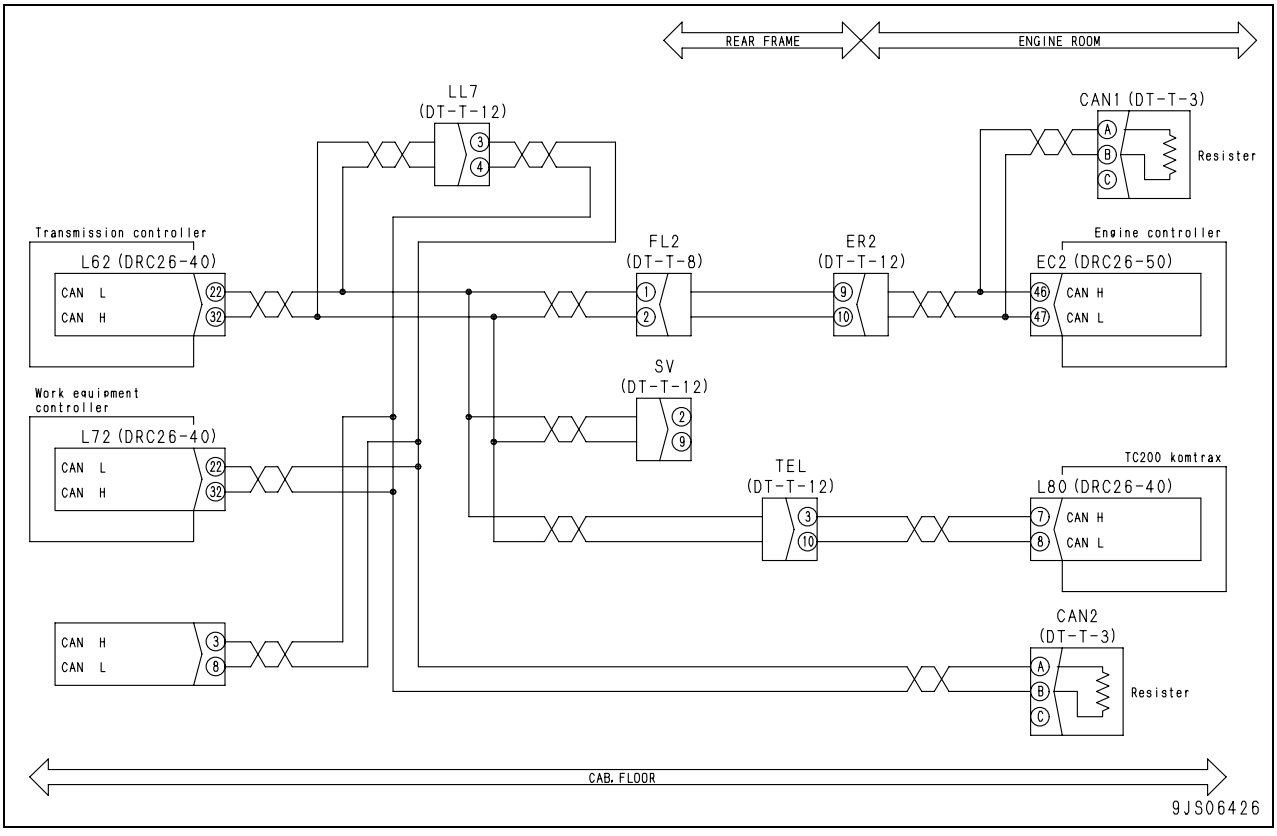
Failure code [DB9RKR] CAN communication with work equipment controller: Defective communication (Abnormality in target component system))

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	• Machine monitor cannot get information from work equipment controller		
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 problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The monitor does not display normally		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective CAN end point resistance	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CAN1 (male)	Resistance	
			Between (A) and (B)	110 – 140 Ω	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CAN2 (male)	Resistance	
			Between (A) and (B)	110 – 140 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L62 (female) (22), (32) – EC2 (female) (46), (47)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – L56 (female) (3), (8)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – L72 (female) (22), (32)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – L80 (female) (7), (8)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – CAN1 (female) (A), (B)	Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (22), (32) – CAN2 (female) (A), (B)	Resistance	Max. 1 Ω

	Causes		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 L62 (female) (22), (32) – EC2 (female) (46), (47) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – L56 (female) (3), (8) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – L72 (female) (22), (32) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – L80 (female) (7), (8) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – CAN1 (female) (A), (B) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L62 (female) (22), (32) – CAN2 (female) (A), (B) and chassis ground	Resistance	Min. 1 MΩ
	4	Defective power supply circuit of work equipment controller	★ Power supply circuit or grounding circuit may be defective. Confirm that there is no disconnection of the circuit or defective mating of the connector.		
	5	Defective machine monitor, transmission controller, work equipment controller, engine controller or KOMTRAX terminal	★ If above troubleshootings 1 – 4 have not identified the cause of the trouble, failure on the machine monitor, transmission controller, work equipment controller, engine controller or KOMTRAX terminal should be suspected. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to CAN communication

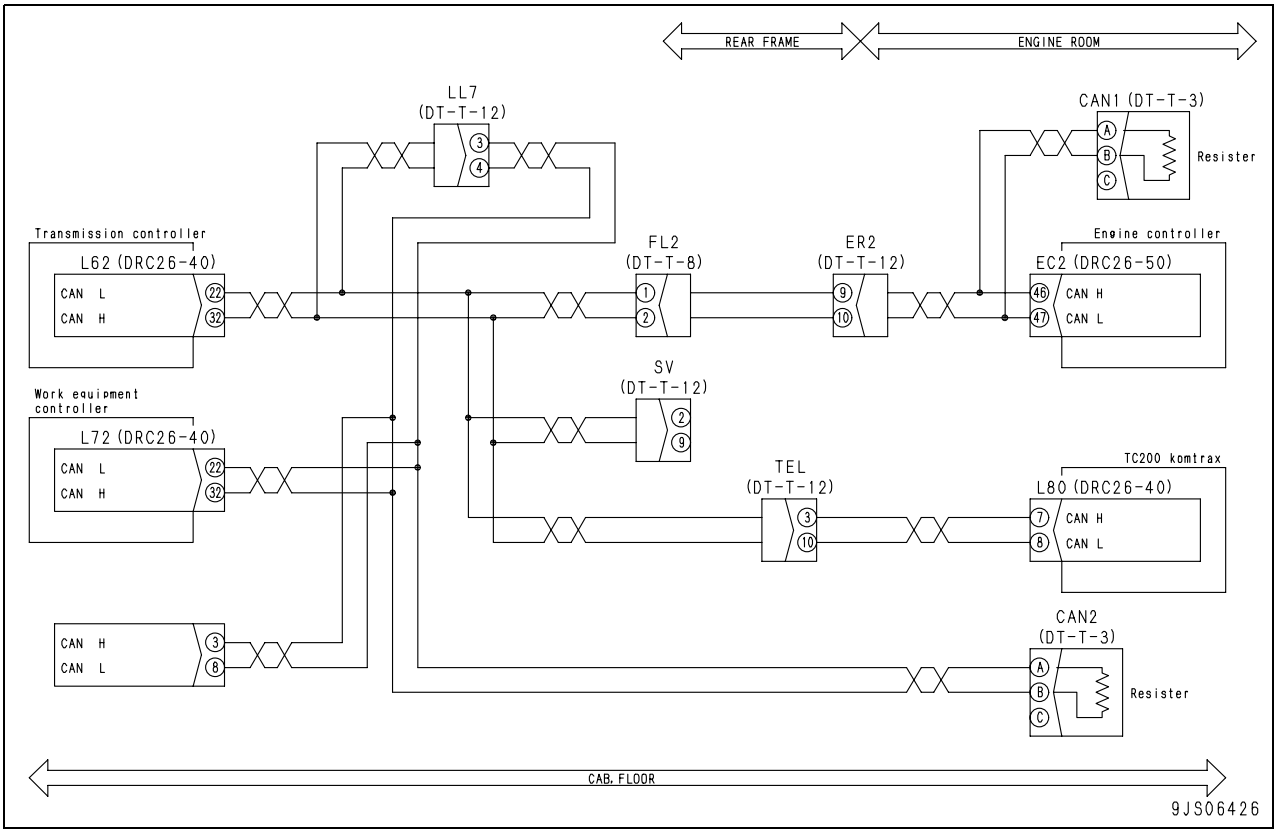


Failure code [DB9RMA] (Work equipment controller option setting: Malfunction)

Action code	Failure code	Trouble	Work equipment controller option setting: Malfunction (Machine monitor system)
E03	**DB9RMA**		
Contents of trouble	• Disagreement between the option setting done by the machine monitor and the option recognition by done the work equipment controller.		
Action of controller	• The work equipment controller follows the option setting being recognized by itself. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• The optional device does not work normally.		
Related information	• Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting
	1	Defective option setting	Adjust the option setting using the adjustment function of the machine monitor (See Testing and adjusting)
	2	Defective work equipment controller	Transmission controller may be defective (Since trouble is in system, troubleshooting cannot be carried out.)
	3	Defective machine monitor	The machine monitor may be defective (Since trouble is in system, troubleshooting cannot be carried out.)

Circuit diagram related to CAN communication

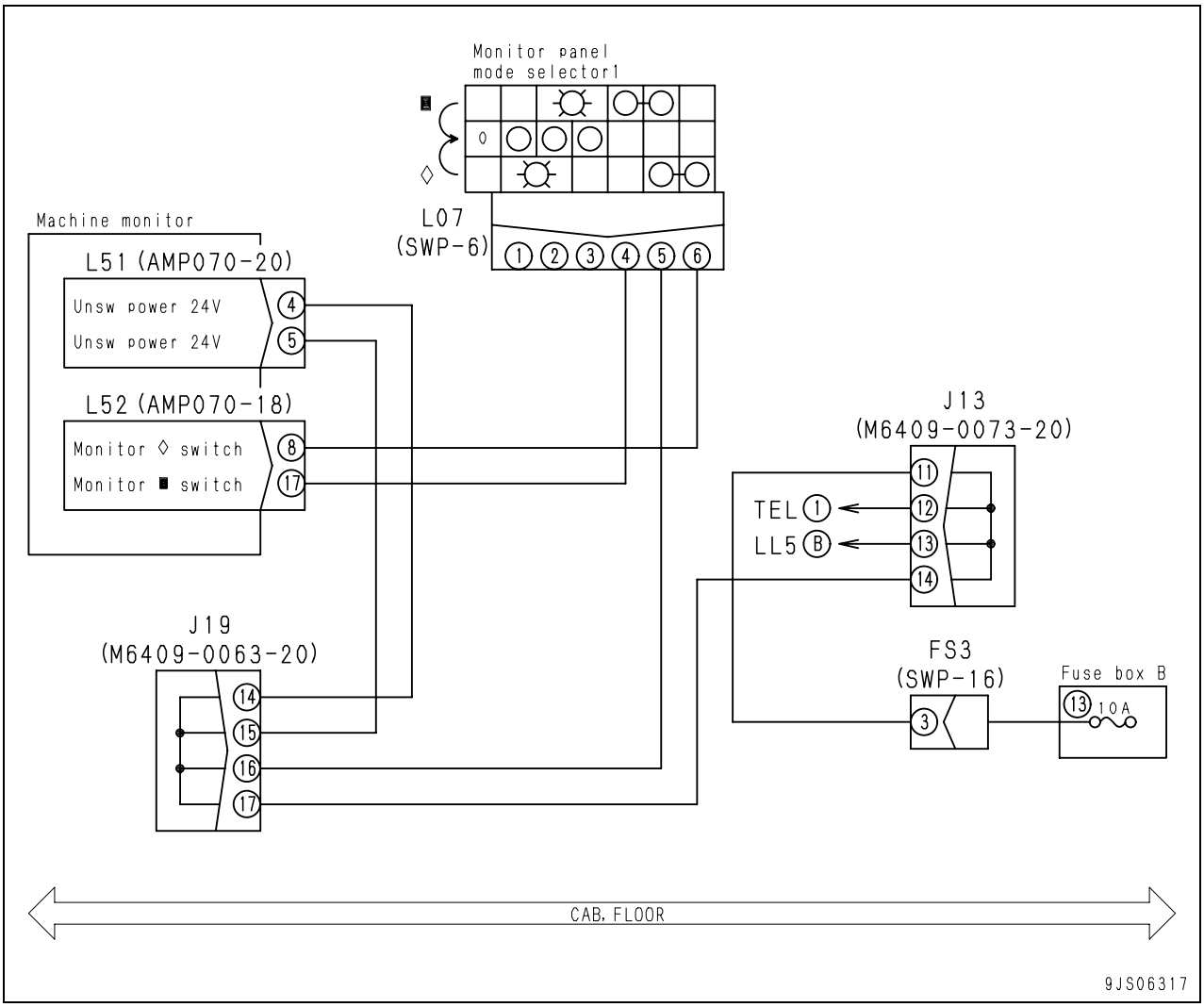


Failure code [DD15LD] ■ switch (Panel switch 1): Switch is kept pressed for long time

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.		
Problem that appears on machine	• The operator cannot operate the monitor (cannot enter the service mode). • Some characters do not appear on the character display.		
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.		

	Causes		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.			
			L07 (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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L52 (female) (17) – L07 (female) (4) and chassis ground		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L52	■ 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

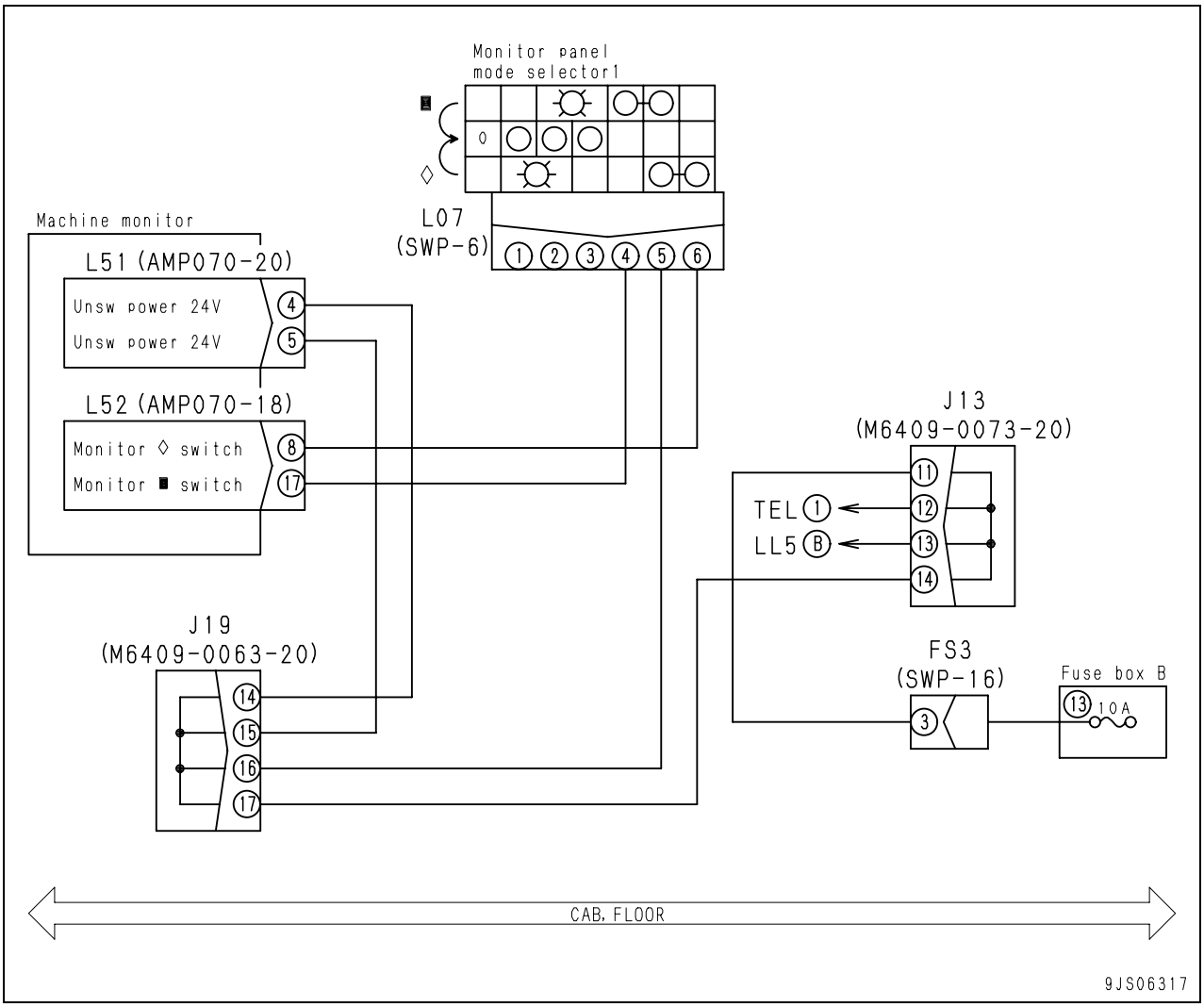


Failure code [DD16LD] ◇ switch (Panel switch 2): Switch is kept pressed for long time

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.		
Problem that appears on machine	• The operator cannot operate the monitor (cannot turn on the service mode). • Some characters do not appear on the character display.		
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.		

	Causes		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.			
			L07 (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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L52 (female) (8) – L07 (female) (6) and chassis ground		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L52	◇ 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

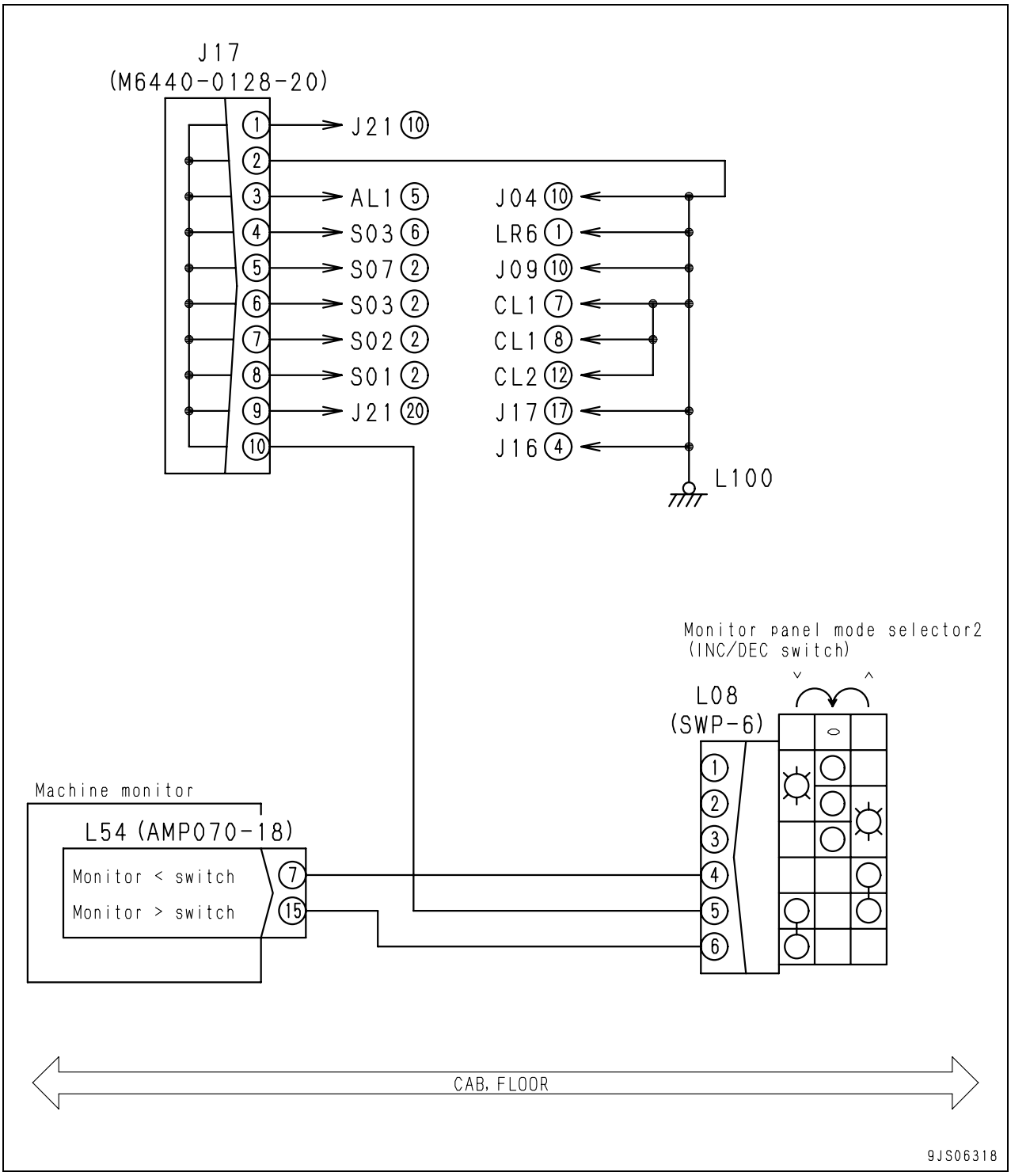


Failure code [DD17LD] < switch (Panel switch 3): Switch is kept pressed for long time

Action code	Failure code	Trouble	< switch (Panel switch 3): Switch is kept pressed for a 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.		
Problem that appears on machine	• The operator cannot operate the monitor. • Some characters do not appear on the character display.		
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.		

	Causes		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.			
			L08 (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 L54 (female) (7) – L08 (female) (4) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L54 (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

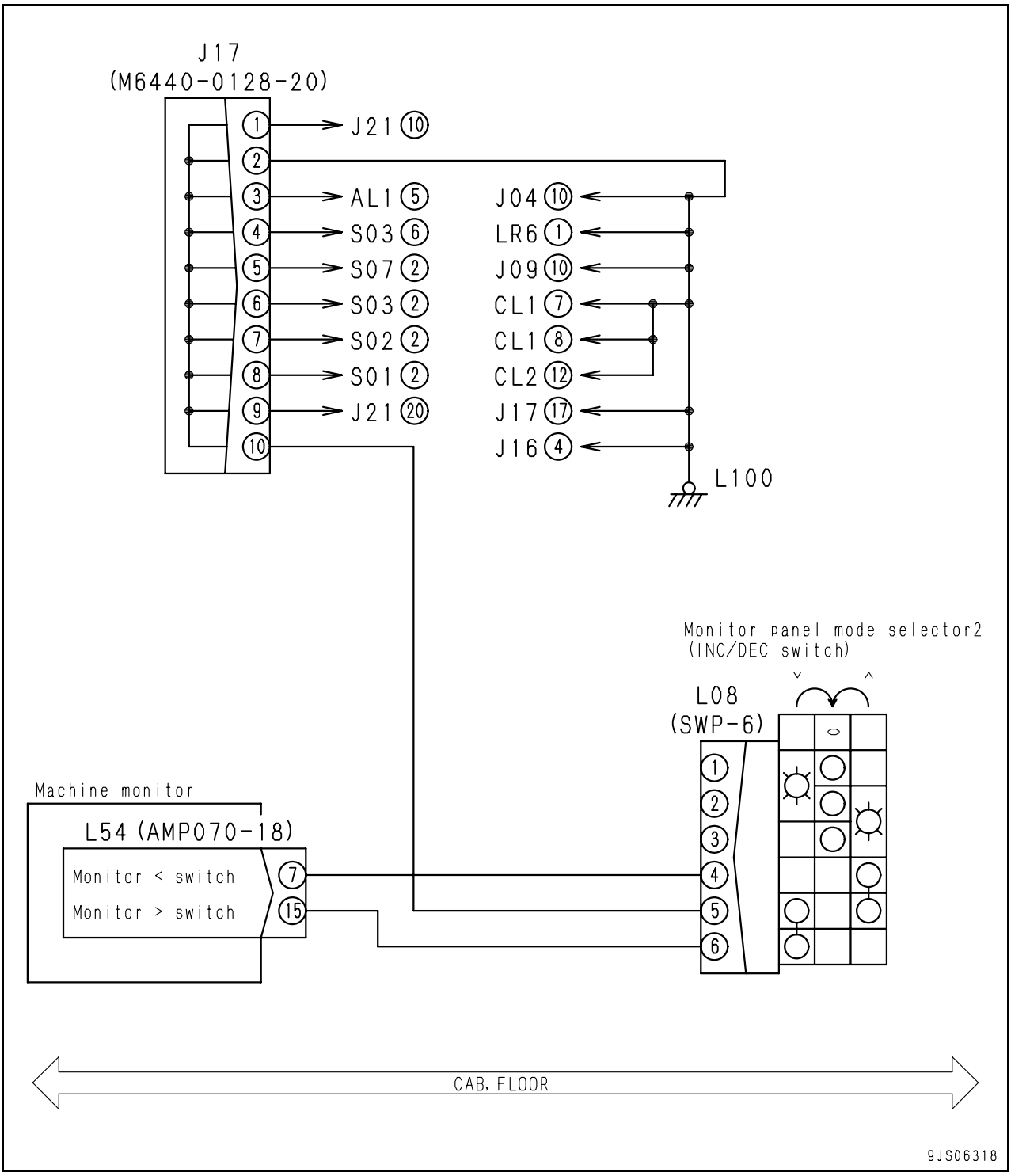


Failure code [DD18LD] > switch (Panel switch 4): Switch is kept pressed for long time

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.		
Problem that appears on machine	• The operator cannot operate the monitor. • Some characters do not appear on the character display.		
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.		

	Causes		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.			
			L08 (female)	> switch (Panel switch 4)	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 L54 (female) (15) – L08 (female) (6) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L54 (female)	> switch (Panel switch 4)	Voltage	
			Between (15) and chassis ground	ON	Max. 1 V	
				Other than above	20 – 30 V	

Circuit diagram related to > switch and < switch

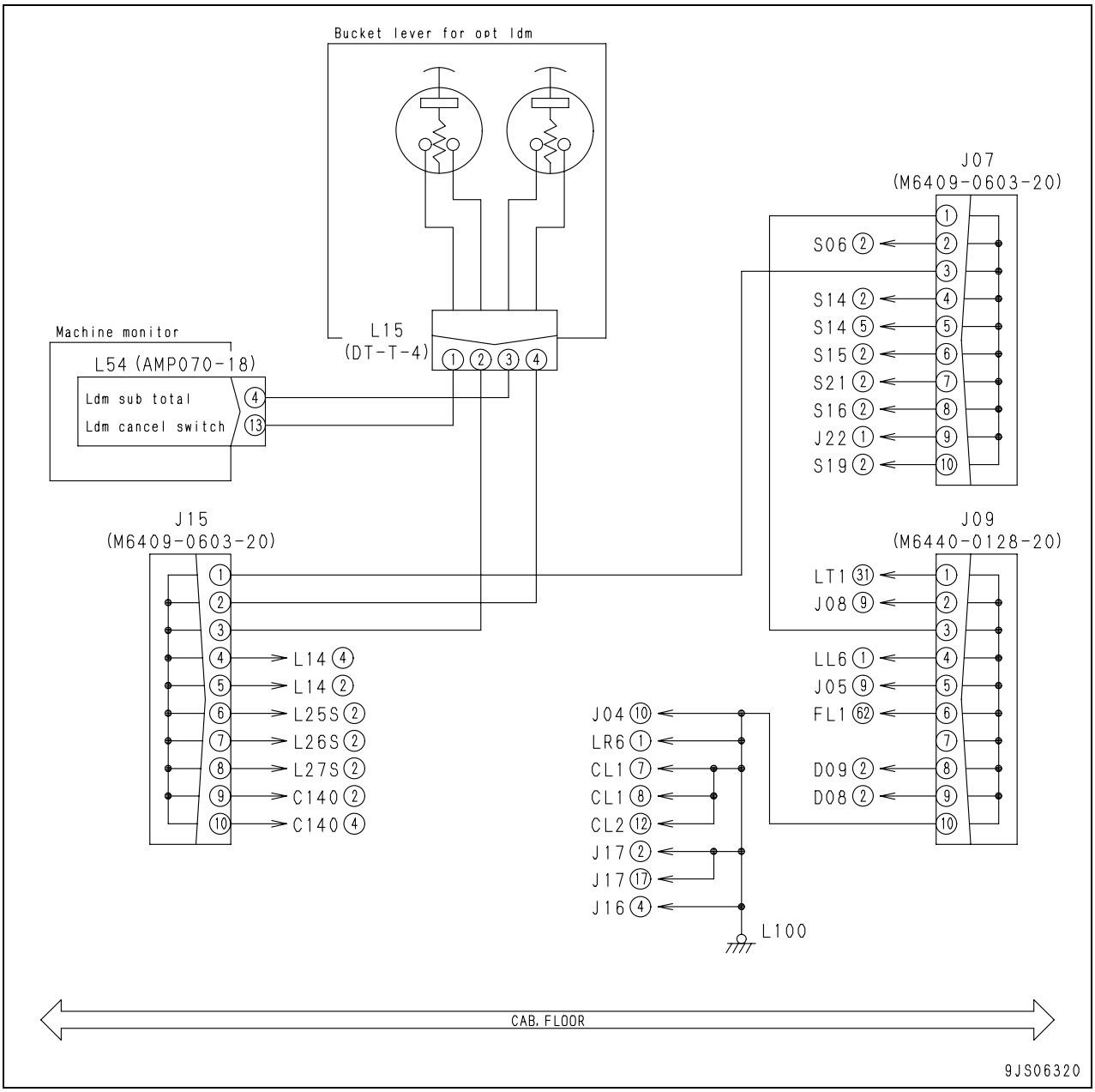


Failure code [DD1CLD] Load meter subtotal switch: Switch is kept pressed for long time

Action code	Failure code	Trouble	Load meter subtotal switch: Switch is kept pressed for long time (Machine monitor system)
E01	**DD1CLD**		
Contents of trouble	• Since the load meter subtotal switch system is shorted, the load meter subtotal switch does not function.		
Action of controller	• None in particular.		
Problem that appears on machine	• The total amount of load cannot be set to 0 on the screen. • Printer (if equipped) is not available		
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). • Only for load meter (if equipped) • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective load meter subtotal switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L15 (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 L54 (female) (4) – L15 (female) (3) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L54 (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 & subtotal switch

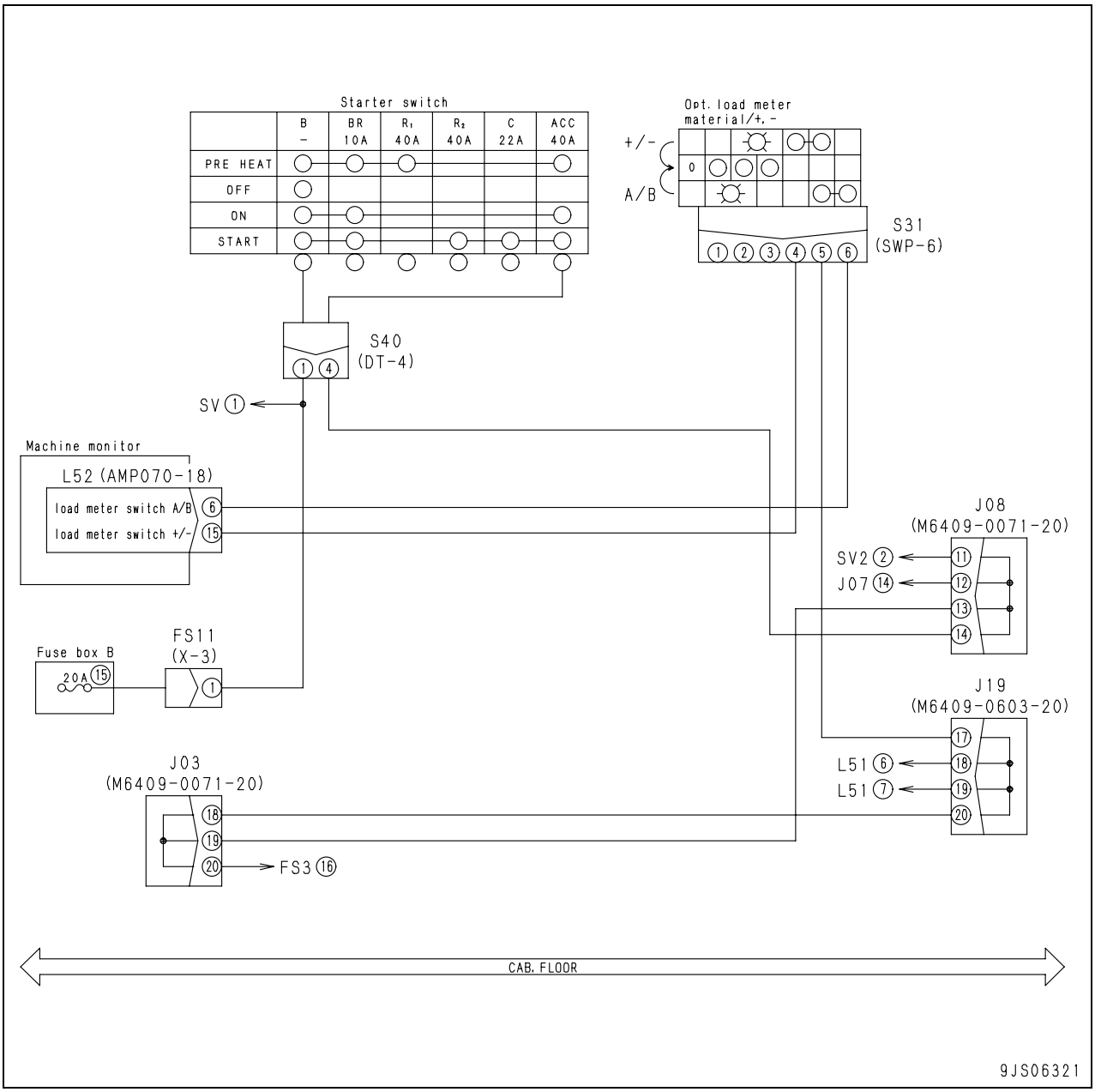


Failure code [DD1FLD] Load meter mode selector switch (A/B): Switch is kept pressed for long time

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.		
Problem that appears on machine	• The working object cannot be changed. • Some characters do not appear on the character display.		
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). • Only for load meter (if equipped) • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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.			
			S31 (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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L52 (female) (6) – S31 (female) (6) and chassis ground		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L52 (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 cancel & subtotal switch

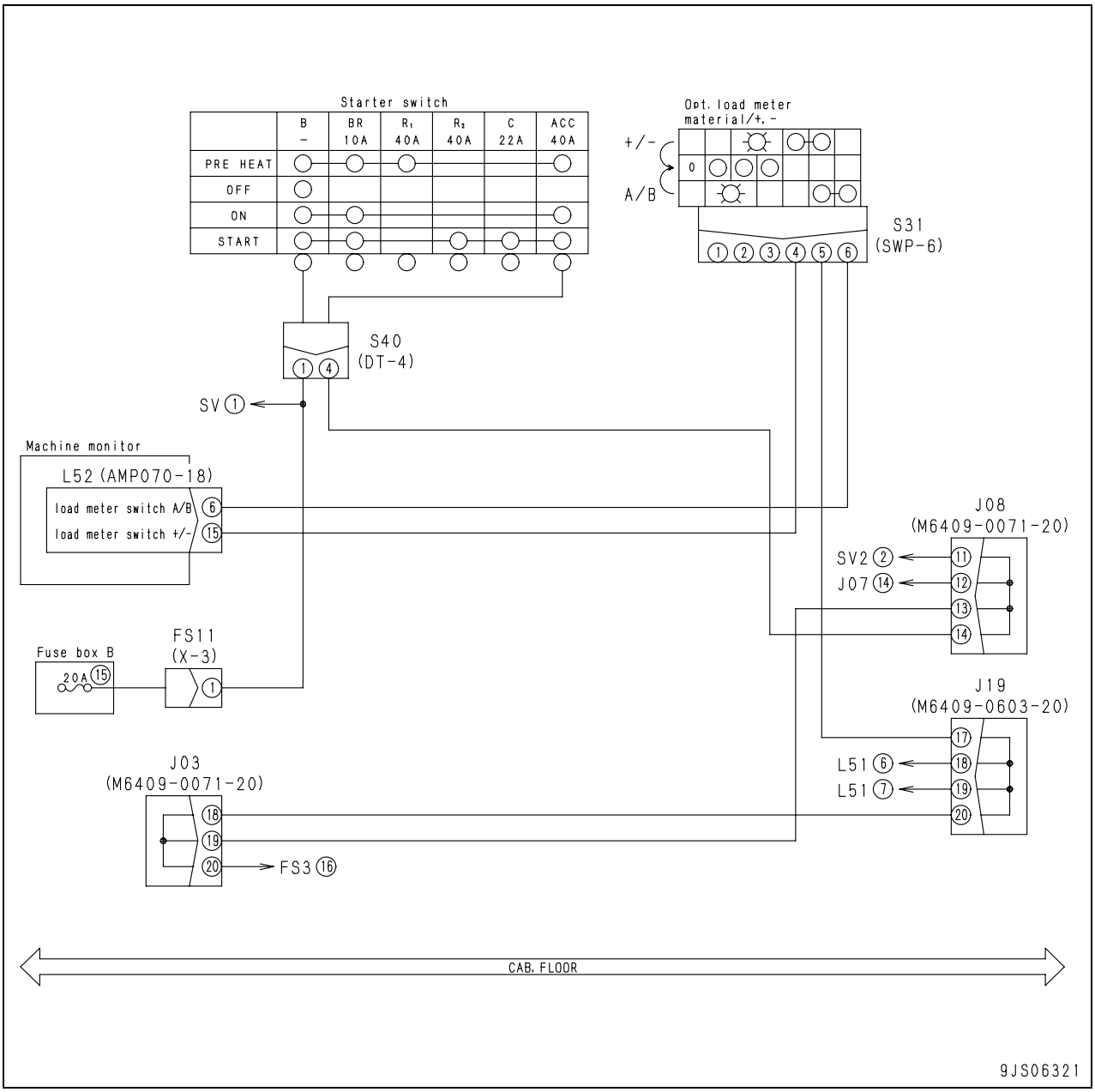


Failure code [DD1GLD] Load meter mode selector switch (+/–): Switch is kept pressed for long time

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.		
Problem that appears on machine	• The operator cannot make settings of load meter addition mode. • Some characters do not appear on the character display.		
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). • Only for load meter (if equipped) • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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.			
			S31 (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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L52 (female) (15) – S31 (female) (4) and chassis ground		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L52 (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

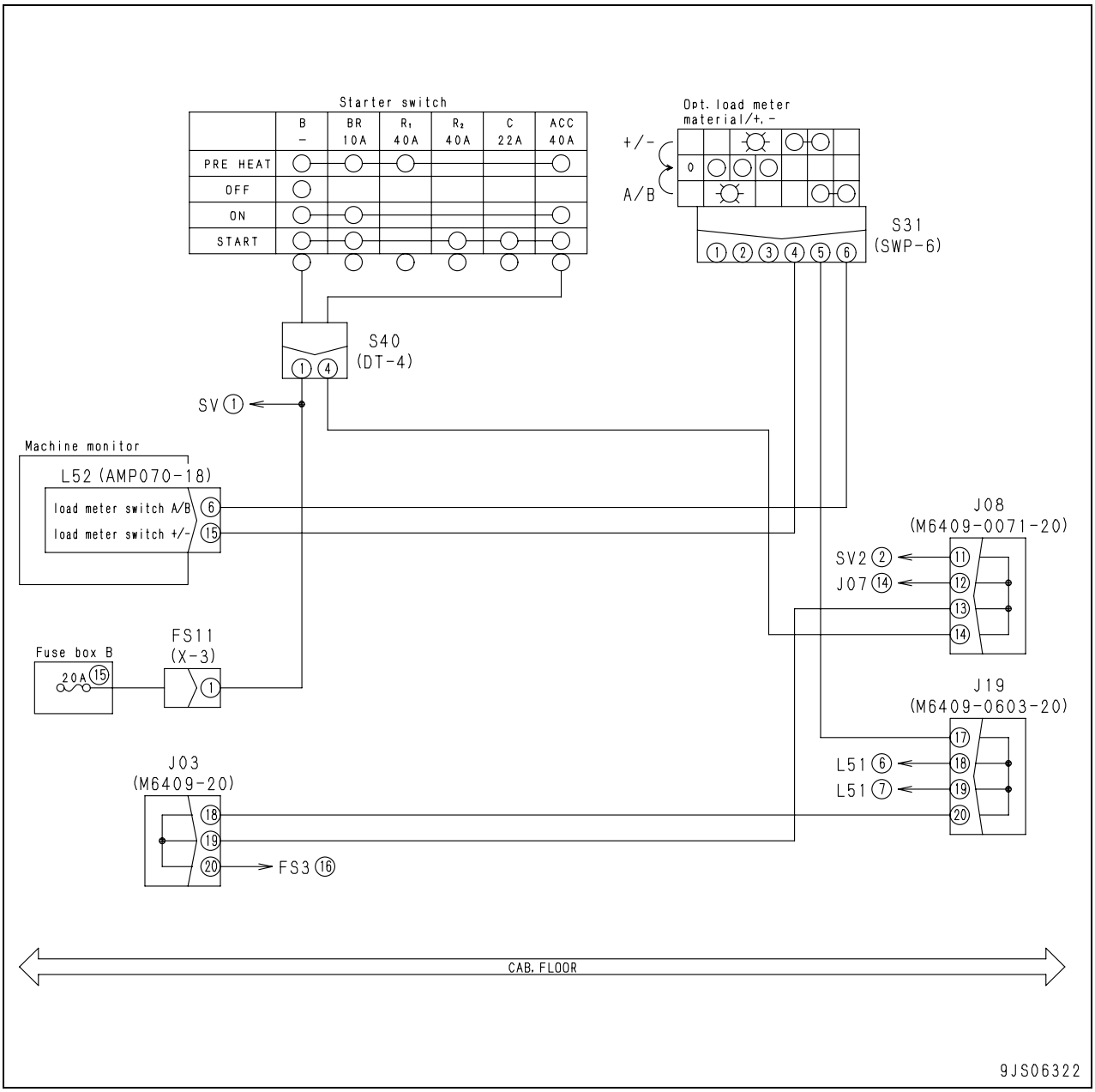


Failure code [DD1HLD] (Load meter display selector switch: Switch is kept pressed for long time)

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	• Since the load meter display selector switch system is shorted, the load meter display selector switch does not function.		
Action of controller	• None in particular.		
Problem that appears on machine	• Unable to display cumulative data • Some characters do not appear on the character display.		
Related information	• The input state (ON/OFF) from the load meter display selector switch can be checked with the monitoring function (Code: 40902, D-IN-23). • Only for load meter (if equipped) • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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.			
			S31 (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	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 L52 (female) (15) – S31 (female) (6) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L52 (male)	Load meter display selector switch	Voltage	
			Between (15) and chassis ground	ON	Max. 1 V	
				OFF	20 – 30 V	

Circuit diagram related to load meter display selector switch

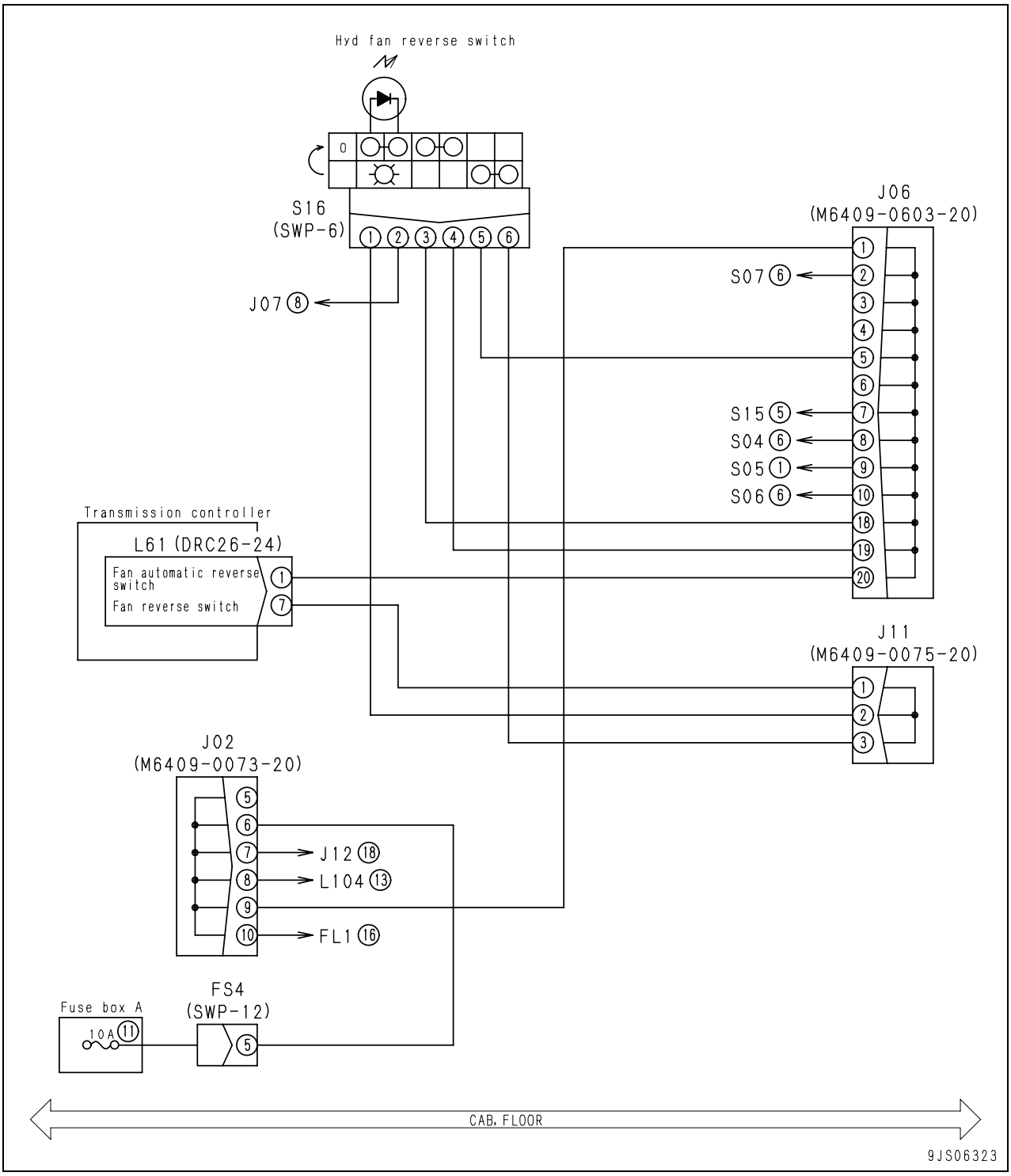


Failure code [DD1NLD] (Fan reverse switch: Switch is kept pressed for long time)

Action code	Failure code	Trouble	Fan reverse switch: Switch is kept pressed for long time (Transmission controller system)
E01	**DD1NLD**		
Contents of trouble	• Since the fan reverse switch system is shorted with the power source, the fan reverse switch remains at ON position.		
Action of controller	• None in particular.		
Problem that appears on machine	• Fan remains in the reverse rotation		
Related information	• The input state (ON/OFF) from the fan reverse switch can be checked with the monitoring function (Code: 93400, FAN REVERSE SW). • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting			
	1	Defective fan reverse switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S16 (male)	Fan reverse switch	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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L61 (female) (7) – S16 (female) (6) and chassis ground		Voltage	20 – 30 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L61 (male)	Fan reverse switch	Voltage	
			Between (7) and chassis ground	ON	20 – 30 V	
				OFF	Max. 1 V	

Circuit diagram related to the fan reverse switch & fan automatic reverse switch

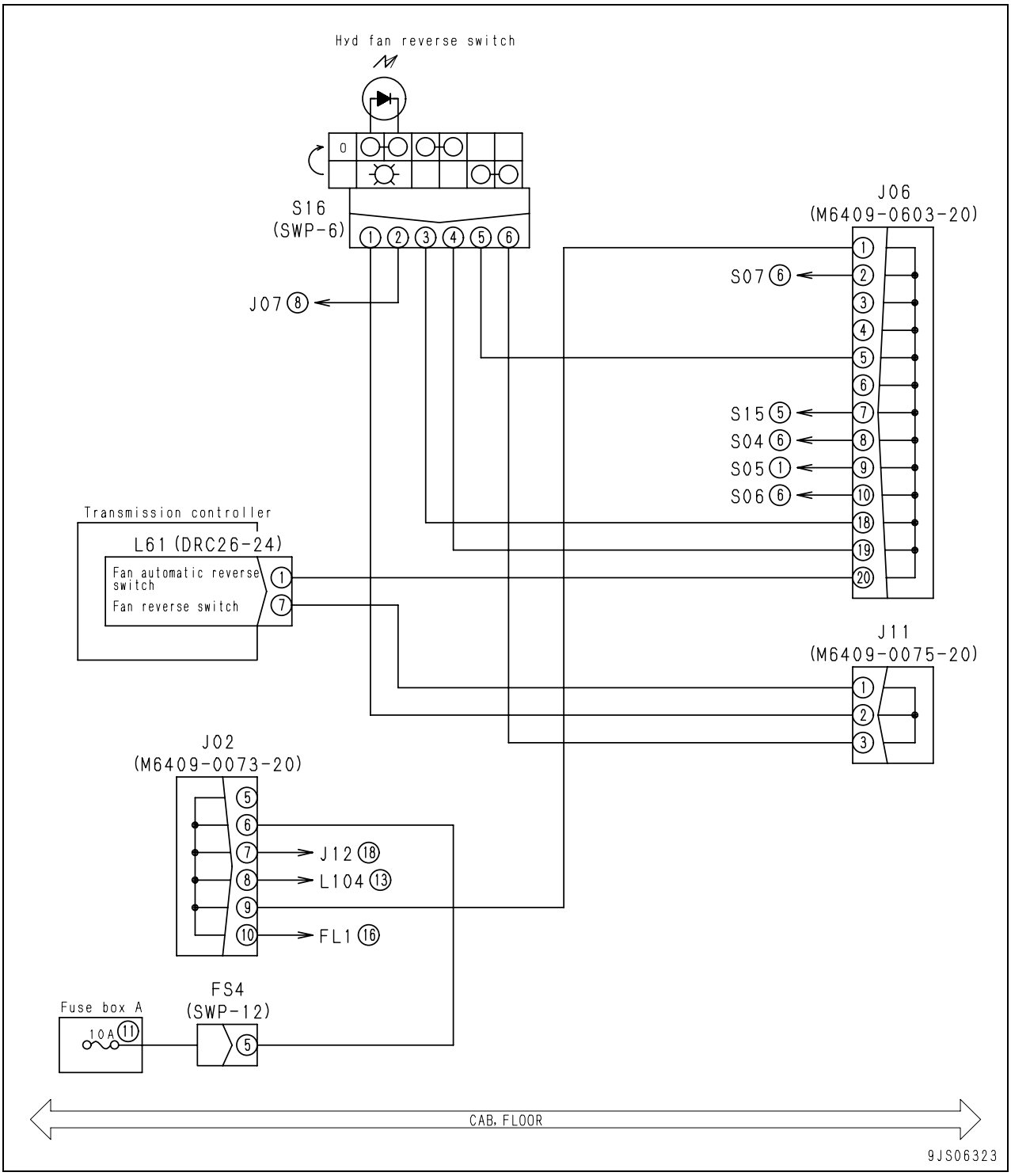


Failure code [DD1NL4] (Fan automatic reverse switch: Switch is kept pressed for long time)

Action code	Failure code	Trouble	Fan automatic reverse switch: Switch is kept pressed for long time (Transmission controller system)
E01	**DD1NL4**		
Contents of trouble	• Since the fan automatic reverse switch system is shorted with the power source, the fan automatic reverse switch function becomes unavailable.		
Action of controller	• The automatic reverse switch is OFF.		
Problem that appears on machine	• Automatic reversing of the fan becomes unavailable		
Related information	• The input state (ON/OFF) from the fan reverse switch can be checked with the monitoring function (Code: 93400, FAN REVERSE SW). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fan automatic reverse switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S16 (male)	Fan automatic reverse 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	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L61 (female) (1) – S16 (female) (3) and chassis ground		Voltage	20 – 30 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L61 (male)	Fan automatic reverse switch	Voltage	
			Between (1) and chassis ground	ON	20 – 30 V	
				OFF	Max. 1 V	

Circuit diagram related to the fan reverse switch & fan automatic reverse switch



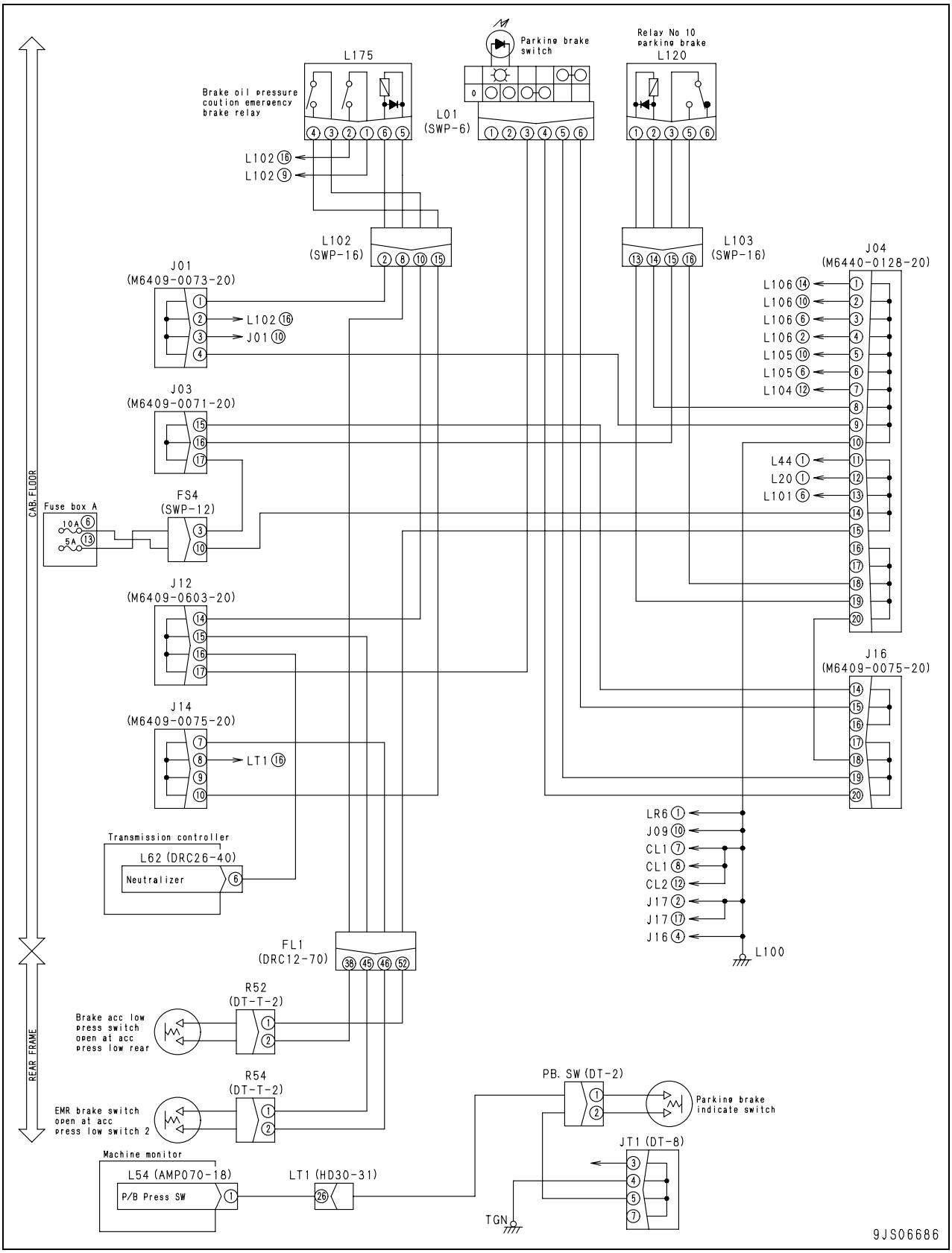
Failure code [DDB6L4] (Parking brake switch (Neutralizer): ON/OFF signals disagree)

Action code	Failure code	Trouble	Parking brake switch (Neutralizer): ON/OFF signals disagree (Transmission controller system)
E03	**DDB6L4**		
Contents of trouble	• Controller outputs a failure signal when the following conditions are all met 1) Parking brake switch signal ON (neutralizer signal OPEN) 2) Parking brake released (by CAN communication from the machine monitor) 3) Hydraulic oil temperature above 25°C		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• Forward and reverse travel of the machine become unavailable. Or the parking brake indicator remains unlighted.		
Related information	• The input state (ON/OFF) from the parking indicator switch to the machine monitor can be checked with the monitoring function (Code: 40903, D-IN-26). • The input state (ON/OFF) from the parking brake 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 indicated, carry out troubleshooting for it first. • If failure code [DAFRKR] (CAN communication with machine monitor: Defective communication (Abnormality in target component system)) is indicated, carry out troubleshooting for it first. • Above is sometimes detected if the emergency parking brake switch is set to ON (release side) when the parking brake switch is turned ON (parking side). • Method of reproducing failure code: Turn the starting switch ON and turn the parking brake switch ON.		

	Causes		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.		
			L01 (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)	Constant	Min. 1 MΩ

<table>
<tr><td rowspan="8">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Disconnection in wiring harness (Disconnection or defective contact)</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 L54 (female) (1) – PB.SW (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between PB.SW (female) (2) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective transmission controller</td><td colspan="3">Wiring harness between L01 (female) (3) – L62 (female) (6)</td><td>Resistance</td><td>Max. 1 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>L62 (male)</td><td colspan="2">Parking brake switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (6) and chassis ground</td><td colspan="2">ON</td><td colspan="2">Max. 1 V</td></tr>
<tr><td colspan="2">Turn on the starting switch and turn on the parking brake switch, then turn it off.</td><td colspan="2">20 – 30 V</td></tr>
</table>

Circuit diagram related to parking brake switch



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 6

Troubleshooting by failure code (Display of code), Part 6 4
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Failure code [DDK6KA] (FNR lever switch: Disconnection) 7
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Failure code [DDT0L4] (Shift mode selector switch: ON/OFF signals disagree) 12
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Failure code [DDWLLD] (Hold switch: Switch is kept pressed for long time) 18
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Troubleshooting by failure code (Display of code), Part 6

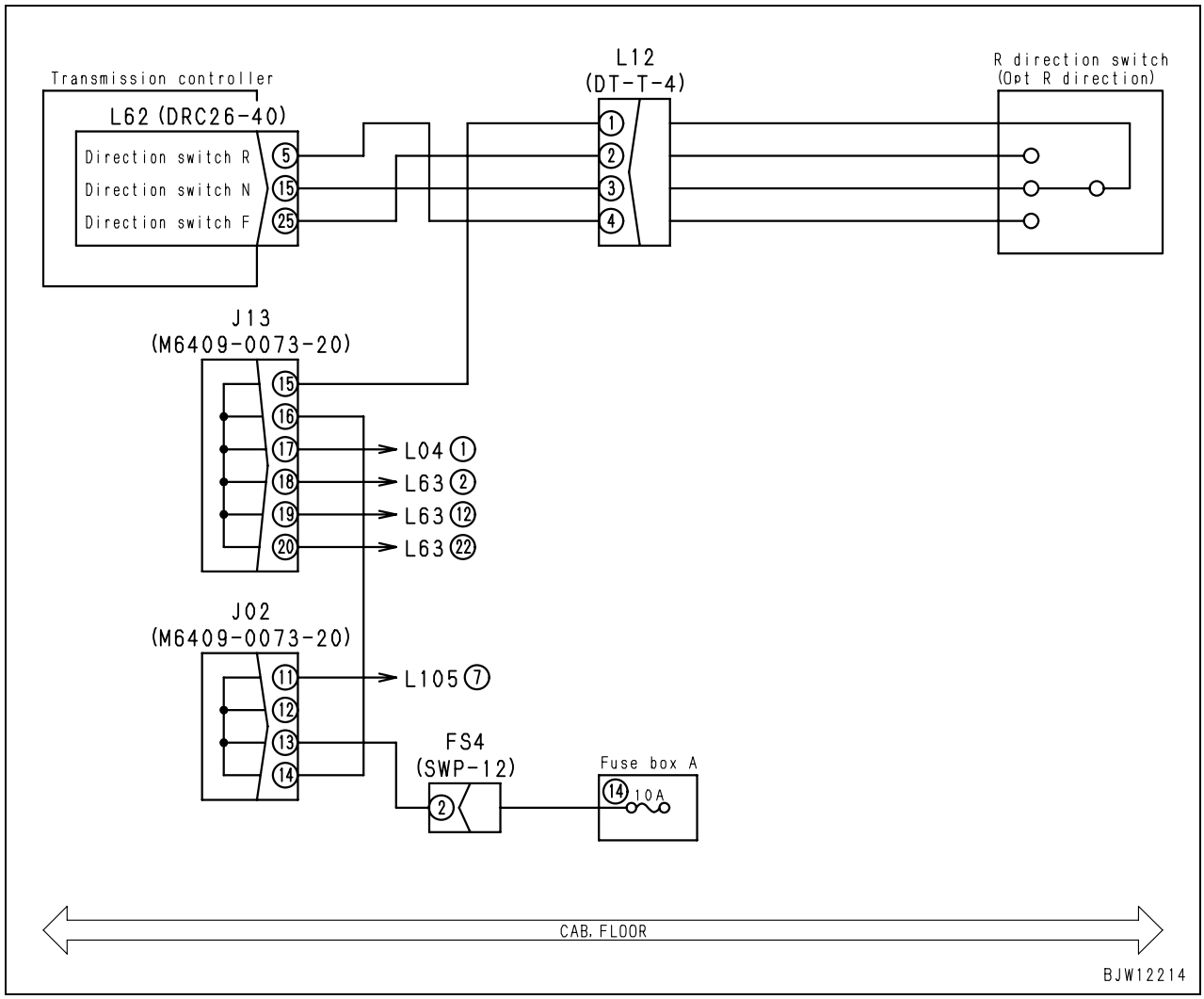
Failure code [DDK3KA] (Right FNR switch: Disconnection)

Action code	Failure code	Trouble	Right FNR switch: Disconnection (Transmission controller system)
E03	**DDK3KA**		
Contents of trouble	• Since the right FNR (directional) switch input signal system is disconnected or shorted, the right FNR (directional) switch signal is not recognized.		
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 the right FNR (directional) switch is set to N (Neutral).		
Problem that appears on machine	• Machine travel with the right FNR (directional) switch becomes unavailable. • Travel with FNR (directional) lever is available. • Shift lever position pilot lamp goes off.		
Related information	• The input signals (ON/OFF) from the right FNR (directional) switch or joystick steering FNR (directional) switch can be checked with the monitoring function (Code: 40907, D-IN-17, D-IN-18 or D-IN-19). • Only for right FNR (directional) switch (if equipped) • Method of reproducing failure code: Turn the starting switch ON, turn the directional selector ON/OFF switch ON, then operate the FNR (directional) switch.		

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse No. 14 of fuse box A</td><td colspan="4">If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 4.)</td></tr>
<tr><td rowspan="8">2</td><td rowspan="8">Defective right FNR (directional) 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>L12 (male)</td><td>Right FNR (directional) switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>F (Forward)</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">Between (1) and (3)</td><td>N (Neutral)</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">Between (1) and (4)</td><td>R (Reverse)</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>Between (1), (2), (3), (4) and chassis ground</td><td>Constant</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Disconnection in wiring harness (Disconnection or defective contact in 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. 14 of fuse box A – L12 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L62 (female) (5) – L12 (female) (4)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L62 (female) (15) – L12 (female) (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L62 (female) (25) – L12 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
</table>

<table>
<tr><td rowspan="10">Possible causes and standard value in normal state</td><td colspan="2">Causes</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. 14 of fuse box A – L12 (female) (1)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L62 (female) (5) – L12 (female) (4) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L62 (female) (15) – L12 (female) (3) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="6">5</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.
• Turn on the directional selector ON/OFF switch</td></tr>
<tr><td>L62</td><td>Right FNR (directional) switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (25) 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 (15) 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 (5) 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 right FNR (directional) switch



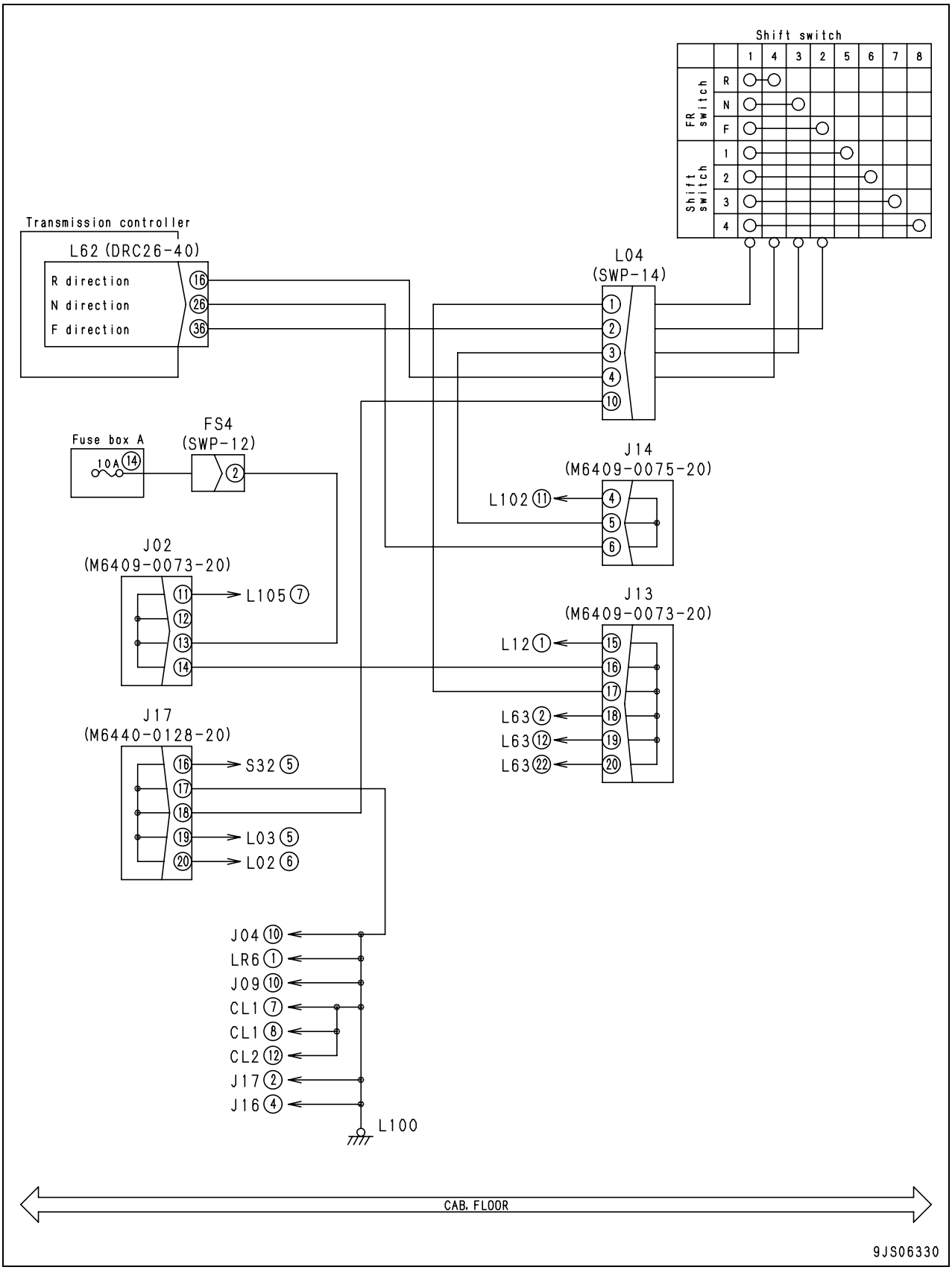
Failure code [DDK6KA] (FNR lever switch: Disconnection)

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 shorted, all the lever signals are not input		
Action of controller	• When the joystick steering ON/OFF switch is set to OFF, set it to Neutral. • When the ON-OFF switch of right FNR switch or joystick steering ON/OFF switch is set to ON: 1) The controller operation follows the right FNR (directional) switch or joystick steering FNR (directional) switch. 2) The controller assumes that FNR (directional) lever switch is set 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	• Machine travel with the FNR (directional) lever switch is unavailable. • Travel is available with right FNR (directional) switch or joystick steering FNR (directional) switch. • Shift lever position pilot lamp goes off.		
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). • Method of reproducing failure code: Turn the starting switch ON and operate FNR (directional) lever		

	Causes		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 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)	Constant	20 – 30 V	
			Between (3) and (10)	N (Neutral)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (2) 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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 14 of fuse box A – L04 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (16) – L04 (female) (4)		Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (26) – L04 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (36) – L04 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L04 (female) (10) – chassis ground		Resistance	Max. 1 Ω

<table>
<tr><td rowspan="10">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="5">4</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 fuse No. 14 of fuse box A – L04 (female) (1) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L62 (female) (16) – L04 (female) (4) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L62 (female) (26) – L04 (female) (3) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L62 (female) (36) – L04 (female) (2) and chassis ground</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>L62</td><td>FNR (directional) lever</td><td colspan="2">Voltage</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 (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 (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

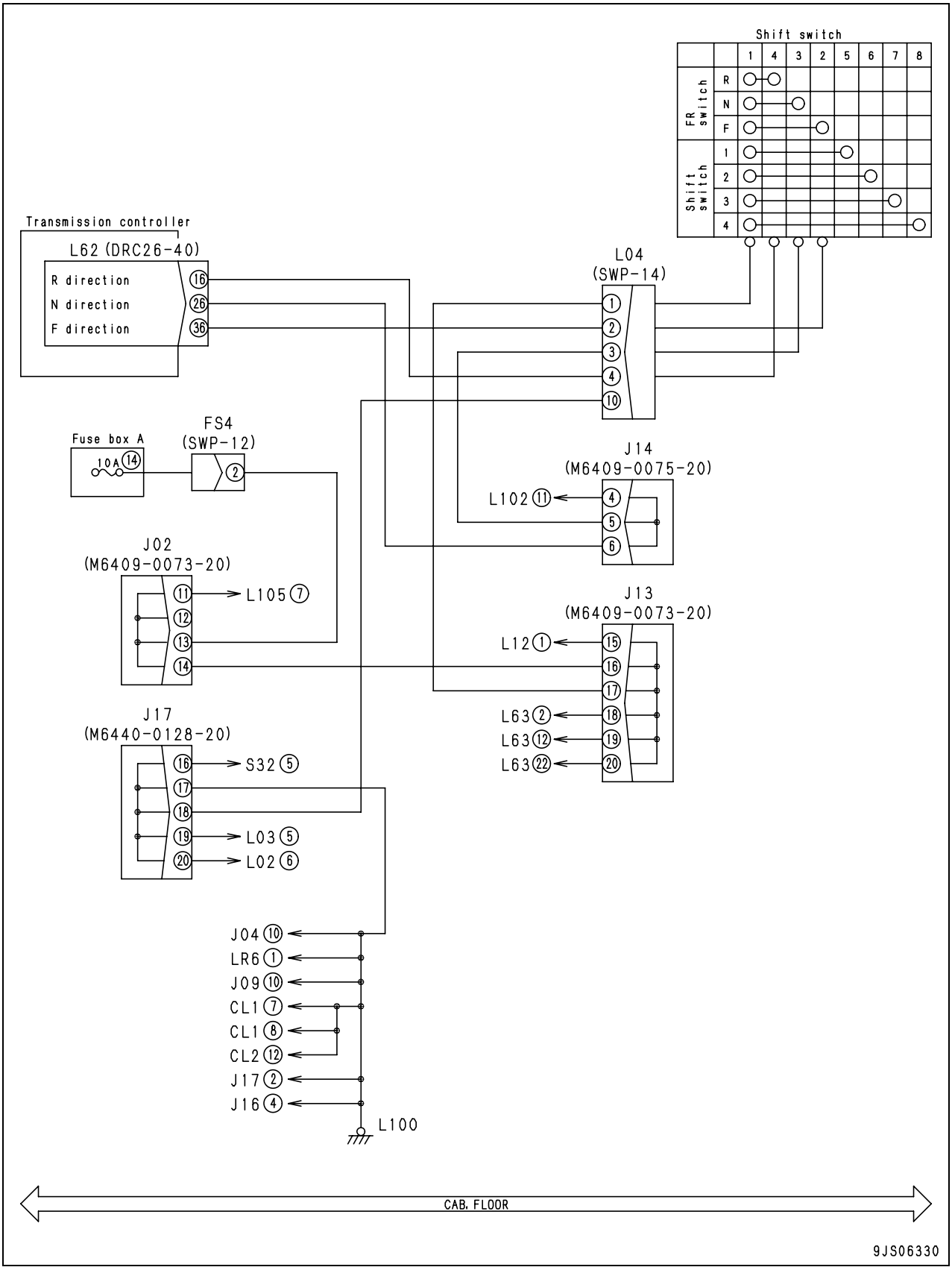


Failure code [DDK6KB] (FNR lever switch: Short circuit)

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 shorted with power source, multiple FNR (directional) lever switch signals are input.		
Action of controller	• Sets to neutral. • Turns the centralized warning lamp and alarm buzzer ON. • As the ON-OFF switch of right FNR switch or joystick steering ON/OFF switch is switched ON → OFF → ON, the controller operation follows the right FNR (directional) switch or joystick steering FNR (directional) switch. • 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	• Machine travel with the FNR (directional) lever switch is unavailable. • Multiple shift lever position pilot lamps light up. • Travel is enabled by using right FNR (directional) switch or joystick steering FNR (directional) 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 (Standard) • Method of reproducing failure code: Turn the starting switch ON and operate FNR (directional) lever		

	Causes		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 (1) and (10)	Constant	20 – 30 V	
			Between (3) and (10)	F (Forward)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (2) and (10)	N (Neutral)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (4) and chassis ground	R (Reverse)	20 – 30 V	
				Other than above	Max. 1 V	
	2	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L62 (female) (16) – L04 (female) (4)		Voltage	Max. 1 V
			Wiring harness between L62 (female) (26) – L04 (female) (3)		Voltage	Max. 1 V
			Wiring harness between L62 (female) (36) – L04 (female) (2)		Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L62	FNR (directional) lever	Voltage	
			Between (26) and chassis ground	N (Neutral)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (36) and chassis ground	F (Forward)	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

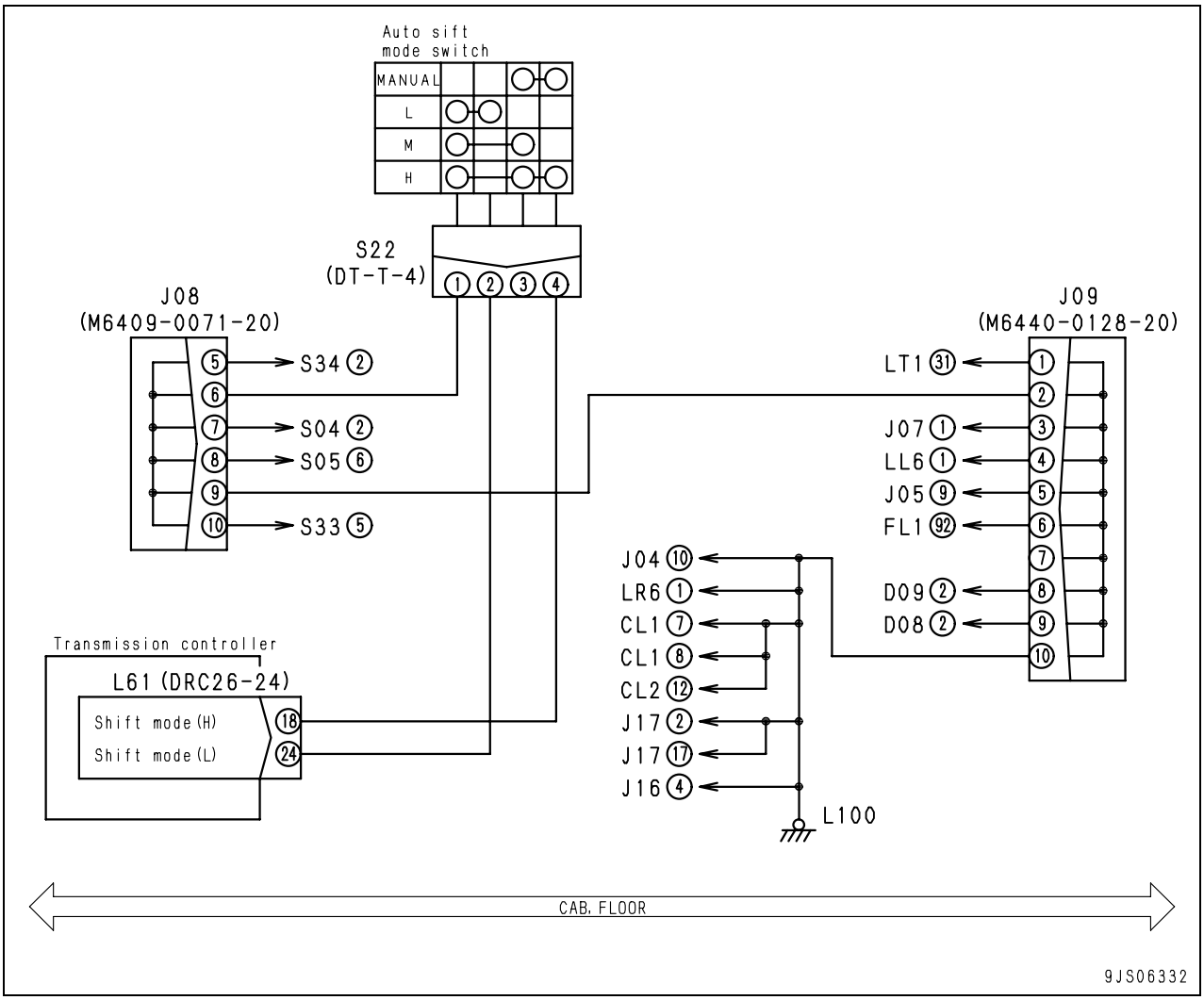


Failure code [DDT0L4] (Shift mode selector switch: ON/OFF signals disagree)

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 problem is removed, system is returned to normal operating state.		
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 or 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.		

	Causes		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.			
			S22 (male)	Shift mode	Resistance	
			Between (1) and (2)	Manual shift	Min. 1 MΩ	
				Auto (L)	Max. 1 Ω	
				Auto (H)	Min. 1 MΩ	
			Between (1) and (4)	Manual shift	Min. 1 MΩ	
				Auto (L)	Min. 1 MΩ	
				Auto (H)	Max. 1 Ω	
			Between (3) and (4)	Manual shift	Max. 1 Ω	
				Auto (L)	Min. 1 MΩ	
				Auto (H)	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L61 (female) (24) – S22 (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 L61 (female) (18) – S22 (female) (4) and chassis ground		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L61 (female) (24) – S22 (female) (2) and chassis ground		Voltage	Max. 1 V
	5	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L61	Shift mode	Voltage	
			Between (18) and chassis ground	Manual shift	Max. 1 V	
				Auto (L)	Max. 1 V	
				Auto (H)	20 – 30 V	
			Between (24) and chassis ground	Manual shift	Max. 1 V	
				Auto (L)	20 – 30 V	
				Auto (H)	Max. 1 V	

Circuit diagram related to transmission manual/auto shift selector switch.

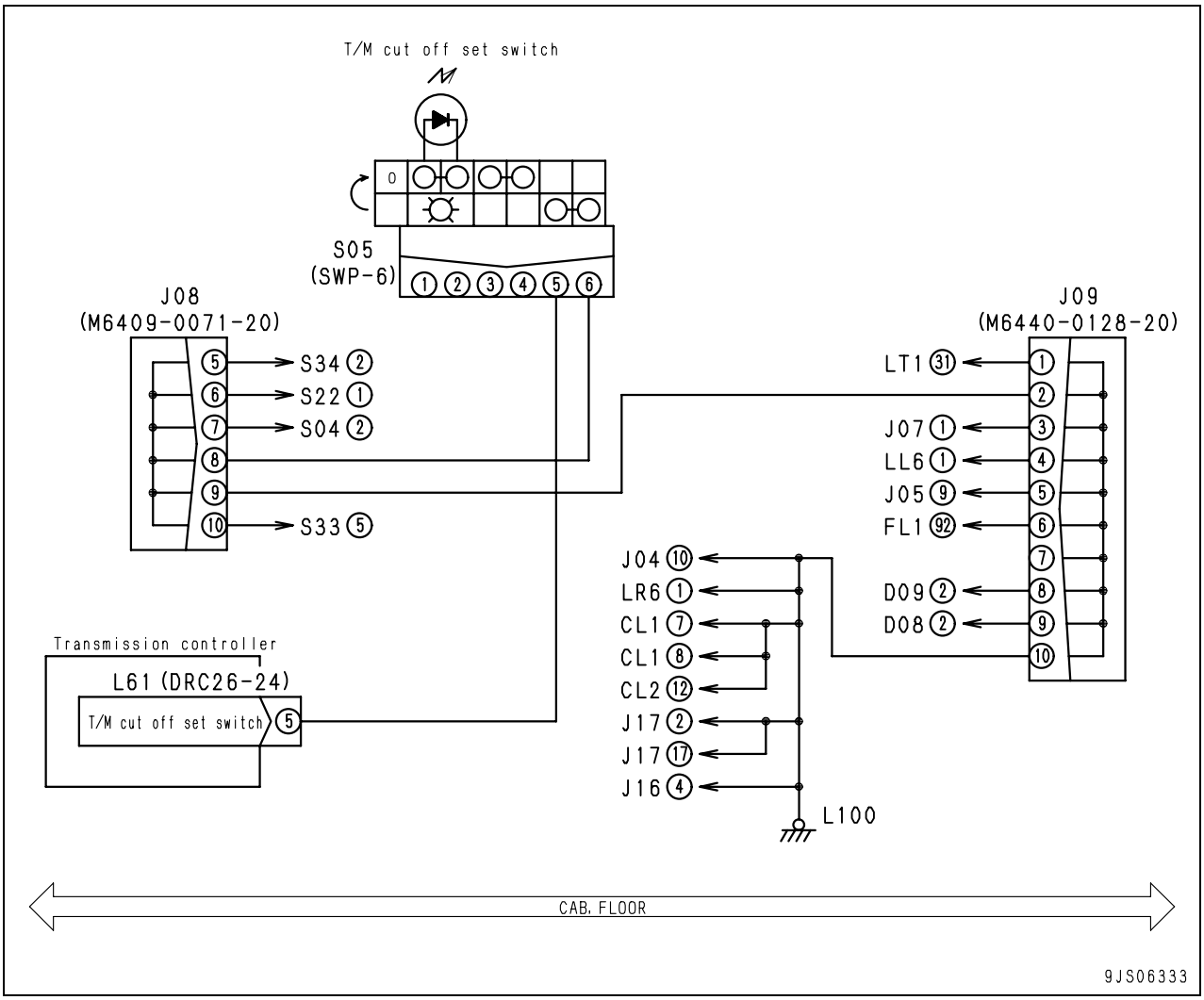


Failure code [DDT4LD] (Transmission cut-off set switch: Switch is kept pressed for long time)

Action code	Failure code	Trouble	The transmission cut-off set switch: Switch is kept pressed for long time (transmission controller system)
E01	**DDT4LD**		
Contents of trouble	• Since the transmission cut-off set switch system is shorted, normal transmission cut-off becomes unavailable.		
Action of controller	• If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The transmission is cut off at an unintended position.		
Related information	• The input state (ON/OFF) from the transmission cut-off set switch can be checked with the monitoring function (Code: 40906, D-IN-9). • Method of reproducing failure code: Turn the starting switch ON.		

<table>
<tr><td rowspan="12">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective transmission cut-off 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>S05 (male)</td><td>Transmission cut-off set switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (5) 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 (5), (6) and chassis ground</td><td>Constant</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 L61 (female) (5) – S05 (female) (5) and chassis ground</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 turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>L61 (female)</td><td>Transmission cut-off set switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (5) and chassis ground</td><td>ON</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
</table>

Circuit diagram related to transmission cut-off set switch

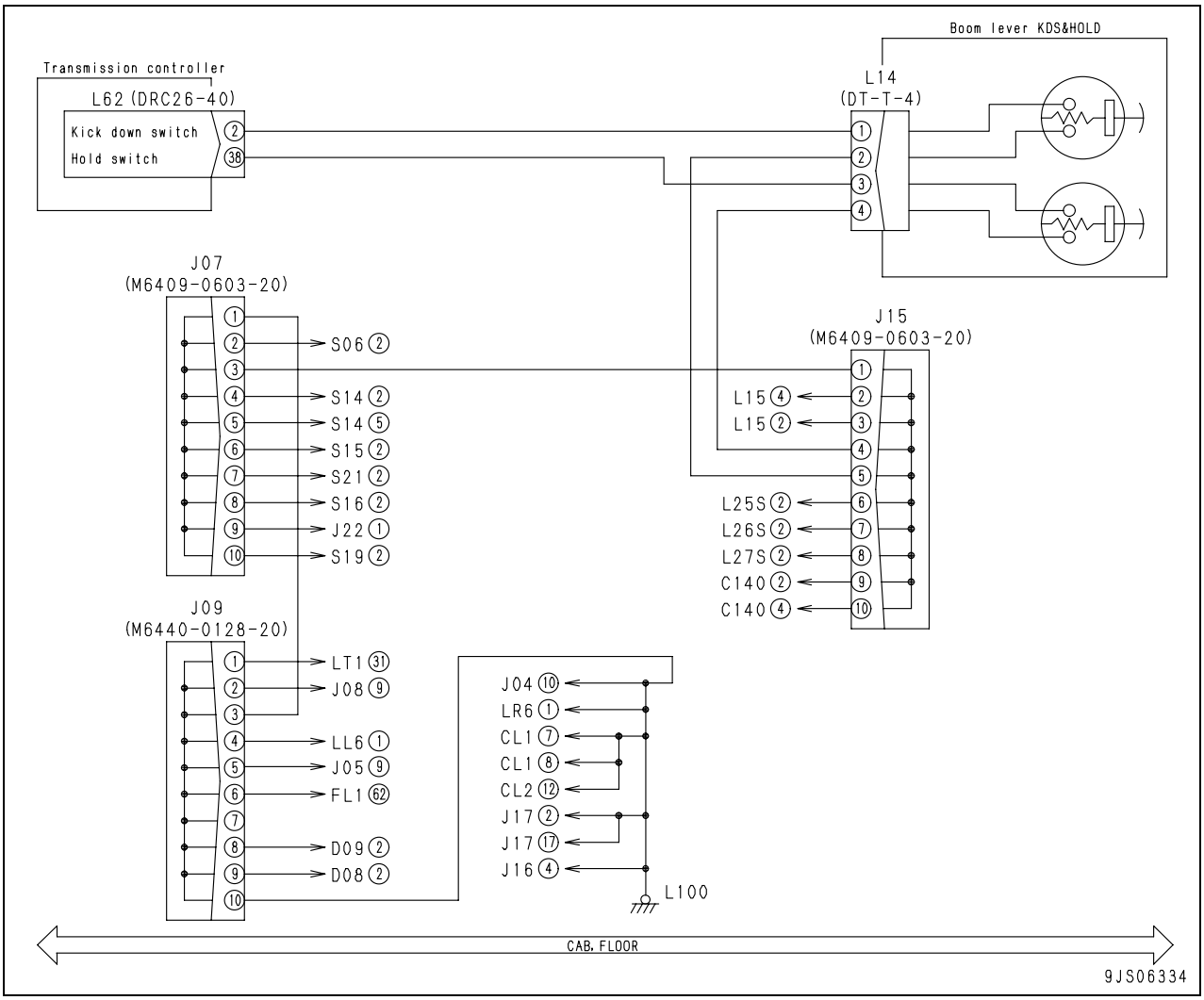


Failure code [DDW9LD] (Kick-down switch: Switch is kept pressed for long time)

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 shorted, kick-down becomes unavailable.		
Action of controller	• Implements kick-down once at occurrence of the ground fault. After that, kick-down control is not executed. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• When ground fault occurs, turns the kick-down ON once. • No kick down is executed after that.		
Related information	• The input state (ON/OFF) from the kick-down switch can be checked with the monitoring function (Code: 40908, D-IN-30). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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.			
			L14 (male)	Kick-down switch	Resistance	
			Between (1) and (2)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (1), (2) 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 L62 (female) (2) – L14 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L62	Kick-down switch	Voltage	
			Between (2) and chassis ground	ON	20 – 30 V	
				OFF	Max. 1 V	

Circuit diagram related to kick-down switch and hold switch

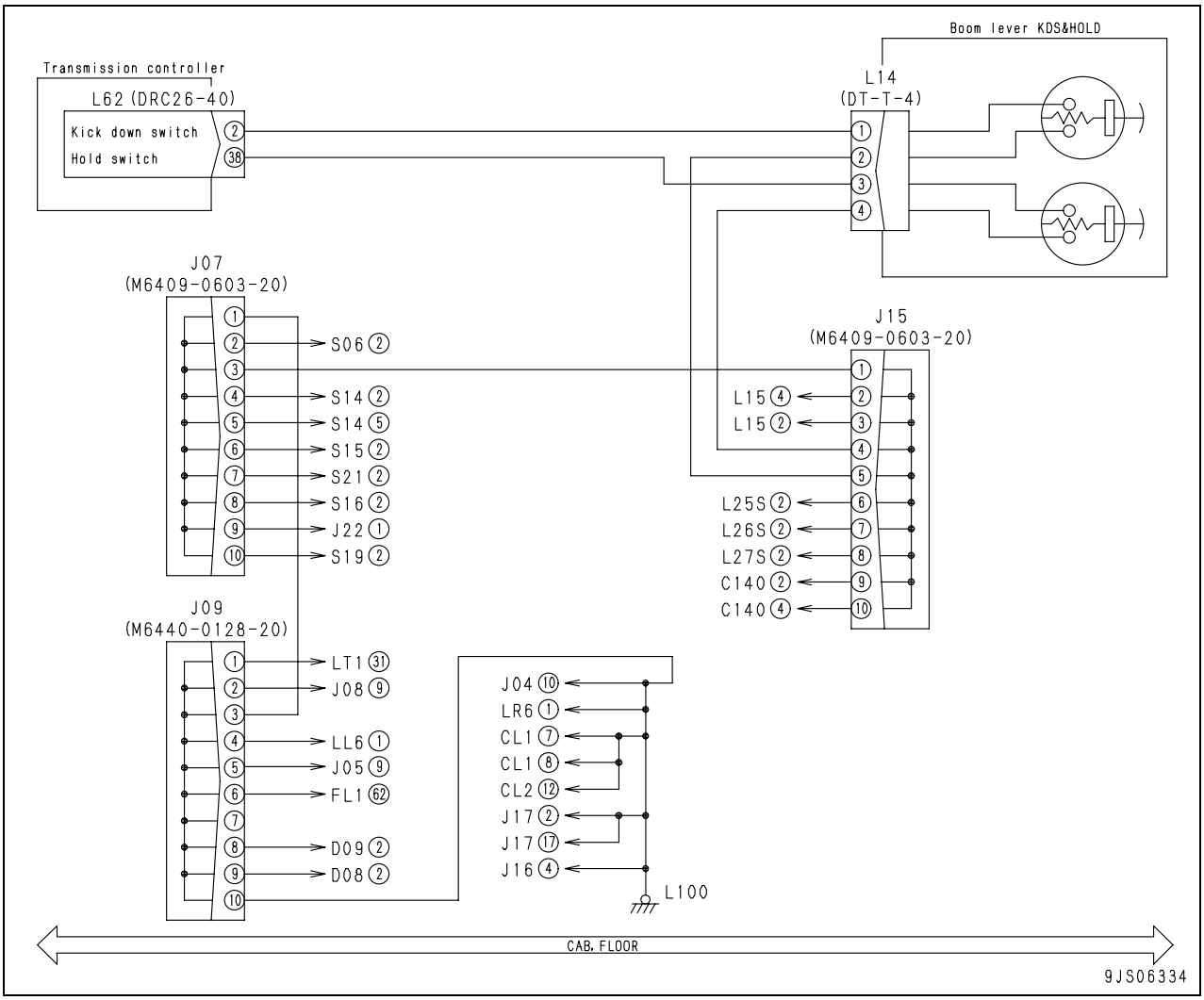


Failure code [DDWLLD] (Hold switch: Switch is kept pressed for long time)

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 shorted, holding of signals becomes unavailable.		
Action of controller	• Holds once when a grounding fault occurs, then does not control holding. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• When ground fault occurs, turns the hold switch once.		
Related information	• The input state (ON/OFF) from the hold switch can be checked with the monitoring function (Code: 40908, D-IN-31). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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.			
			L04 (male)	Hold 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 L62 (female) (38) – L07 (female) (3) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L62	Hold switch	Voltage	
			Between (38) and chassis ground	ON	20 – 30 V	
				OFF	Max. 1 V	

Circuit diagram related to kick-down switch and hold switch

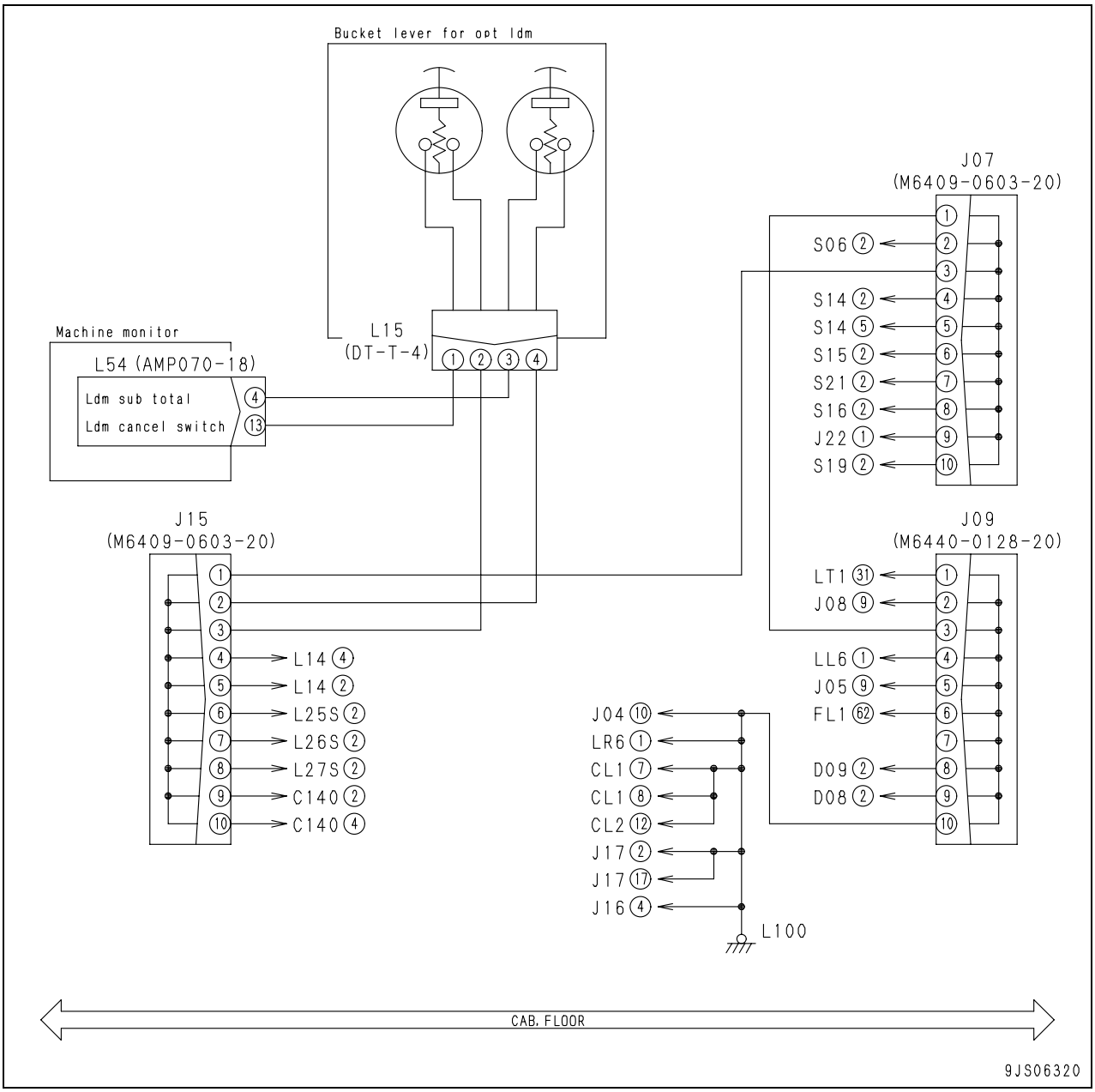


Failure code [DDY0LD] (Load meter cancel switch: Switch is kept pressed for long time)

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 shorted and load meter cancel switch does not function.		
Action of controller	• None in particular.		
Problem that appears on machine	• Cancellation of calculated load becomes unavailable		
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 (if equipped). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective load meter cancel switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L15 (male)	Load meter cancel switch	Resistance	
			Between (1) and (2)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (1), (2) 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 L54 (female) (13) – L15 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L54 (male)	Load meter cancel switch	Voltage	
			Between (13) and chassis ground	ON	Max. 1 V	
				OFF	20 – 30 V	

Circuit diagram related to load meter cancel & subtotal switch



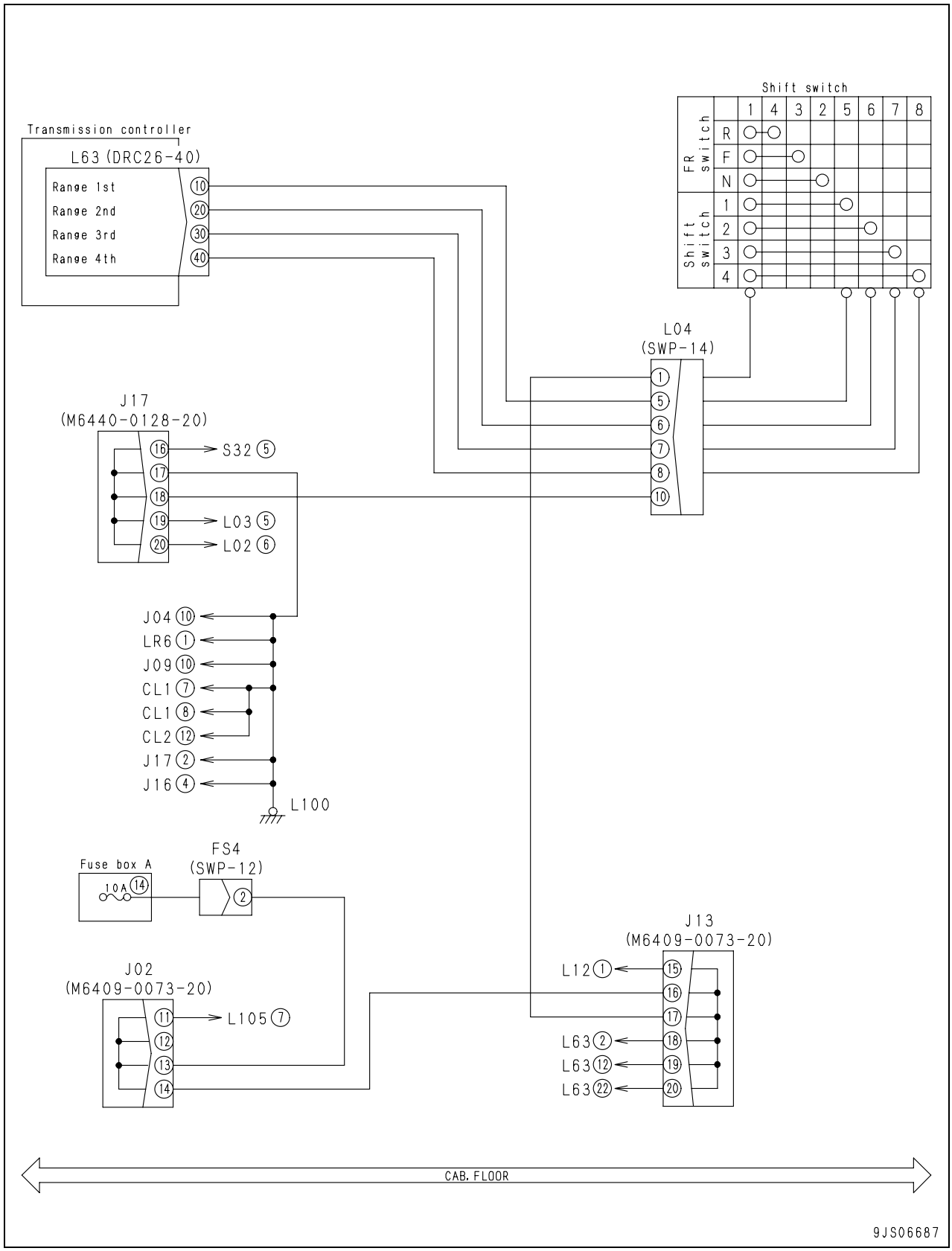
Failure code [DF10KA] (Transmission shift lever switch: Disconnected)

Action code	Failure code	Trouble	Transmission shift lever switch: Disconnected (Transmission controller system)
E01	**DF10KA**		
Contents of trouble	• Since the transmission shift lever switch input signal system is disconnected or shorted, the signal is not input.		
Action of controller	• Fixes 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: 40906, D-IN-8, D-IN-9, D-IN-10 or D-IN-11) • Method of reproducing failure code: Turn the starting switch ON and operate shift lever		

	Causes		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 (10)	Constant	20 – 30 V	
			Between (5) and (10)	1st (1st speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (6) and (10)	2nd (2nd speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (7) and (10)	3rd (3rd speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (8) and (10)	4th (4th speed)	20 – 30 V	
				Other than above	Max. 1 V	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 14 of fuse box A – L04 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L63 (female) (10) – L04 (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between L63 (female) (20) – L04 (female) (6)		Resistance	Max. 1 Ω
			Wiring harness between L63 (female) (30) – L04 (female) (7)		Resistance	Max. 1 Ω
			Wiring harness between L63 (female) (40) – L04 (female) (8)		Resistance	Max. 1 Ω
			Wiring harness between L04 (female) (10) – chassis ground		Resistance	Max. 1 Ω

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="6">3</td><td rowspan="6">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 fuse No. 14 of fuse box A – L04 (female) (1) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">Wiring harness between L63 (female) (10) – L04 (female) (5) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">Wiring harness between L63 (female) (20) – L04 (female) (6) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">Wiring harness between L63 (female) (30) – L04 (female) (7) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">Wiring harness between L63 (female) (40) – L04 (female) (8) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">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>L63</td><td colspan="2">Shift range</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (10) and chassis ground</td><td colspan="2">1st (1st speed)</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="2">Other than above</td><td colspan="2">Max. 1 V</td></tr>
<tr><td rowspan="2">Between (20) and chassis ground</td><td colspan="2">2nd (2nd speed)</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="2">Other than above</td><td colspan="2">Max. 1 V</td></tr>
<tr><td rowspan="2">Between (30) and chassis ground</td><td colspan="2">3rd (3rd speed)</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="2">Other than above</td><td colspan="2">Max. 1 V</td></tr>
<tr><td rowspan="2">Between (40) and chassis ground</td><td colspan="2">4th (4th speed)</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="2">Other than above</td><td colspan="2">Max. 1 V</td></tr>
</table>

Circuit diagram related to transmission shift lever switch

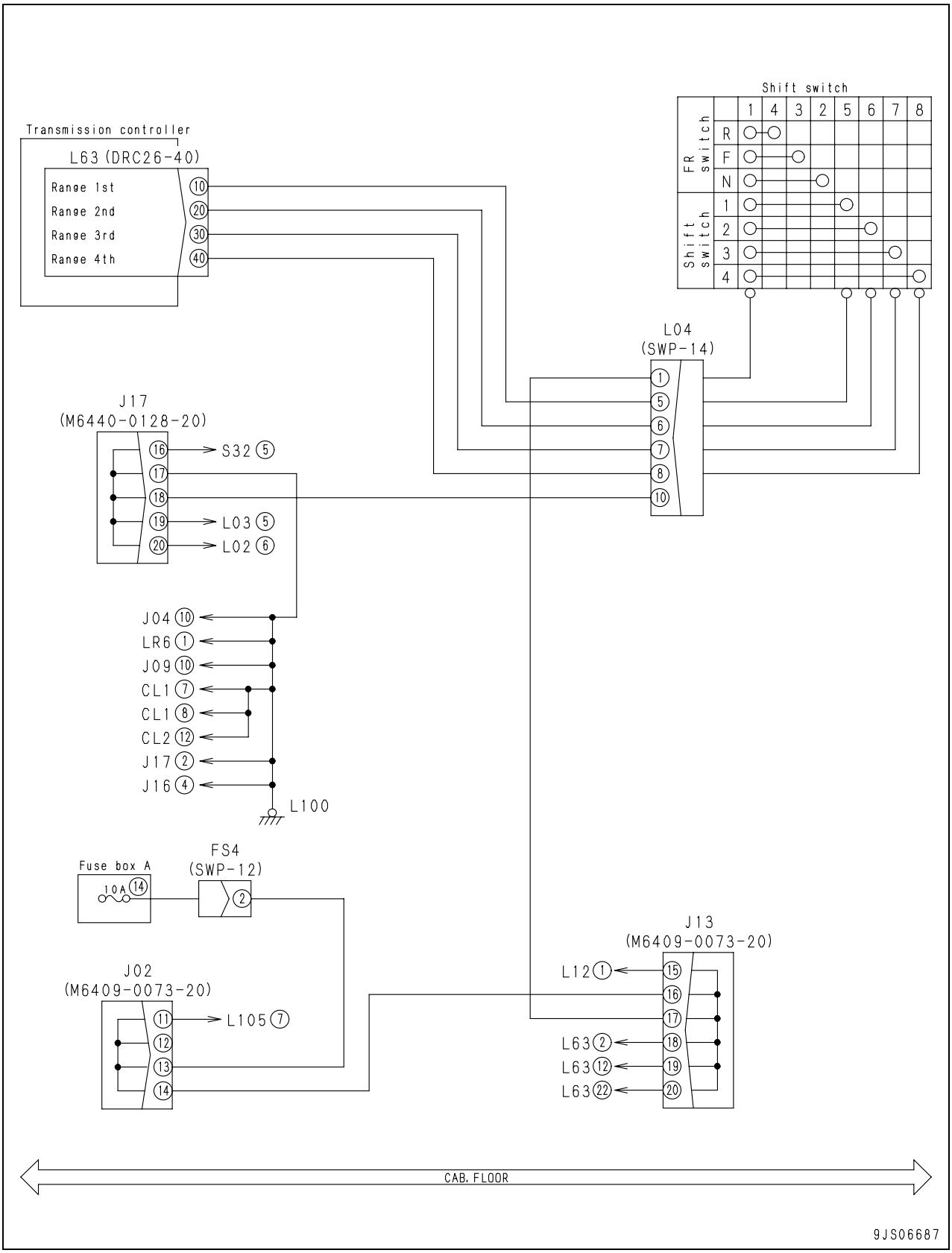


Failure code [DF10KB] (Transmission shift lever switch: Short circuit)

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 shorted with the power source, multiple transmission shift lever switch signals are input.		
Action of controller	• Uses the shift range input to the higher gear speed • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• Specified gear speed is not available (1st speed or 2nd speed not selectable from the transmission shift lever) • 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: 40906, D-IN-8, D-IN-9, D-IN-10 or D-IN-11) • Method of reproducing failure code: Turn the starting switch ON and operate shift lever		

	Causes		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 (10)	1st (1st speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (6) and (10)	2nd (2nd speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (7) and (10)	3rd (3rd speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (8) and (10)	4th (4th speed)	20 – 30 V	
				Other than above	Max. 1 V	
	2	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L63 (female) (10) – L04 (female) (5) and chassis ground		Voltage	Max. 1 V
			Wiring harness between L63 (female) (20) – L04 (female) (6) and chassis ground		Voltage	Max. 1 V
			Wiring harness between L63 (female) (30) – L04 (female) (7) and chassis ground		Voltage	Max. 1 V
			Wiring harness between L63 (female) (40) – L04 (female) (8) and chassis ground		Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L63	Shift range	Voltage	
			Between (10) and chassis ground	1st (1st speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (20) and chassis ground	2nd (2nd speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (30) and chassis ground	3rd (3rd speed)	20 – 30 V	
				Other than above	Max. 1 V	
			Between (40) and chassis ground	4th (4th speed)	20 – 30 V	
				Other than above	Max. 1 V	

Circuit diagram related to transmission shift lever switch

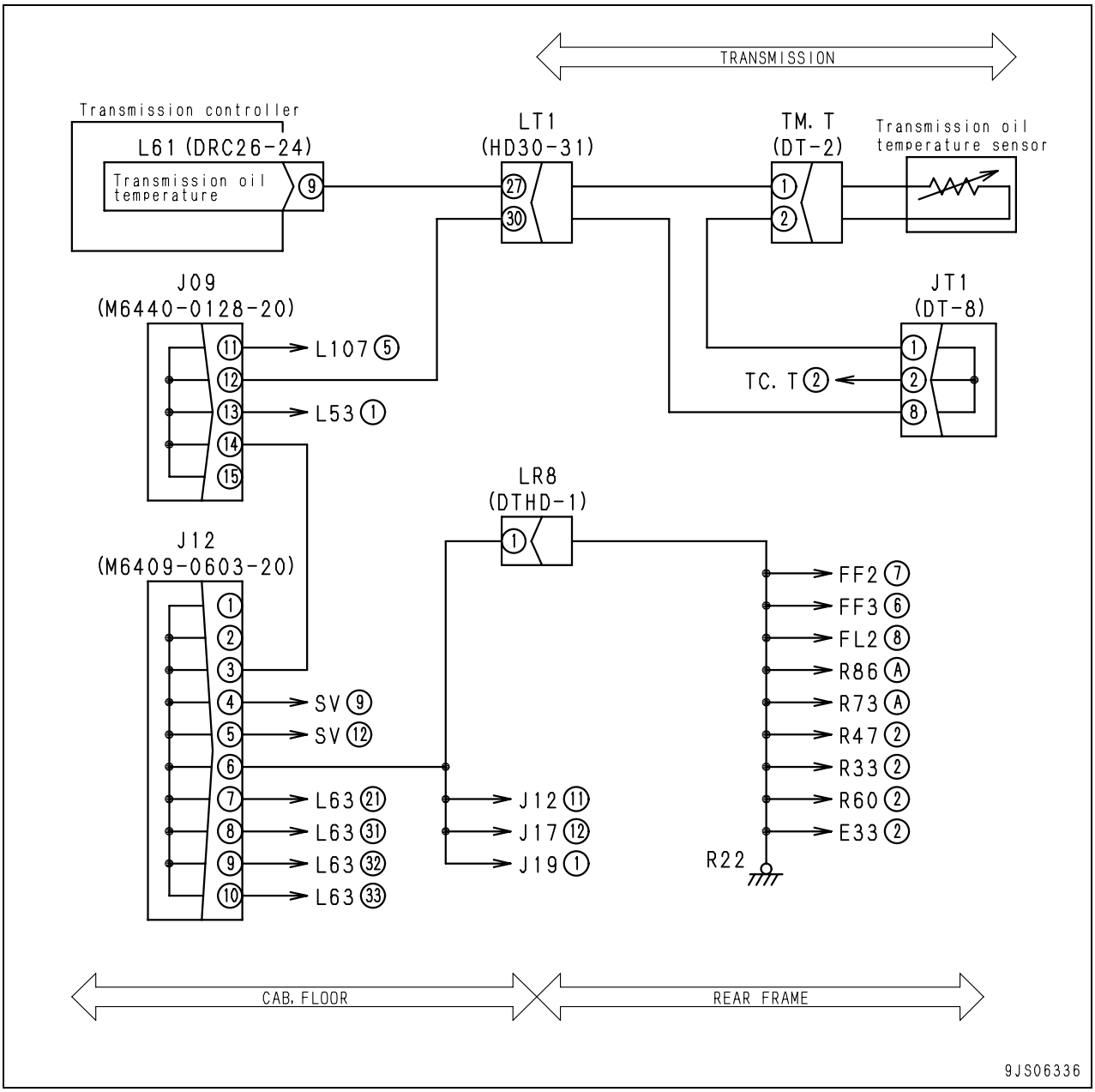


Failure code [DGF1KA] (Transmission oil temperature sensor: Disconnected)

Action code	Failure code	Trouble	Transmission oil temperature sensor: Disconnected (Transmission controller system)
E01	**DGF1KA**		
Contents of trouble	• Since the transmission oil temperature sensor signal system is disconnected, the signal level is higher than normal range (Transmission oil temperature sensor signal voltage: Min. 4.56 V (Max. 15°C)) and the torque converter oil temperature sensor signal voltage: Min. 3.7 V (Max. 5.5°C).		
Action of controller	• Cannot judge the transmission oil temperature normally. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• Gear shifting shocks can result.		
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). • 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.		

	Causes		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 temperature)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L61 (female) (9) – TM.T (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between TM.T (female) (2) – chassis ground		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L61 (female)	Transmission oil temperature	Resistance	
			Between (9) and (21)	25°C (Normal temperature)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	

Circuit diagram related to transmission oil temperature sensor

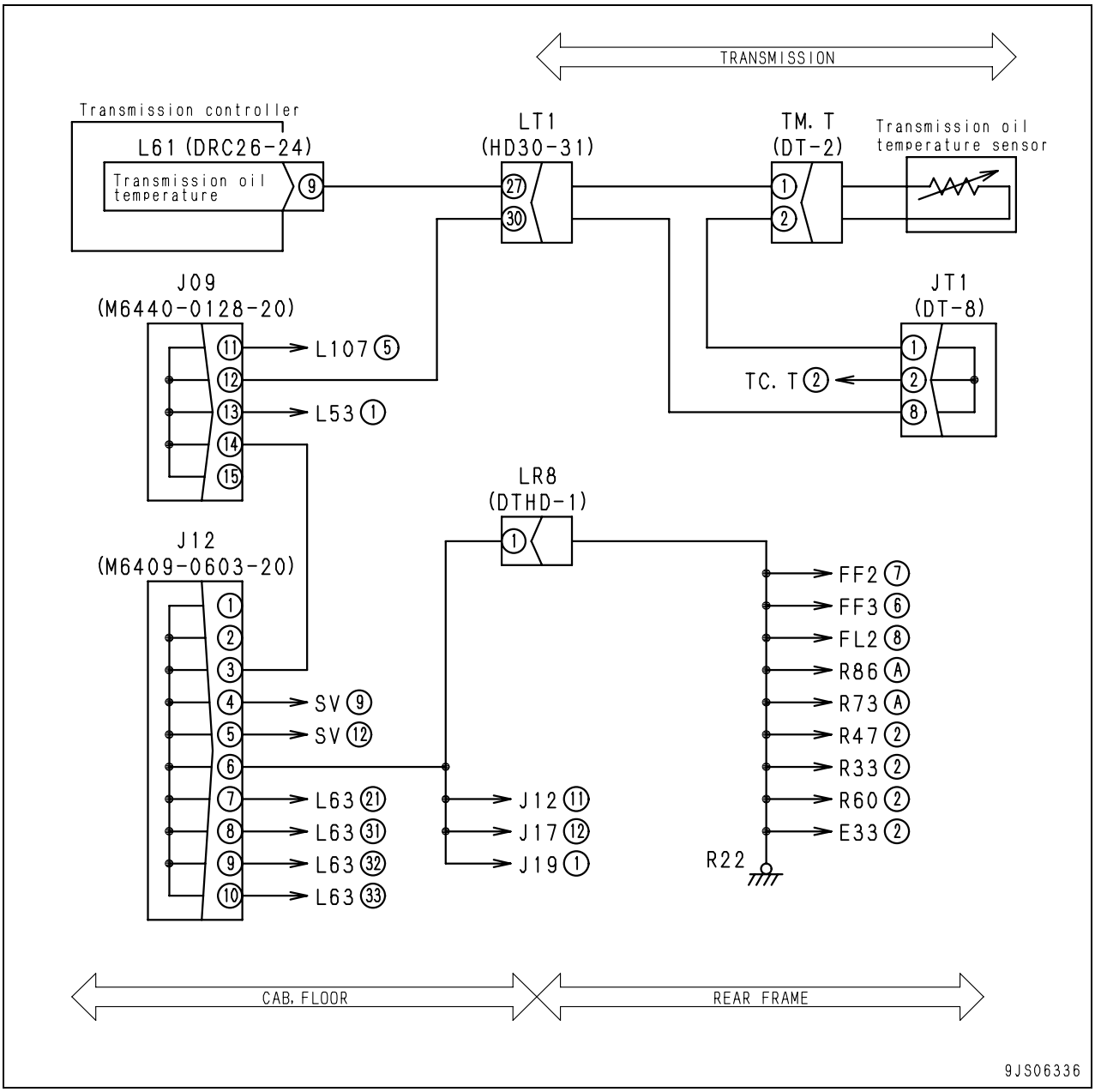


Failure code [DGF1KB] (Transmission oil temperature sensor: Short circuit)

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	• Cannot judge the transmission oil temperature normally. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• Gear shifting shocks can result.		
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.		

	Causes		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 temperature)	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 L61 (female) (9) – TM.T (female) (1) 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.			
			L61 (female)	Transmission oil temperature	Resistance	
			Between (9) and (21)	25°C (Normal temperature)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	

Circuit diagram related to transmission oil temperature sensor

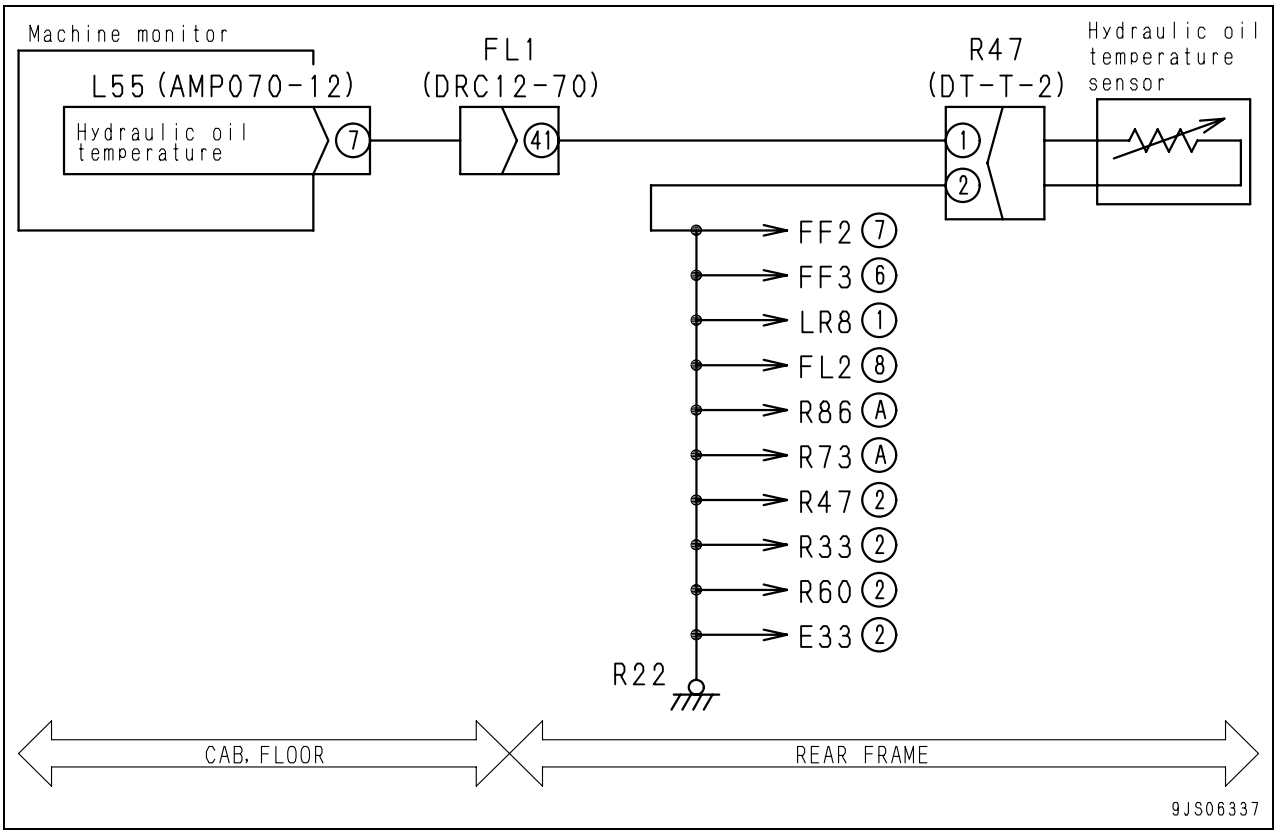


Failure code [DGH2KX] (Hydraulic oil temperature sensor: Out of input signal range)

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	• If problem is removed, system is returned to normal operating state.		
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.		

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting			
	1	Defective hydraulic oil temperature sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R47 (male)	Hydraulic oil temperature	Resistance	
			Between (1) and (2)	25°C (Normal temperature)	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 L55 (female) (7) – R47 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L55 (female)	Hydraulic oil temperature	Resistance	
			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

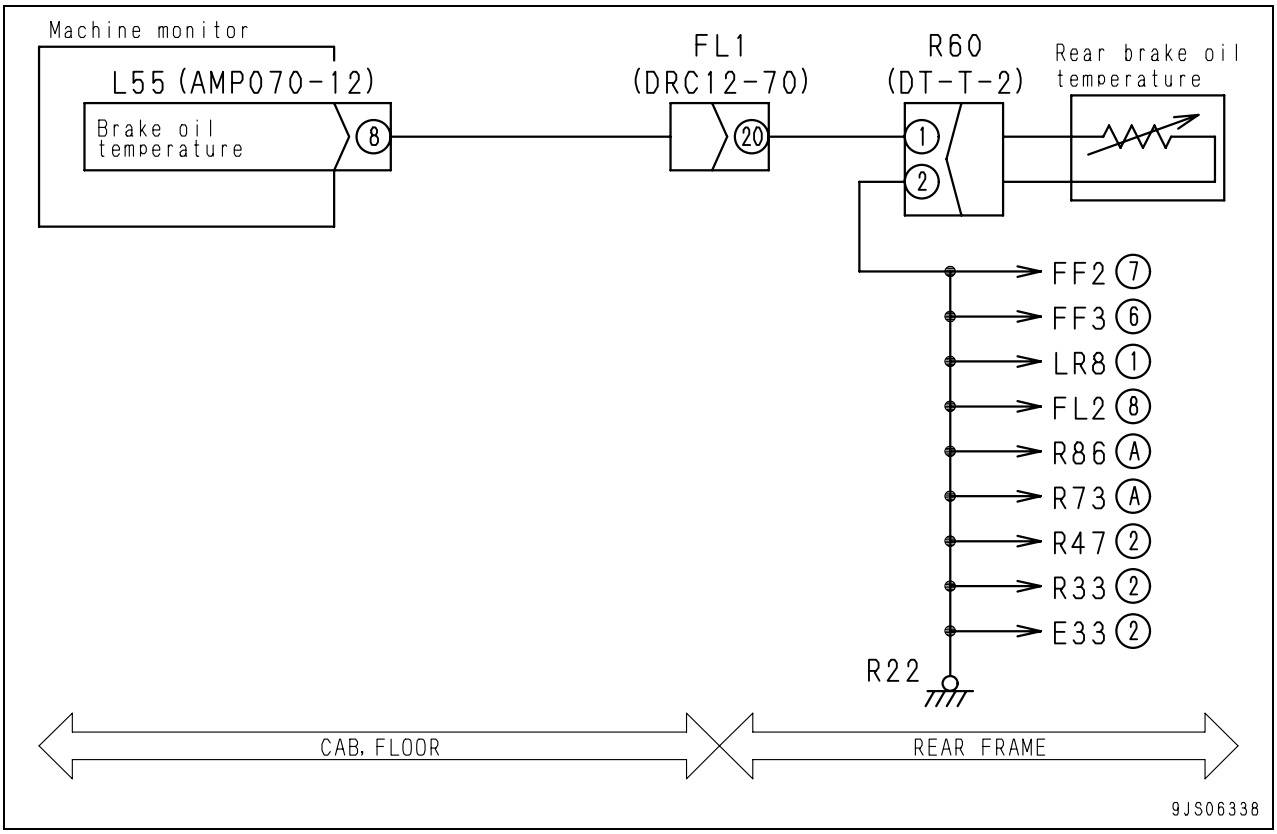


Failure code [DGR2KA] (Rear brake oil temperature sensor: Disconnected)

Action code	Failure code	Trouble	Rear brake oil temperature sensor: Disconnected (Machine monitor system)
E01	**DGR2KA**		
Contents of trouble	• Disconnection in the rear brake oil temperature sensor signal system		
Action of controller	• If problem is removed, system is returned to normal operating state.		
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.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective rear brake oil temperature sensor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R60 (male)	Rear brake oil temperature	Resistance	
			Between (1) and (2)	25°C (Normal temperature)	35 – 50 kΩ	
				100°C	3.1 – 4.5 kΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L55 (female) (8) – R60 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between R60 (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.			
			L55 (female)	Rear brake oil temperature	Resistance	
			Between (8) and 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

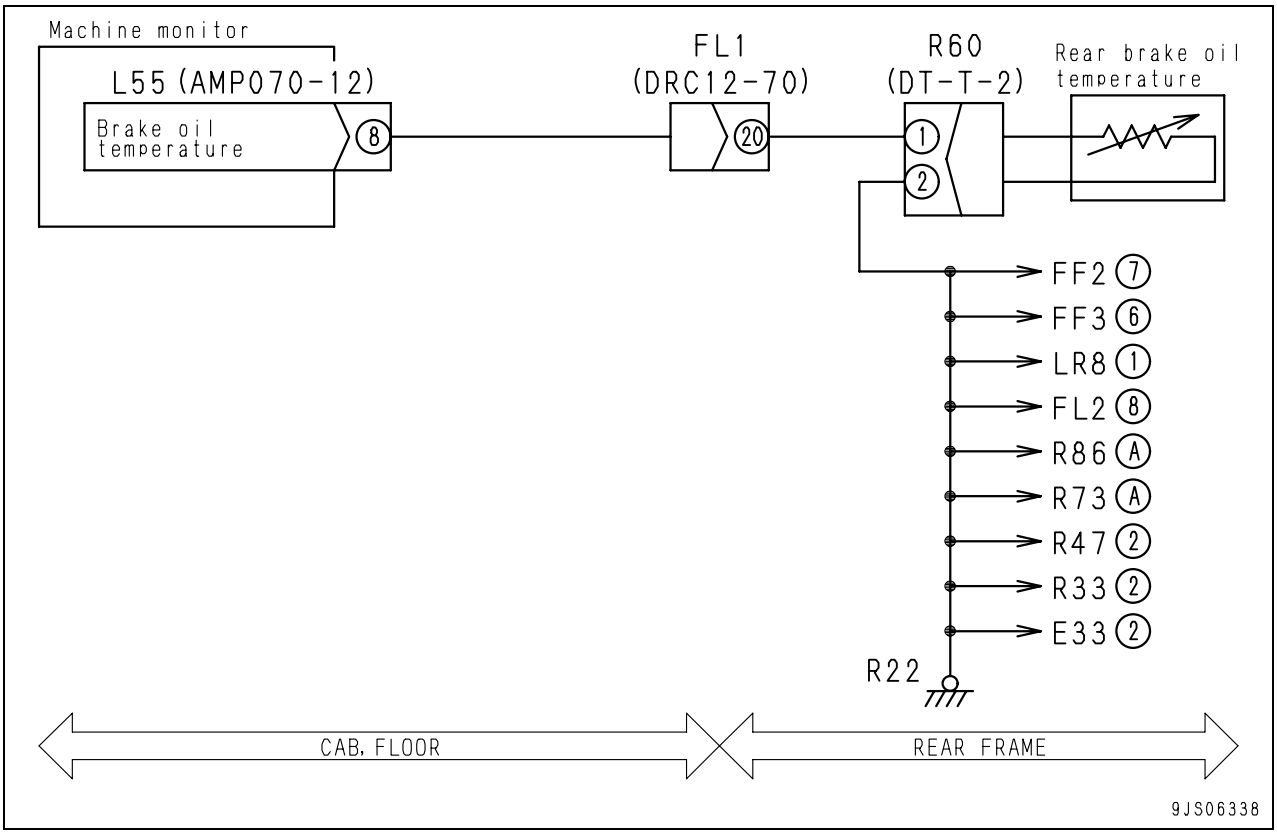


Failure code [DGR2KX] (Rear brake oil temperature sensor: Out of input signal range)

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 the 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	• If problem is removed, system is returned to normal operating state.		
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.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective rear brake oil temperature sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R60 (male)	Rear brake oil temperature	Resistance	
			Between (1) and (2)	25°C (Normal temperature)	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 L55 (female) (8) – R60 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L55 (female)	Rear brake oil temperature	Resistance	
			Between (8) and 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

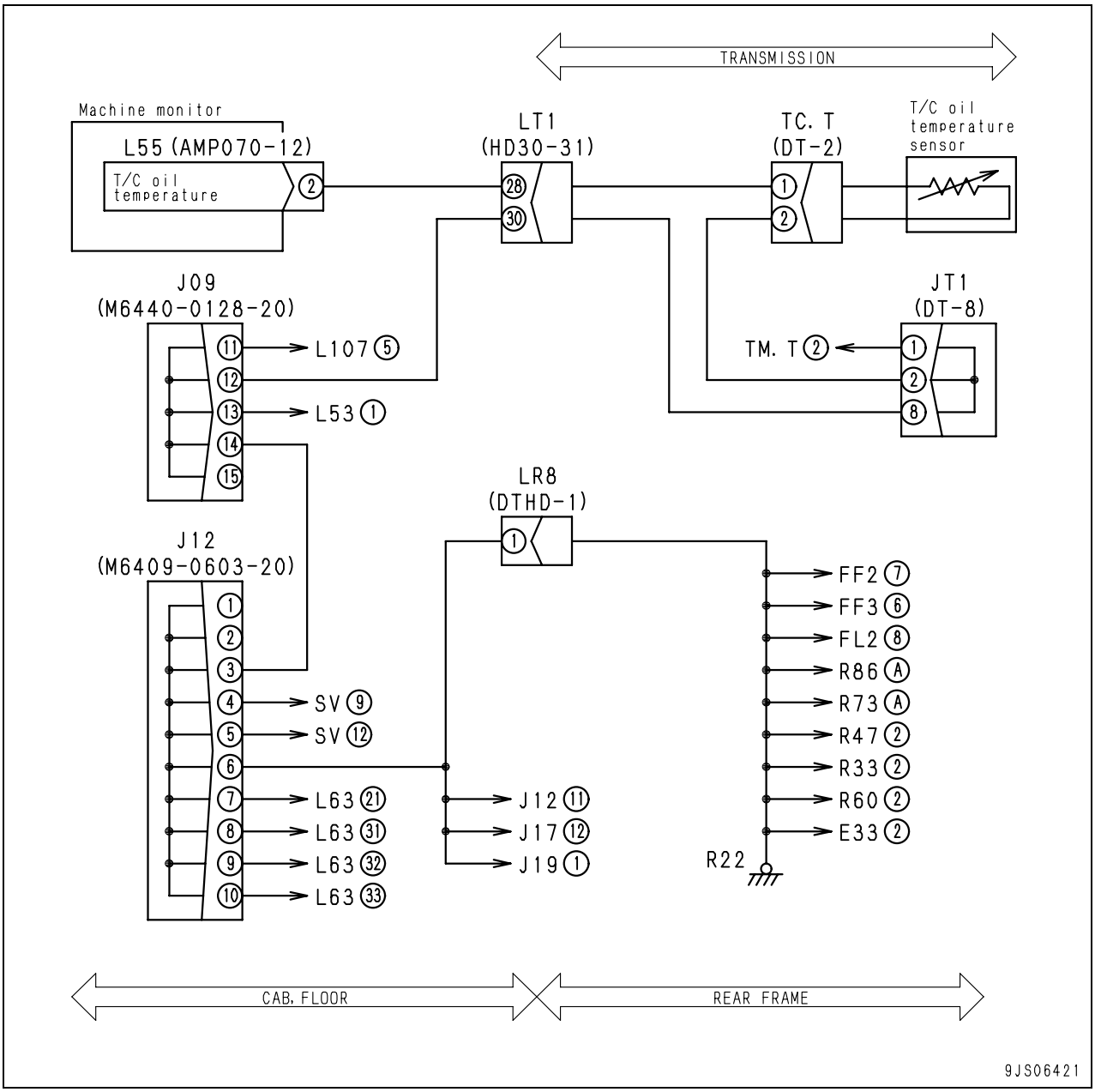


Failure code [DGT1KX] (Torque converter oil temperature sensor: Out of input signal range)

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 the torque converter oil temperature sensor signal system, the signal level is lower than normal range (Transmission oil temperature signal voltage: Max. 0.97 V (Min. 150°C))		
Action of controller	• If problem is removed, system is returned to normal operating state.		
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.		

	Causes		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.			
			TC.T (male)	Torque converter oil temperature	Resistance	
			Between (1) and (2)	25°C (Normal temperature)	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 L55 (female) (2) – TC.T (female) (1) and chassis ground		Resistance	Max. 1 Ω
	3	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L55 (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



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 7

Troubleshooting by failure code (Display of code), Part 7 2
Failure code [DHPCKX] (Lift arm cylinder bottom pressure sensor: Out of input signal range)..... 2
Failure code [DHPDKX] (Lift arm cylinder head pressure sensor: Out of input signal range)..... 4
Failure code [DHT1KX] (Transmission cut-off pressure sensor: Out of input signal range)..... 6
Failure code [DHT8KA] (Steering pump pressure sensor: Disconnection) 8
Failure code [DHT8KB] (Steering pump pressure sensor: Short circuit)..... 10

Troubleshooting by failure code (Display of code), Part 7

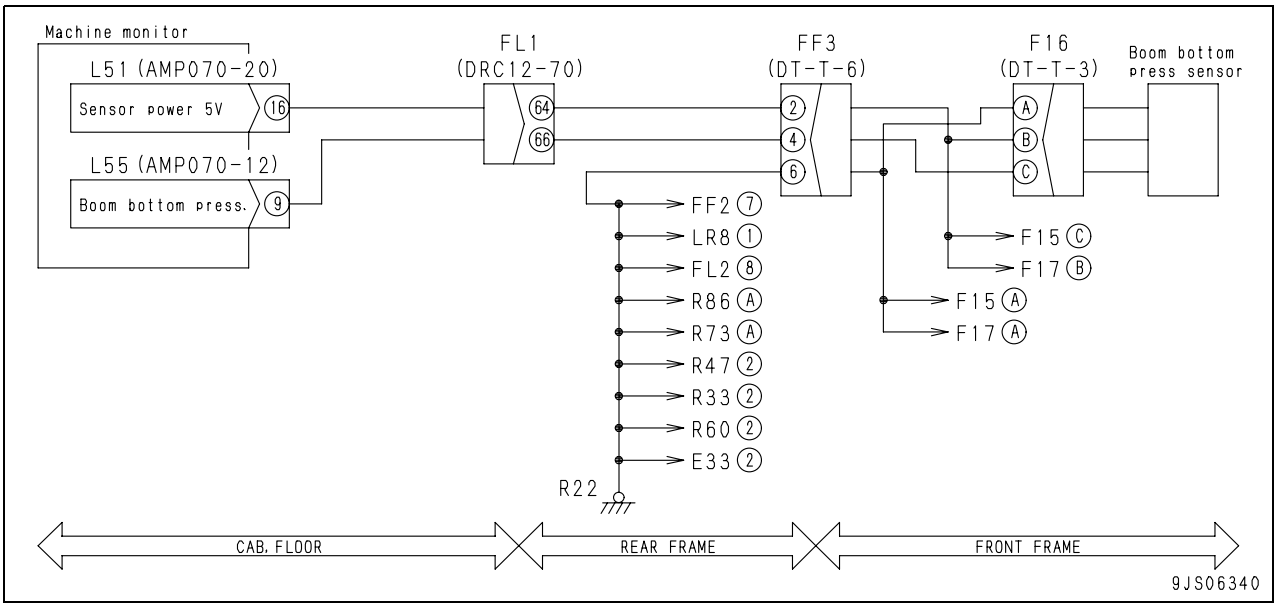
Failure code [DHPCKX] (Lift arm cylinder bottom pressure sensor: Out of input signal range)

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 bottom pressure sensor signal voltage: Below 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 higher than normal range (Lift arm cylinder bottom pressure sensor signal voltage: Min. 4.7 V)		
Action of controller	• If problem is removed, system is returned to normal operating state.		
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). • Only for load meter (if equipped) • Method of reproducing failure code: Start engine and perform lift arm lever operation		

	Causes		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)	Check the failure code comes not to be displayed when the lift arm cylinder bottom pressure sensor is replaced.			
			★ Prepare with starting switch OFF, then start engine, raise the lift arm and carry out troubleshooting.			
			F16	Lift arm	Voltage	
			Between (B) and (A)	Constant	4.85 – 5.15 V	
			Between (C) and (A)	Constant	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 or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L51 (female) (16) – F16 (female) (B)		Resistance	Max. 1 Ω
			Wiring harness between L55 (female) (9) – F16 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between F16 (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 L51 (female) (16) – F16 (female) (B), – circuit branch end and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L55 (female) (9) – F16 (female) (C), – circuit branch end and chassis ground		Resistance	Min. 1 MΩ

<table>
<tr><td rowspan="6">Possible causes and standard value in normal state</td><td colspan="2">Causes</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 24V 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 L51 (female) (16) – F16 (female) (B), – circuit branch end and chassis ground</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td colspan="2">Wiring harness between L55 (female) (9) – F16 (female) (C), – circuit branch end and chassis ground</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, raise the lift arm and carry out troubleshooting.</td></tr>
<tr><td>L51, L55</td><td>Lift arm</td><td colspan="2">Voltage</td></tr>
<tr><td>Between L51 (16) and chassis ground</td><td>Constant</td><td colspan="2">4.85 – 5.15 V</td></tr>
<tr><td rowspan="3">Between L55 (9) and chassis ground</td><td>Constant</td><td colspan="2">0.50 – 4.50 V</td></tr>
<tr><td>Neutral</td><td colspan="2">0.50 – 0.90 V</td></tr>
<tr><td>Lift arm bottom relief</td><td colspan="2">3.02 – 3.42 V</td></tr>
</table>

Circuit diagram related to lift arm cylinder bottom pressure sensor



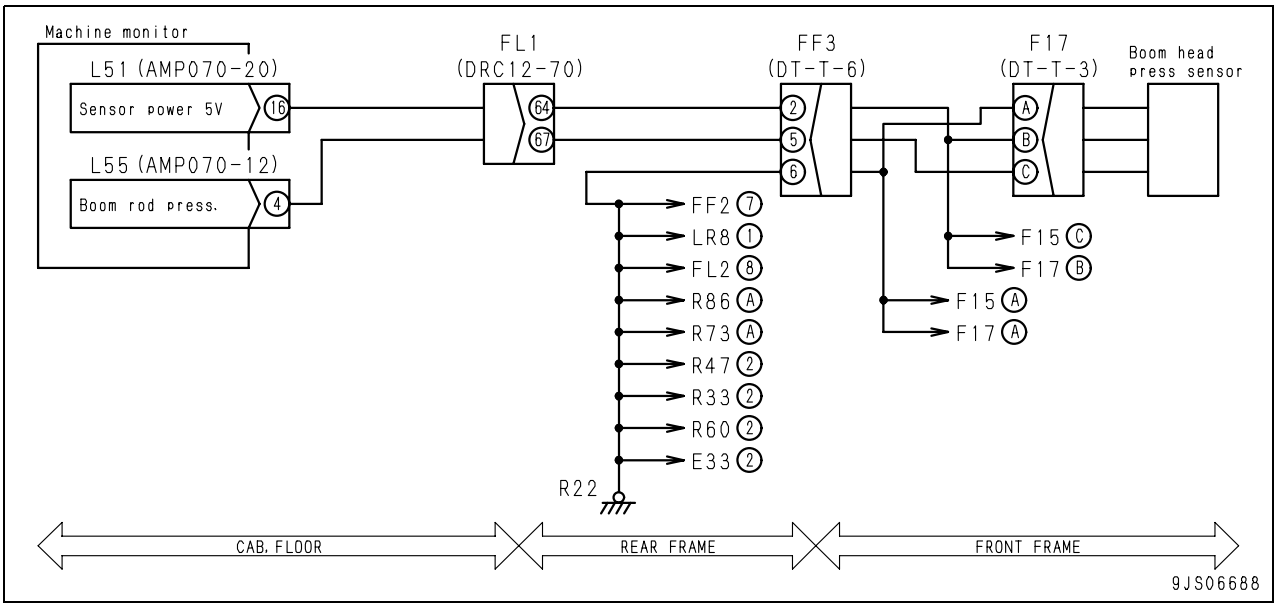
Failure code [DHPDKX] (Lift arm cylinder head pressure sensor: Out of input signal range)

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: Below 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 problem is removed, system is returned to normal operating state.		
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 (voltage) from the lift arm cylinder head pressure sensor can be checked with the monitoring function (Code: 40501, BOOM HEAD PRESS). • Only for load meter (if equipped) • Method of reproducing failure code: Start engine and perform lift arm lever operation		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lift arm cylinder head pressure sensor (Internal disconnection or short circuit)	Check the failure code comes not to be displayed when the lift arm cylinder bottom pressure sensor is replaced.			
			★ Prepare with starting switch OFF, then start engine, lower the lift arm and carry out troubleshooting.			
			F17 (male)	Lift arm	Voltage	
			Between (B) and (A)	Constant	4.85 – 5.15 V	
			Between (C) and (A)	Constant	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 or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L51 (female) (16) – F17 (female) (B)		Resistance	Max. 1 Ω
			Wiring harness between L55 (female) (4) – F17 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between F17 (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 L51 (female) (16) – F17 (female) (B), – circuit branch end and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L55 (female) (4) – F17 (female) (C), – circuit branch end and chassis ground		Resistance	Min. 1 MΩ

<table>
<tr><td rowspan="5">Possible causes and standard value in normal state</td><td colspan="2">Causes</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 24V 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 L51 (female) (16) – F17 (female) (B), – circuit branch end and chassis ground</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td colspan="2">Wiring harness between L55 (female) (4) – F17 (female) (C), – circuit branch end and chassis ground</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Defective machine monitor</td><td colspan="4">★ Prepare with starting switch OFF, then start engine, raise the lift arm and carry out troubleshooting.</td></tr>
<tr><td>L51, L55</td><td>Lift arm</td><td colspan="2">Voltage</td></tr>
<tr><td>Between L51 (16) and chassis ground</td><td>Constant</td><td colspan="2">4.85 – 5.15 V</td></tr>
<tr><td rowspan="3">Between L55 (4) and chassis ground</td><td>Constant</td><td colspan="2">0.50 – 4.50 V</td></tr>
<tr><td>Neutral</td><td colspan="2">0.50 – 0.90 V</td></tr>
<tr><td>Lift arm head relief</td><td colspan="2">3.02 – 3.42 V</td></tr>
</table>

Circuit diagram related to lift arm cylinder head pressure sensor



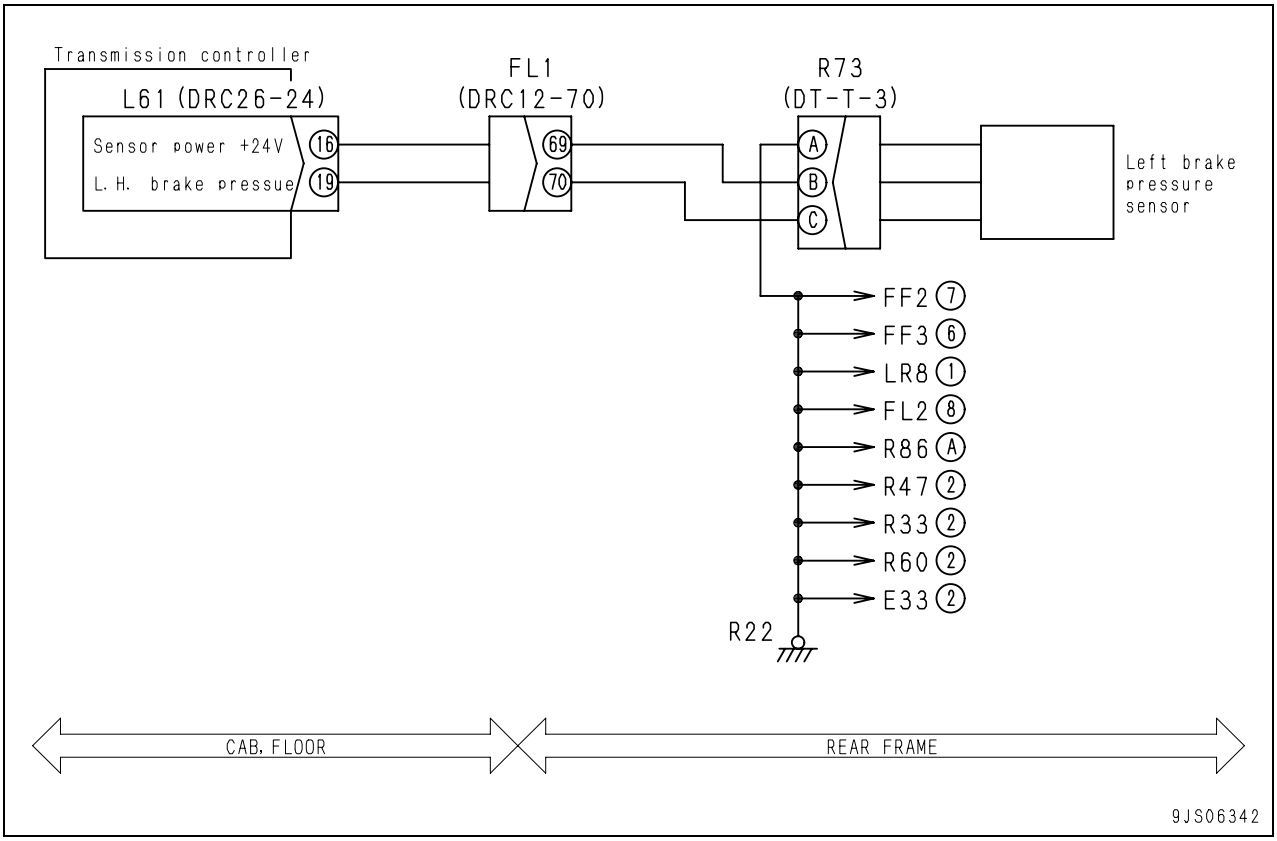
Failure code [DHT1KX] (Transmission cut-off pressure sensor: Out of input signal range)

Action code	Failure code	Trouble	Transmission cut-off pressure sensor: Out of input signal range (Transmission controller system)
E01	**DHT1KX**		
Contents of trouble	• Due to grounding fault in transmission cut-off pressure sensor signal system, the signal level is lower than normal range.		
Action of controller	• Turns off the transmission cut-off function • Does not allow changing the transmission cut-off set • Even if cause of failure disappears, system does not reset itself until FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch is set to N (Neutral). Or the transmission cut-off switch must be turned off.		
Problem that appears on machine	• The transmission cut-off indicator goes off. • The transmission cut-off does not work.		
Related information	• Input voltage of the transmission cut-off pressure sensor is max. 0.3 V • The input state (oil pressure) from the transmission cut-off pressure sensor can be checked with the monitoring function (Code: 41201, T/M CUT OFF P). • The input state (voltage) from the transmission cut-off pressure sensor can be checked with the monitoring function (Code: 41202, T/M CUT OFF P). • Method of reproducing failure code: Turn the starting switch and the transmission cut-off switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission cut-off pressure sensor (Internal short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. • Transmission cut-off switch is ON.			
			R73	Brake	Voltage	
			Between (C) and (A)	When brake is released	0.9 – 1.1 V	
				When the left brake pedal is pressed down	1.1 – 5.1 V	
				When the right brake pedal is pressed down	1.1 – 5.1 V	
				Other than above	0.9 – 5.1 V	
	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 L61 (female) (19) – R73 (female) (C) 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.			
			L61	Brake	Voltage	
			Between (19) and chassis ground	When brake is released	0.9 – 1.1 V	
				When the left brake pedal is pressed down	1.1 – 5.1 V	
				When the right brake pedal is pressed down	1.1 – 5.1 V	
				Other than above	0.9 – 5.1 V	

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	4	Disconnection of harness (Disconnection of harness, defective contact or improper mating of connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Between L61 (female) (16) and R73 (female) (B)	Resistance	Max. 1 Ω
			Between L61 (female) (19) and R73 (female) (C)	Resistance	Max. 1 Ω
			Between R73 (female) (A) and R22	Resistance	Max. 1 Ω

Circuit diagram related to transmission cut-off pressure sensor

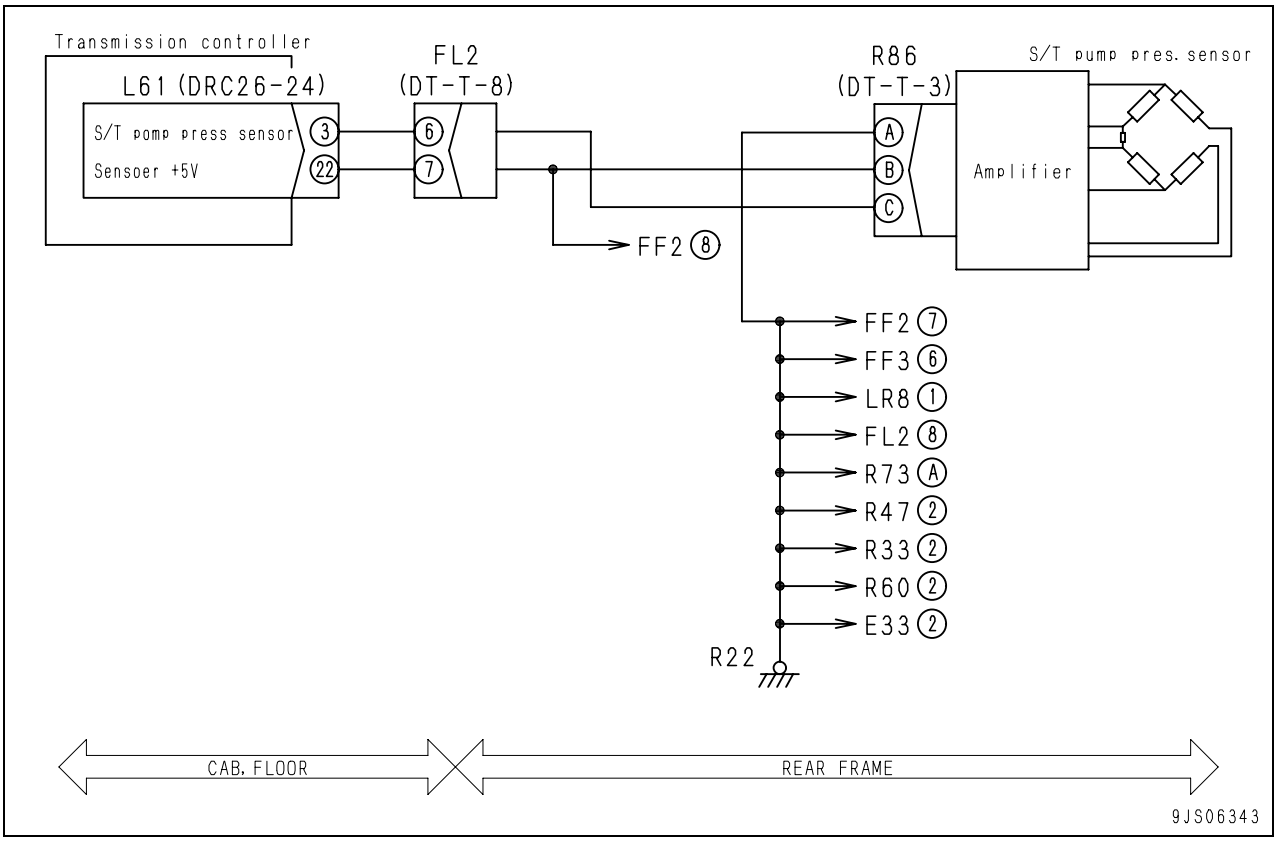


Failure code [DHT8KA] (Steering pump pressure sensor: Disconnection)

Action code	Failure code	Trouble	Steering pump pressure sensor: Disconnection (Transmission controller system)
E01	**DHT8KA**		
Contents of trouble	• Due to disconnection or ground fault in steering pump pressure sensor system, the signal level is lower than normal range. (Steering pump pressure sensor signal voltage: Max. 0.3 V)		
Action of controller	• Judges the steering pump pressure is absent • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• Engine does not pickup smoothly at low speed		
Related information	• The input state (oil pressure) from the steering pump pressure sensor can be checked with the monitoring function (Code: 95300, S/T OIL PRESS). • The input state (voltage) from the steering pump pressure sensor can be checked with the monitoring function (Code: 95301, S/T OIL PRESS). • Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective steering pump pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			R86	Steering pump pressure	Voltage	
			Between (B) and (A)	Constant	4.75 – 5.25 V	
			Between (C) and (A)	Constant	0.50 – 4.50 V	
				When steering is in neutral	0.50 – 0.90 V	
				When steering is relieved	3.02 – 3.42 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.			
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L61 (female) (3) – R86 (female) (C)		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 L61 (female) (3) – R86 (female) (C) and chassis ground		Resistance	Min. 1 MΩ
	4	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L61	Steering pump pressure	Voltage	
			Between (3) and chassis ground	Constant	0.50 – 4.50 V	
				When steering is in neutral	0.50 – 0.90 V	
				When steering is relieved	3.02 – 3.42 V	

Circuit diagram related to steering pump pressure sensor

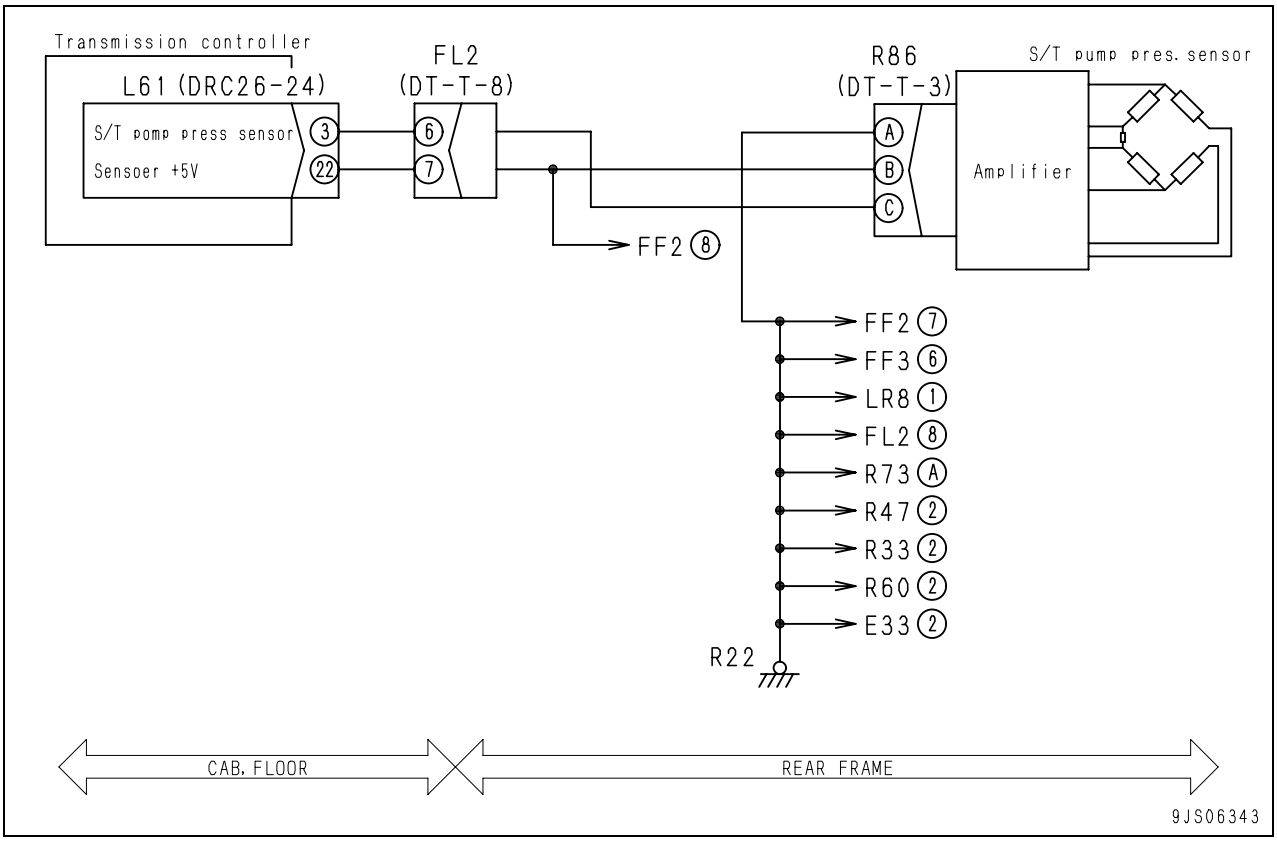


Failure code [DHT8KB] (Steering pump pressure sensor: Short circuit)

Action code	Failure code	Trouble	Steering pump pressure sensor: Short circuit (Transmission controller system)
E01	**DHT8KB**		
Contents of trouble	• Due to hot short circuit in the steering pump pressure sensor signal system, the signal level is higher than normal range. (Steering pump pressure sensor signal voltage: Min. 4.7 V)		
Action of controller	• Judges the steering pump pressure is absent • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• Engine does not pickup smoothly at low speed		
Related information	• The input state (oil pressure) from the steering pump pressure sensor can be checked with the monitoring function (Code: 95300, S/T OIL PRESS). • The input state (voltage) from the steering pump pressure sensor can be checked with the monitoring function (Code: 95301, S/T OIL PRESS). • Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective steering pump oil pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			R86	Steering pump pressure	Voltage	
			Between (B) and (A)	Constant	4.75 – 5.25 V	
			Between (C) and (A)	Constant	0.50 – 4.50 V	
				When steering is in neutral	0.50 – 0.90 V	
				When steering is relieved	3.02 – 3.42 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.			
	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 L61 (female) (3) – R86 (female) (C) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			L61	Steering pump pressure	Voltage	
			Between (3) and chassis ground	Constant	0.50 – 4.50 V	
				When steering is in neutral	0.50 – 0.90 V	
				When steering is relieved	3.02 – 3.42 V	

Circuit diagram related to steering pump pressure sensor



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 8

Troubleshooting by failure code (Display of code), Part 8 2
Failure code [DLT3KA] (Transmission output shaft speed sensor: Disconnection) 2
Failure code [DLT3LC] (Transmission output shaft speed sensor: Out of input signal range) 4
Failure code [DT20KB] (Transmission cut-off indicator lamp: Short circuit) 6
Failure code [DV00KB] (Alarm buzzer: Short circuit) 8

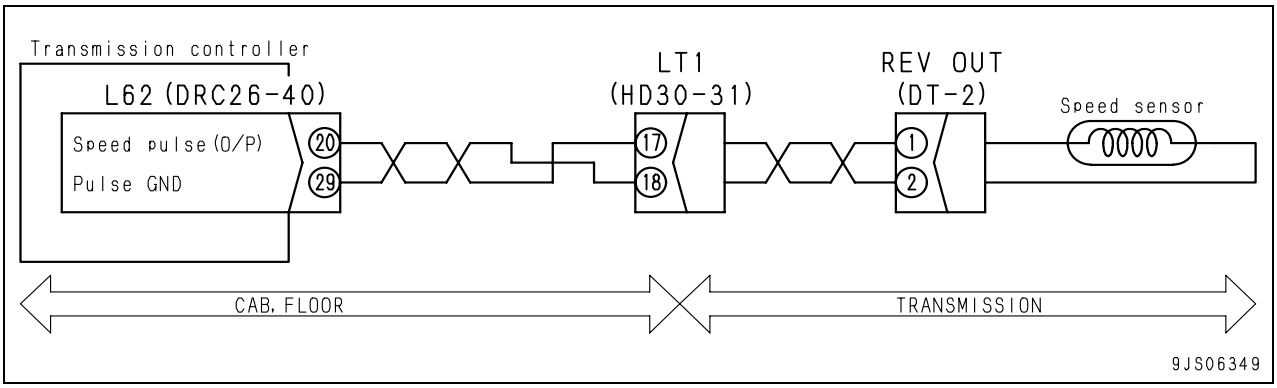
Troubleshooting by failure code (Display of code), Part 8

Failure code [DLT3KA] (Transmission output shaft speed sensor: Disconnection)

Action code	Failure code	Trouble	Transmission output shaft speed sensor: Disconnection (Transmission controller system)
E03	**DLT3KA**		
Contents of trouble	• Due to disconnection in the transmission output shaft speed sensor system, the signal voltage is outside the higher limit. • This failure code appears under the following conditions. 1) Input voltage is 1.5 V or above 2) Pulse has not been input		
Action of controller	• In the auto-shift mode, changes the shift mode to the manual mode. • In the auto-shift mode, changes the mode for transmitting signal to the machine monitor to the manual mode. • When the manual shift mode is turned on, normal control is carried out. • Releases the lockup clutch (if equipped). • When the 1st speed is set, the controller constantly turns on the torque derating function. • Maintains the travel speed that had been set prior to the failure. • Turns the centralized warning lamp and alarm buzzer ON. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The auto-shift mode is not turned on (the manual shift mode is selected) • Lockup becomes unavailable • Travel speed derating function is unavailable • Transmission protection function is unavailable • When the 1st speed is set, digging torque is reduced. • Gear shifting shocks are made. • The auto-shift pilot lamp goes off.		
Related information	• The input state (speed) from the transmission output shaft speed sensor can be checked with the monitoring function (Code: 31400, T/M SPEED OUT). • Method of reproducing failure code: Start engine and move the machine		

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	1	Defective adjustment of transmission output shaft speed sensor	★ The transmission output shaft speed sensor adjustment may be defective. Check it directly (see Testing and adjusting, Adjusting transmission speed sensor).		
	2	Defective transmission output shaft speed sensor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			REV OUT (male)	Resistance	
			Between (1) and (2)	500 – 1,000 Ω	
	3	Disconnection in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L62 (female) (20) – REV OUT (female) (2)	Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L62	Resistance	
			Between (20) and (29)	500 – 1,000 Ω	

Circuit diagram related to transmission output shaft speed sensor



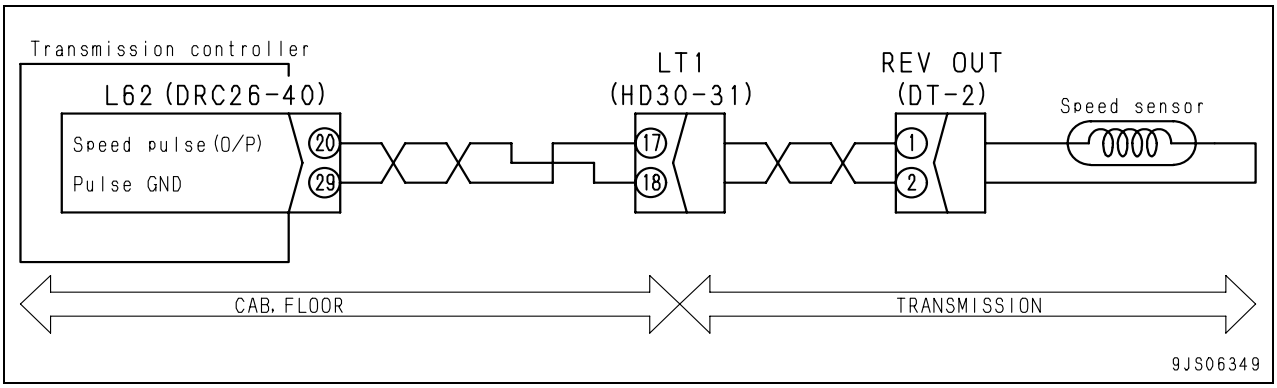
Failure code [DLT3LC] (Transmission output shaft speed sensor: Out of input signal range)

Action code	Failure code	Trouble	Transmission output shaft speed sensor: Out of input signal range (Transmission controller system)
E03	**DLT3LC**		
Contents of trouble	• Due to ground fault in the transmission output shaft speed sensor system, the signal voltage is lower than the normal range. • Failure detection condition 1) If the current travel speed – 15 km/h or above – were changed (reduced) by 5 km/h or more and the pulse is 10 msec or above, the travel speed immediately preceding the change is maintained. (If pulse update of the transmission output shaft speed sensor is continued 50 msec or more and the travel speed pulse input voltage below 1.5 V is detected 5 times or more, the currently held immediately preceding travel speed is canceled.) 2) When the output is not set to N, an error is turned on if the immediately preceding travel speed is held for more than 10 seconds.		
Action of controller	• In the auto-shift mode, changes the shift mode to the manual mode. • In the auto-shift mode, changes the mode for transmitting signal to the machine monitor to the manual mode. • When the manual shift mode is turned on, normal control is carried out. • Controls the operation by determining the output shaft speed from the input shaft speed and the gear speed reduction ratio. • Resets the torque converter lockup. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• The auto-shift mode is not turned on (the manual shift mode is selected) • Torque converter lockup becomes unavailable. • Travel speed derating function is unavailable • Transmission protection function is unavailable • When the 1st speed is set, digging torque goes low. • Gear shifting shocks are made.		
Related information	• The input state (speed) from the transmission output shaft speed sensor can be checked with the monitoring function (Code: 31400, T/M SPEED OUT). • Method of reproducing failure code: Start engine and move the machine		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective adjustment of transmission output shaft speed sensor	★ The transmission output shaft speed sensor adjustment may be defective. Check it directly (see Testing and adjusting, Adjusting transmission speed sensor).			
	2	Defective transmission output shaft speed sensor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			REV 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 or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L62 (female) (20) – REV OUT (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L62 (female) (29) – REV OUT (female) (1)		Resistance	Max. 1 Ω
	4	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L62 (female) (20) – REV OUT (female) (2) and chassis ground		Voltage	Max. 1 V

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting	
	5	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.	
			L62	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

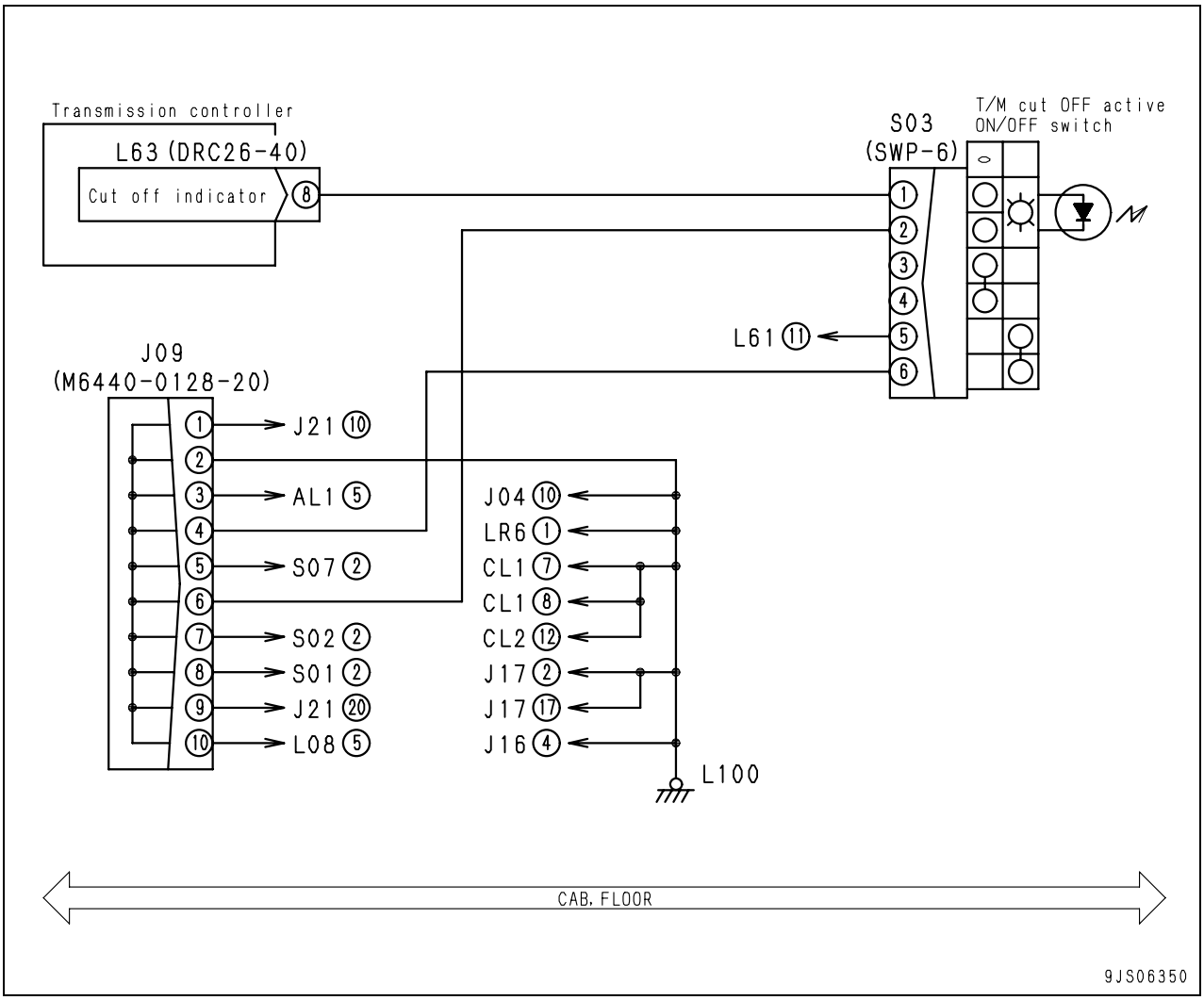


Failure code [DT20KB] (Transmission cut-off indicator lamp: Short circuit)

Action code	Failure code	Trouble	Transmission cut-off indicator lamp: Short circuit (Transmission controller system)
E01	**DT20KB**		
Contents of trouble	• Since the transmission cut-off indicator lamp system is shorted, output signals are not entered to the indicator lamp.		
Action of controller	• Turns off the transmission cut-off indicator lamp. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Transmission cut-off indicator lamp does not light up.		
Related information	• Method of reproducing failure code: Start engine and turn transmission cut-off switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission cut-off indicator lamp (LED) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S03 (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 L63 (female) (8) – S03 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L63	Transmission cut-off switch	Voltage	
			Between (8) and chassis ground	ON	Max. 1 V	
				OFF	20 – 30 V	

Circuit diagram related to transmission cut-off indicator lamp

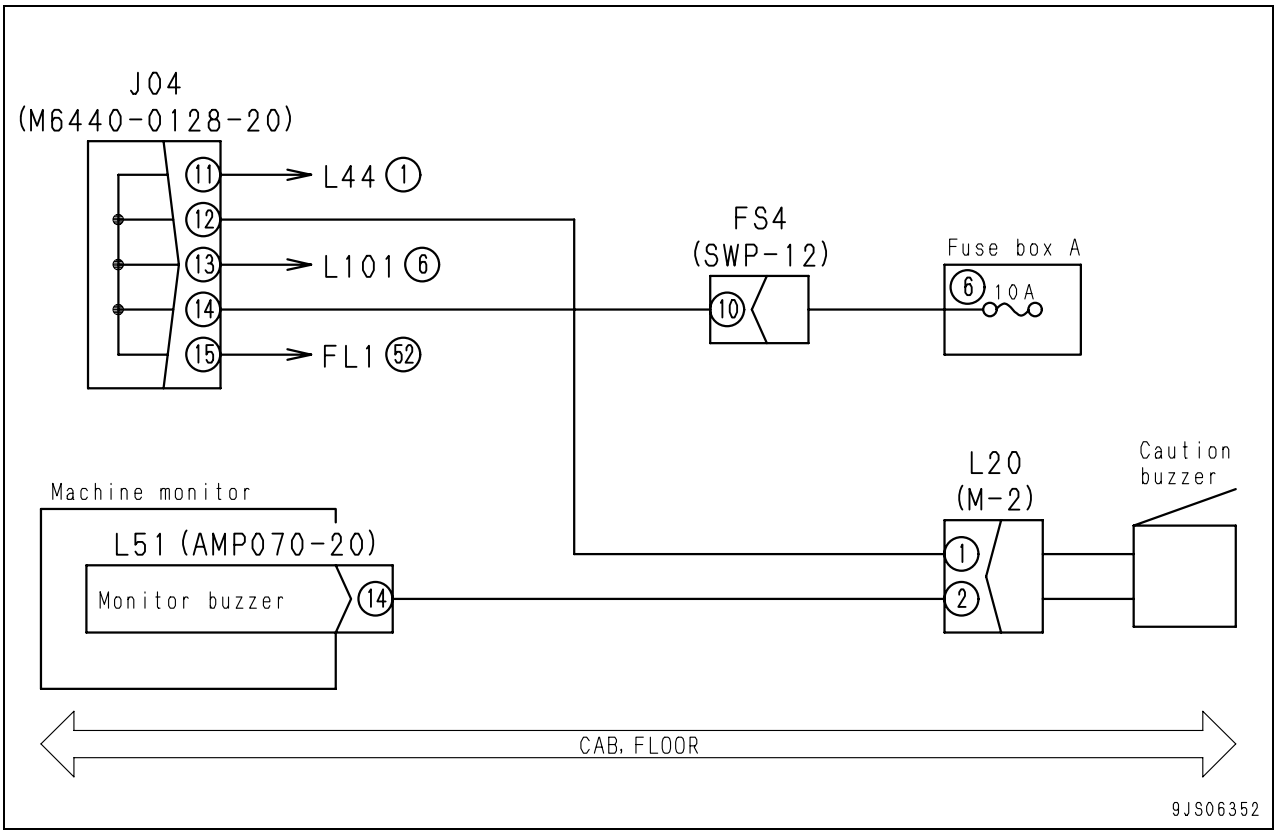


Failure code [DV00KB] (Alarm buzzer: Short circuit)

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 source.		
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.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between L51 (female) (14) – L20 (female) (2) and chassis ground	Voltage	Max. 1 V
	2	Defective alarm buzzer (Internal short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. • Remove the buzzer, then connect +24 V to L20 (male) (1) and GND to L20 (male) (2).		
			Alarm buzzer sounds	Alarm buzzer is normal	
			Alarm buzzer does not sound	Defective alarm buzzer	
	3	Defective machine monitor	• When above 1) and 2) are normal, failure on the machine monitor can be suspected.		

Circuit diagram related to alarm buzzer



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 9

Troubleshooting by failure code (Display of code), Part 9 2
Failure code [DW7BKA] (Fan reverse solenoid: Disconnection) 2
Failure code [DW7BKB] (Fan reverse solenoid: Short circuit) 3
Failure code [DW7BKY] (Fan reverse solenoid: Short circuit with power supply line) 4
Failure code [DX16KA] (Fan pump EPC solenoid: Disconnection) 6
Failure code [DX16KB] (Fan pump EPC solenoid: Short circuit) 7
Failure code [DX16KY] (Fan pump EPC solenoid: Short circuit with power supply line) 8
Failure code [DXH1KA] (Lockup ECMV solenoid: Disconnection) 10
Failure code [DXH1KB] (Lockup ECMV solenoid: Short circuit) 12
Failure code [DXH1KY] (Lockup ECMV solenoid: Short circuit with power supply line) 14
Failure code [DXH4KA] (1st clutch ECMV solenoid: Disconnection) 16
Failure code [DXH4KB] (1st clutch ECMV solenoid: Short circuit) 18

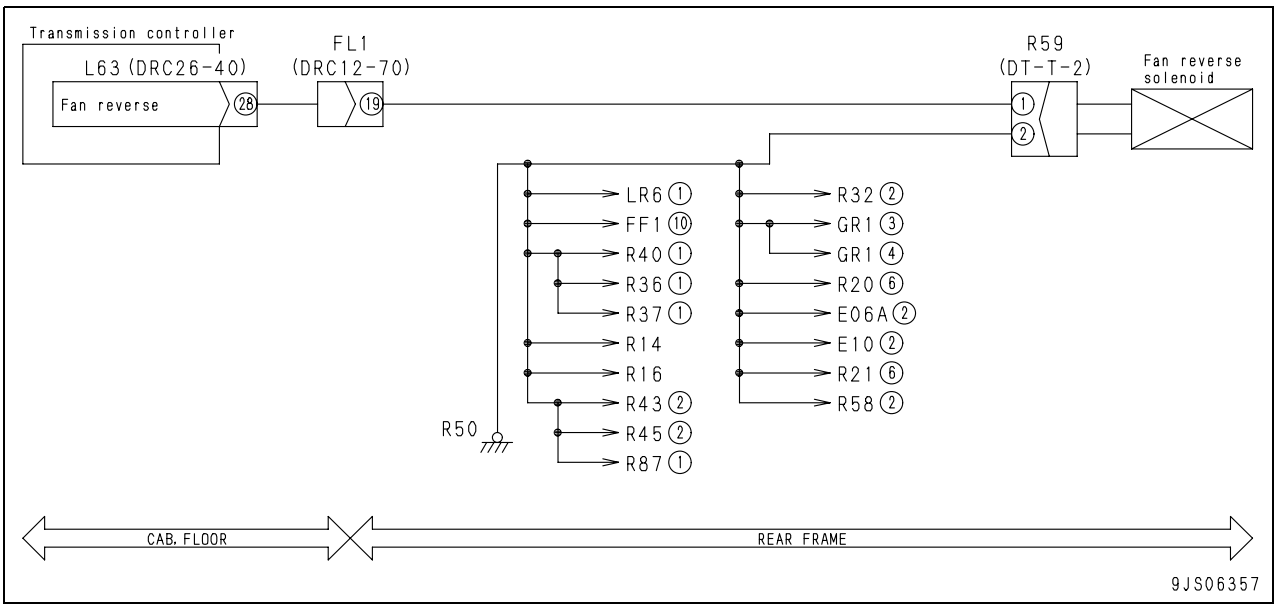
Troubleshooting by failure code (Display of code), Part 9

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 (OPT). • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The automatic fan reverse function is disabled in the case of automatic fan reverse function (OPT) specification.		
Related information	• The output state (ON/OFF) to the fan reverse solenoid can be checked with the monitoring function (Code: 40949, D-OUT-4). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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.		
			R59 (male)	Resistance	
			Between (1) and (2)	35 – 45 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L63 (female) (28) – R59 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between R59 (female) (2) – chassis ground	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R59 (female)	Resistance	
			Between (28) and chassis ground	35 – 45 Ω	

Circuit diagram related to fan reverse solenoid

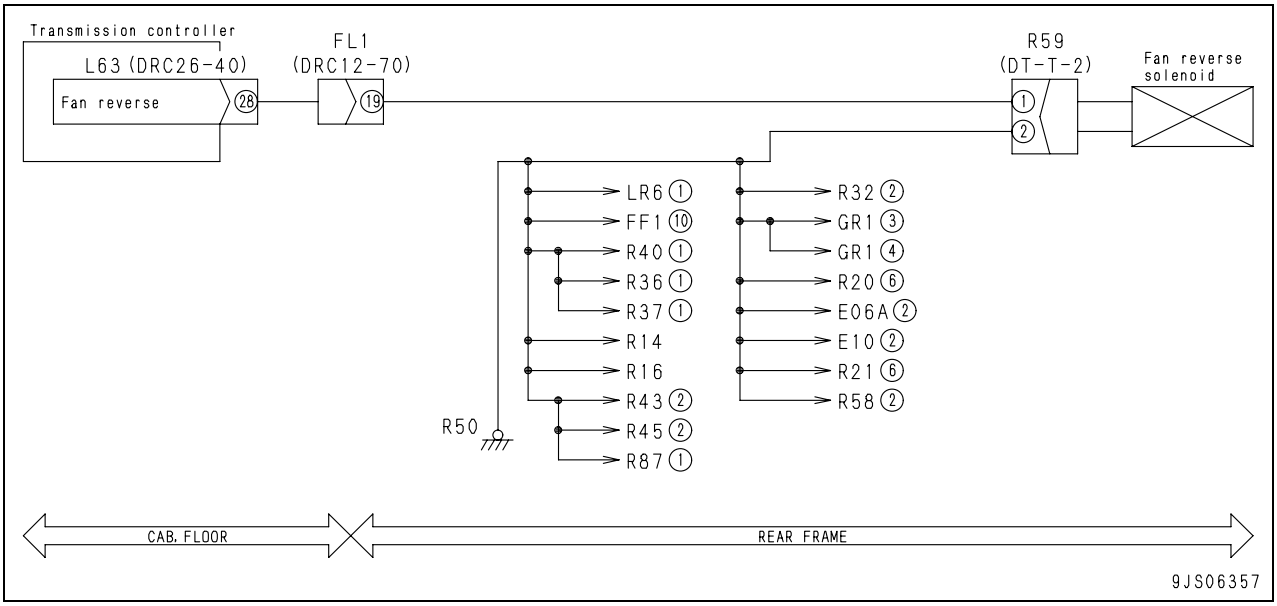


Failure code [DW7BKB] (Fan reverse solenoid: Short circuit)

Action code	Failure code	Trouble	Fan reverse solenoid: Short circuit (Transmission controller system)
E01	**DW7BKB**		
Contents of trouble	• Since the fan reverse solenoid system is shorted, abnormal current flows when the fan reverse solenoid output is turned on.		
Action of controller	• Turns the output to the fan reverse solenoid OFF. • Disables the automatic fan reverse function (OPT). • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
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 (OPT) specification.		
Related information	• The output state (ON/OFF) to the fan reverse solenoid can be checked with the monitoring function (Code: 40949, D-OUT-4). • Method of reproducing failure code: Turn the starting switch ON.		

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	1	Defective fan reverse solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R59 (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 L63 (female) (28) – R59 (female) (1) 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.		
			L63 (female)	Resistance	
			Between (28) and chassis ground	35 – 45 Ω	

Circuit diagram related to fan reverse solenoid

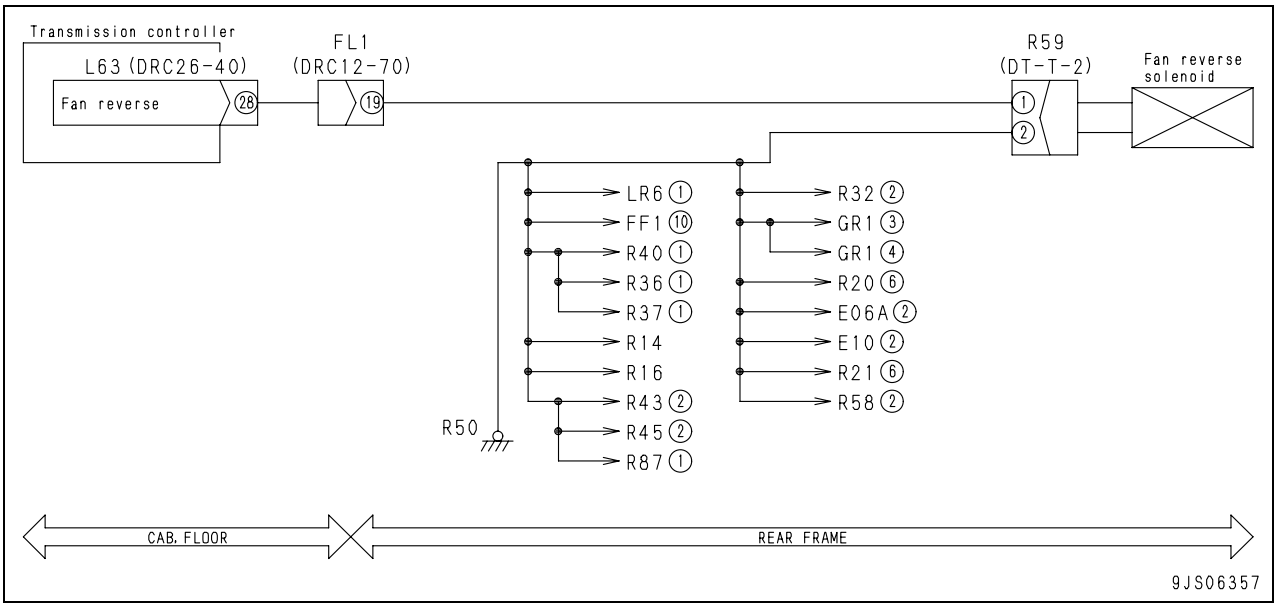


Failure code [DW7BKY] (Fan reverse solenoid: Short circuit with power supply line)

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 is shorted with the power source, abnormal voltage is applied when the fan reverse switch output is OFF.		
Action of controller	• Disables the automatic fan reverse function (OPT). • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The automatic fan reverse function is disabled in the case of automatic fan reverse function (OPT) specification. • Forward rotation of the fan becomes unavailable. • Overheating can result.		
Related information	• The output state (ON/OFF) to the fan reverse solenoid can be checked with the monitoring function (Code: 40949, D-OUT-4). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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.		
			R59 (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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between L63 (female) (28) – R59 (female) (1) and chassis ground	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L63 (female)	Resistance	
			Between (28) and chassis ground	35 – 45 Ω	

Circuit diagram related to fan reverse solenoid

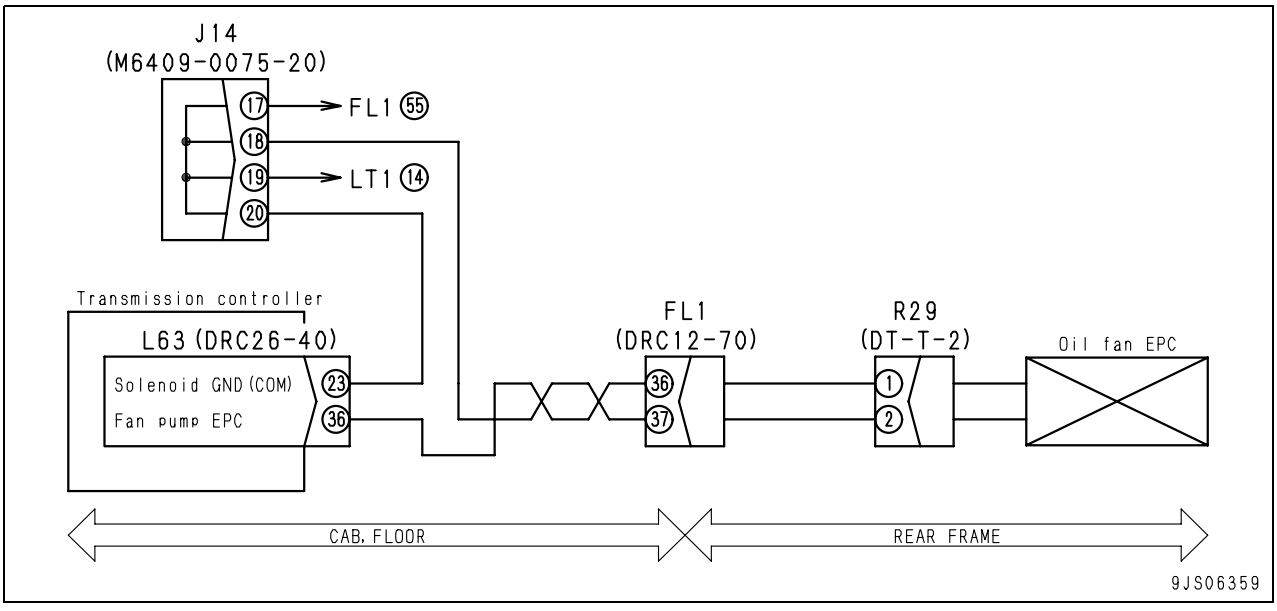


Failure code [DX16KA] (Fan pump EPC solenoid: Disconnection)

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	• Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
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.		

	Causes		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.			
			R29 (male)	Resistance		
			Between (1) and (2)	5 – 10 Ω		
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L63 (female) (23) – R29 (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L63 (female) (36) – R29 (female) (1)	Resistance	Max. 1 Ω	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L63 (female)	Resistance		
			Between (36) and (23)	5 – 10 Ω		

Circuit diagram related to fan pump EPC solenoid

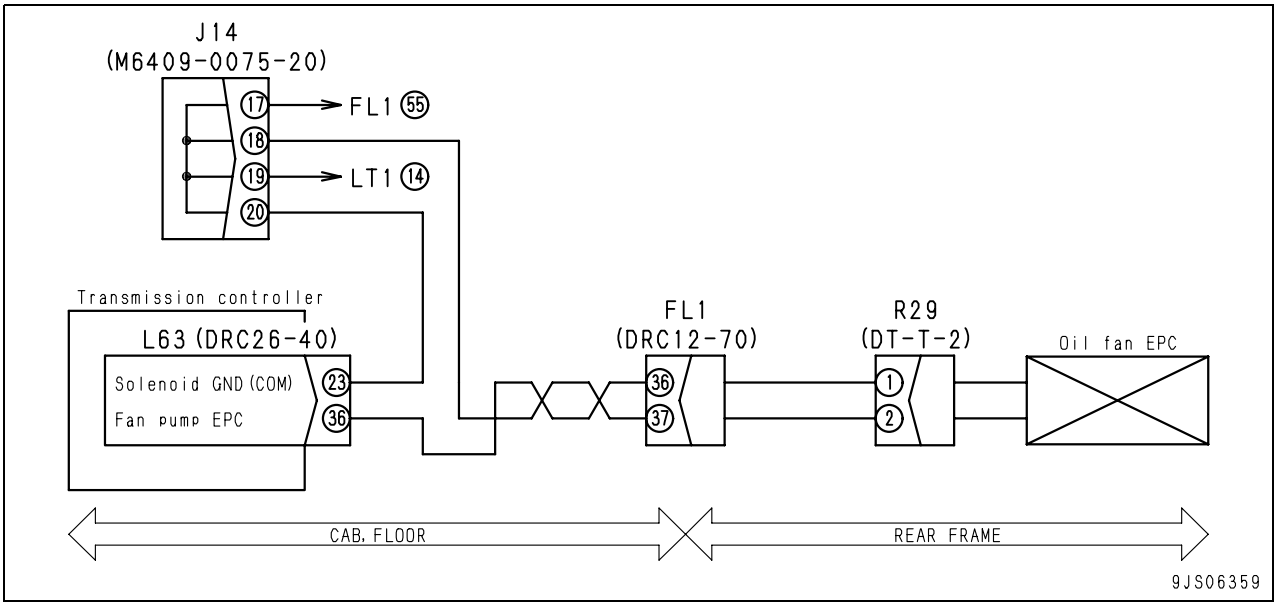


Failure code [DX16KB] (Fan pump EPC solenoid: Short circuit)

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 is shorted, abnormal current flows when the fan pump EPC solenoid output is ON.		
Action of controller	• Turns the output to the fan pump EPC 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 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.		

	Causes		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.			
			R29 (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 L63 (female) (36) – R29 (female) (1) 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.			
			L63 (female)	Resistance		
			Between (36) and (23)	5 – 10 Ω		
			Between (36), (23) and chassis ground	Min. 1 MΩ		

Circuit diagram related to fan pump EPC solenoid

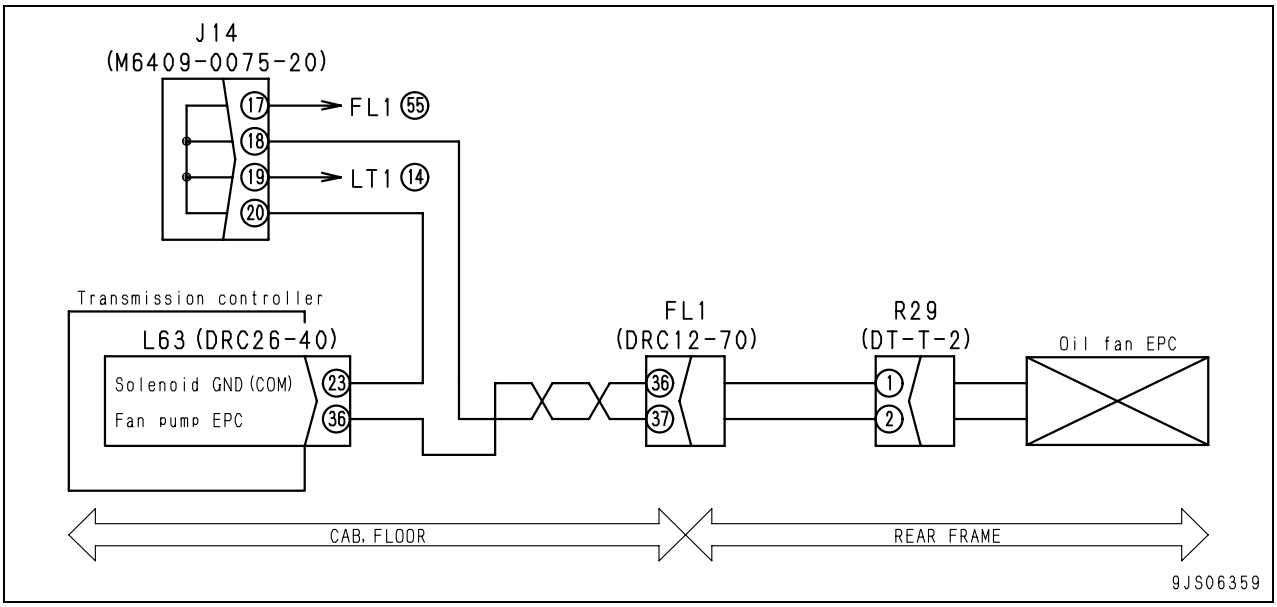


Failure code [DX16KY] (Fan pump EPC solenoid: Short circuit with power supply line)

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 is shorted with the power source, abnormal voltage is applied when the fan pump EPC solenoid output is OFF.		
Action of controller	• Turns the output to the fan pump EPC solenoid OFF. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The fan speed is minimized.		
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.		

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	1	Defective fan pump EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R29 (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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between L63 (female) (36) – R29 (female) (1) and chassis ground	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L63 (female)	Resistance	
			Between (36) and (23)	5 – 10 Ω	
			Between (36), (23) and chassis ground	Min. 1 MΩ	

Circuit diagram related to fan pump EPC solenoid

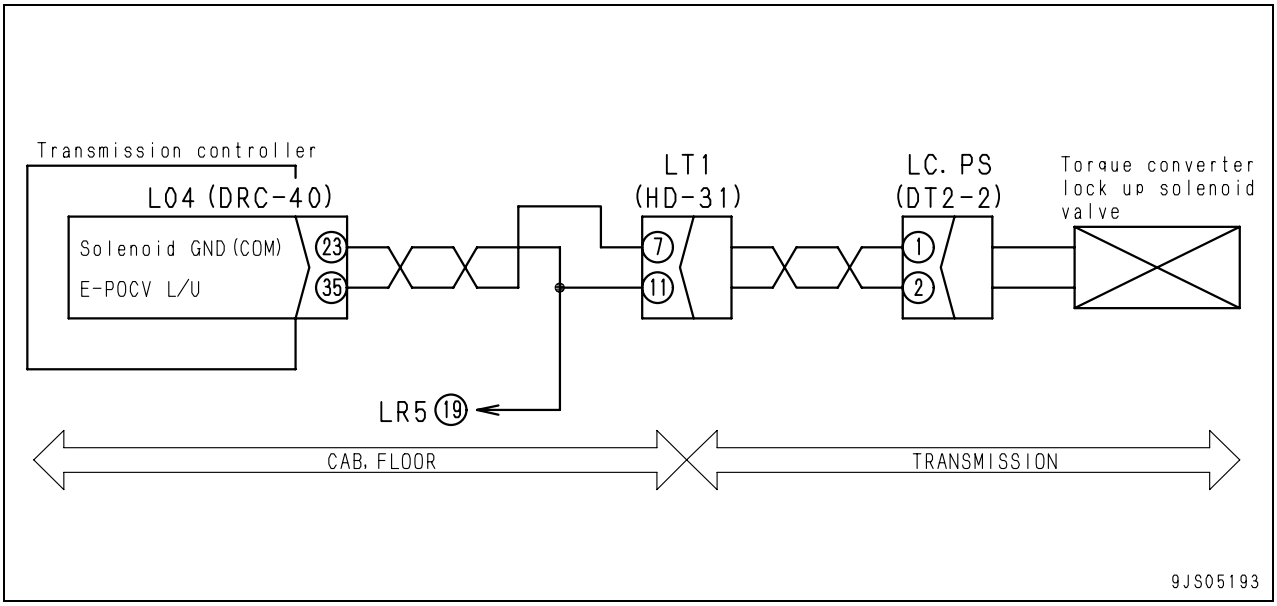


Failure code [DXH1KA] (Lockup ECMV solenoid: Disconnection)

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

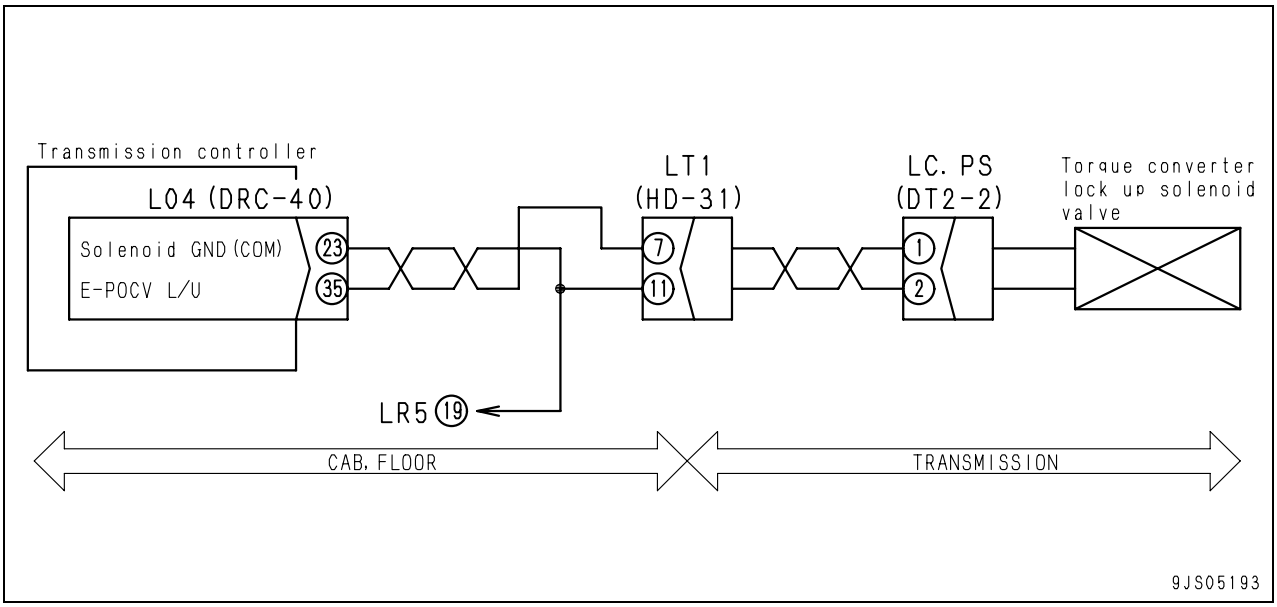


Failure code [DXH1KB] (Lockup ECMV solenoid: Short circuit)

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) (1) 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 (23) and (35)	5 – 15 Ω		
			Between (23), (35) and chassis ground	Min. 1 MΩ		

Circuit diagram related to lockup ECMV solenoid

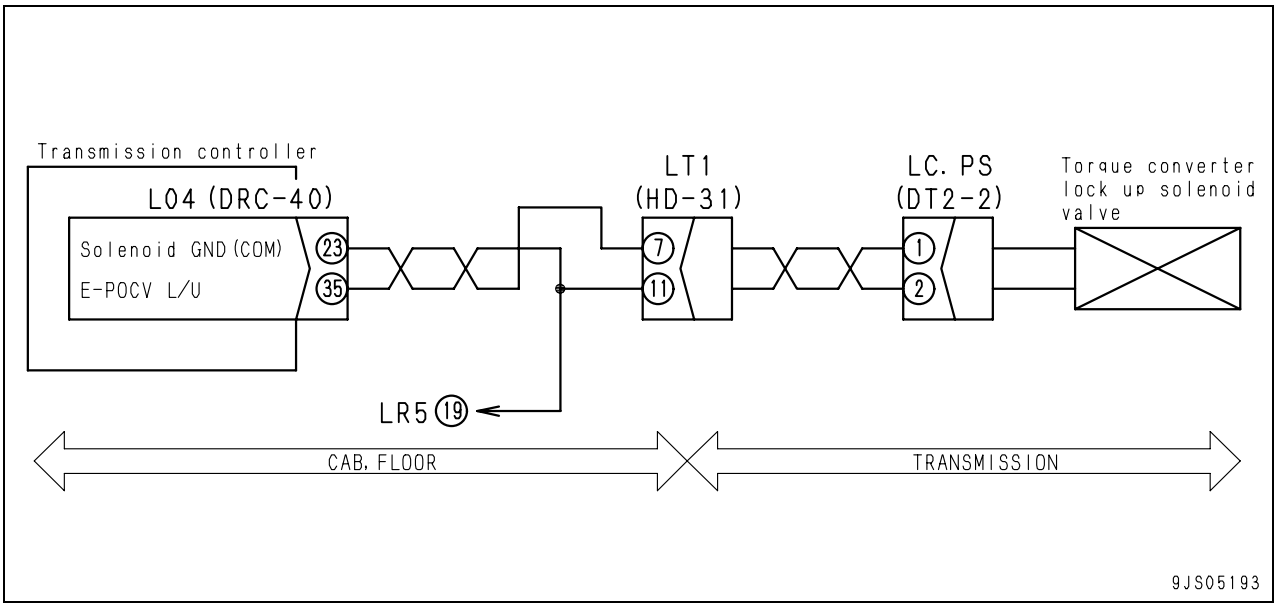


Failure code [DXH1KY] (Lockup ECMV solenoid: Short circuit with power supply line)

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 FNR (directional) lever, joystick steering FNR (directional) switch, or right FNR (directional) 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 FNR (directional) lever, joystick steering FNR (directional) switch, or right FNR (directional) switch is set to N (Neutral).		
Problem that appears on machine	• Neutral is held until the FNR (directional) lever, joystick steering FNR (directional) switch, or right FNR (directional) switch is set to N (neutral). • The lockup clutch is always in the meshed state.		
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: Turn starting switch ON.		

	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) (1) and chassis ground	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

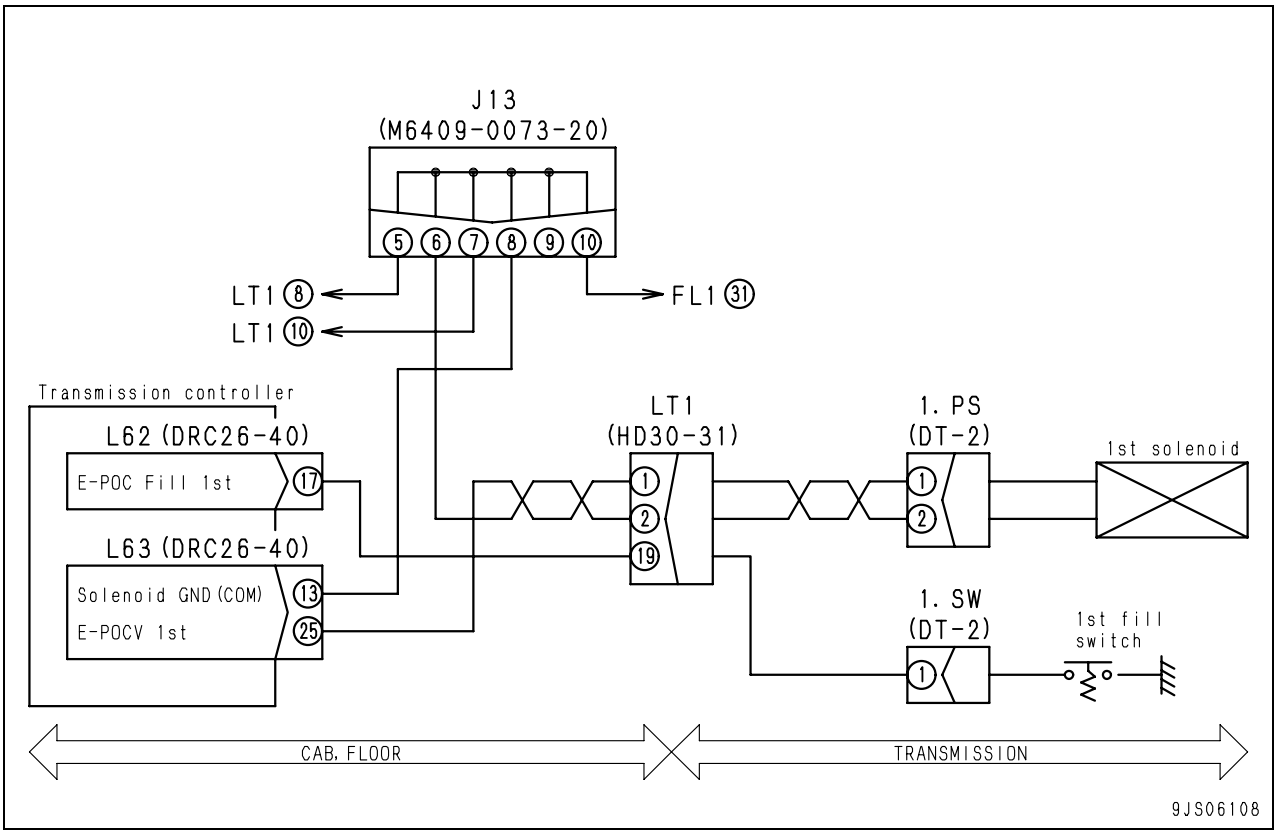


Failure code [DXH4KA] (1st clutch ECMV solenoid: Disconnection)

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 value) to the 1st (1st speed) clutch ECMV solenoid can be checked with the monitoring function (Code: 31602, ECMV 1 DIR). • Method of reproducing failure code: Turn on the starting switch, set the transmission auto-shift/manual shift selector switch in the MANUAL position and select 1st using the shift down switch or move the gear shift lever to 1st.		

	Causes		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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L63 (female) (13) – 1.PS (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L63 (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.			
			L63 (female)	Resistance		
			Between (25) and (13)	5 – 15 Ω		

Circuit diagram related to 1st clutch ECMV solenoid

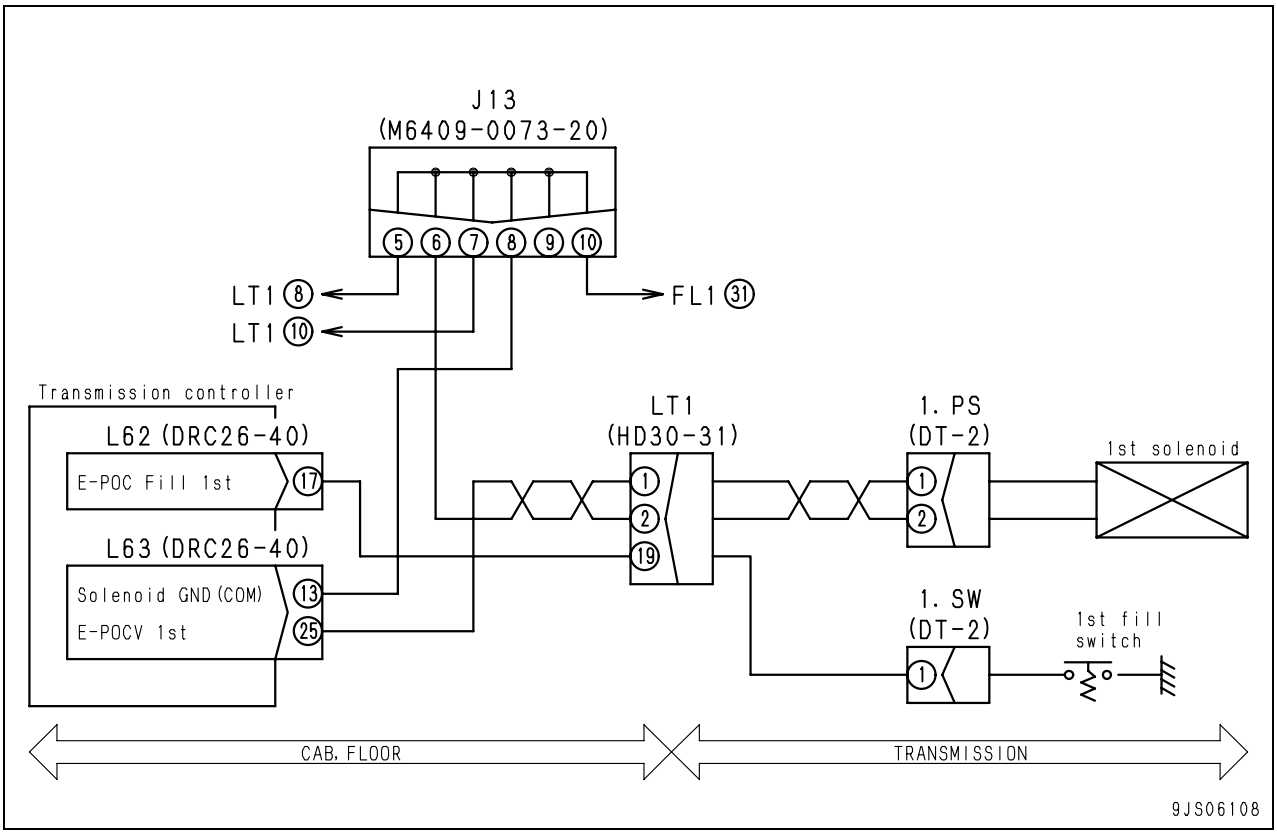


Failure code [DXH4KB] (1st clutch ECMV solenoid: Short circuit)

Action code	Failure code	Trouble	1st clutch ECMV solenoid: Short circuit (Transmission controller system)
E03	**DXH4KB**		
Contents of trouble	• Since the 1st ECMV solenoid system is shorted, abnormal 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 value) to the 1st (1st speed) clutch ECMV solenoid can be checked with the monitoring function (Code: 31602, ECMV 1 DIR). • Method of reproducing failure code: Turn on the starting switch, set the transmission auto-shift/manual shift selector switch in the MANUAL position and select 1st using the shift down switch or move the gearshift lever to 1st.		

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting			
	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 L63 (female) (25) – 1.PS (female) (1) 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.			
			L63 (female)	Resistance		
			Between (25) and (13)	5 – 15 Ω		
			Between (25), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 1st clutch ECMV solenoid



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 10

Troubleshooting by failure code (Display of code), Part 10 4
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Failure code [DXH5KA] (2nd clutch ECMV solenoid: Disconnection) 6
Failure code [DXH5KB] (2nd clutch ECMV solenoid: Short circuit) 8
Failure code [DXH5KY] (2nd clutch ECMV solenoid: Short circuit with power supply line) 10
Failure code [DXH6KA] (3rd clutch ECMV solenoid: Disconnection) 12
Failure code [DXH6KB] (3rd clutch ECMV solenoid: Short circuit) 14
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Failure code [DXH7KA] (R clutch ECMV solenoid: Disconnection) 18
Failure code [DXH7KB] (R clutch ECMV solenoid: Short circuit) 20
Failure code [DXH7KY] (R clutch ECMV solenoid: Short circuit with power supply line) 22
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Failure code [DXHHKA] (4th clutch ECMV solenoid: Disconnection) 30
Failure code [DXHHKB] (4th clutch ECMV solenoid: Short circuit) 32
Failure code [DXHHKY] (4th clutch ECMV solenoid: Short circuit with power supply line) 34

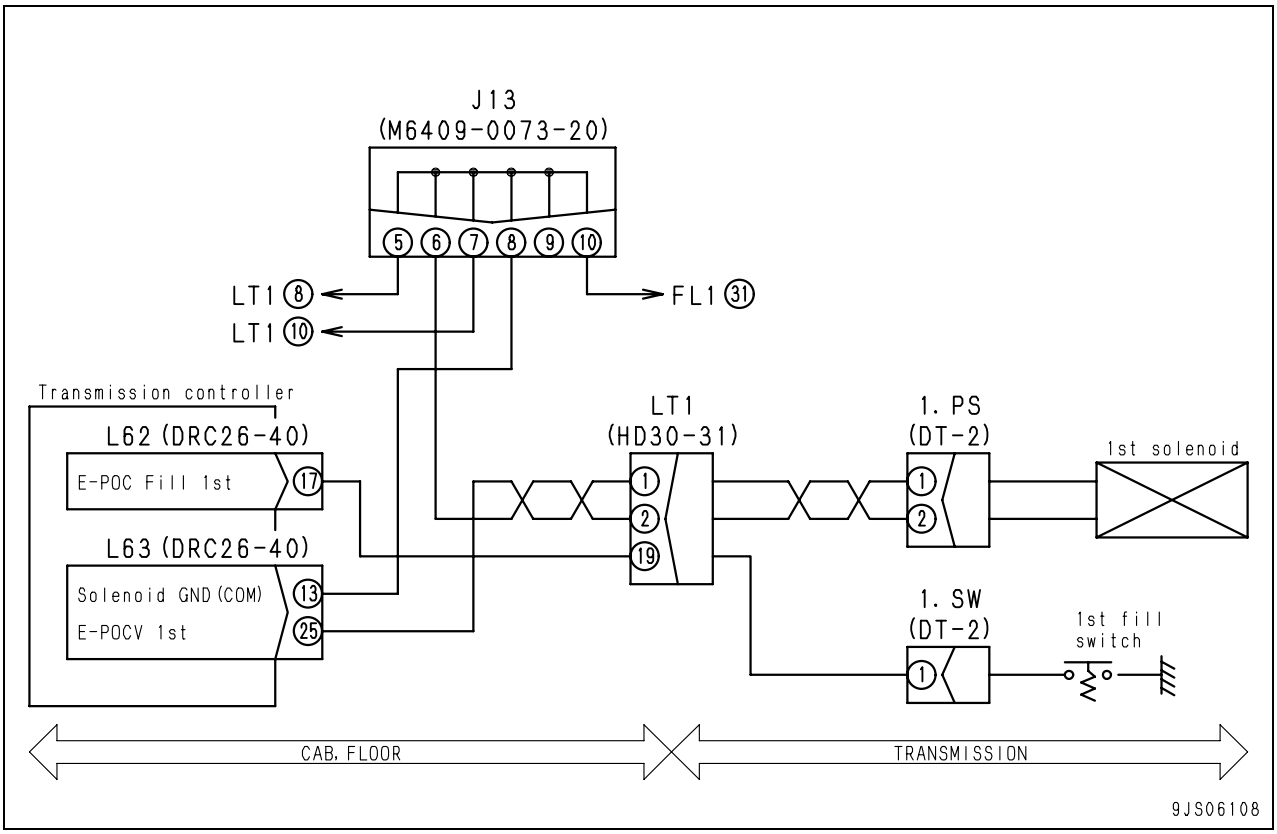
Troubleshooting by failure code (Display of code), Part 10

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	• Since the 1st ECMV solenoid system is shorted with the power source, abnormal voltage is applied when 1st clutch ECMV solenoid output is 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 (other than 1st speed). • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) 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 value) to the 1st (1st speed) clutch ECMV solenoid can be checked with the monitoring function (Code: 31602, ECMV 1 DIR). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L63 (female) (25) – 1.PS (female) (1) and chassis ground	Voltage	Max. 1 V	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L63 (female)	Resistance		
			Between (25) and (13)	5 – 15 Ω		
			Between (25), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 1st clutch ECMV solenoid

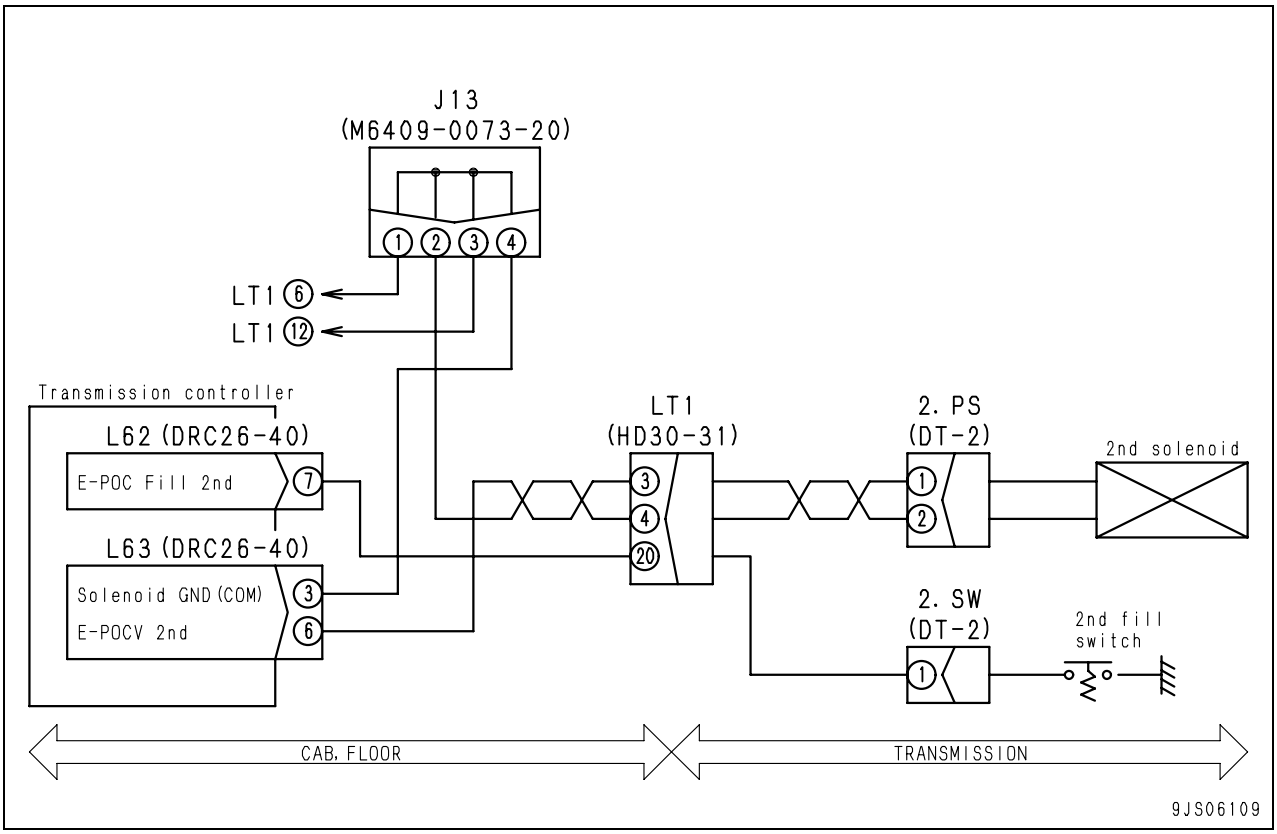


Failure code [DXH5KA] (2nd clutch ECMV solenoid: Disconnection)

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 value) to the 2nd (2nd speed) clutch ECMV solenoid can be checked with the monitoring function (Code: 31603, ECMV 2 DIR). • Method of reproducing failure code: Turn on the starting switch, set the transmission auto-shift/manual shift selector switch in the MANUAL position, and select 2nd using the shift down switch or moving the gear shift lever to 2nd.		

	Causes		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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L63 (female) (6) – 2.PS (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between L63 (female) (3) – 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.			
			L63 (female)	Resistance		
			Between (6) and (3)	5 – 15 Ω		

Circuit diagram related to 2nd clutch ECMV solenoid

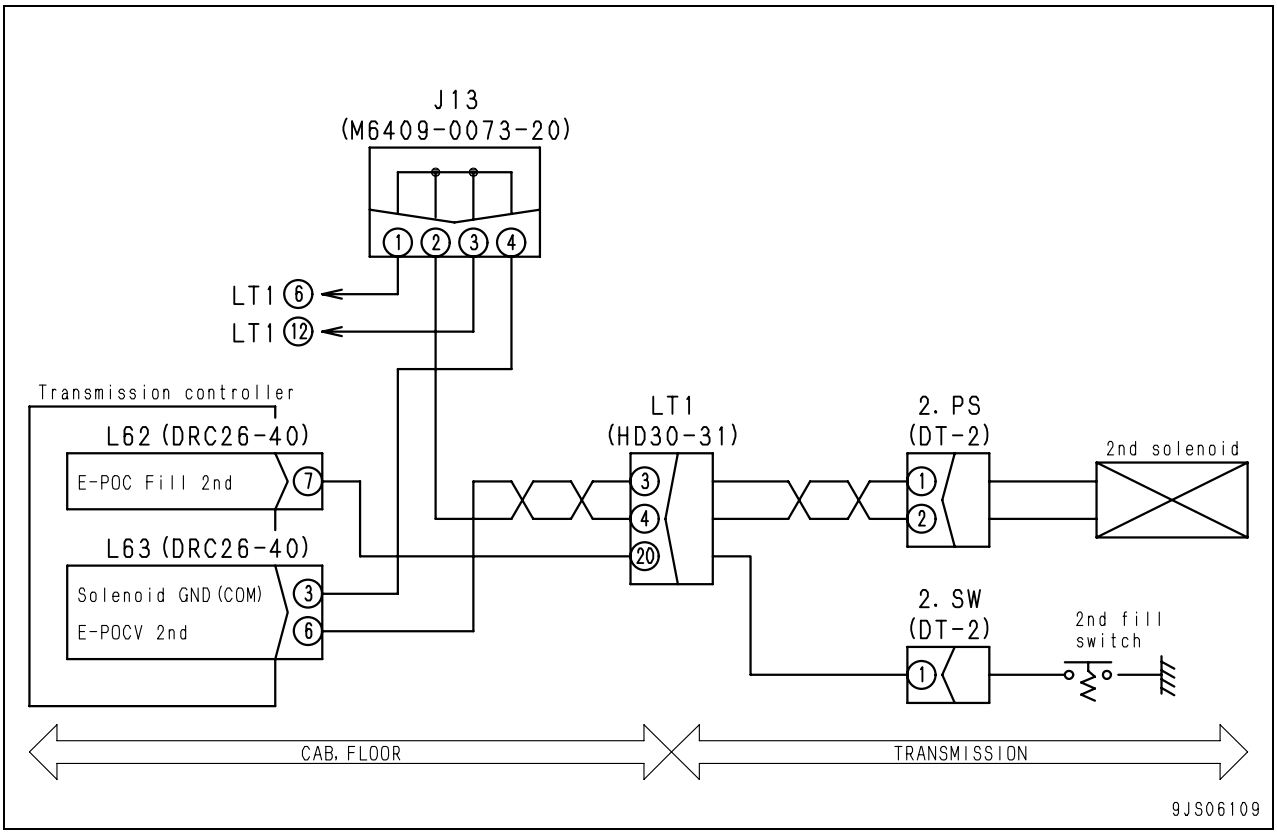


Failure code [DXH5KB] (2nd clutch ECMV solenoid: Short circuit)

Action code	Failure code	Trouble	2nd clutch ECMV solenoid: Short circuit (Transmission controller system)
E03	**DXH5KB**		
Contents of trouble	• Since the 2nd clutch ECMV solenoid system is shorted, abnormal 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 value) to the 2nd (2nd speed) clutch ECMV solenoid can be checked with the monitoring function (Code: 31603, ECMV 2 DIR). • Method of reproducing failure code: Turn on the starting switch, set the transmission auto-shift/manual shift selector switch in the MANUAL position, and select 2nd using the shift down switch or moving the gear shift lever to 2nd.		

	Causes		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 L63 (female) (6) – 2.PS (female) (1) 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.			
			L63 (female)	Resistance		
			Between (6) and (3)	5 – 15 Ω		
			Between (6), (3) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 2nd clutch ECMV solenoid

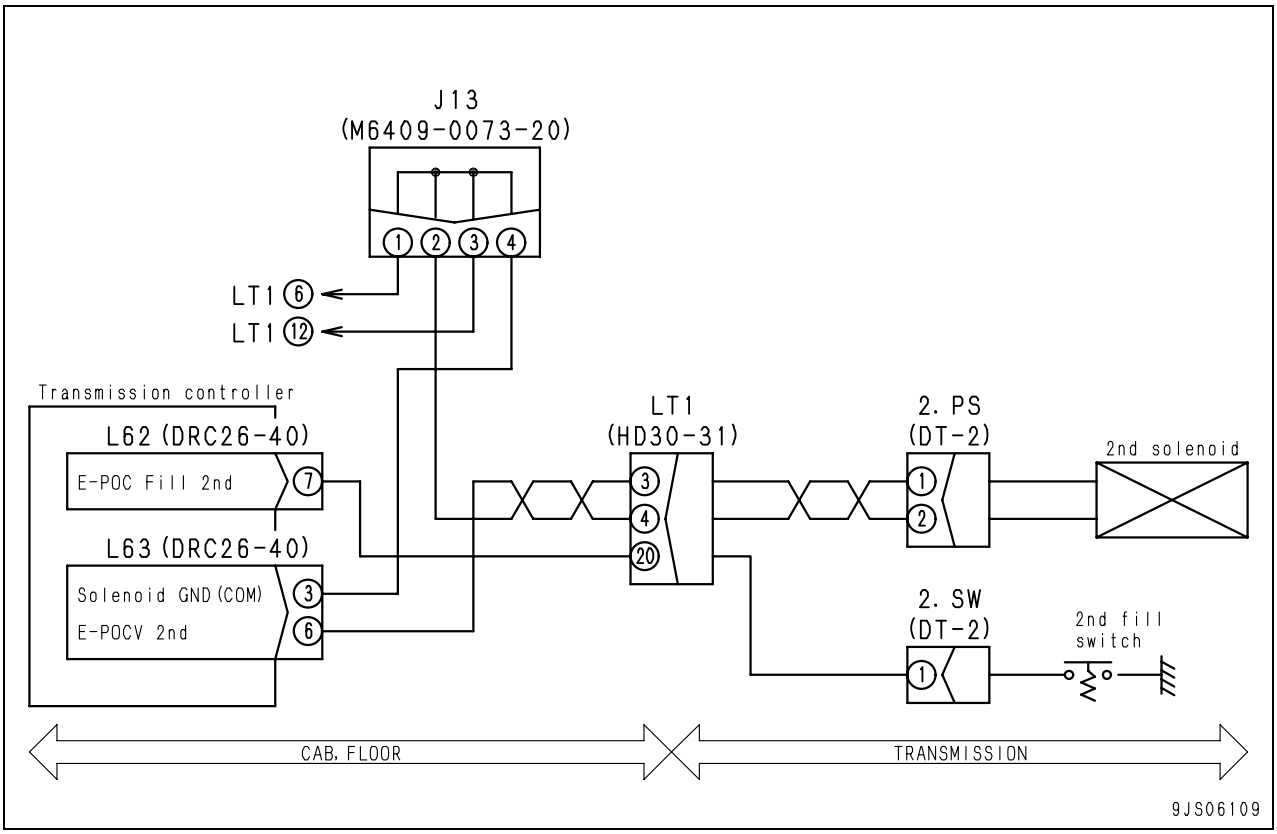


Failure code [DXH5KY] (2nd clutch ECMV solenoid: Short circuit with power supply line)

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 (other than 2nd speed). • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until the FNR (directional) lever, joystick steering FNR (directional) switch, or right FNR (directional) 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 ON.		

	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	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) and chassis ground	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 (3)	5 – 15 Ω		
			Between (6), (3) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 2nd clutch ECMV solenoid

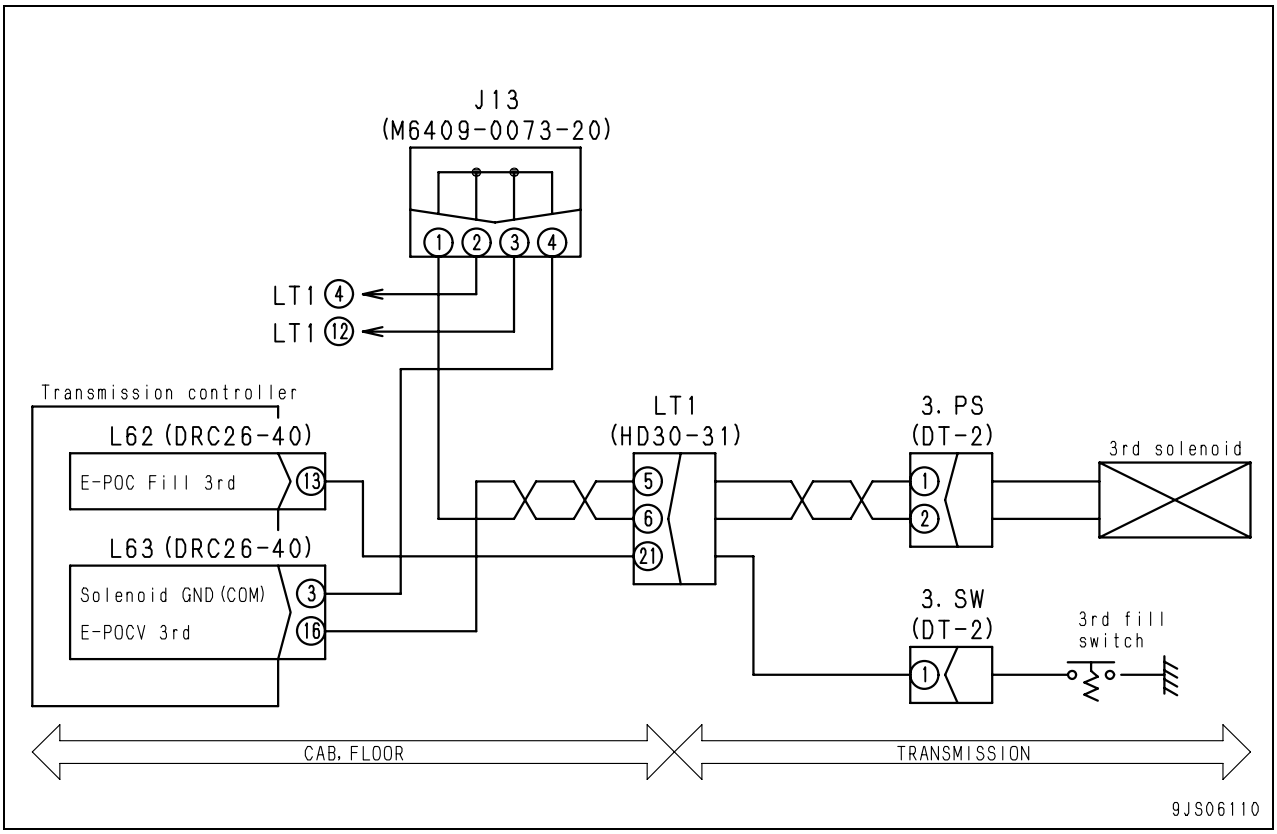


Failure code [DXH6KA] (3rd clutch ECMV solenoid: Disconnection)

Action code	Failure code	Trouble	3rd clutch ECMV solenoid: Disconnection (Transmission controller system)
E03	**DXH6KA**		
Contents of trouble	• Since 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 value) to the 3rd clutch ECMV solenoid can be checked with the monitoring function (Code: 31604, ECMV 3 DIR). • Method of reproducing failure code: Turn on the starting switch, set the transmission auto-shift/manual shift selector switch to the MANUAL position, and select 3rd using the shift down switch or moving the gear shift lever to 3rd.		

	Causes		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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L64 (female) (3) – 3.PS (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L64 (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.			
			L64 (female)	Resistance		
			Between (16) and (3)	5 – 15 Ω		

Circuit diagram related to 3rd clutch ECMV solenoid

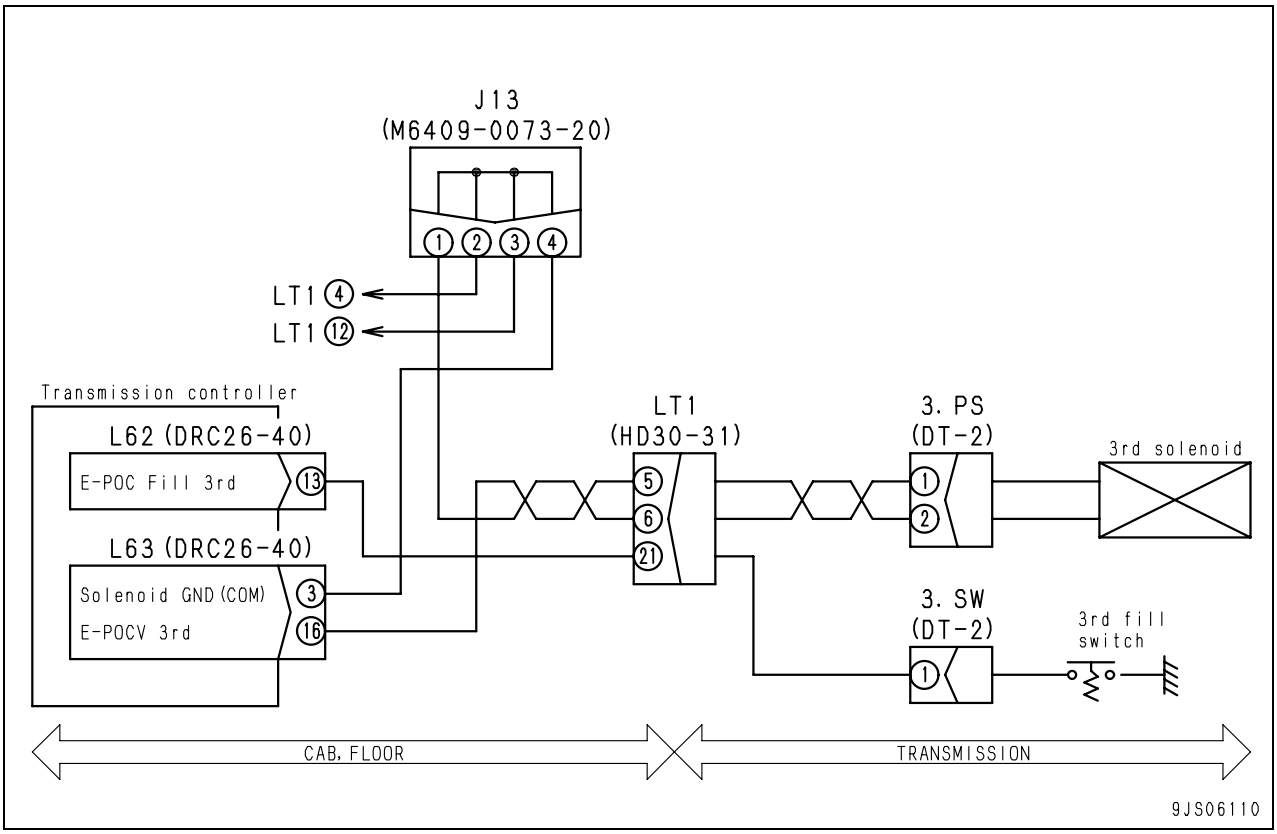


Failure code [DXH6KB] (3rd clutch ECMV solenoid: Short circuit)

Action code	Failure code	Trouble	3rd clutch ECMV solenoid: Short circuit (Transmission controller system)
E03	**DXH6KB**		
Contents of trouble	• Since the 3rd clutch ECMV solenoid system is shorted, abnormal 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 value) to the 3rd clutch ECMV solenoid can be checked with the monitoring function (Code: 31604, ECMV 3 DIR). • Method of reproducing failure code: Turn on the starting switch, set the transmission auto-shift/manual shift selector switch to the MANUAL position, and select 3rd using the shift down switch or moving the gear shift lever to 3rd.		

	Causes		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	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 L64 (female) (16) – 3.PS (female) (1) 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.			
			L64 (female)	Resistance		
			Between (16) and (3)	5 – 15 Ω		
			Between (16), (3) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 3rd clutch ECMV solenoid

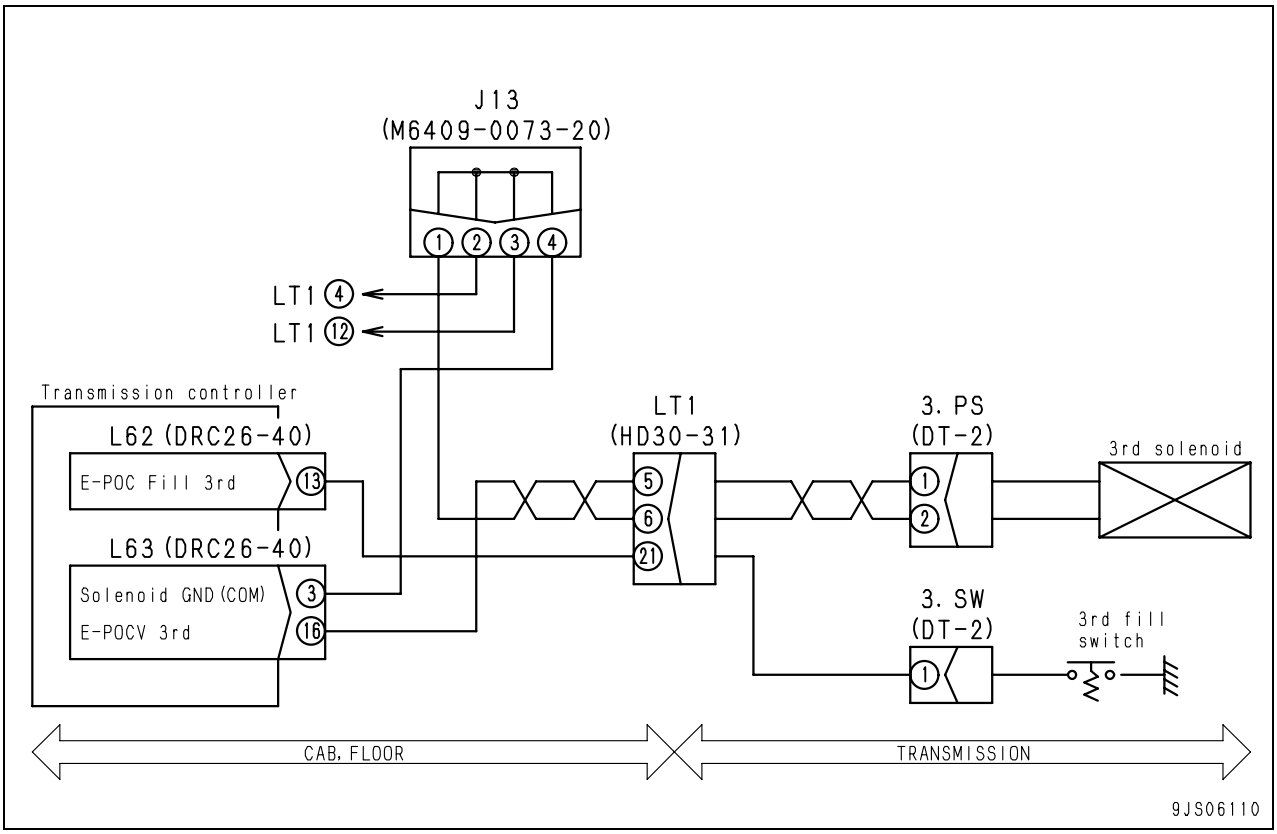


Failure code [DXH6KY] (3rd clutch ECMV solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	3rd clutch ECMV solenoid: Short circuit with power supply line (Transmission controller system)
E03	**DXH6KY**		
Contents of trouble	• Since the 3rd ECMV solenoid system is shorted with the power source, abnormal voltage is applied when 3rd clutch ECMV solenoid output is 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 (other than 3rd speed). • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch is set to N (Neutral).		
Problem that appears on machine	• The transmission does not shift into 1st, 2nd or 4th (the machine can travel at 3rd).		
Related information	• The output state (current value) to the 3rd clutch ECMV solenoid can be checked with the monitoring function (Code: 31604, ECMV 3 DIR). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L64 (female) (16) – 3.PS (female) (1) and chassis ground	Voltage	Max. 1 V	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L64 (female)	Resistance		
			Between (16) and (3)	5 – 15 Ω		
			Between (16), (3) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 3rd clutch ECMV solenoid

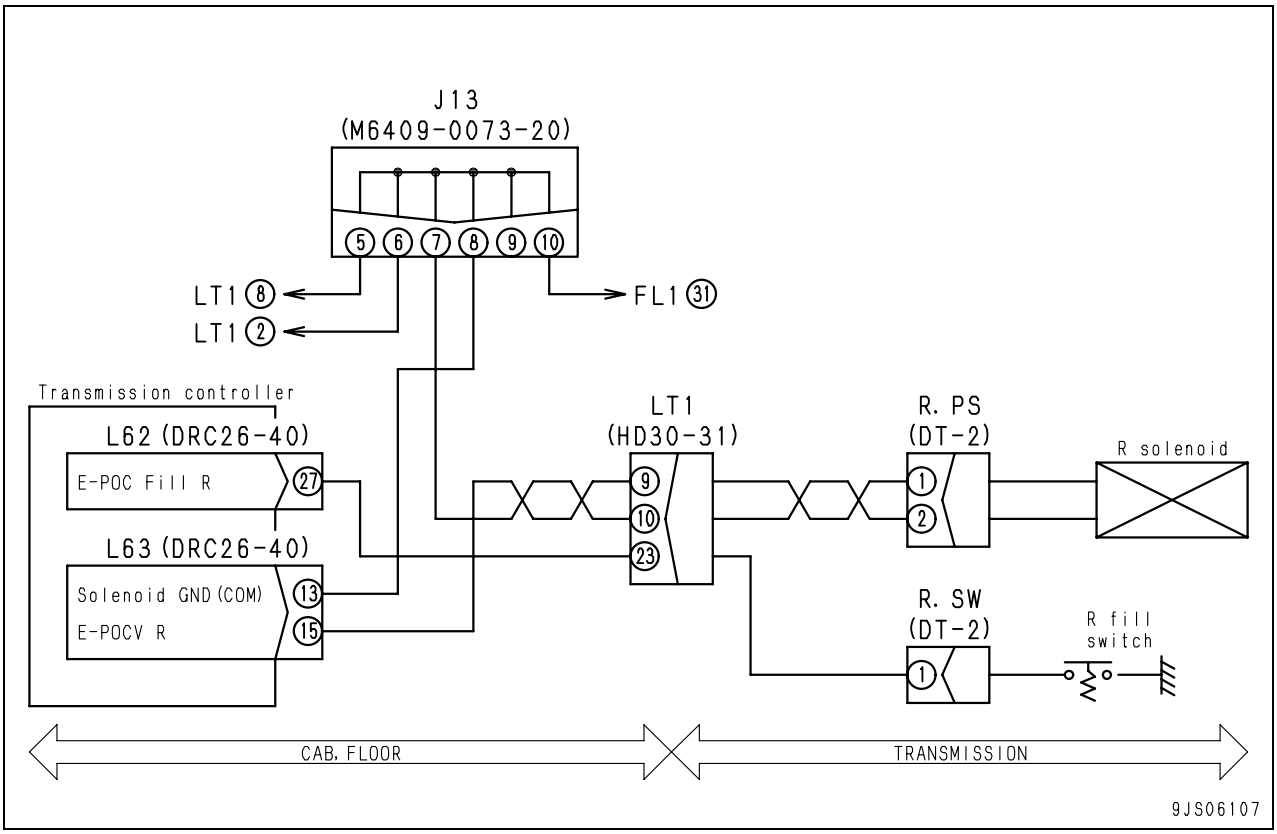


Failure code [DXH7KA] (R clutch ECMV solenoid: Disconnection)

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 at F (Forward)).		
Related information	• The output state (current value) 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 the starting switch ON and set FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to R (reverse).		

	Causes		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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L73 (female) (13) – R.PS (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L73 (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.			
			L73 (female)	Resistance		
			Between (15) and (13)	5 – 15 Ω		

Circuit diagram related to R (Reverse) clutch ECMV solenoid

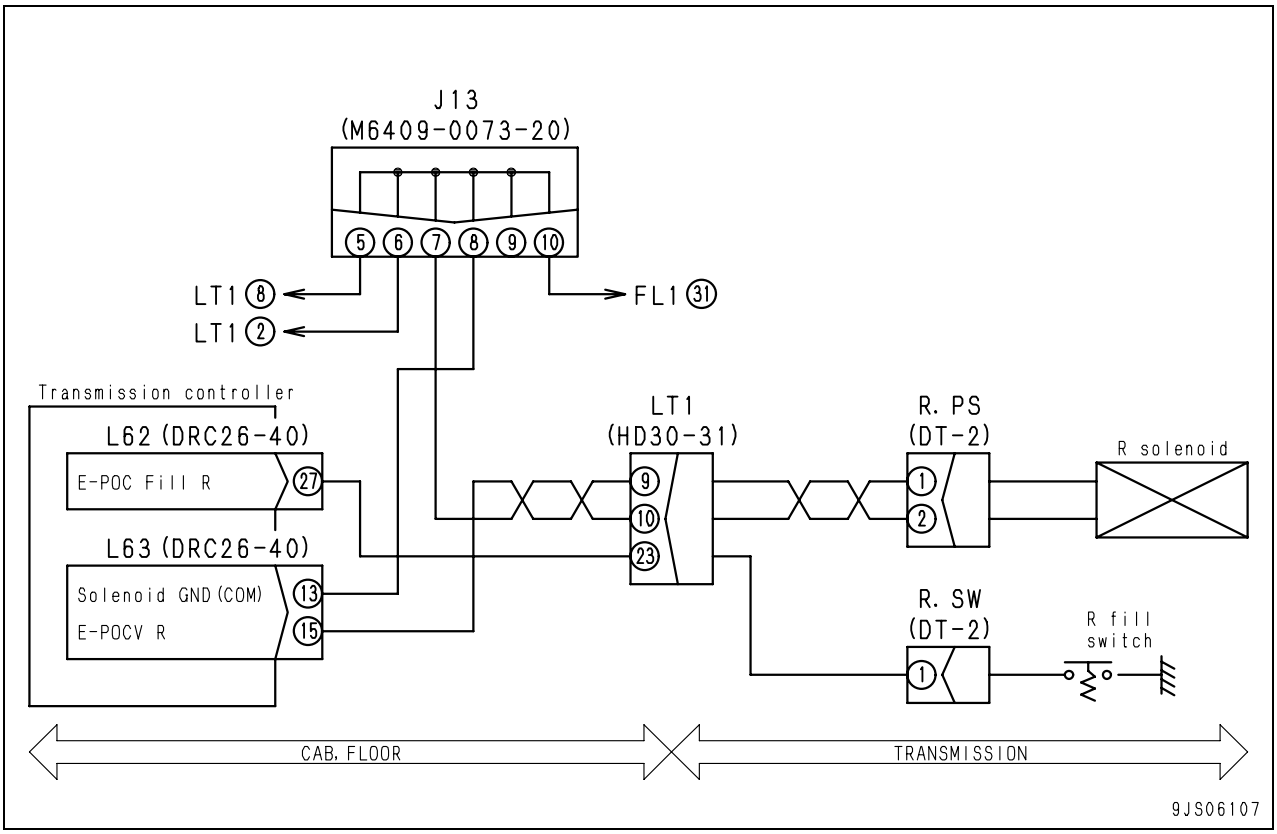


Failure code [DXH7KB] (R clutch ECMV solenoid: Short circuit)

Action code	Failure code	Trouble	R clutch ECMV solenoid: Short circuit (Transmission controller system)
E03	**DXH7KB**		
Contents of trouble	• Since the R (Reverse) clutch ECMV solenoid system is shorted, abnormal 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 at F (Forward)).		
Related information	• The output state (current value) 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 the starting switch ON and set FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch to R (reverse).		

	Causes		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 L63 (female) (15) – R.PS (female) (1) 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.			
			L63 (female)	Resistance		
			Between (15) and (13)	5 – 15 Ω		
			Between (15), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to R (Reverse) clutch ECMV solenoid

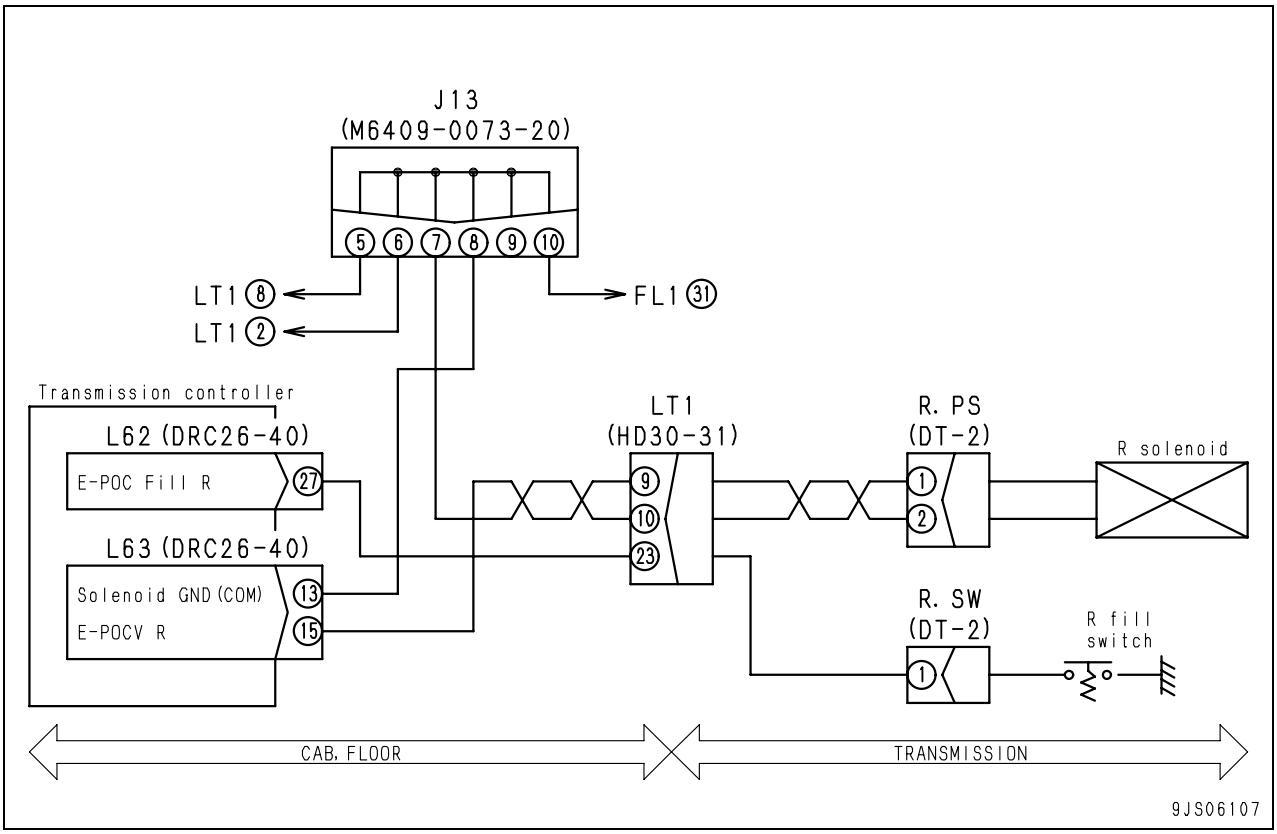


Failure code [DXH7KY] (R clutch ECMV solenoid: Short circuit with power supply line)

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 is shorted with the power source, abnormal voltage is applied when the R (Reverse) ECMV solenoid output is 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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch is set to N (Neutral).		
Problem that appears on machine	• The machine can travel in the R (Reverse) position alone.		
Related information	• The output state (current value) 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 the starting switch ON.		

	Causes		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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L63 (female) (15) – R.PS (female) (1) and chassis ground	Voltage	Max. 1 V	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L63 (female)	Resistance		
			Between (15) and (13)	5 – 15 Ω		
			Between (15), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to R (Reverse) clutch ECMV solenoid

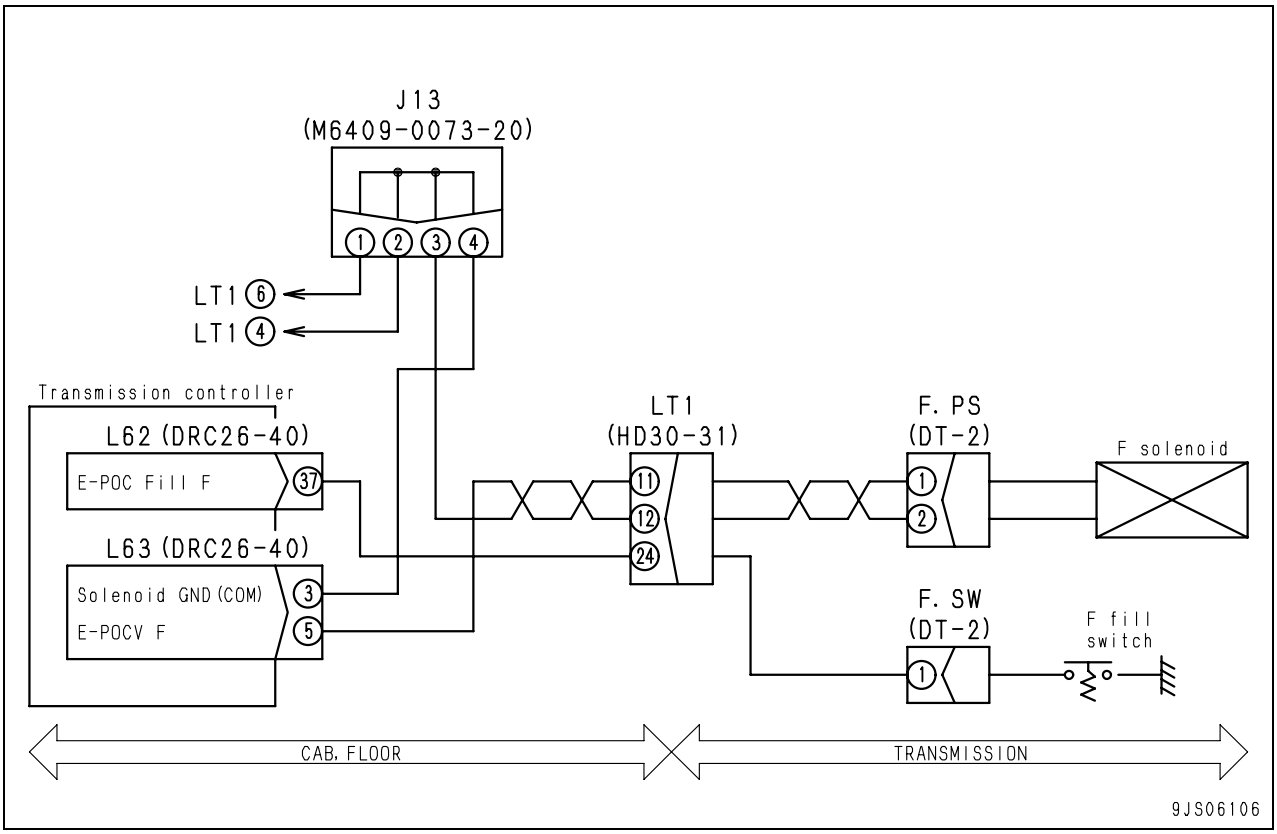


Failure code [DXH8KA] (F clutch ECMV solenoid: Disconnection)

Action code	Failure code	Trouble	F clutch ECMV solenoid: Disconnection (Transmission controller system)
E03	**DXH8KA**		
Contents of trouble	• Since 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 at R (Reverse)).		
Related information	• The output state (current value) 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 the starting switch ON and set FNR (directional) lever, joystick steering FNR (directional) switch, or right FNR (directional) switch to F (forward).		

	Causes		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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L63 (female) (3) – F.PS (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L63 (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.			
			L63 (female)	Resistance		
			Between (5) and (3)	5 – 15 Ω		

Circuit diagram related to F (Forward) clutch ECMV solenoid

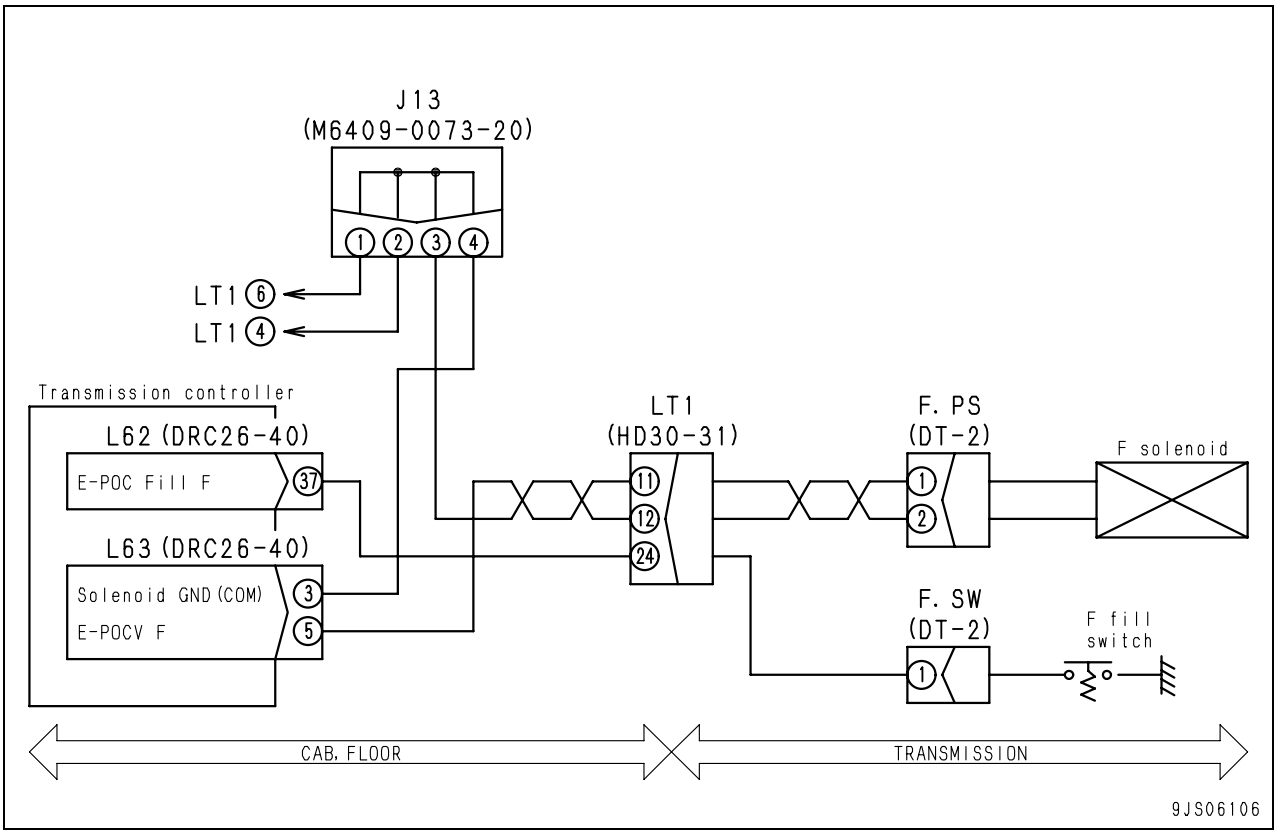


Failure code [DXH8KB] (F clutch ECMV solenoid: Short circuit)

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 is shorted, abnormal 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 at R (Reverse)).		
Related information	• The output state (current value) 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 the starting switch ON and set FNR (directional) lever, joystick steering FNR (directional) switch, or right FNR (directional) switch to F (forward).		

	Causes		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 L63 (female) (5) – F.PS (female) (1) 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.		
			L63 (female)	Resistance	
			Between (5) and (3)	5 – 15 Ω	
			Between (5), (3) and chassis ground	Min. 1 MΩ	

Circuit diagram related to F (Forward) clutch ECMV solenoid

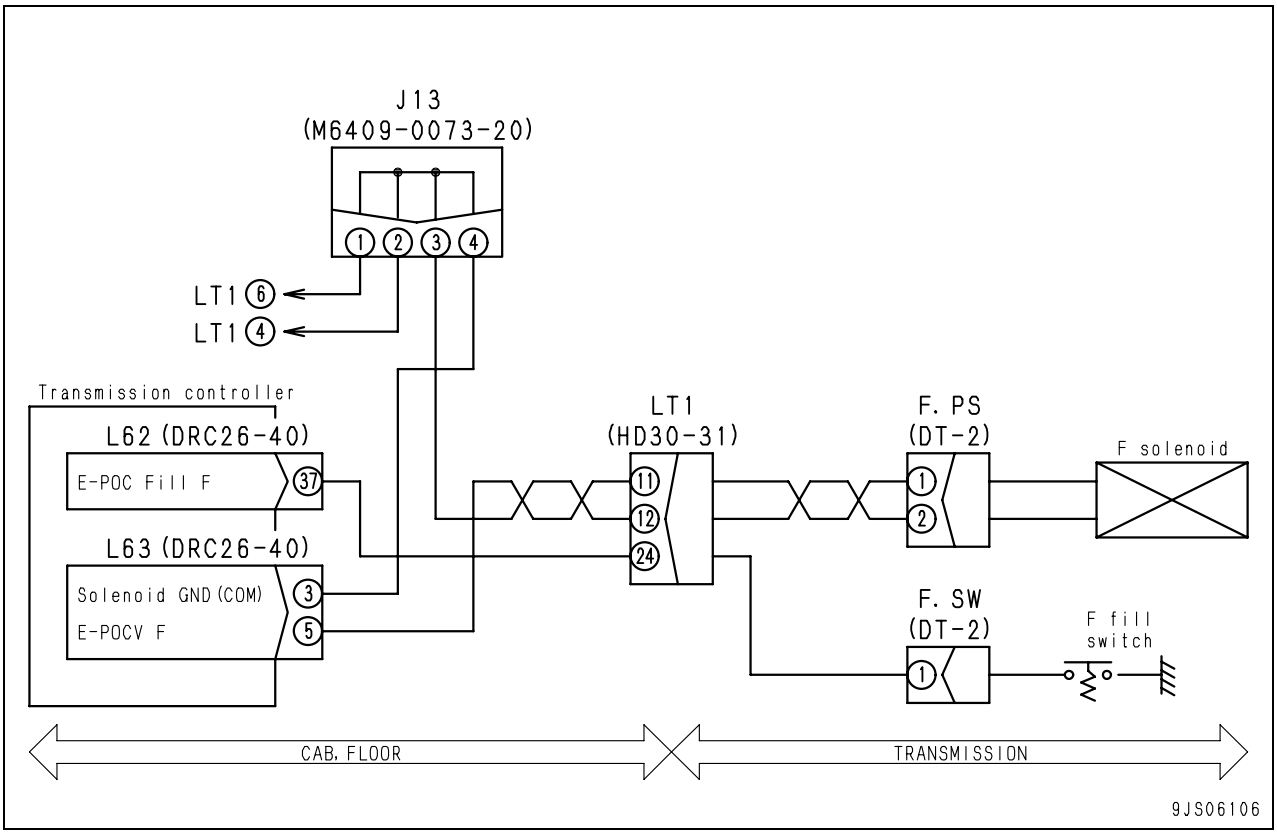


Failure code [DXH8KY] (F clutch ECMV solenoid: Short circuit with power supply line)

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 is shorted with the power source, abnormal voltage is applied when the F (Forward) ECMV solenoid output is 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 FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch is set to N (Neutral).		
Problem that appears on machine	• The machine can travel in the F (Forward) position alone.		
Related information	• The output state (current value) 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 the starting switch ON.		

	Causes		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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L63 (female) (5) – F.PS (female) (1) and chassis ground	Voltage	Max. 1 V	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L63 (female)	Resistance		
			Between (5) and (3)	5 – 15 Ω		
			Between (5), (3) and chassis ground	Min. 1 MΩ		

Circuit diagram related to F (Forward) clutch ECMV solenoid

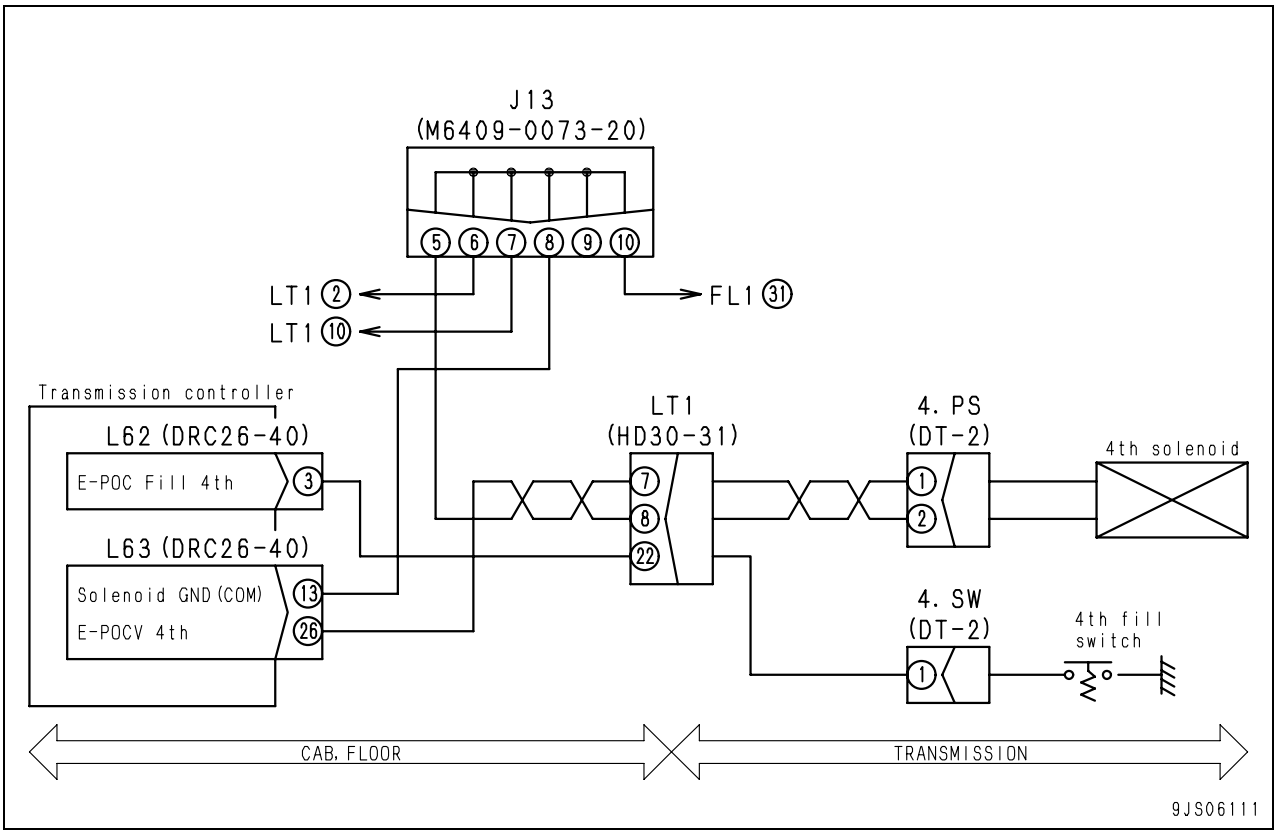


Failure code [DXHHKA] (4th clutch ECMV solenoid: Disconnection)

Action code	Failure code	Trouble	4th clutch ECMV solenoid: Disconnection (Transmission controller system)
E03	**DXHHKA**		
Contents of trouble	• Since 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 value) to the 4th clutch ECMV solenoid can be checked with the monitoring function (Code: 31605, ECMV 4 DIR). • Method of reproducing failure code: Turn the starting switch ON, set the transmission auto-shift/manual shift selector switch in the MANUAL position, and select 4th using the shift down switch or moving the gear shift lever to 4th.		

	Causes		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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L63 (female) (13) – 4.PS (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between L63 (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.			
			L63 (female)	Resistance		
			Between (26) and (13)	5 – 15 Ω		

Circuit diagram related to 4th clutch ECMV solenoid

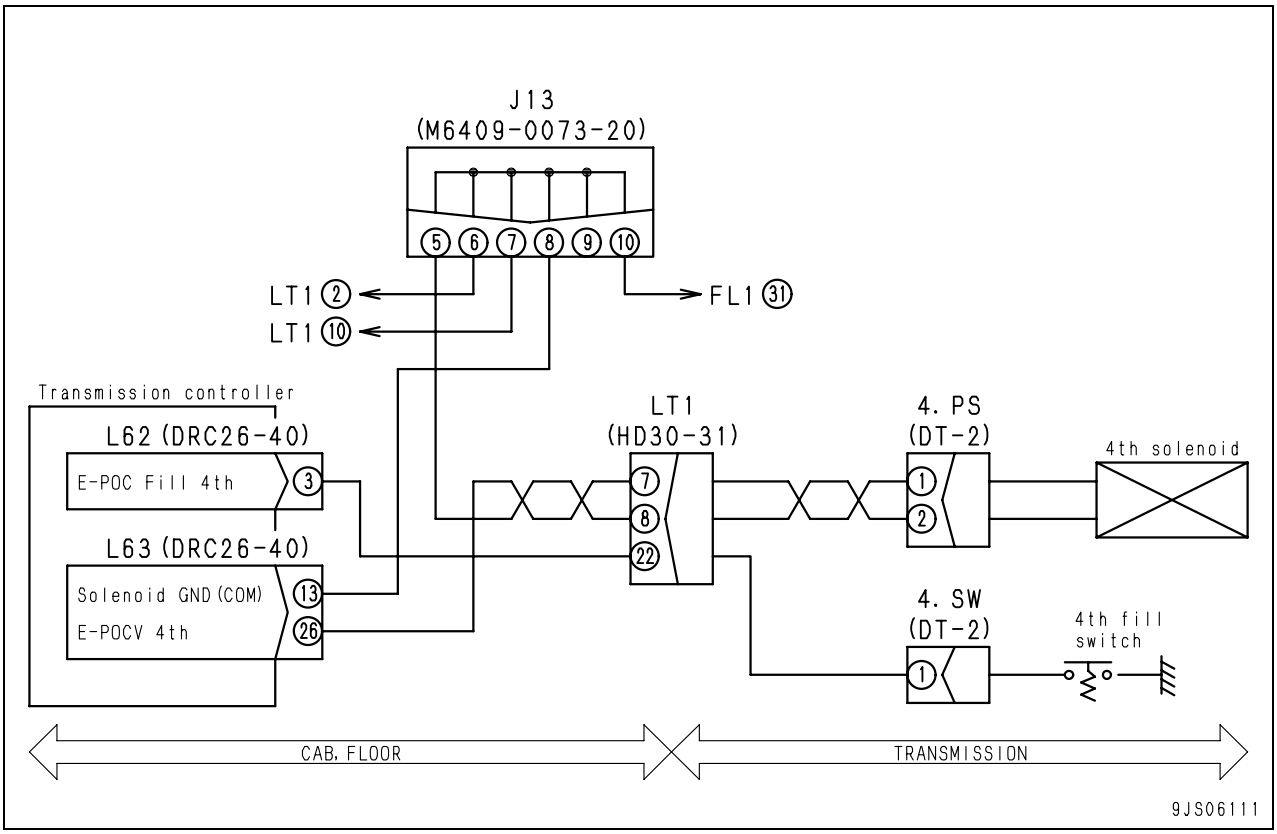


Failure code [DXHHKB] (4th clutch ECMV solenoid: Short circuit)

Action code	Failure code	Trouble	4th clutch ECMV solenoid: Short circuit (Transmission controller system)
E03	**DXHHKB**		
Contents of trouble	• Since the 4th clutch ECMV solenoid system is shorted, abnormal 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 value) to the 4th clutch ECMV solenoid can be checked with the monitoring function (Code: 31605, ECMV 4 DIR). • Method of reproducing failure code: Turn the starting switch ON, set the transmission manual/auto shift selector switch in the MANUAL position, and select 4th using the shift down switch or moving the gear shift lever to 4th.		

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting			
	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 L63 (female) (26) – 4.PS (female) (1) 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.			
			L63 (female)	Resistance		
			Between (26) and (13)	5 – 15 Ω		
			Between (26), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 4th clutch ECMV solenoid

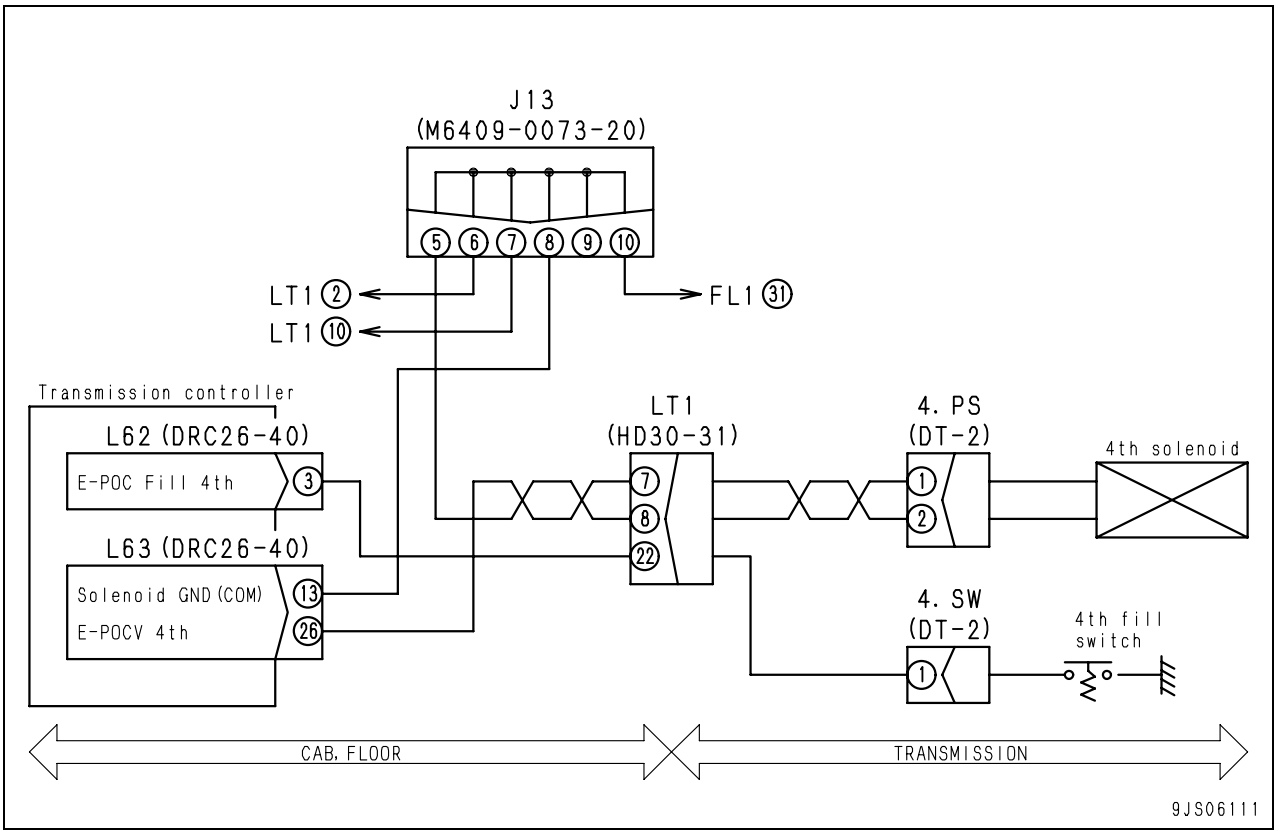


Failure code [DXHHKY] (4th clutch ECMV solenoid: Short circuit with power supply line)

Action code	Failure code	Trouble	4th clutch ECMV solenoid: Short circuit with power supply line (Transmission controller system)
E03	**DXHHKY**		
Contents of trouble	• Since the 4th ECMV solenoid system is shorted with the power source, abnormal voltage is applied when 4th clutch ECMV solenoid output is 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 (other than 4th speed). • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until FNR (directional) lever, joystick steering FNR (directional) switch or right FNR (directional) switch is set to N (Neutral).		
Problem that appears on machine	• The transmission does not shift into 1st, 2nd or 3rd (the machine can travel at 4th).		
Related information	• The output state (current value) to the 4th clutch ECMV solenoid can be checked with the monitoring function (Code: 31605, ECMV 4 DIR). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		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 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L63 (female) (26) – 4.PS (female) (1) and chassis ground	Voltage	Max. 1 V	
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L63 (female)	Resistance		
			Between (26) and (13)	5 – 15 Ω		
			Between (26), (13) and chassis ground	Min. 1 MΩ		

Circuit diagram related to 4th clutch ECMV solenoid



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

40 Troubleshooting

Troubleshooting of electrical system (E-mode)

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Troubleshooting of electrical system (E-mode)

Before carrying out troubleshooting for electrical system

Connection table of fuse box and slow blow fuse

★ This connection table indicates the devices to which the power of the fuse box and slow blow fuse 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 slow blow fuse to see if the power is supplied normally.

Fuse box A

Type of power supply	Fuse No	Capacity of fuse	Destination of power
Switch power supply Head lamp relay	1	10 A	Headlamp (left) circuit
	2	10 A	Headlamp (right) circuit
Switch power supply Lamp switch	3	10 A	Clearance lamp (left) circuit
	4	10 A	Clearance lamp (right) circuit
Switch power supply Slow-blow fuse (50 A)	5	20 A	Main lamp circuit
	6	10 A	Machine monitor (B) circuit Load meter printer (if equipped) circuit
	7	5 A	Air conditioner (B) circuit
	8	20 A	Air conditioner (A) circuit
	9	20 A	Wiper and washer circuit
	10	20 A	Rear lamp and brake lamp circuit
	11	10 A	Work equipment positioner circuit Work equipment controller (A) circuit (if equipped)
	12	5 A	Emergency steering circuit (if equipped)
	13	5 A	Parking brake circuit
	14	10 A	Transmission controller (A) circuit
	15	10 A	Horn circuit

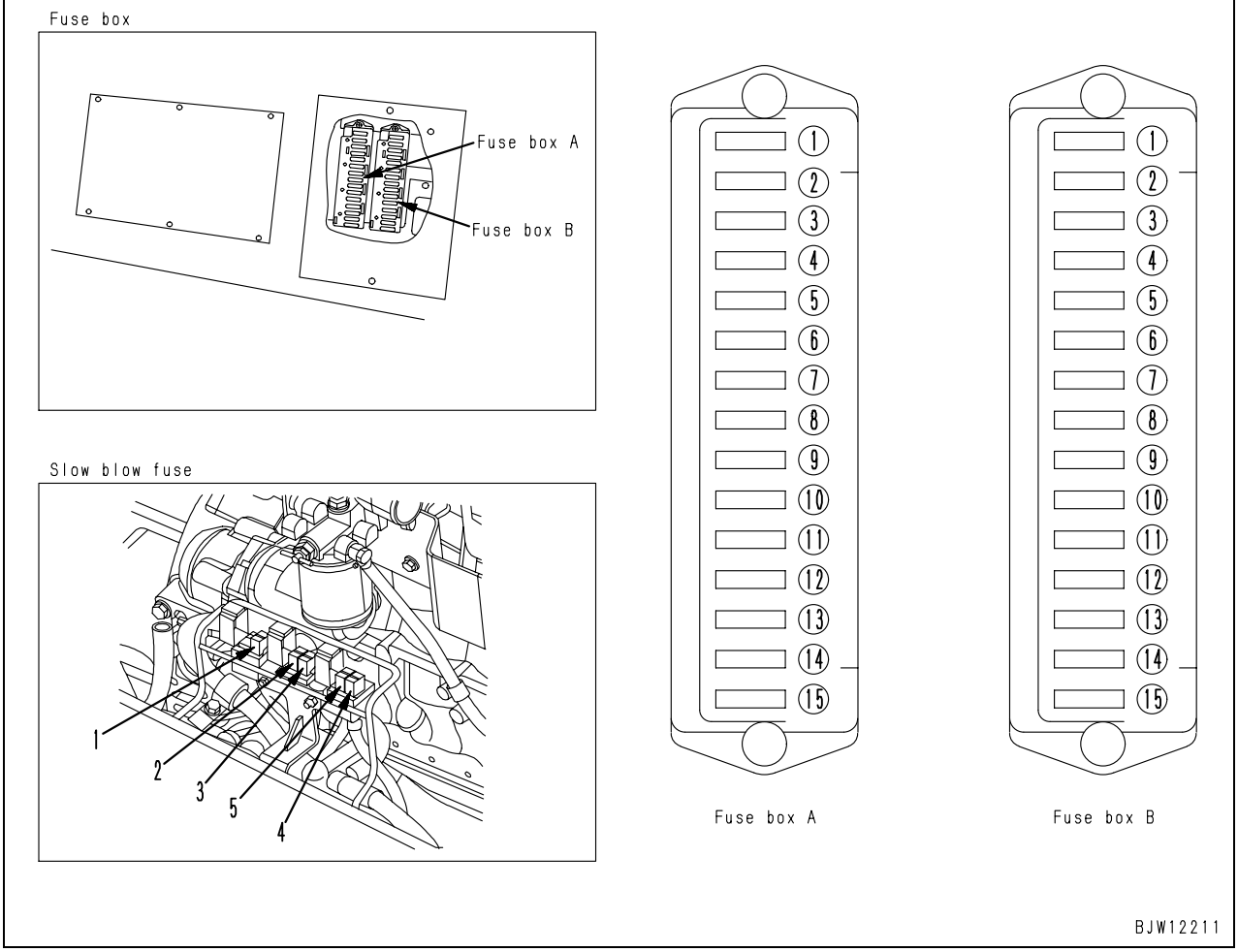
Fuse box B

Type of power supply	Fuse No	Capacity of fuse	Destination of power
Switch power supply Starting switch ACC	1	5 A	Engine controller (B) circuit
Switch power supply Slow-blow fuse (50 A)	2	20 A	Rear glass heater circuit
	3	10 A	Air suspension seat
	4	20 A	Yellow rotary lamp circuit (if equipped)
	5	10 A	Turn signal lamp circuit
	6	20 A	Car radio circuit and 12V converter circuit
	7	10 A	Rear working lamp circuit
	8	10 A	Front working lamp circuit
Constant power supply Slow-blow fuse (50 A)	9	20 A	Spare 1
	10	30 A	Engine controller (A) circuit
	11	5 A	Transmission controller (B) circuit Work equipment controller (B) circuit (OPT)
	12	10 A	Room lamp circuit
	13	10 A	Machine monitor (B) circuit KOMTRAX circuit (if equipped)
	14	10 A	Hazard lamp circuit
	15	20 A	Starting switch circuit

Slow blow fuse

Type of power supply	Slow-blow fuse No.	Capacity of fuse	Destination of power
Constant power supply	1	50 A	Spare 1, engine controller (A) circuit, transmission controller (B) circuit, work equipment controller (B) circuit (if equipped), room lamp circuit, machine monitor (B) circuit, KOMTRAX (B) circuit (if equipped), hazard lamp circuit and starting switch circuit
Switch power supply	2	50 A	Main lamp circuit, machine monitor (B) circuit, load meter printer (if equipped) circuit, air conditioner (B) circuit, air conditioner (A) circuit, wiper and washer circuit, rear lamp and brake lamp circuit, work equipment positioner circuit, work equipment controller (A) circuit (if equipped), emergency steering circuit (if equipped), parking brake circuit, transmission controller (A) circuit and horn circuit
	3	50 A	Rear glass heater circuit, air suspension seat, yellow rotary lamp circuit (if equipped), turn signal lamp circuit, car radio circuit, 12V converter circuit, rear working lamp circuit and front working lamp circuit
	4	120 A	Heater relay circuit
	5	120 A	Charging circuit

Locations and numbers of fuse boxes and slow blow fuse



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 (24 V) 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-adapter** **For troubleshooting, insert or connect T-adapter shown below unless especially specified.** **• When "male" or "female" is not indicated for a connector number, disconnect the connector, and insert the T-adapters in both the male and female.** **• When "male" or "female" is indicated for a connector number, disconnect connector, and insert the T-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 troubleshooting
- 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	• The engine does not start.
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. 15 fuse of fuse box B is normal. (If it is broken, check the related wiring harness for grounding fault.) • The input state (ON/OFF) to the machine monitor from the starting switch terminal C can be checked with the monitoring function (Code: 40900, D-IN-2). • The input state (ON/OFF) to the transmission controller from starting switch terminal C can be checked with the monitoring function (Code: 40907, D-IN-16). • The input state (ON/OFF) to the work equipment controller from the starting switch terminal C can be checked with the monitoring function (Code: 40912, D-IN-17). • If failure codes D5ZHKA, D5ZHKB, D5ZHKZ, D5ZH16, DDK3KA, DDK4KA, DDK6KA, DDK6KB, and DB2RKR are indicated, curry out troubleshooting for it first.

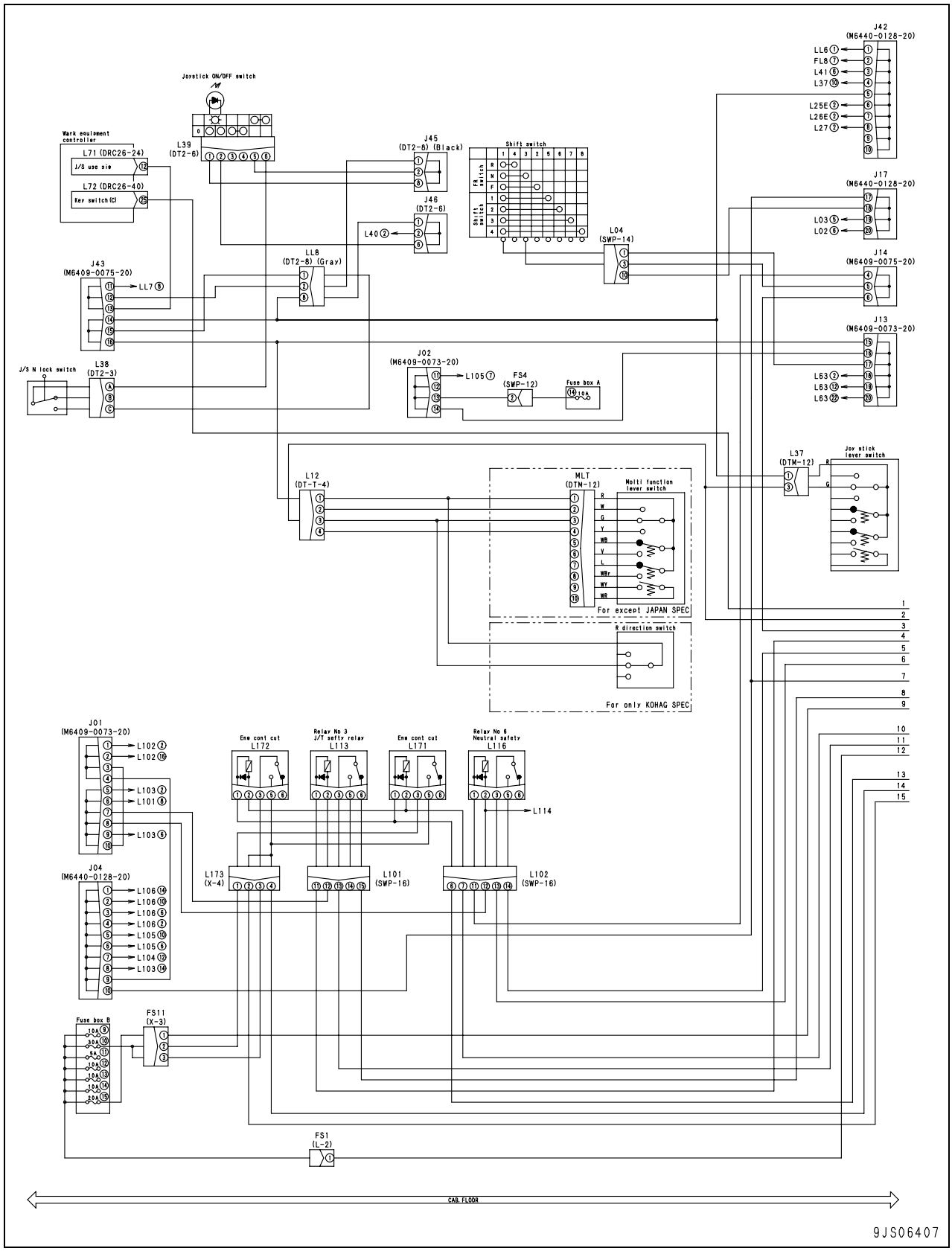
	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective battery	Specific gravity		Min. 1.26	
			Voltage		Min. 25 V	
	2	Defective battery relay (Internal disconnection or short circuit)	The battery relay can be judged normal if operating sounds are audible when the starting switch is operated. • Starting switch operation in the order of OFF → ON → OFF			
	3	Defective fuse No. 15 of fuse box B	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 15.)			
	4	Defective starting motor (Internal trouble)	★ 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 terminal R E01 (male) (2) and terminal E	Battery input	Max. 1 V	
			Between terminal C E01 (male) (1) and terminal 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 trouble)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between alternator terminal R E02 (female) (1) – chassis ground		Voltage	Max. 1 V
	6	Defective starting switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting with starting OFF and START each.			
			S40 (male)	Position of switch	Resistance	
			Between (1) and (3)	OFF	Min. 1 MΩ	
				START	Max. 1 Ω	
	7	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)	Constant	20 – 30 V	
			Between (3) and (10)	N (Neutral).	20 – 30 V	
				Other than above	Max. 1 V	

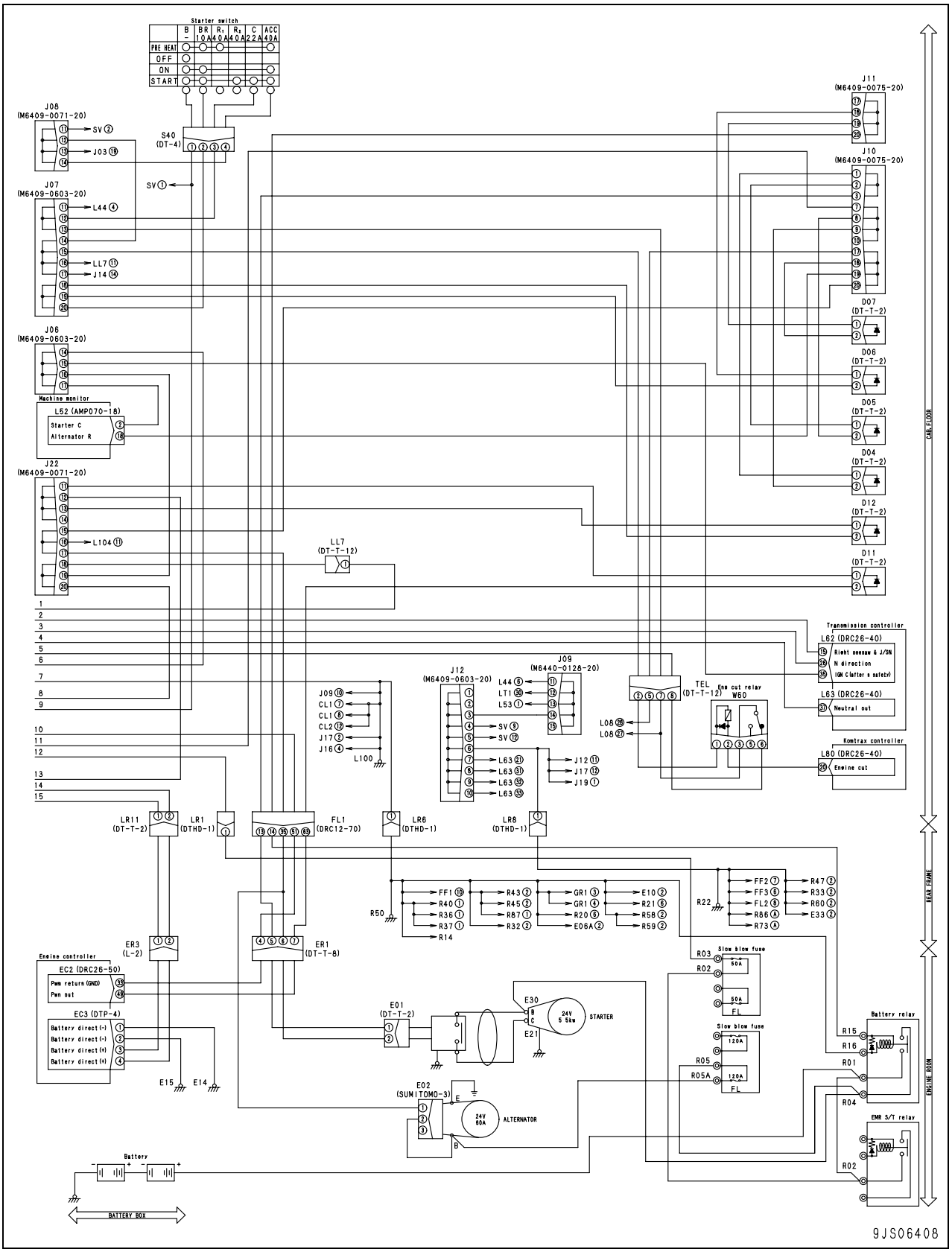
<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">8</td><td rowspan="4">Defective joystick steering FNR (directional) switch (Internal disconnection 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>L37 (male)</td><td>Joystick steering FNR (directional) switch</td><td>Resistance</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 MΩ</td></tr>
<tr><td>Between (1), (3) and chassis ground</td><td>Constant</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="4">9</td><td rowspan="4">Defective right FNR (directional) switch (Internal disconnection or short circuit)</td><td>L12 (male)</td><td>Right FNR (directional) switch</td><td>Resistance</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 MΩ</td></tr>
<tr><td>Between (1), (3) and chassis ground</td><td>Constant</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="5">10</td><td rowspan="5">Defective diodes (D04, D05) (Internal disconnection)</td><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>D04 (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>Continue</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>D05 (male)</td><td>Diode range</td><td>Continuity</td></tr>
<tr><td rowspan="4">11</td><td rowspan="4">Defective joystick safety relay (L113) (Internal trouble)</td><td>Between (2) and (1)</td><td>Measure at (2) in diode range.</td><td>Continue</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">L113 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td>200 – 400 Ω</td></tr>
<tr><td rowspan="4">12</td><td rowspan="4">Defective neutral safety relay (L116) (Internal trouble)</td><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 joystick safety relay (L113) is replaced with a relay of the same type, if the condition becomes normal, the joystick safety relay is defective.</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">L116 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td>200 – 400 Ω</td></tr>
<tr><td rowspan="4">13</td><td rowspan="4">Defective engine control cut-out relays (L171, L172) (Internal defect)</td><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 (L116) is replaced with a relay of the same type, if the condition becomes normal, the neutral safety relay is defective.</td></tr>
<tr><td colspan="3">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">L171 (male), L172 (male)</td><td>Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td>200 – 400 Ω</td></tr>
<tr><td rowspan="2">13</td><td rowspan="2">Defective engine control cut-out relays (L171, L172) (Internal defect)</td><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 engine control cut-out relay (L171, L172) is replaced with a relay of the same type, if the condition becomes normal, the engine control cut-out relay is defective.</td></tr>
</table>

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	14	Defective KOMTRAX engine cut-out relay (W60) (Internal trouble)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			W60 (male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch to START and carry out troubleshooting.		
			When KOMTRAX engine cut-out relay (W60) is replaced with a relay of the same type, if the condition becomes normal, the KOMTRAX engine cut-out relay is defective.		
	15	Disconnection in wiring harness (Disconnection in wiring harness or defective contact)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between battery relay R04 – starting motor terminal B (E30)	Resistance	Max. 1 Ω
			Wiring harness between starting motor terminal E – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between S40 (female) (3) – W60 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between W60 (female) (6) – L116 (female) (5)	Resistance	Max. 1 Ω
			Wiring harness between S40 (female) (4) – W60 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between W60 (female) (2) – L80 (female) (20)	Resistance	Max. 1 Ω
			Wiring harness between L116 (female) (3) – L113 (female) (6)	Resistance	Max. 1 Ω
			Wiring harness between L04 (female) (3) – L116 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between L116 (female) (2) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between L113 (female) (3) – D05 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between D05 (female) (1) – E01 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between L63 (female) (37) – L113 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between L113 (female) (2) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between S40 (female) (2) – L171 (male) (1), L172 (male) (1)	Resistance	Max. 1 Ω
			Wiring harness between L171 (male) (2), L172 (male) (2) – EC2 (female) (33)	Resistance	Max. 1 Ω
			Wiring harness between fuse No. 10 of fuse box B – L171 (male) (3), L172 (male) (3)	Resistance	Max. 1 Ω
			Wiring harness between L171 (male) (4), L172 (male) (4) – EC3 (female) (3), (4)	Resistance	Max. 1 Ω
			Wiring harness between EC3 (female) (1), (2) – chassis ground	Resistance	Max. 1 Ω

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting			
	16	Ground 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 R04 – starting motor terminal B (E30) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between S40 (male) (3) – W60 (female) (3), – circuit branch end and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between W60 (female) (6) – L116 (female) (5) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between S40 (female) (4) – W60 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L116 (female) (3) – L113 (female) (6) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L04 (female) (3) – L116 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L113 (female) (3) – D05 (female) (2) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between D05 (female) (1) – E01 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L63 (female) (37) – L113 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between S40 (female) (2) – L171 (male) (1) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between fuse No. 10 of fuse box B – L171 (male) (3), L172 (male) (3) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L171 (male) (4), L172 (male) (4) – EC3 (female) (3), (4) and chassis ground		Resistance	Min. 1 MΩ
	17	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between alternator terminal R E02 (female) (1) – E01 (female) (2), – circuit branch end and chassis ground (Note: if hot short occurs across them, the charging lamp will be lighted as the starting switch is ON.		Voltage	Max. 1 V
	18	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L63	Work equipment control lever	Voltage	
			Between (37) and chassis ground	Neutral	Max. 1 V	
				Other than above	20 – 30 V	

Circuit diagram related to engine starting system




Starter switch
B BR R1 R2 C ACC
PRE HEAT
OFF
ON
START
S40 (DT-4)
J08 (M6409-0071-20)
J07 (M6409-0603-20)
J06 (M6409-0603-20)
J22 (M6409-0071-20)
J11 (M6409-0075-20)
J10 (M6409-0075-20)
D07 (DT-T-2)
D06 (DT-T-2)
D05 (DT-T-2)
D04 (DT-T-2)
D12 (DT-T-2)
D11 (DT-T-2)
Machine monitor
L52 (AMP070-18)
Starter C
Alternator R
LL7 (DT-T-12)
J12 (M6409-0603-20)
J09 (M6440-0128-20)
TEL (DT-T-12)
Ena cut relay W60
Transmission controller
L62 (DRC26-40)
Right seesaw & J/SW
N direction
IGN (after s safety)
L63 (DRC26-40)
Neutral out
Komtrax controller
L80 (DRC26-40)
Engine cut
L100
LR11 (DT-T-2)
LR1 (DTHD-1)
FL1 (DRC12-70)
LR6 (DTHD-1)
LR8 (DTHD-1)
ER3 (L-2)
ER1 (DT-T-8)
Engine controller
EC2 (DRC26-50)
Pwm return (GND)
Pwm out
EC3 (DTP-4)
Battery direct (-)
Battery direct (-)
Battery direct (+)
Battery direct (+)
E01 (DT-T-2)
E30
24V 5.5kw
STARTER
E21
E02 (SUMITOMO-3)
24V 60A
ALTERNATOR
Slow blow fuse
50A
120A
Battery relay
EMR S/T relay
Battery
BATTERY BOX
CAB FLOOR
REAR FRAME
ENGINE ROOM
9JS06408

E-2 Wiper does not operate

Contents of trouble	(1) Front wiper does not operate.
Related information	• The front wiper does not operate due to the defective front wiper switch, timer, or wiring harness.

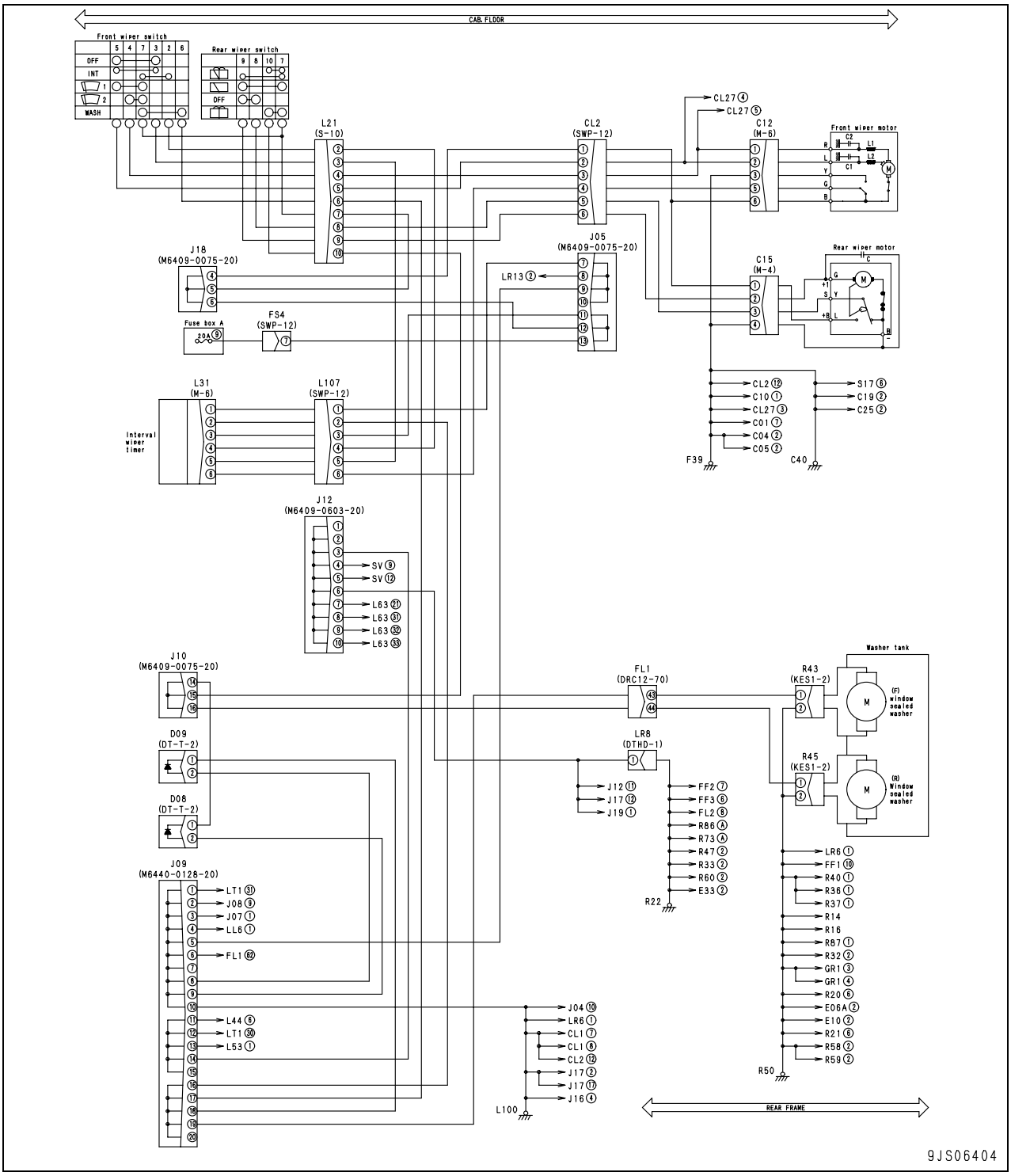
<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse No. 9 of fuse box A</td><td colspan="4">If the fuse is burn, the circuit 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="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>C12</td><td>Front wiper switch</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (6) and chassis ground</td><td>Constant</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between (2) and chassis ground</td><td>Lo</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between (1) and chassis ground</td><td>Hi</td><td colspan="2">20 – 30 V</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">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>L31</td><td>Front wiper switch</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (3) and chassis ground</td><td>Constant</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between (4) and chassis ground</td><td>INT</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between (2) and chassis ground</td><td>Washer side</td><td colspan="2">20 – 30 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>Between (5) and chassis ground</td><td>INT (If wiper switch is set in INT, voltage is output intermittently.)</td><td colspan="2">Repeat 20 to 30 V → 0 V</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2">L21</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>L22</td><td>Front wiper switch</td><td colspan="2">Resistance</td></tr>
<tr><td>Between (7) and (5)</td><td>Lo</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (7) and (4)</td><td>Hi</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (7) and (2)</td><td>INT</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (3) and (5)</td><td>INT</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td colspan="3">Other than above</td><td colspan="2">Min. 1 MΩ</td></tr>
</table>

	Causes		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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L21 (female) (3) – L31 (female) (5)	Resistance	Max. 1 Ω
			Wiring harness between L21 (female) (5) – C12 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L21 (female) (7) – fuse No. 9 of fuse box A, – circuit branch end	Resistance	Max. 1 Ω
			Wiring harness between L21 (female) (4) – C12 (female) (1)	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 L21 (female) (3) – L31 (female) (5), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L21 (female) (5) – C12 (female) (2), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L21 (female) (7) – fuse No. 9 of fuse box A, – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L21 (female) (4) – C12 (female) (1), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ

Contents of trouble	(2) Rear wiper does not operate.
Related information	• Since the rear wiper switch or wiring harness is defective, the rear wiper does not operate.

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective rear wiper motor (Internal trouble)</td><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>C15</td><td colspan="2">Rear wiper switch</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (1) and chassis ground</td><td colspan="2">Constant</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between (2) and chassis ground</td><td colspan="2">ON</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="6">• If wiper switch is turned OFF while wiper is operating, voltage is applied between C15 (1) and chassis ground until wiper motor stops.</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Defective rear wiper switch (Internal trouble)</td><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="3">L21</td><td colspan="2">Voltage</td></tr>
<tr><td colspan="3">Between (7) and chassis ground</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="6">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L21</td><td colspan="2">Rear wiper switch</td><td colspan="2">Resistance</td></tr>
<tr><td>Between (7) and (9)</td><td colspan="2">ON</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (8) and (9)</td><td colspan="2">OFF</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td colspan="3">Other than above</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Disconnection in wiring harness (Disconnection or defective contact in 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 L21 (female) (7) – C15 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between L21 (female) (8) – C15 (female) (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between L21 (female) (9) – C15 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between C15 (female) (4) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Ground 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 L21 (female) (7) – C15 (female) (1), – circuit branch end and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">Wiring harness between L21 (female) (8) – C15 (female) (3) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">Wiring harness between L21 (female) (9) – C15 (female) (2) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
</table>

Circuit diagram related to wiper



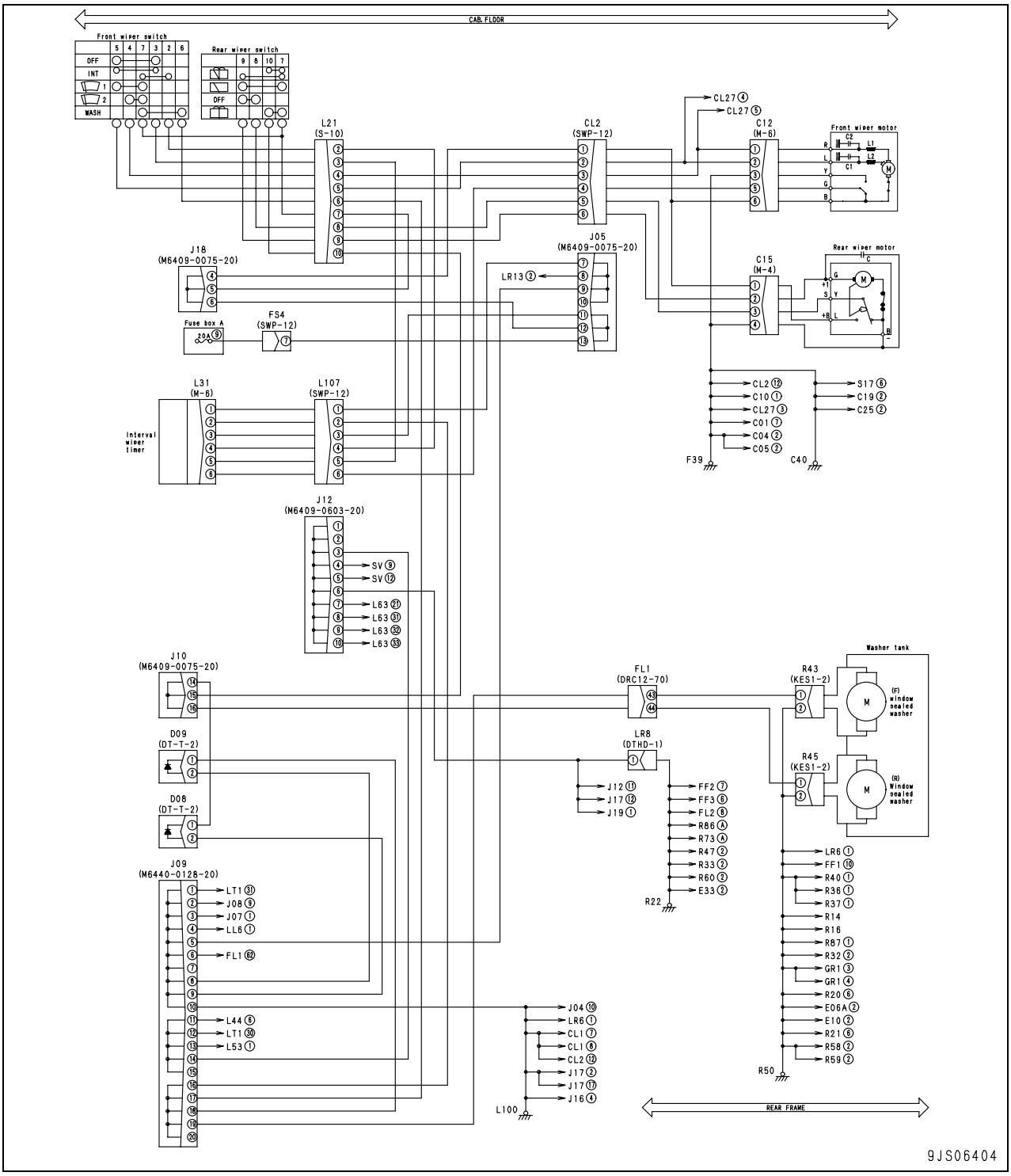
E-3 Windshield washer does not operate

Contents of trouble	Windshield washer does not operate.
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><td rowspan="19">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><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">R43</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">R45</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="6">3</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">L21</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>L21 (male)</td><td>Washer switch for front wiper</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>Constant</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="6">4</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">L21</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>L21 (male)</td><td>Washer switch for rear wiper</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>Constant</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Defective wiper timer (relay) (for only front wiper)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L31 (male)</td><td>Washer switch for front wiper</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (3) and chassis ground</td><td>Constant</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between (2) and chassis ground</td><td>ON</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between (5) and chassis ground</td><td>0.2 – 0.8 sec after ON</td><td colspan="2">20 – 30 V</td></tr>
</table>

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	6	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L21 (female) (6) – R43 (female) (1), – L31 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L21(female) (7) – fuse No. 9 of fuse box A	Resistance	Max. 1 Ω
			Wiring harness between L21 (female) (10) – R45 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between R43 (female) (2), R45 (female) (2) – chassis ground	Resistance	Max. 1 Ω
	7	Ground 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 L21 (female) (6) – R43 (female) (1), – L31 (female) (2), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L21 (female) (7) – fuse No. 9 of fuse box A, – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L21 (female) (10) – R45 (female) (1), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ

Circuit diagram related to windshield washer



E-4 Headlamp, clearance lamp, tail lamp, and license lamp do not light up or go off

Contents of trouble	(1) Headlamp, clearance lamp, tail lamp, and license lamp do not light up or go off.
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. • The input state (voltage) from the lamp switch (small lamp) to the machine monitor can be checked with the monitoring function (Code: 40200, SMALL LAMP). • The input state (ON/OFF) to the machine monitor from the lamp switch (head lamp) can be checked with the monitoring function (Code: 40900, D-IN-0). • The input state (ON/OFF) to the machine monitor from the dimmer switch (high beam) can be checked with the monitoring function (Code: 40904, D-IN-34).

<table>
<tr><td rowspan="13">Possible causes and standard value in normal state</td><td colspan="2">Causes</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 burn, the circuit probably has a grounding fault, etc. (See cause 4.)</td></tr>
<tr><td rowspan="8">2</td><td rowspan="8">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>Lamp 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="3">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 colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (1), (2), (5) and chassis ground</td><td>Constant</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 connector 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 fuse No. 5 of fuse box A – L02 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Ground 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 A – L02 (female) (1), – circuit branch end and chassis ground</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.
Related information	• The switch, lamp, or wiring harness of the headlamp (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. • The input state (ON/OFF) to the machine monitor from the lamp switch (head lamp) can be checked with the monitoring function (Code: 40900, D-IN-0). • The input state (ON/OFF) to the machine monitor from the dimmer switch (high beam) can be checked with the monitoring function (Code: 40904, D-IN-34).

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuses No. 1 and No. 2 of fuse box A	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 6.)		
	2	Defective headlamp relay (L131)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L131 (male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			When headlamp relay (L131) is replaced with a relay of the same type, if the condition becomes normal, the headlamp relay is defective.		
	3	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	Constant	Min. 1 MΩ
	4	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 (6) and (3)	Low	Min. 1 MΩ
				High	Max. 1 Ω
			Between (6) and (4)	Low	Max. 1 Ω
				High	Min. 1 MΩ
			Between (3), (4), (6) and chassis ground	Constant	Min. 1 MΩ

	Causes		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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L02 (female) (2) – L131 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between L131 (female) (2) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between fuse No. 5 of fuse box A – L131 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between L131(female) (5) – fuses No. 1, No. 2 of fuse box A	Resistance	Max. 1 Ω
			Wiring harness between fuse No. 1 of fuse box A – left HEAD (female) (B)	Resistance	Max. 1 Ω
			Wiring harness between fuse No. 2 of fuse box A – right HEAD (female) (B)	Resistance	Max. 1 Ω
	6	Ground 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) (2) – L131 (female) (1), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L131(female) (5) – fuses No. 1, No. 2 of fuse box A and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between fuse No. 1 of fuse box A – left HEAD (female) (B) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between fuse No. 2 of fuse box A – right HEAD (female) (B) and chassis ground	Resistance	Min. 1 MΩ
	7	Hot short in wiring harness (Contact with 24V 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) – L131 (female) (1), – circuit branch end and chassis ground	Voltage	Max. 1 V
			Wiring harness between L131(female) (5) – fuses No. 1, No. 2 of fuse box A and chassis ground	Voltage	Max. 1 V
			Wiring harness between fuse No. 1 of fuse box A – left HEAD (female) (B) and chassis ground	Voltage	Max. 1 V
			Wiring harness between fuse No. 2 of fuse box A – right HEAD (female) (B) and chassis ground	Voltage	Max. 1 V

Contents of trouble	(3) Headlamp (low beam) does not light up or go off.
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. • The input state (ON/OFF) to the machine monitor from the lamp switch (head lamp) can be checked with the monitoring function (Code: 40900, D-IN-0). • The input state (ON/OFF) to the machine monitor from the dimmer switch (high beam) can be checked with the monitoring function (Code: 40904, D-IN-34).

<table>
<tr><td rowspan="13">Possible causes and standard value in normal state</td><td colspan="2">Causes</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="6">2</td><td rowspan="6">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>Dimmer switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (6) and (3)</td><td>Low</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>High</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td rowspan="2">Between (6) and (4)</td><td>Low</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>High</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>Between (3), (4), (6) and chassis ground</td><td>Constant</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 in 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 HEAD (female) (A) – L02 (female) (4)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Ground 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 HEAD (female) (A) – L02 (female) (4) and chassis ground</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.
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. • The input state (ON/OFF) to the machine monitor from the lamp switch (head lamp) can be checked with the monitoring function (Code: 40900, D-IN-0). • The input state (ON/OFF) to the machine monitor from the dimmer switch (high beam) can be checked with the monitoring function (Code: 40904, D-IN-34).

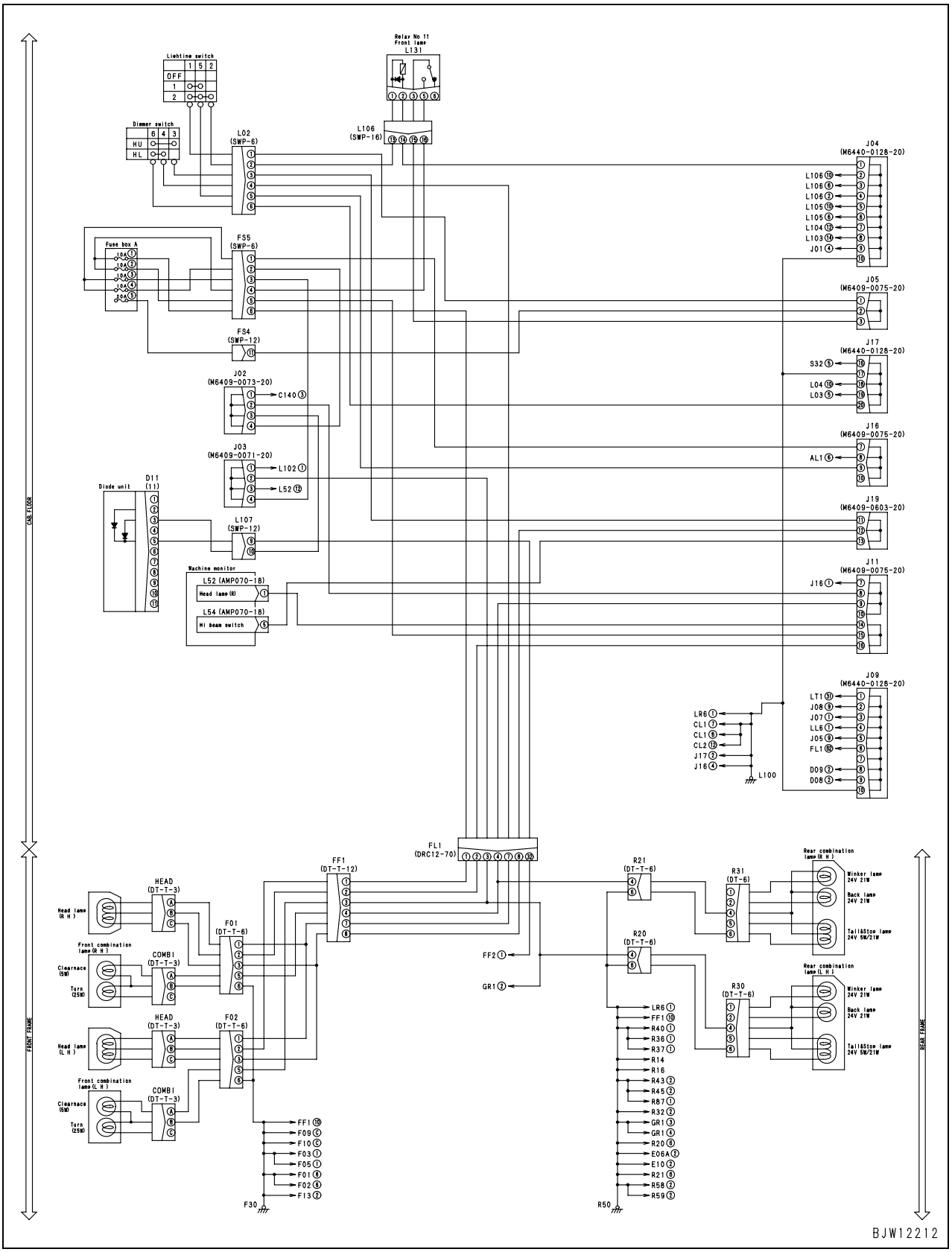
<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Broken bulb</td><td colspan="4">If a specific headlamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">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>Dimmer switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (6) and (3)</td><td>Low</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>High</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td rowspan="2">Between (6) and (4)</td><td>Low</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>High</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>Between (3), (4), (6) and chassis ground</td><td>Constant</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 in 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 HEAD (female) (C) – L02 (female) (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Ground 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 HEAD (female) (C) – L02 (female) (3), – circuit branch end and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
</table>

Contents of trouble	(5) Clearance lamp does not light up or go off. (6) Tail lamp does not light up or go off.
Related information	• Defective switch, lamp, or wiring harness of the clearance lamp or tail lamp system. • When the headlamp and turn signal lamp light up. • The input state (voltage) from the lamp switch (small lamp) to the machine monitor can be checked with the monitoring function (Code: 40200, SMALL LAMP).

	Causes		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 fuses No. 3 and No. 4 of fuse box A	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 5.)			
	3	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 (5)	OFF	Min. 1 MΩ	
				SMALL or HEAD	Max. 1 Ω	
			Between (1) and (2)	OFF	Min. 1 MΩ	
				SMALL	Min. 1 MΩ	
				HEAD	Max. 1 Ω	
			Between (1), (2), (5) and chassis ground	Constant	Min. 1 MΩ	
	4	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L02 (female) (5) – fuses No. 3, No. 4 of fuse box A		Resistance	Max. 1 Ω
			Wiring harness between fuse No. 4 of fuse box A – right COMBI (female) (A), – R31 (female) (4)		Resistance	Max. 1 Ω
			Wiring harness between fuse No. 3 of fuse box A – left COMBI (female) (A)		Resistance	Max. 1 Ω
	5	Ground 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) (5) – fuses No. 3, No. 4 of fuse box A and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between fuse No. 4 of fuse box A – right COMBI (female) (A), – R31 (female) (4) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between fuse No. 3 of fuse box A – left COMBI (female) (A) and chassis ground		Resistance	Min. 1 MΩ

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	6	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. • Headlamp switch is OFF		
			Wiring harness between L02 (female) (5) – fuses No. 3, No. 4 of fuse box A, – circuit branch end and chassis ground	Voltage	Max. 1 V
			Wiring harness between fuse No. 4 of fuse box A – right COMBI (female) (A), – R31 (female) (4), – circuit branch end and chassis ground	Voltage	Max. 1 V
			Wiring harness between fuse No. 3 of fuse box A – left COMBI (female) (A), – circuit branch end and chassis ground	Voltage	Max. 1 V

Circuit diagram related to headlamp, clearance lamp and tail lamp



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.

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	1	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L02 (female) (5) – fuse No. 4 of fuse box A	Resistance	Max. 1 Ω
			Wiring harness between fuse No. 4 of fuse box A – J16 (female) (1)	Resistance	Max. 1 Ω

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 • When the rear working lamp lights up (goes off) • If the clearance lamp does not light up or go off either, carry out troubleshooting for the clearance lamp first.

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	1	Broken bulb	If a specific working lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.		
	2	Defective fuse No. 8 of fuse box B	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 6.)		
	3	Defective front working lamp relay (L127)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L127 (male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			When front working lamp relay (L127) is replaced with a relay of the same type, if the condition becomes normal, the front working lamp relay is defective.		
	4	Defective front working lamp switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			S01 (male)	Front working lamp switch	Resistance
			Between (5) and (6)	ON	Max. 1 Ω
				OFF	Min. 1 MΩ
			Between (5), (6) and chassis ground	Constant	Min. 1 MΩ

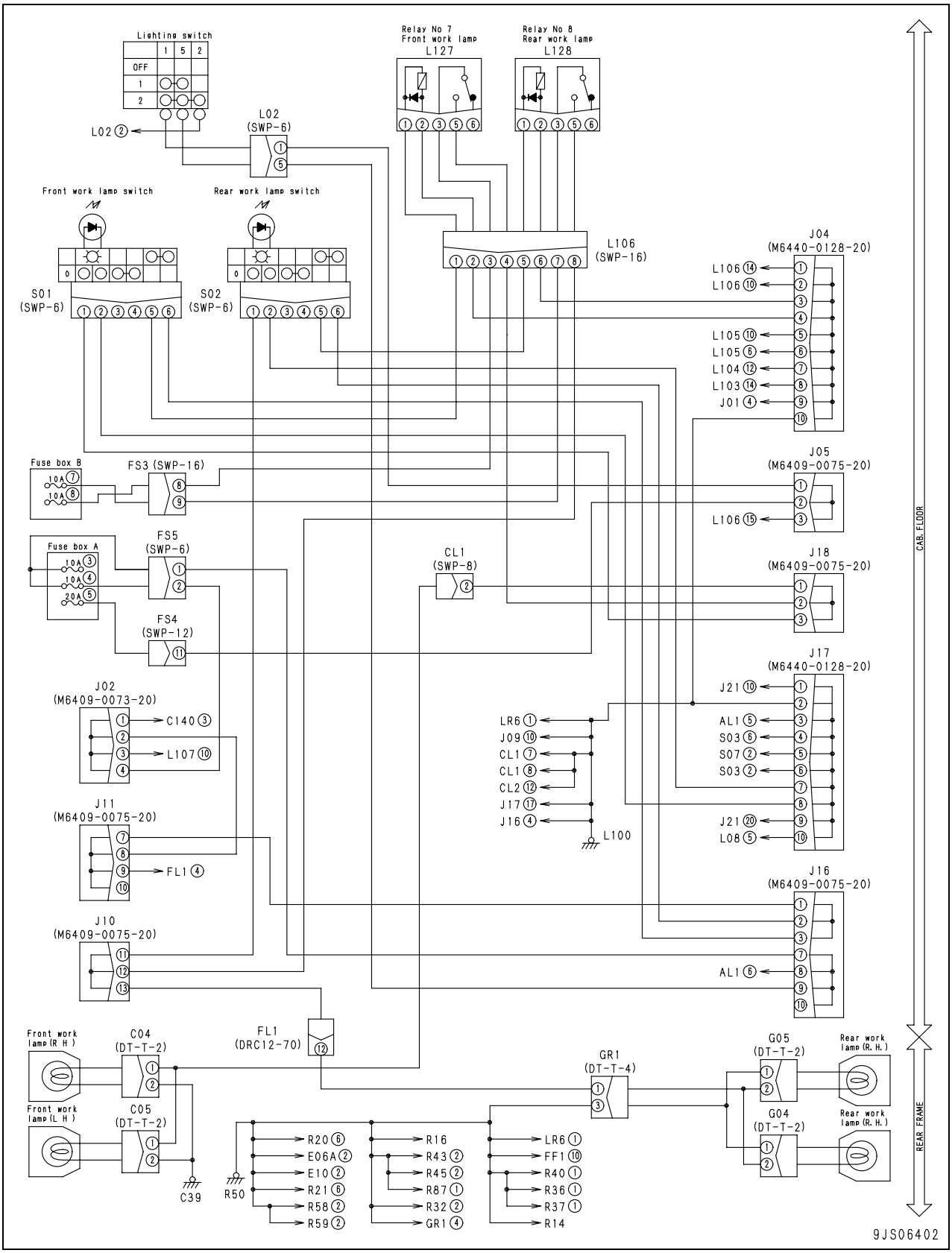
	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	5	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between J16 (female) (3) – S01 (female) (6)	Resistance	Max. 1 Ω
			Wiring harness between S01 (female) (5) – L127 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between L127 (female) (2) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between fuse No. 8 of fuse box B – L127 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between L127 (female) (5) – C04 (female) (1), – C05 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between C04 (female) (2), C05 (female) (2) – chassis ground	Resistance	Max. 1 Ω
	6	Ground 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 J16 (female) (3) – S01 (female) (6) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between S01 (female) (5) – L127 (female) (1) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between fuse No. 8 of fuse box B – L127 (female) (3) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L127 (female) (5) – C04 (female) (1), – C05 (female) (1), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
	7	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. • Front working lamp switch turned off		
			Wiring harness between J16 (female) (3) – S01 (female) (6) and chassis ground	Voltage	Max. 1 V
			Wiring harness between S01 (female) (5) – L127 (female) (1) and chassis ground	Voltage	Max. 1 V
			Wiring harness between fuse No. 8 of fuse box B – L127 (female) (3) and chassis ground	Voltage	Max. 1 V
			Wiring harness between L127 (female) (5) – C04 (female) (1), – C05 (female) (1), – circuit branch end and chassis ground	Voltage	Max. 1 V

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. • When the front working lamp and side working lamp (if equipped) light up (go off) • If the clearance lamp does not light up or go off either, carry out troubleshooting for the clearance lamp first.

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Broken bulb	If a specific working lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.			
	2	Defective fuse No. 7 of fuse box B	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 6.)			
	3	Defective rear working lamp relay (L128)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L128 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			When rear working lamp relay (L128) is replaced with a relay of the same type, if the condition becomes normal, the rear working lamp relay is defective.			
	4	Defective rear working lamp switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S02 (male)	Rear working lamp switch	Resistance	
			Between (5) and (6)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (5), (6) and chassis ground	Constant	Min. 1 MΩ	
	5	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between J16 (female) (2) – S02 (female) (6)	Resistance	Max. 1 Ω	
			Wiring harness between S02 (female) (5) – L128 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between L128 (female) (2) – chassis ground	Resistance	Max. 1 Ω	
			Wiring harness between fuse No. 7 of fuse box B – L128 (female) (3)	Resistance	Max. 1 Ω	
			Wiring harness between L128 (female) (5) – G04 (female) (2), – G05 (female) (2), – circuit branch end	Resistance	Max. 1 Ω	
			Wiring harness between G04 (female) (1), G05 (female) (1) – chassis ground	Resistance	Max. 1 Ω	

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	6	Ground 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 J16 (female) (2) – S02 (female) (6) and chassis ground	Resistance	Max. 1 Ω
			Wiring harness between S02 (female) (5) – L128 (female) (1) and chassis ground	Resistance	Max. 1 Ω
			Wiring harness between fuse No. 7 of fuse box B – L128 (female) (3) and chassis ground	Resistance	Max. 1 Ω
			Wiring harness between L128 (female) (5) – G04 (female) (2), – G05 (female) (2), – circuit branch end and chassis ground	Resistance	Max. 1 Ω
	7	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. • Front working lamp switch turned off		
			Wiring harness between J16 (female) (2) – S02 (female) (6) and chassis ground	Voltage	Max. 1 V
			Wiring harness between S02 (female) (5) – L128 (female) (1) and chassis ground	Voltage	Max. 1 V
			Wiring harness between fuse No. 7 of fuse box B – L128 (female) (3) and chassis ground	Voltage	Max. 1 V
			Wiring harness between L128 (female) (5) – G04 (female) (2), – G05 (female) (2), – circuit branch end and chassis ground	Voltage	Max. 1 V

Circuit diagram related to working lamp



E-6 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.
Related information	• The switch, lamp, or wiring harness of the turn signal lamp and hazard lamp system is defective. • The input state (ON/OFF) to the machine monitor from the turn signal lamp & hazard lamp switch (right turn signal lamp) can be checked with the monitoring function (Code: 40901, D-IN-12). • The input state (ON/OFF) to the machine monitor from the turn signal lamp & hazard lamp switch (left turn signal lamp) can be checked with the monitoring function (Code: 40901, D-IN-13).

	Causes		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective No.5 and No.14 fuses of fuse box B	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 6.)	
	2	Defective hazard relay (L111)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.	
			L111 (male)	Resistance
			Between (1) and (2)	200 – 400 Ω
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.	
			When hazard relay (L111) 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	Voltage
			Between (3) and (1)	20 – 30 V
			Between (4) and (1)	20 – 30 V and 0 V are indicated repeatedly.
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.	
			L19 (male)	Resistance
			Between (3), (4) and chassis ground	Min. 1 MΩ
	4	Defective flasher unit (Internal disconnection or short circuit) (KOHAG specification)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.	
			L19	Voltage
			Between (2) and (4)	20 – 30 V
			Between (1) and (4)	20 – 30 V and 0 V are indicated repeatedly.
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.	
			L19 (male)	Resistance
			Between (1), (2) and chassis ground	Min. 1 MΩ

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	5	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 lamp lever: Left	Min. 1 MΩ	
				Turn signal lamp lever: Neutral	Min. 1 MΩ	
				Turn signal lamp lever: Right	Max. 1 Ω	
				Hazard lamp switch: ON	Max. 1 Ω	
			Between (2) and (4)	Turn signal lamp lever: Left	Max. 1 Ω	
				Turn signal lamp lever: Neutral	Min. 1 MΩ	
				Turn signal lamp lever: Right	Min. 1 MΩ	
				Hazard lamp switch: ON	Max. 1 Ω	
			Between (1) and (5)	Hazard lamp switch: ON	Max. 1 Ω	
				Hazard lamp switch: OFF	Min. 1 MΩ	
			Between (1), (2), (3), (4) or (5) and chassis ground	Constant	Min. 1 MΩ	
	6	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L111 (female) (3) – L19 (female) (3)		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
	7	Disconnection in wiring harness (Disconnection or defective contact in connector) (KOHAG specification)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L111 (female) (3) – L19 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L19 (female) (1) – L03 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L19 (female) (4) – chassis ground		Resistance	Max. 1 Ω
	8	Ground 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 L111 (female) (3) – L19 (female) (3) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L19 (female) (4) – L03 (female) (2) and chassis ground		Resistance	Min. 1 MΩ
	9	Ground fault in wiring harness (Contact with ground circuit) (KOHAG specification)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L111 (female) (3) – L19 (female) (2) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L19 (female) (1) – L03 (female) (2) and chassis ground		Resistance	Min. 1 MΩ

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	10	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between L111 (female) (3) – L19 (female) (3) and chassis ground	Voltage	Max. 1 V
			Wiring harness between L19 (female) (4) – L03 (female) (2) and chassis ground	Voltage	Max. 1 V
	11	Hot short in wiring harness (Contact with 24V circuit) (KOHAG specification)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between L111 (female) (3) – L19 (female) (2) and chassis ground	Voltage	Max. 1 V
			Wiring harness between L19 (female) (1) – L03 (female) (2) and chassis ground	Voltage	Max. 1 V

Contents of trouble	(2) Turn signal lamp does not light up or go off.
Related information	• The switch, lamp, or wiring harness of the turn signal lamp system is defective. • When the hazard lamp lights up. • The input state (ON/OFF) to the machine monitor from the turn signal lamp and hazard lamp switch (right turn signal lamp) can be checked with the monitoring function (Code: 40901, D-IN-12). • The input state (ON/OFF) to the machine monitor from the turn signal lamp and hazard lamp switch (left turn signal lamp) can be checked with the monitoring function (Code: 40901, D-IN-13).

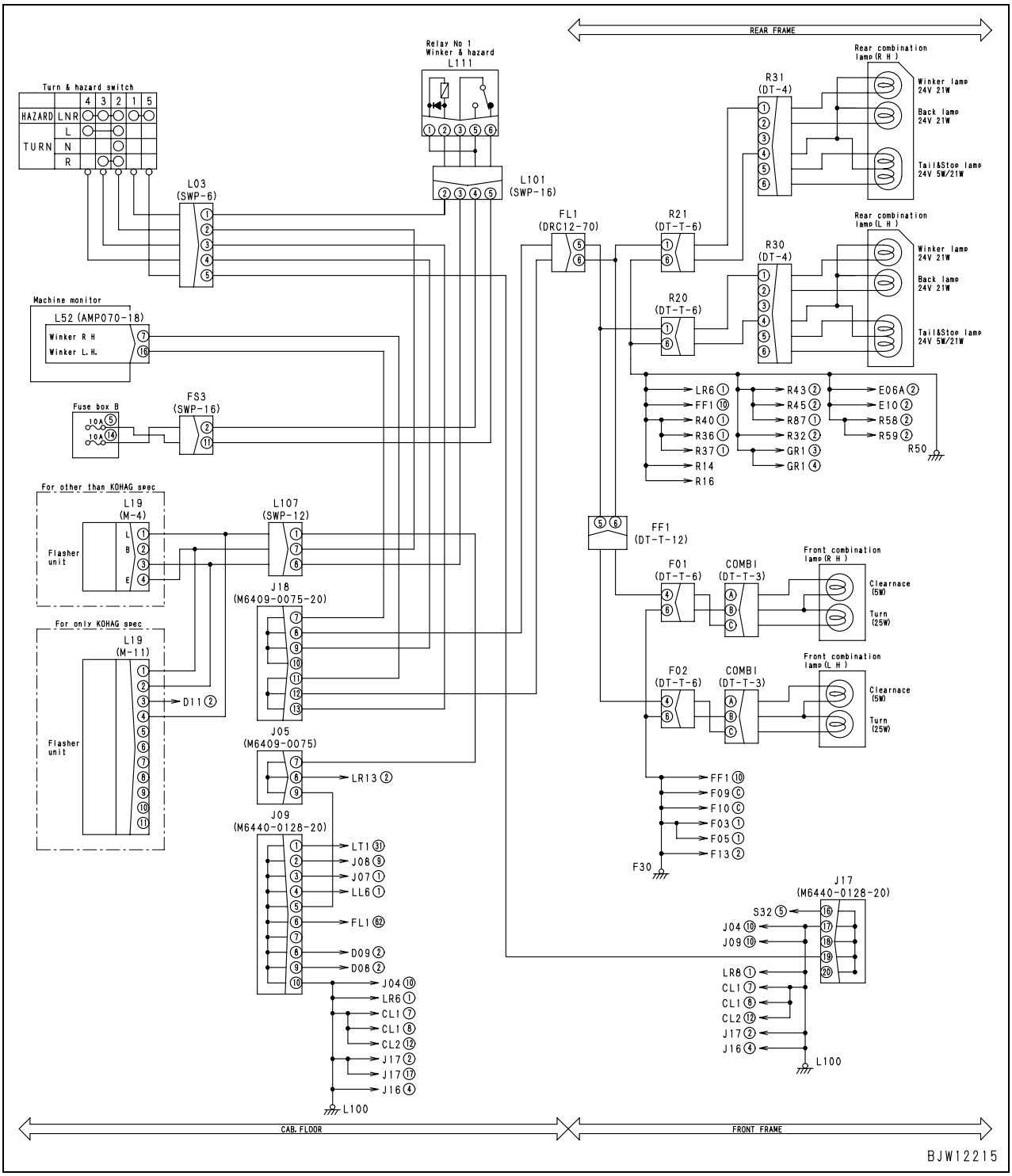
Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	1	Broken bulb	If a specific turn signal lamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.		
	2	Defective turn signal lamp and hazard lamp switches (Internal disconnection or short circuit)	L03 (male)	Turn signal lamp and hazard lamp switches	Resistance
			Between (2) and (3)	Turn signal lamp lever: Left	Min. 1 MΩ
				Turn signal lamp lever: Neutral	Min. 1 MΩ
				Turn signal lamp lever: Right	Max. 1 Ω
				HaΩard lamp switch: ON	Max. 1 Ω
			Between (2) and (4)	Turn signal lamp lever: Left	Max. 1 Ω
				Turn signal lamp lever: Neutral	Min. 1 MΩ
				Turn signal lamp lever: Right	Min. 1 MΩ
				Hazard lamp switch: ON	Max. 1 Ω
			Between (2), (3), (4) and chassis ground	Constant	Min. 1 MΩ

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	3	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L03 (female) (3) – R31 (female) (1), – right COMBI (female) (C)	Resistance	Max. 1 Ω
			Wiring harness between L03 (female) (4) – R30 (female) (1), – left COMBI (female) (C)	Resistance	Max. 1 Ω
			Wiring harness between R30 (female) (4) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between R31 (female) (4) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between right COMBI (female) (B) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between left COMBI (female) (B) – chassis ground	Resistance	Max. 1 Ω
	4	Ground 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) – R31 (female) (1), – right COMBI (female) (C), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L03 (female) (4) – R30 (female) (1), – left COMBI (female) (C), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
	5	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between L03 (female) (3) – R31 (female) (1), – right COMBI (female) (C), – circuit branch end and chassis ground	Voltage	Max. 1 V
			Wiring harness between L03 (female) (4) – R30 (female) (1), – left COMBI (female) (C), – circuit branch end and chassis ground	Voltage	Max. 1 V

Contents of trouble	(3) Hazard lamp does not light up or go off.
Related information	• The switch or lamp of the hazard lamp is defective. • Carry out the following troubleshooting when the turn signal lamp flashes normally.

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No. 14 of fuse box B	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 6.)			
	2	Defective hazard relay (L111)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L111 (male)		Resistance	
			Between (1) and (2)		200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			When hazard relay (L111) is replaced with a relay of the same type, if the condition becomes normal, the hazard relay is defective.			
	3	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 (1) and (5)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
			Between (1), (2), (3), (4) or (5) and chassis ground	Constant	Min. 1 MΩ	
	4	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 14 of fuse box B – L111 (female) (1), (5)		Resistance	Max. 1 Ω
			Wiring harness between L111 (female) (2) – L03 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L03 (female) (5) – chassis ground		Resistance	Max. 1 Ω
	5	Ground 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 B – L111 (female) (1), (5) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between L111 (female) (2) – L03 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	6	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. • When hot short resulted on the wiring harnesses of the following two circuits			
			Wiring harness between L03 (female) (3) – R31 (female) (1), – right COMBI (female) (C), – circuit branch end and chassis ground		Voltage	Max. 1 V
			Wiring harness between L03 (female) (4) – R30 (female) (1), – left COMBI (female) (C), – circuit branch end and chassis ground		Voltage	Max. 1 V

Circuit diagram related to turn signal lamp and hazard lamp



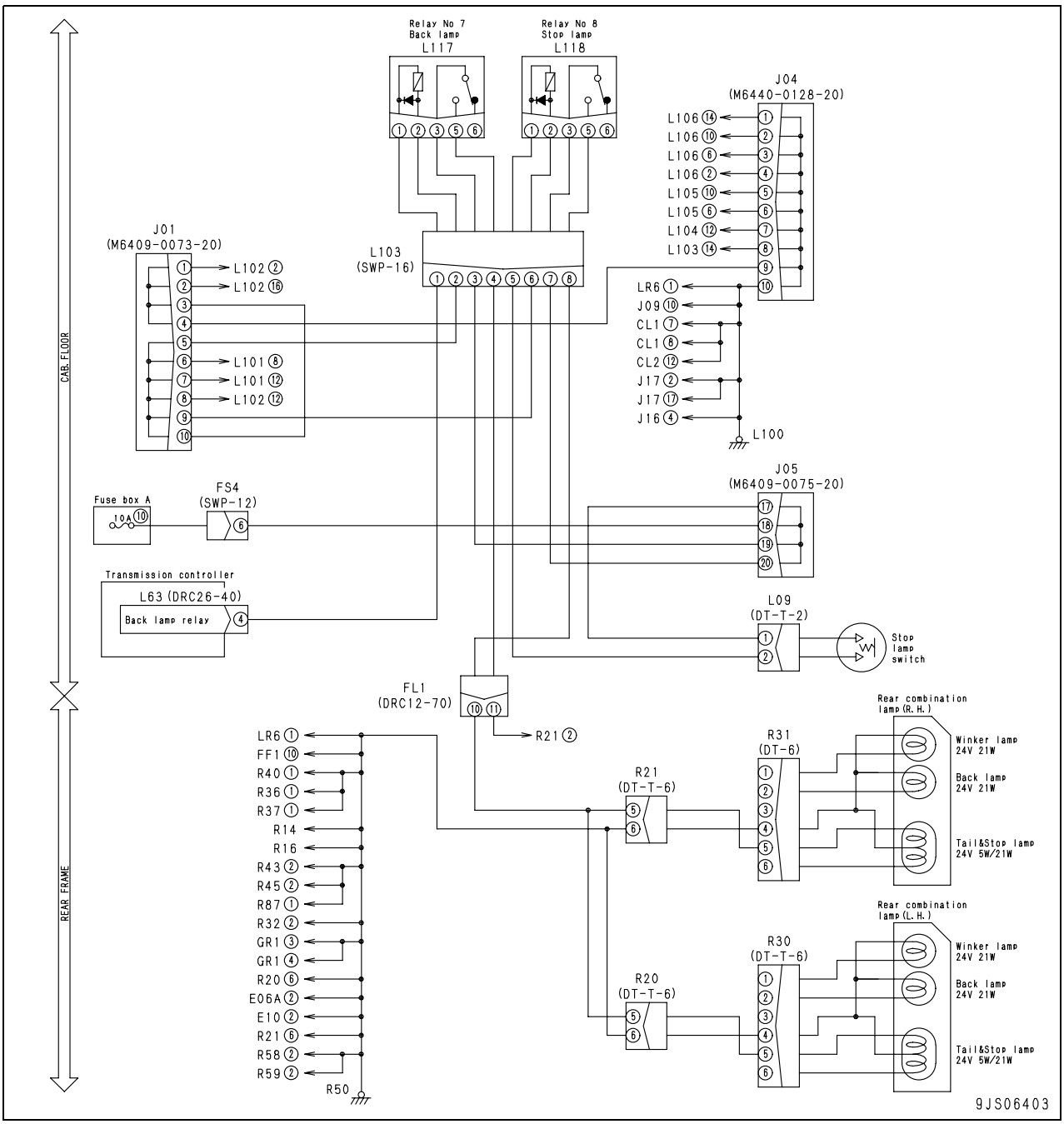
E-7 Brake lamp does not light or it keeps lighting up

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.

	Causes		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.10 of fuse box A	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 6.)			
	3	Defective brake lamp relay (L118) (Internal disconnection or short circuit)	★ 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 brake lamp relay (L118) 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.			
			L09 (male)	Brake pedal	Resistance	
			Between (1) and (2)	Press	Max. 1 Ω	
				Released	Min. 1 MΩ	
			Between (1), (2) and chassis ground	Constant	Min. 1 MΩ	
	5	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 10 of fuse box A – L118 (female) (3), – L09 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between L09 (female) (2) – L118 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between L118 (female) (2) – chassis ground	Resistance	Max. 1 Ω	
			Wiring harness between L118 (female) (5) – R30 (female) (5), – R31 (female) (5)	Resistance	Max. 1 Ω	
			Wiring harness between R30 (female) (4), R31 (female) (4) – chassis ground	Resistance	Max. 1 Ω	
	6	Ground 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. 10 of fuse box A – L118 (female) (3), – L09 (female) (1), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ	
			Wiring harness between L09 (female) (2) – L118 (female) (1) and chassis ground	Resistance	Min. 1 MΩ	
			Wiring harness between L118 (female) (5) – R30 (female) (5), – R31 (female) (5) and chassis ground	Resistance	Min. 1 MΩ	

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
	7	Hot short in wiring harness (Contact with 24V circuit)	Wiring harness between L09 (female) (2) – L118 (female) (1) and chassis ground	Voltage	Max. 1 V
			Wiring harness between L118 (female) (5) – R30 (female) (5), – R31 (female) (5) and chassis ground	Voltage	Max. 1 V

Circuit diagram related to brake lamp



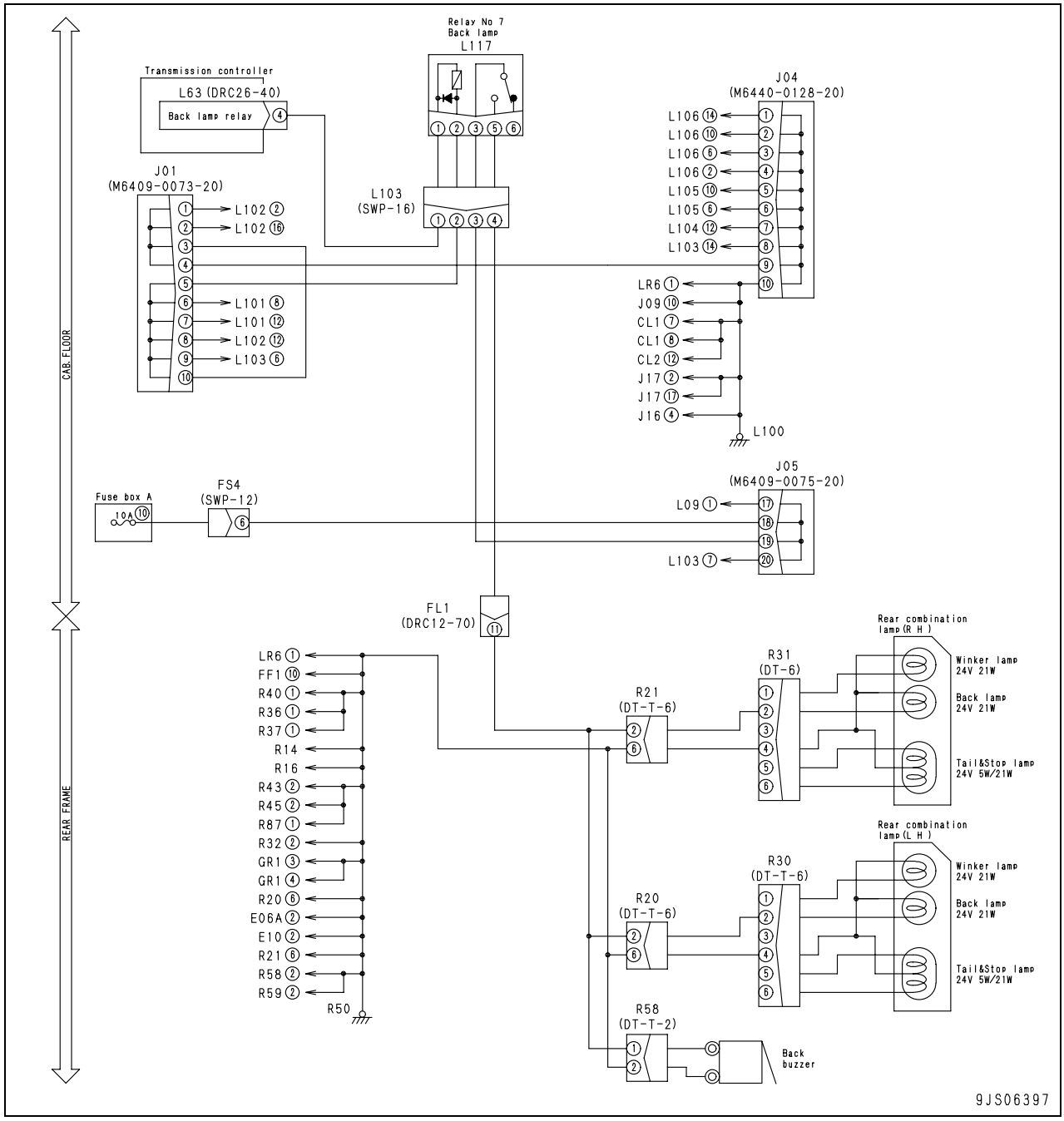
E-8 Backup lamp does not light or it keeps lighting up

Contents of trouble	Backup lamp does not light or it keeps lighting up.
Related information	• The transmission controller monitors the primary circuit of the backup lamp relay for a trouble. (If disconnection or short circuit occurs in the primary side of the back lamp relay, failure code [D160KA], [D160KB] or [D160KZ] is indicated. Carry out troubleshooting for it first.)

	Causes		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.10 of fuse box A	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 5.)		
	3	Defective backup lamp 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 backup lamp relay (L117) 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 in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 10 of fuse box A – L117 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between L117 (female) (5) – R30 (female) (2), – R31 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L63 (female) (4) – L117 (female) (1) • As a failure is detected, failure code [D160KA] is indicated.	Resistance	Max. 1 Ω
			Wiring harness between L117 (female) (2) – chassis ground • As a failure is detected, failure code [D160KA] is indicated	Resistance	Max. 1 Ω
			Wiring harness between R30 (female) (4) – chassis ground	Resistance	Max. 1 Ω
			Wiring harness between R31 (female) (4) – chassis ground	Resistance	Max. 1 Ω
	5	Ground 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. 10 of fuse box A – L117 (female) (3), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L117 (female) (5) – R30 (female) (2), – R31 (female) (2), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L63 (female) (4) – L117 (female) (1) and chassis ground • As a failure is detected, failure code [D160KB] or [D160KZ] is displayed	Resistance	Min. 1 MΩ

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	6	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between L117 (female) (5) – R30 (female) (2), – R31 (female) (2), – circuit branch end and chassis ground	Voltage	Max. 1 V

Circuit diagram related to backup lamp relay



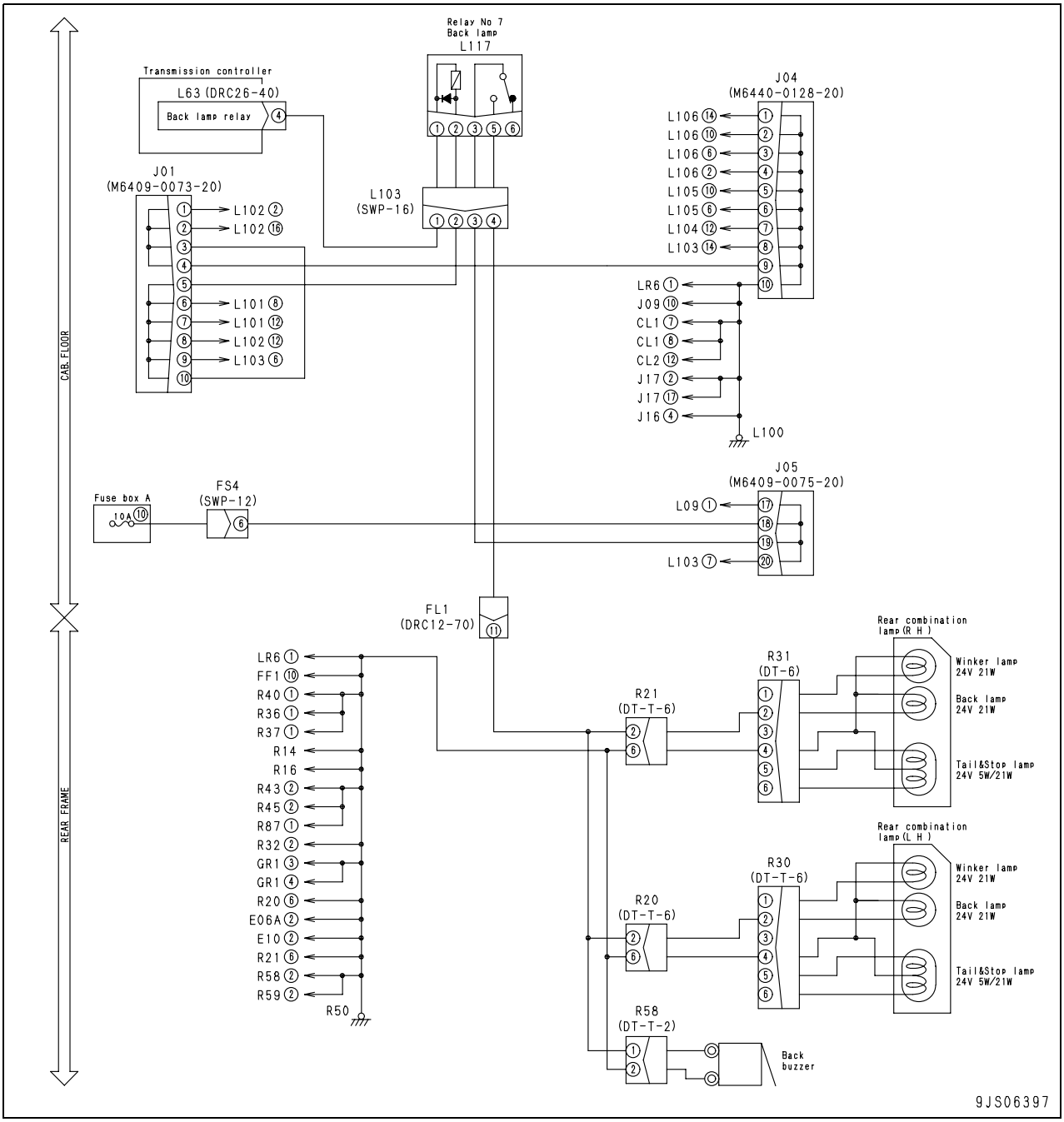
E-9 Backup buzzer does not sound or it keeps sounding

Contents of trouble	Backup buzzer does not sound or it keeps sounding.
Related information	• The transmission controller monitors the primary circuit of the backup lamp relay for a trouble. (If disconnection or ground fault occurs in the primary side of the back lamp relay, failure code [D160KA], [D160KB] or [D160KZ] is indicated. In such case, give precedence to the troubleshooting of the failure indicated with the code.)

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective backup buzzer (Internal disconnection or short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>R58</td><td>Gear shift lever</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (1) and (2)</td><td>R</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Other than R</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>2</td><td>Defective fuse No.10 of fuse box A</td><td colspan="4">If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 5.)</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Defective backup lamp relay (L101) (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 colspan="2">L117 (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 ON and carry out troubleshooting.</td></tr>
<tr><td colspan="4">When backup lamp relay (L117) is replaced with a relay of the same type, if the condition becomes normal, the backup lamp relay is defective.</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Disconnection in wiring harness (Disconnection or defective contact in 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. 10 of fuse box A – L117 (female) (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L117 (female) (5) – R58 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L63 (female) (4) – L117 (female) (1)
• As a failure is detected, failure code [D160KA] is indicated.</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L117 (female) (2) – chassis ground
• As a failure is detected, failure code [D160KA] is indicated.</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between R58 (female) (2) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Ground 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. 10 of fuse box A – L117 (female) (3) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L117 (female) (5) – R58 (female) (1), – circuit branch end and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
</table>

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	5	Ground fault in wiring harness (Contact with ground circuit)	Wiring harness between L63 (female) (4) – L117 (female) (1), – circuit branch end and chassis ground • As a failure is detected, failure code [D160KB] or [D160KZ] is indicated	Resis-tance	Min. 1 MΩ
	6	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between L117 (female) (5) – R58 (female) (1), – circuit branch end and chassis ground	Voltage	Max. 1 V

Circuit diagram related to backup buzzer



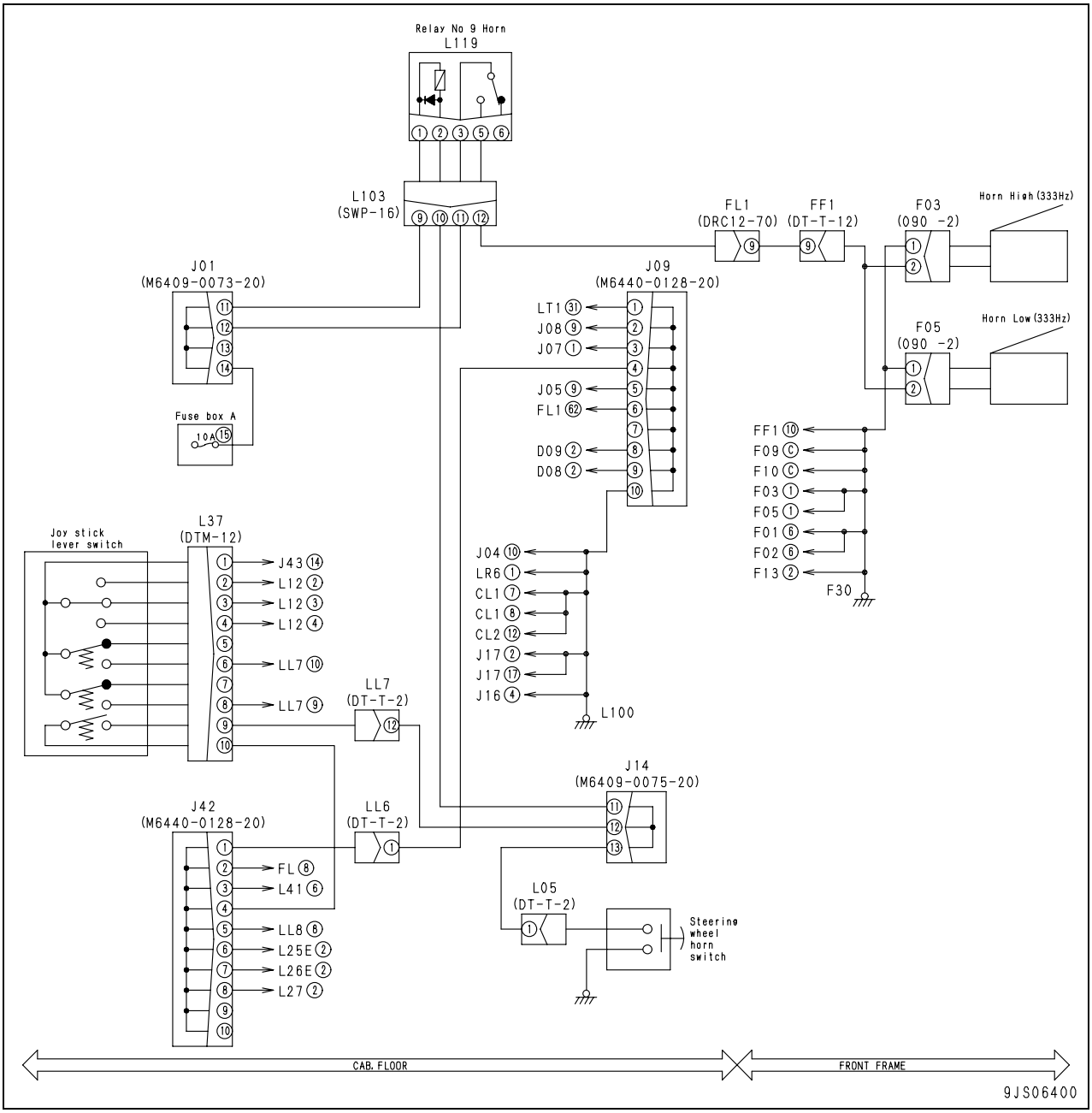
E-10 Horn does not sound or it keeps sounding

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="19">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse No.15 of fuse box A</td><td colspan="5">If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 7.)</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective horn relay (L119) (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">L119 (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="4">3</td><td rowspan="4">Defective steering wheel horn switch (Internal disconnection or short circuit)</td><td colspan="5">When horn relay (L119) is replaced with a relay of the same type, if the condition becomes normal, the horn 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>L05 (male)</td><td>Steering wheel horn switch</td><td colspan="3">Resistance</td></tr>
<tr><td rowspan="2">Between (1) and chassis ground</td><td>ON</td><td colspan="3">Max. 1 Ω</td></tr>
<tr><td>OFF</td><td colspan="3">Min. 1 MΩ</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective joystick lever 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>L37 (male)</td><td>Joystick lever horn switch</td><td colspan="3">Resistance</td></tr>
<tr><td rowspan="2">Between (9) and (10)</td><td>ON</td><td colspan="3">Max. 1 Ω</td></tr>
<tr><td>OFF</td><td colspan="3">Min. 1 MΩ</td></tr>
<tr><td rowspan="5">5</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, F05</td><td>Horn switch</td><td colspan="3">Voltage</td></tr>
<tr><td rowspan="2">Between F03 (2) and (1)</td><td>ON</td><td colspan="3">Max. 1 V</td></tr>
<tr><td>OFF</td><td colspan="3">20 – 30 V</td></tr>
<tr><td rowspan="2">Between F05 (2) and (1)</td><td>ON</td><td colspan="3">Max. 1 V</td></tr>
<tr><td>OFF</td><td colspan="3">20 – 30 V</td></tr>
<tr><td rowspan="7">6</td><td rowspan="7">Disconnection in wiring harness (Disconnection or defective contact in 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. 15 of fuse box A – L119 (female) (1), (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between L119 (female) (2) – L05 (female) (1), – L37 (female) (9)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between L119 (female) (5) – F03 (female) (2), – F05 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between F03 (female) (1) – F05 (female) (1) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between steering wheel horn switch – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between L37 (female) (10) – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
</table>

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	7	Ground 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. 15 of fuse box A – L119 (female) (1), (3), – circuit branch end and chassis ground	Resis-tance	Min. 1 MΩ
			Wiring harness between L119 (female) (5) – F03 (female) (2), – F05 (female) (2), – circuit branch end and chassis ground	Resis-tance	Min. 1 MΩ

Circuit diagram related to horn

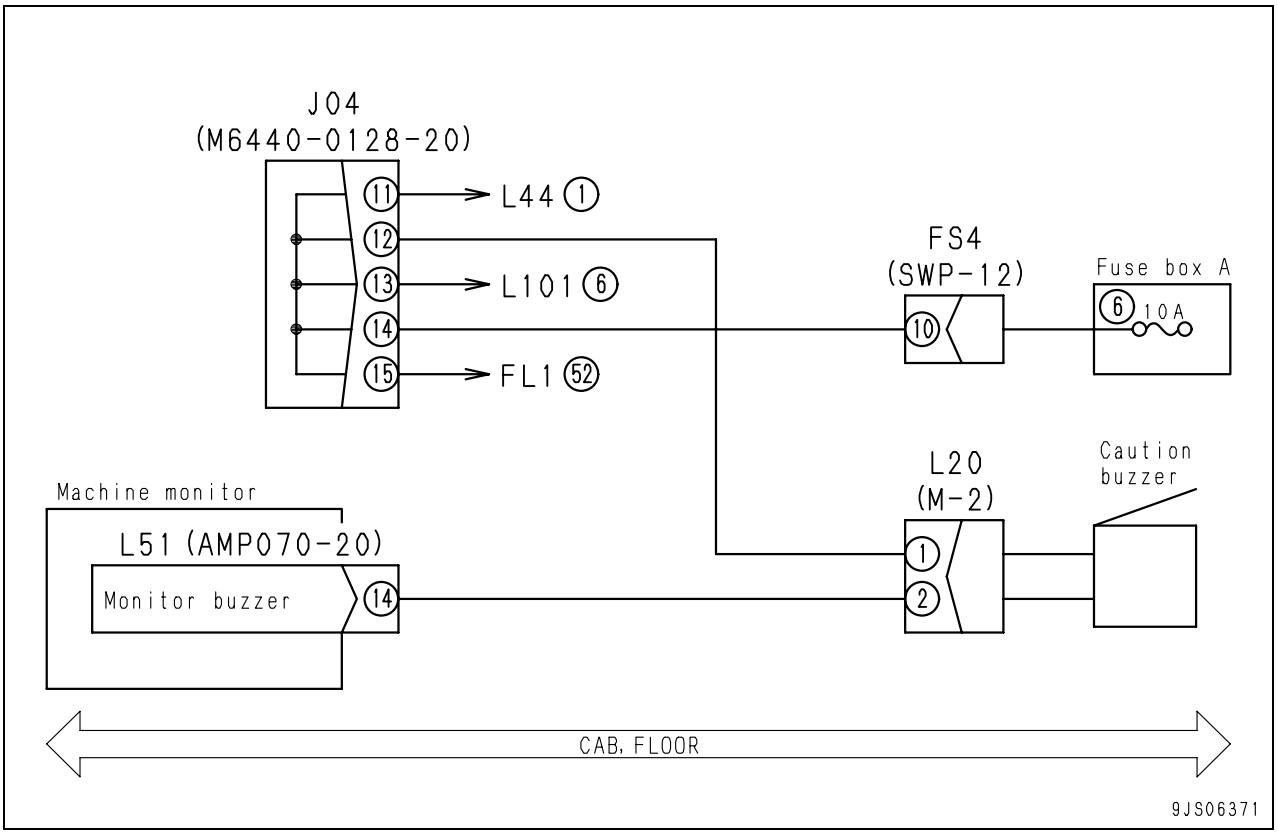


E-11 Alarm buzzer does not sound or it keeps sounding

Contents of trouble	• Alarm buzzer does not sound or it keeps sounding.
Related information	• Disconnection or ground fault in alarm buzzer output circuit • The output state (ON/OFF) from the alarm buzzer to the machine monitor can be checked with the monitoring function (Code: 40952, D-OUT-0). • If failure code [DV00KB] (Alarm buzzer: Short circuit) is indicated, carry out troubleshooting for it first.

	Causes		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 4.)		
	2	Defective alarm buzzer (Internal short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. • Remove the buzzer then connect +24 V to L20 (male) (1) and GND to L20 (male) (2).		
			Alarm buzzer sounds	Alarm buzzer is normal	
			Alarm buzzer does not sound	Defective alarm buzzer	
	3	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between fuse No. 6 of fuse box A – L20 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between L20 (female) (2) – L51 (female) (14)	Resistance	Max. 1 Ω
	4	Ground 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 – L20 (female) (1), – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L20 (female) (2) – L51 (female) (14) and chassis ground	Resistance	Min. 1 MΩ
	5	Defective machine monitor	• When above 1 – 4 are normal, failure on the machine monitor can be suspected.		

Circuit diagram related to alarm buzzer



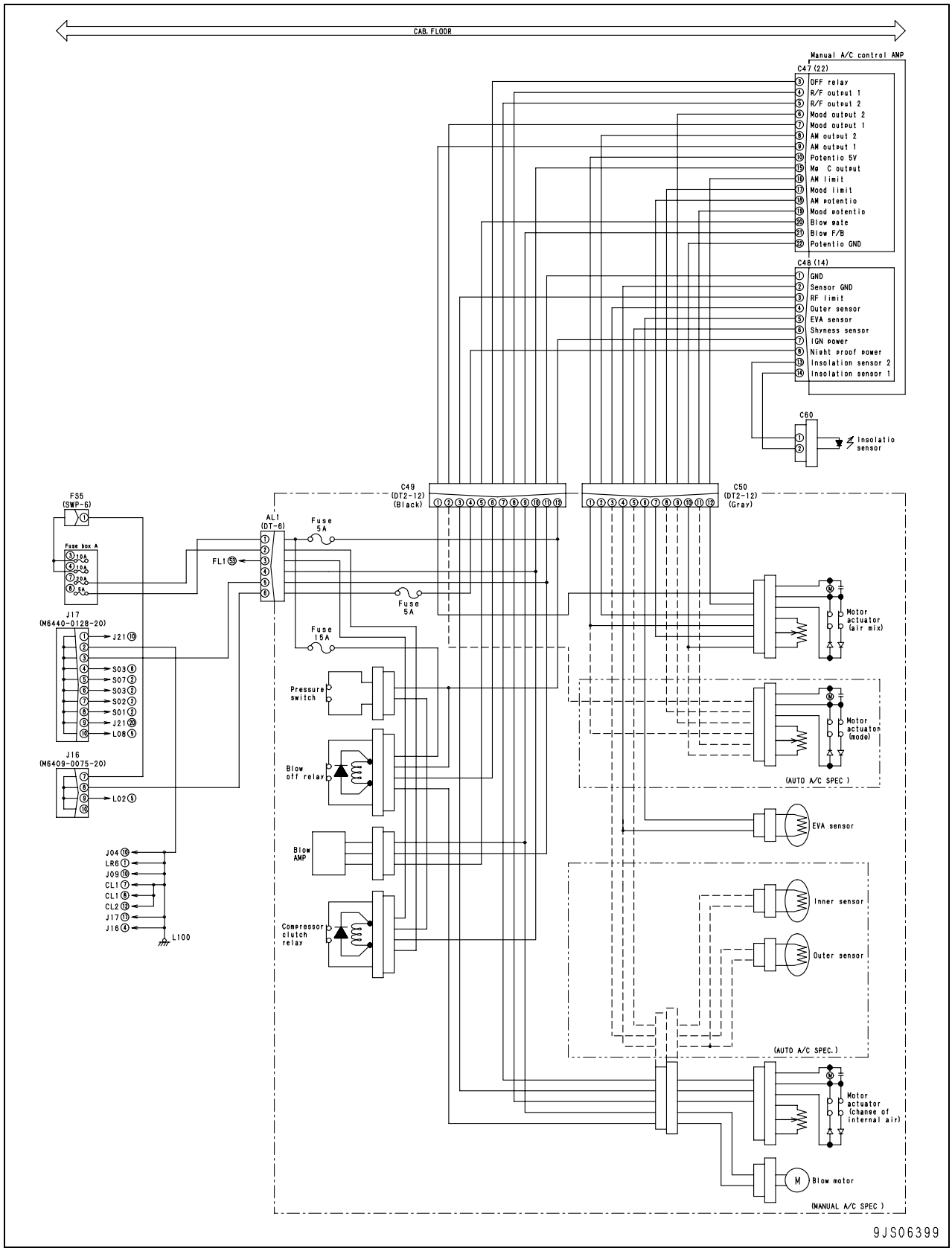
E-12 Air conditioner does not operate or stop

Contents of trouble	Air conditioner does not operate or stop.
Related information	• The following is troubleshooting applicable only to the power supply and GND circuit between the air conditioner and operator's cab. For troubleshooting of the air conditioner unit, see the Shop Manual for the air conditioner.

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective No.7 and No.8 fuses of fuse box A or defective 5A and 15A fuses of the main circuit in the air conditioner unit.	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 2.)			
	2	Grounding fault in power supply wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. • When fuse No. 8 of fuse box A is blown			
			Wiring harness between fuse No. 8 of fuse box A – 5A fuse of air conditioner main circuit, – 15A fuse in the air conditioner and chassis ground		Resistance	Min. 1 MΩ
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. • When fuse No. 7 of fuse box A is broken			
			Wiring harness between fuse No. 7 of fuse box A – compressor clutch relay and chassis ground		Resistance	Min. 1 MΩ
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. • When 5A fuse of the air conditioner unit main circuit is broken			
			Wiring harness between 5A fuse of air conditioner unit main circuit – C48 (female) (7), – pressure switch, – blower OFF relay primary side and chassis ground		Resistance	Min. 1 MΩ
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. • When 15A fuse of the air conditioner unit is broken			
			Wiring harness between 15A fuse of air conditioner unit – blower OFF relay and chassis ground		Resistance	Min. 1 MΩ
	3	Defective A/C control panel power supply and disconnection of GND wring harness (disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			C48	Starting switch	Voltage	
			Between (7) and (1)	ON	20 – 30 V	
				OFF	Max. 1 V	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 8 of fuse box A – C48 (female) (7)		Resistance	Max. 1 Ω
			Wiring harness between C48 (female) (1) – chassis ground		Resistance	Max. 1 Ω

<table>
<tr><td rowspan="14">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="14">4</td><td rowspan="14">Disconnection in wiring harness of relay power supply (Disconnection or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>Blower OFF relay, pressure switch</td><td>Starting switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Blower OFF relay (15A fuse line) and chassis ground</td><td>ON</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>OFF</td><td colspan="2">Max. 1 V</td></tr>
<tr><td rowspan="2">Blower OFF relay (5A fuse line of main circuit) and chassis ground</td><td>ON</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>OFF</td><td colspan="2">Max. 1 V</td></tr>
<tr><td rowspan="2">Pressure switch (5A fuse line of main circuit) and chassis ground</td><td>ON</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>OFF</td><td colspan="2">Max. 1 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 colspan="2">Wiring harness between fuse No. 8 of fuse box A – blower OFF relay (on the 15A fuse line)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between fuse No. 8 of fuse box A – blower OFF relay (on the 5A fuse line of main circuit)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between fuse No. 8 of fuse box A – pressure switch (on the 5A fuse line of main circuit)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between pressure switch – compressor clutch relay</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
</table>

Circuit diagram related to air conditioner

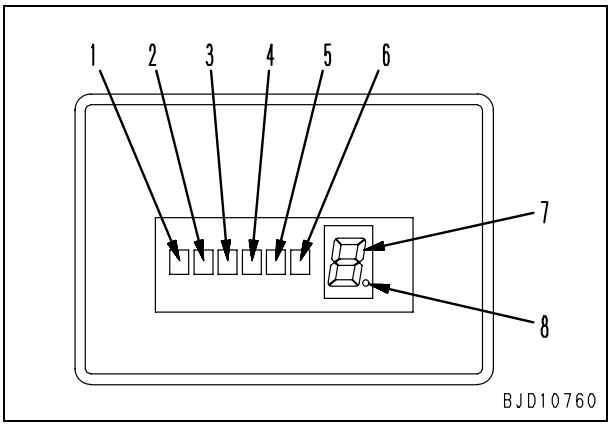


E-13 The KOMTRAX system does not work properly

Trouble	• The KOMTRAX system does not work properly.
Related information	• If the KOMTRAX system administrator asks you to check whether any defect occurs in the machine system, carry out the following troubleshooting. • A defect in the KOMTRAX system, if any, does not appear especially as a defective phenomenon.

<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="3">1</td><td rowspan="3">Defective power supply</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L80</td><td colspan="2">Signal</td><td>Voltage</td></tr>
<tr><td>Between (39), (40) – (37) and (38)</td><td colspan="2">Constant power supply</td><td>20 – 30 V</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Defective starting switch ACC signal and alternator R signal</td><td colspan="4">★ Turn the starting switch ON, then start engine and carry out troubleshooting.</td></tr>
<tr><td colspan="2">LED (6)</td><td colspan="2">Normal state</td></tr>
<tr><td colspan="2">LED-C1</td><td colspan="2">ON</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.</td></tr>
<tr><td>L80</td><td colspan="2">Signal</td><td>Voltage</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Defective starting switch C signal</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>L80</td><td colspan="2">Signal</td><td>Voltage</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Defective CAN connection state</td><td colspan="4">★ Turn the starting switch ON, and carry out troubleshooting.</td></tr>
<tr><td colspan="2">LED (4)</td><td colspan="2">Normal state</td></tr>
<tr><td colspan="2">LED-C4</td><td colspan="2">ON</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Number of unsent mails</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L80 (female)</td><td colspan="2">Signal</td><td>Resistance</td></tr>
<tr><td>Between (7) and (8)</td><td colspan="2">CAN</td><td>40 – 80 Ω</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Defective GPS positioning status</td><td colspan="4">★ Turn the starting switch ON, and carry out troubleshooting.</td></tr>
<tr><td colspan="2">LED (7)</td><td colspan="2">Normal state</td></tr>
<tr><td colspan="2">7 segments</td><td colspan="2">0 – 9</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Defective GPS positioning status</td><td colspan="4">★ Turn the starting switch ON, and carry out troubleshooting.</td></tr>
<tr><td colspan="2">LED (8)</td><td colspan="2">Normal state</td></tr>
<tr><td colspan="2">Dot</td><td colspan="2">ON</td></tr>
<tr><td colspan="5">One or more minute may be taken until GPS positioning is completed after the starting switch was turned ON even in an outdoor service area.</td></tr>
</table>

Lamp display section of KOMTRAX terminal



LED for communication module

1. LED-A1 (power indicator lamp)
2. LED-A2 (within communication range lamp)
3. LED-A3 (on communicating lamp)
4. LED-A4 (internal transmission lamp)
5. LED-A (internal reception lamp)

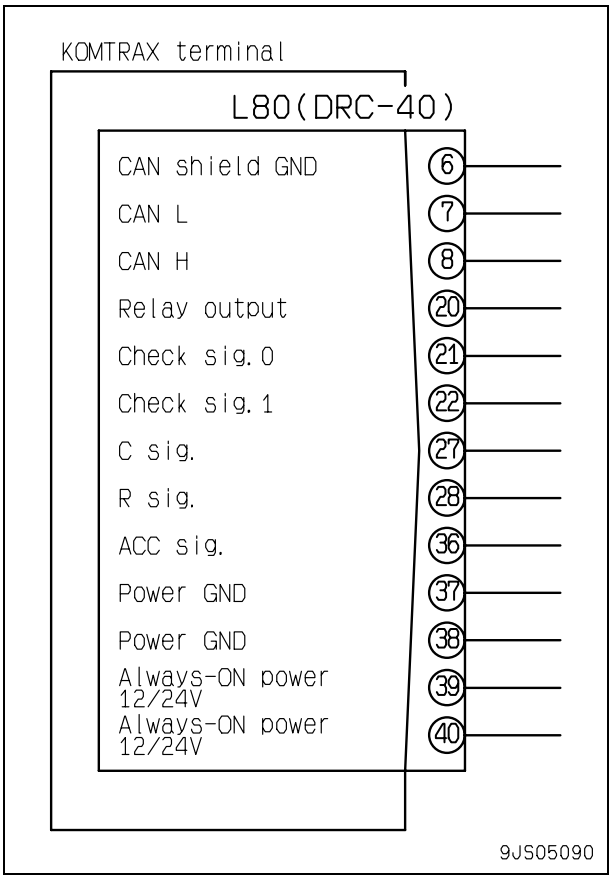
CPU LED

6. LED-C1 (R signal and ACC signal status)
7. LED-C2 (starting output status)
8. LED-C3 (S-NET, C signal status)
9. LED-C4 (CAN status)
10. LED-C5 (download writing condition)
11. LED-C6 (download writing condition)

7 segments and dot for CPU

12. 7 segments (number of mails not yet sent)
13. Dot (GPS positioning in progress)

L80 connector



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

40 Troubleshooting

Troubleshooting of hydraulic and mechanical system (H-mode)

Troubleshooting of hydraulic and mechanical system (H-mode) 3
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H-20 Lift arm speed is low or rising force of lift arm is insufficient ... 33
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H-28 The bucket cylinder cannot hold down the bucket ... 37
H-29 Hydraulic drifts of the bucket is large ... 37
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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?

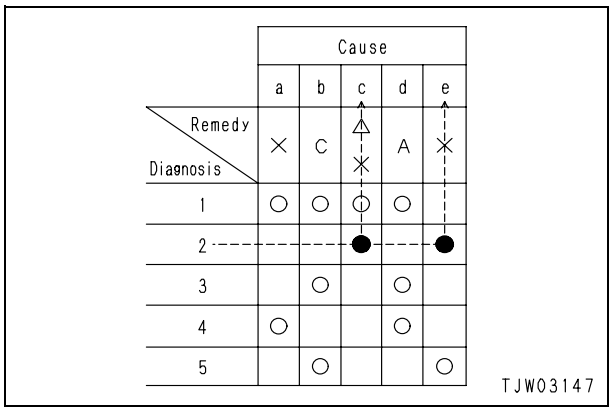
Step 3. Method of reading matrix

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]

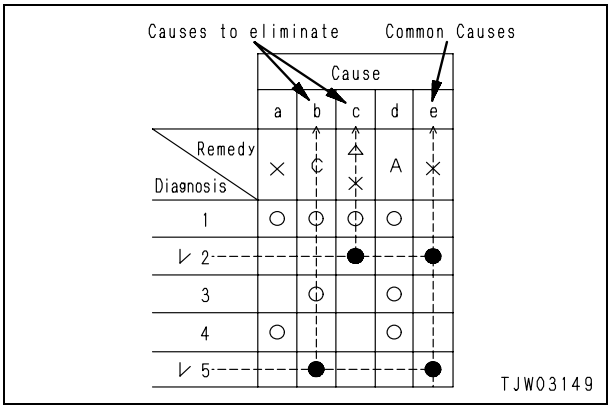
No.	Remedys / Diagnosis
1	Steering does not turn in both directions (left and right)
2	Steering turns only in one direction (left or right)
3	Steering is heavy when turned in both directions (left and right)
4	Steering wheel is heavy in one direction (left or right)
5	Work equipment moves

2. Find the matching cause in the Cause column. In the same way as in Step 2), if a problem is found, the Q marks on the same line for the troubleshooting item 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 ○ marks:
   Go to Step 3) to narrow down the cause.

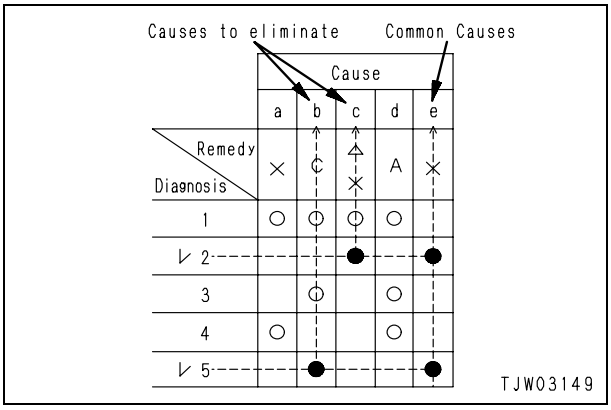


3. Operate the machine and carry out troubleshooting of the items not checked in Step 1. Operate the machine in the same way as in Step 1, and if any problem occurs, put a check against the item. (In Troubleshooting item 5 in the diagram below, the problem was re-enacted.)

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, take the action given in the remedy line.
Marks and remedies in remedy line
×: Replace △: Repair A: Adjust C: Clean

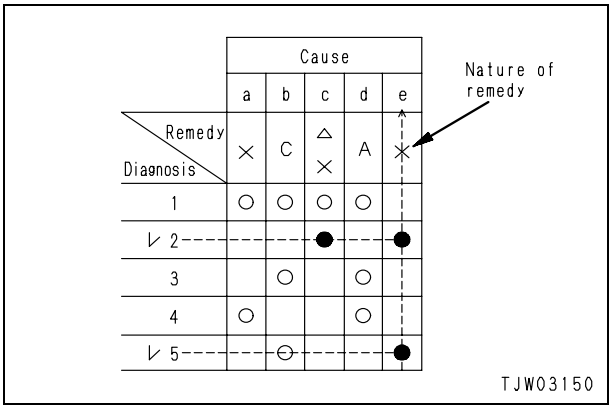


Table of failure modes and causes

Failure mode \ Part that can cause failures		Defective engine	The PTO is defective	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
Power train	Machine does not start		○	○	○	○	○			○	○	○
	Torque converter lockup is not switched off (engine stalls) [Lockup clutch specification (if equipped)]											
	Torque converter lockup is not turned on [Lockup clutch specification (if equipped)]										○	○
	Travel speed is slow, the thrusting force is weak, the uphill traveling power is weak, and the gear is not shifted	○		○	○	○	○	○	○	○	○	○
	Large shocks are made when machine starts and gear is shifted			○	○	○					○	○
	Large time lag is made when machine starts and gear is shifted			○	○	○					○	○
	Torque converter oil temperature is high	○		○	○	○	○		○		○	
Steering	Steering does not turn		○									
	Steering does not turn [Joystick steering specification (if equipped)]		○									
	Steering response is low		○									
	Steering response is low [Joystick steering specification (if equipped)]		○									
	Steering is heavy											
	Steering wheel shakes or makes large shocks											
	Steering wheel shakes or makes large shocks [Joystick steering specification (if equipped)]											
Brake	Wheel brake does not work or braking force is low											
	Wheel brake does not reset or drag											
	Parking brake does not work or braking force is low											
	The 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 lift arm rises, its speed lowers at specific height											
	The lift arm cylinder cannot hold down the bucket (Bucket floats)											
	Hydraulic drift of lift arm is large											
	Lift arm shakes during operation											
	Bucket does not tilt		○									
	Bucket speed is low or tilt-back force is insufficient											
	Bucket speed goes low during tilt-back operation											
	Bucket cannot be held with bucket cylinder											
	Hydraulic drift of bucket is large											
	Bucket shakes during travel with load (Work equipment valve is in HOLD)											
	Lift arm and bucket control levers do not move smoothly and they are heavy											
	Large engine speed reduction or engine stall occurs during work equipment control	○										
	Large shock is made when work equipment starts and stops											
	When work equipment is relieved singly, other work equipment moves											
	ECSS does not operate, allowing pitching or bouncing to occur											

Troubleshooting No.	Defective operation of relevant ECMV	Defect of transmission controller system	Internal breakage of transmission	War or seizure of relevant clutch	Low oil pressure due to defective transmission valve	Defective clutch piston	The relevant clutch piston seal is defective	Defective seal of relevant clutch shaft	Clogging of transmission breather	Defective 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 flow control spool	Defective steering spool of steering valve	Defective overload relief valve	Defective seal of steering cylinder piston	Clogging of joystick steering solenoid valve line filter	Defective joystick steering solenoid valve	Defective steering wheel or steering shaft	Defective seal of brake piston	Defective operation of brake piston	Failure inside wheel brake valve	Wear or abnormality of wheel brake disc	Contact of metallic site due to complete wear on wheel brake disc	Defective fan pump	Clogging or air intake on fan pump suction side	Air in wheel brake circuit	Defective brake valve
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-35											○																							

Failure mode / Part that can cause failures		Gas leakage from accumulator, defective seal of piston	Defective accumulator charge valve	Defective operation of check valve (between last chance filter and parking brake solenoid)	Damages on parking brake switch line wiring harness	Defective parking brake emergency release valve	Defective operation of parking brake solenoid valve	Defective parking brake spring
Power train	Machine does not start			○		○	○	
	Torque converter lockup is not switched off (engine stalls) [Lockup clutch specification (if equipped)]							
	Torque converter lockup is not turned on [Lockup clutch specification (if equipped)]							
	Travel speed is slow, the thrusting force is weak, the uphill traveling power is weak, and the gear is not shifted							
	Large shocks are made when machine starts and gear is shifted							
	Large time lag is made when machine starts and gear is shifted							
	Torque converter oil temperature is high							
Steering	Steering does not turn		○					
	Steering does not turn [Joystick steering specification (if equipped)]		○					
	Steering response is low		○					
	Steering response is low [Joystick steering specification (if equipped)]		○					
	Steering is heavy		○					
	Steering wheel shakes or makes large shocks		○					
	Steering wheel shakes or makes large shocks [Joystick steering specification (if equipped)]		○					
Brake	Wheel brake does not work or braking force is low	○	○					
	Wheel brake does not reset or drag							
	Parking brake does not work or braking force is low					○	○	○
	Parking brake cannot be reset or it drags				○	○	○	
Work equipment	Lift arm does not rise		○					
	Lift arm speed is low or rising force of lift arm is insufficient		○					
	When lift arm rises, its speed lowers at specific height							
	The lift arm cylinder cannot hold down the bucket (Bucket floats)							
	Hydraulic drift of lift arm is large							
	Lift arm shakes during operation							
	Bucket does not tilt		○					
	Bucket speed is low or tilt-back force is insufficient		○					
	Bucket speed lowers during tilt-back operation		○					
	Bucket cannot be held with bucket cylinder							
	Hydraulic drift of bucket is large							
	Bucket shakes while machine is traveling with load (Work equipment valve is in HOLD)							
	Lift arm and bucket control levers do not move smoothly and are heavy							
	Engine speed lowers remarkably or engine stalls during work equipment control							
	Large shock is made when work equipment starts and stops							
	When work equipment is relieved singly, other work equipment moves							
	ECSS. does not operate, and pitching or bouncing occurs	○						

Defective operation of parking brake piston	The parking brake piston seal is defective	Wear of parking brake disc	Pinching due to peeling of parking brake disc	Defective harness of parking brake switch line	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	Malfunction of lift arm pressure compensation valve of work equipment	Defective safety-suction valve on bucket head side of work equipment valve	Defective safety-suction valve on bucket bottom side of work equipment valve	Malfunction of PPC valve spool	Defective PPC valve body	Malfunction of bucket pressure compensation valve of work equipment	Malfunction of work equipment back pressure 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 electric 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-35

H-1 The machine does not start

Ask the operator about the following questions.

- Has the machine come not to start suddenly?
  → **Seizure of clutch, breakage of parts**
  Did any abnormal noise occur at the time and where?

Testing before troubleshooting

- Does the machine monitor function normally?
- Is any failure code of the electrical system displayed on the machine monitor?
- Are the transmission oil level and the oil type appropriate?
- Did you smell deteriorated or burnt transmission oil?
- Haven't 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		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	Drop of main relief valve set pressure	Clogging of last chance filter	Defective operation of relevant ECMV	Internal breakage of transmission	War or seizure of relevant clutch	The relevant clutch piston seal is defective	Defective seal of relevant clutch shaft	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
			Causes																
			Torque converter charging pump				Torque converter	Defective 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
			△ x	△ C	△ x	x	△ x	△ x	△ x	x	*	△ x	*	*	x	△ x	△ x	x	x
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			○	○														
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 vibrates		○	○														
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 troubleshooting, 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

Gear Speed		Clutch					
		F	R	1st	2nd	3rd	4th
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 can not be changed.

No.		Diagnosis / Remedy	Failure code	Causes: 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	Causes: 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 off (engine stalls) [Machine with lockup clutch (if equipped)]

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 switched on [Machine with lockup clutch (if equipped)]

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	Cause a: Drop of transmission main relief valve set pressure (△ x)	b: Defective operation of lockup clutch ECMV (x)	c: Defective seal of lockup clutch piston (x)	d: Wear or seizure of lockup clutch disc (x)	e: Crack on lockup clutch case (x)	f: Clogging of last chance filter (C)	g: Defective seal of lockup clutch shaft (x)
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 The travel speed is slow, the thrusting force is weak, the uphill traveling power is weak, and the gear is not shifted

Ask the operator about the following questions.
- 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

Checking for abnormalities
- 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

Testing 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 pipes 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 Engine system troubleshooting (S mode).

No.	Diagnosis \ Remedy		Causes: Torque converter charging pump			Torque converter oil cooler		Torque converter		Defective main relief valve			ECMV	Transmission				Parking brake	Others	
			a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
			Clogging of strainer	Clogging or air intake on pump suction side	The charging pump is defective	Clogging of oil cooler and pipe (After torque converter outlet)	Breakage of oil cooler and pipe (After torque converter outlet)	Oil leak inside torque converter	Internal breakage of torque converter	Defective operation of torque converter relief valve	Drop of main relief valve set pressure	Clogging of last chance filter	Defective operation of relevant ECMV	Internal breakage of transmission	The relevant clutch piston seal is defective	Defective seal of relevant clutch shaft	Clogging of breather	The parking brake piston seal is defective	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	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 rises abnormally high		○	○	○	○	○	○	○	○				○			○		○	
5	The transmission oil level rises or falls					○	○										○		○	○
6	Metal powders (Aluminum, copper, iron, etc.) are adhered to the transmission filter and 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 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 vibrates	○	○																
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 troubleshooting, 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

Gear Speed		Clutch					
		F	R	1st	2nd	3rd	4th
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 can not be changed.

No.		Diagnosis / Remedy	Failure code	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	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)
				Causes: Transmission						ECMV					
				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 questions.

- 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**

Testing 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-4**

Testing 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 pipes 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?
- Is the initial learning of transmission completed? (Refer to the section “Testing and adjusting”.)

No.	Diagnosis \ Remedy		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	The relevant clutch piston seal is defective	Defective return (Release) of relevant clutch piston	Defective seal of relevant clutch shaft	The parking brake piston seal is defective	Defective transmission oil temperature sensor
			Causes: Torque converter charging pump			Defective main relief valve		ECMV		Transmission			Parking brake	Sensors
			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).”

**: Proceed to the paragraph of “Troubleshooting of transmission controller system (TM mode).”

*** 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 troubleshooting, 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 can not be changed.

No.		**Remedy / Diagnosis**	**Failure code**	**Causes**											
				Transmission						ECMV					
				a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
				Wear or seizure of F clutch disc or wear of piston seal	Wear or seizure of R clutch disc or wear of piston seal	Wear or seizure of 1st clutch disc or wear of piston seal	Wear or seizure of 2nd clutch disc or wear of piston seal	Wear or seizure of 3rd clutch disc or wear of piston seal	Wear or seizure of 4th clutch disc or wear of piston seal	Defective operation of F clutch ECMV (Fill switch)	Defective operation of R clutch ECMV (Fill switch)	Defective operation of 1st clutch ECMV (Fill switch)	Defective operation of 2nd clutch ECMV (Fill switch)	Defective operation of 3rd clutch ECMV (Fill switch)	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-4**

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: a Clogging of strainer	b Clogging or air intake on pump suction side	c The charging pump is defective	d Drop of main relief valve set pressure	e Clogging of last chance filter	f Defective operation of relevant ECMV ★	g The relevant clutch piston seal is defective	h Defective seal of relevant clutch shaft	i The parking brake piston seal is defective	j Defective transmission oil temperature sensor
			Torque converter charging pump			Main relief valve		ECMV	Transmission		Parking brake	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 troubleshooting, 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				●		
	N 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 can not be changed.

No.		Diagnosis / Remedy	Failure code	Causes: 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 The torque converter oil temperature is high

Ask the operator about the following questions.

- 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**

Checking for abnormalities

- Measure the torque converter oil temperature to find if the oil temperature is really high.
  → **The torque converter oil temperature gauge is defective**

Testing before troubleshooting

- Are the coolant level in the radiator and the fan 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 Engine system troubleshooting (S mode).

No.	Diagnosis \ Remedy		Causes: Torque converter charging pump			Torque converter oil cooler		Torque converter		Main relief	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 pipe (After torque converter outlet)	Breakage of oil cooler and pipe (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 or falls					○	○					○		
5	Metal powers (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 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

Ask the operator about the following questions.

- Did the problem suddenly start? → **Breakage of related equipment**
  Did the machine cause any abnormal noise at the time and where?

Testing 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		Causes: Hydraulic pump a: The PTO is defective	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	Defective Orbit-roll f: Defective Orbit-roll	Defective stop valve g: Defective stop valve	Steering valve h: Malfunction of flow control spool	Steering valve i: Defective actuation of steering spool	Steering valve j: Defective overload relief valve	Hydraulic cylinder k: Defect in steering cylinder (defective piston seal)
	Remedy		△ x	△	△ x	△ x	△ 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	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 fan pump or hydraulic tank			○		○							
9	When steering relief pressure is measured	Oil pressure is low or there is no oil pressure in both directions (left and right)	○	○	○	○	○	○		○	○		○
10		Oil pressure is low or there is no oil 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 joystick steering (if equipped)]

Ask the operator about the following questions.

- Did the problem suddenly start?
  → Breakage of related equipment
  Did the machine cause any abnormal noise at the time and where?

Testing 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 safety bar been removed from the frame?
- Is the connect of the connector of joystick steering ON/OFF switch correct?

No.	Diagnosis / Remedy		Causes: The PTO is defective (△ x)	Air sucked in at suction end of pump (△)	Defective steering pump (△ x)	Defective fan pump (△ x)	Defective accumulator charge valve (△ x)	Defective Orbit-roll (△ x)	Clogged line filter (C x)	Defective joystick steering solenoid valve (x)	Malfunction of stop valve (△ x)	Malfunction of flow control spool (△ x)	Defective actuation of steering spool (△ x)	Defective overload relief valve (x)	Defect in steering cylinder (defective piston seal) (x)
			a	b	c	d	e	f	g	h	i	j	k	l	m
1	When joystick ON/OFF switch is operated	Steering does not move (steering wheel mode only)						○							
2		Steering does not move (joystick mode only)							○	○					
3		Steering does not move in either mode	○	○	○	○	○				○	○	○	○	○
4	Steering does not turn in both directions (left and right)		○	○	○	○	○	○	○	○		○	○		○
5	Steering turns only in one direction (left or right)										○			○	
6	Joystick steering is heavy in both directions (left and right)					○	○	○					○		
7	Joystick steering is heavy in one direction (left or right)										○				
8	Work equipment moves				○			○	○	○	○	○	○	○	○
9	Work equipment does not move		○	○		○	○								
10	Abnormal noise comes from around PTO		○												
11	Abnormal noise comes from around fan pump or hydraulic tank			○		○									
12	When steering relief pressure is measured	Oil pressure is low or there is no oil pressure in both directions (left and right)	○	○	○	○	○	○	○	○		○	○		○
13		Oil pressure is low or there is no oil pressure in one direction (left or right)									○			○	
14	When Orbit-roll output pressure is measured, oil pressure is found to be low or there is no oil pressure		○	○		○	○	○							
15	When joystick steering EPC solenoid valve output pressure is measured, oil pressure is found to be low or there is no oil pressure		○	○		○	○		○	○					
16	When Orbit-roll basic pressure is measured	Oil pressure is low	○	○		○	○								
17		There is no oil pressure	○	○		○									

H-10 Steering response is low

Ask the operator about the following questions.

- 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

Testing before troubleshooting

- Is oil level in hydraulic tank correct? Is the type of oil correct?

No.	Diagnosis \ Remedy		Causes: Hydraulic pump					Charge valve	Defective Orbit-roll	Defective stop valve	Steering valve				Hydraulic cylinder
			a	b	c	d	e	f	g	h	i	j	k	l	m
			The PTO is defective	Clogging or air intake on pump suction side	Defective fan pump	Defective steering pump	Defective steering pump servo	Defective accumulator charge valve	Defective Orbit-roll	Defective stop valve	Malfunction of flow control spool	Defective main relief valve	Defective steering spool	Defective overload relief valve	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 fan pump or hydraulic tank			○		○									
9	When steering relief pressure is measured	Oil pressure is low or there is no oil pressure in both directions (left and right)	○	○	○	○	○	○	○		○	○			○
10		Oil pressure is low or there is no oil 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 oil 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 steering is poor [machine with joystick steering (if equipped)]

Ask the operator about the following questions.

- 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 steering related parts, defective seal

Testing before troubleshooting

- Is oil level in hydraulic tank correct? Is the type of oil correct?

No.	Diagnosis \ Remedy		Causes														
			Steering pump					Charge valve	Joystick steering solenoid valve	Defective stop valve	Steering valve					Hydraulic cylinder
			a	b	c	d	e	f	g	h	i	j	k	l	m	n
			The PTO is defective	Clogging or air intake on pump suction side	Defective fan pump	Defective steering pump	Defective steering pump servo	Defective accumulator charge valve	Clogged line filter	Defective joystick steering solenoid valve	Defective stop valve	Malfunction of flow control spool	Defective main relief valve	Defective actuation of steering spool	Defective overload relief valve	Defect in steering cylinder (defective piston seal)
			△ x	△	△ x	△ x	△ x	△ x	C x	x	△ x	△ x	△ x	△ x	x	△ x
1	Turning, response of joystick steering is poor in both directions (left and right)		○	○	○	○	○	○	○	○		○	○	○		○
2	Turning, response of joystick steering is poor in one direction (left or right)										○				○	
3	Joystick steering is heavy in both directions (left and right)				○			○						○		
4	Joystick 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 oil pressure in both directions (left and right)	○	○	○	○	○	○	○	○		○	○			○
10		Oil pressure is low or there is no oil pressure in one direction (left or right)									○				○	
11	When joystick steering solenoid valve output pressure is measured, oil pressure is found to be low or there is no oil pressure		○	○	○			○	○	○						
12	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

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 questions.

- Did the problem suddenly start? → **Breakage of related equipment broken**
- Was there previously any symptom that may lead to heavy steering? → **Wear of steering related parts, defective seal**

Testing before troubleshooting

- Is oil level in hydraulic tank correct? Is the type of oil correct?
- Is the tire inflation pressure correct?

No.	Diagnosis \ Remedy		Defective fan pump △ x	Defective accumulator charge valve △ x	Defective Orbit-roll △ x	Defective stop valve △ x	Defective actuation of steering spool △ x	Defective actuation of steering wheel or steering shaft △ x
			Causes					
			Hydraulic pump	Charge valve	Defective Orbit-roll	Defective stop valve	Steering valve	Others
			a	b	c	d	e	f
1	Steering wheel is heavy when turned in both directions (left and right)		○	○	○		○	○
2	Steering wheel is heavy in one direction (left or right)					○		
3	Steering wheel 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 oil pressure in both directions (left and right)	○	○	○		○	
5		Oil pressure is low or there is no oil pressure in one direction (left or right)				○		
6	When Orbit-roll output pressure is measured, oil pressure is found to be low or there is no oil pressure		○	○	○			○
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

Checking for abnormalities

- Is the steering difficult to turn? → **See H-8**
- Is there any abnormal noise from around the steering equipment

Testing 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		Causes: Hydraulic pump	Charge valve	Defective Orbit-roll	Defective stop valve	Steering valve				Cylinder
			a	b	c	d	e	f	g	h	i
			Defective fan pump	Defective accumulator charge valve	Defective Orbit-roll	Defective stop valve	Malfunction of flow control spool	Defective main relief valve	Defective actuation of steering spool	Defective overload relief valve	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 one directions (left or right)					○				○	
3	During operations or when traveling (steering is neutral), the machine shakes or jerks								○	○	○
4	Steering wheel 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 discharge pressure (steering pilot pressure) was 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 joystick steering (if equipped)]

Checking for abnormalities

- Is the steering difficult to turn? → **See H-9**
- Is there any abnormal noise from around the steering equipment

Testing before troubleshooting

- Has the machine monitor displayed any failure code?
  → **See the troubleshooting by failure code (Display of code)**
- Is play of the steering wheel appropriate?
- Is there any abnormality in the connection between the steering shaft and the Orbit-roll?
- Is the tire inflation pressure correct?

No.	Diagnosis \ Remedy		Causes: Defective fan pump (△ x)	Defective accumulator charge valve (△ x)	Malfunction of the joystick steering solenoid valve (x)	Malfunction of stop valve (△ x)	Malfunction of flow control spool (△ x)	Defective main relief valve (△ x)	Defective actuation of steering spool (△)	Defective overload relief valve (△ x)	Defect in steering cylinder (defective piston seal) (△ x)
			Hydraulic pump	Charge valve	Joystick steering solenoid valve	Defective stop valve	Steering valve				Cylinder
			a	b	c	d	e	f	g	h	i
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	Steering wheel 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 output pressure from the joystick steering solenoid valve (steering pilot circuit pressure) was measured	Oil pressure is unstable in both directions (left and right)	○	○	○						
9		Oil pressure is unstable in one direction (left or right)				○					
10	When basic pressure of joystick steering (Orbit-roll basic pressure) is measured, oil pressure is found to be unstable		○	○							

H-15 The wheel brake does not work or does not work well

Ask the operator about the following questions.

- Has the brake come not to turn suddenly? → **Breakage of brake**
- Has the brake come out to work gradually?
  → **Weakening of seals and wear of lining and disc**

Testing before troubleshooting

- Is the hydraulic oil level appropriate?
- Is the play of brake pedal appropriate?
- Oil leak from brake tube and connector and deformation of tube
- Tire air pressure and state of tire tread

Checking for abnormalities

- 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

No.	Diagnosis \ Remedy	Causes: Fan pump	Charge valve	Accumulator	Brake valve	Wheel brake					Others
		a	b	c	d	e	f	g	h	i	j
		Defective fan pump	Defective operation of charge valve	Defective seal of accumulator piston, insufficient gas pressure	Defective brake valve	Defective seal of brake piston in axle	Defective operation of brake piston in axle	The brake in axle is defective	Wear or abnormality of brake disc in axle	Metal contact due to complete wear of brake disc in axle	Mixing of air in brake circuit
		△ x	△ x	△ x	△ x	△ x	△ x	△ x	△ x	△ x	△
1	When the brake pedal is stepped on, only a little resistance is felt		○		○	○					○
2	When the brake pedal is stepped on, a strong resistance is felt				○						
3	To get the specified braking force, an abnormal leg-power is required			○	○		○		○	○	
4	When the brake works, an abnormal noise occurs from the axle brake								○	○	
5	The machine does not travel well (insufficient drawbar pull)				○						
6	When the four wheels are jacked up, the axle is placed on a table and the brake is applied at the forward 1st speed, only a specific wheel rotates					○	○	○	○	○	○
7	An airflow is observed in bleeding air from the brake circuit, and the brake returns to normal after the bleeding										○
8	Brake oil leaks abnormally from the axle during inspection					○					
9	Much metal powders are mixed in the axle oil									○	
10	The brake pedal leg-power and stroke are normal, but the brake does not work well						○	○	○	○	
11	The brake does not work often when the engine is stopped		○	○	○	○					
12	The accumulator is not charged, and a buzzer sounds	○	○	○							
13	The brake works after some time lag										○

H-16 The wheel brake is not released or it drags

Testing before troubleshooting

- Has the brake pedal returned completely?
- Is the parking brake released completely?

Checking for abnormalities

- Abnormal heat of brake
- Does the machine travel smoothly by inertia on a level ground?

No.	Diagnosis \ Remedy	Causes: Brake valve a: Defect inside brake valve (Sticking of piston) △ x	Causes: Wheel brake b: Abnormal lining of brake in axle △ x	Causes: Wheel brake c: Defective operation of brake piston in axle △ x
1	The brake pedal is released, but the brake is still applied	○	○	○
2	When the brake pedal is released, oil is drained from the air bleeder, the circuit pressure drops and the brake is released	○		
3	The four wheels are jacked up, the axle is placed on a table, the engine is stopped, the parking brake is released and the tires are rotated by hand but a specific tire hardly rotates		○	○

H-17 The 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	Cause: Valve — b: Defective parking brake emergency release valve	Cause: Parking brake — c: Defective parking brake spring	Cause: Parking brake — d: Defective operation of parking brake piston	Cause: 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 The parking brake is not released or it drags (including emergency release system)

Testing before troubleshooting

- Check if the parking brake emergency release switch is not turned ON?
- Check if the parking brake is automatically applied when the engine stops.

No.	Diagnosis \ Remedy	Causes: Solenoid a: Defect inside parking brake solenoid valve	Transmission valve b: Insufficient oil level due to defect of transmission valve	Wiring harness c: Damages on parking brake switch line wiring harness	Parking brake d: Pinching due to peeling of parking brake disc	Parking brake e: Defective operation of parking brake piston
		△ x	△ x	△	△ x	△ x
1	When the parking brake switch is off, the parking brake is not released	○	○	○	○	○
2	When the parking brake switch is off, the brake is not applied even if the engine stops					○
3	When the parking brake switch is on, the parking brake does not work well		○		○	

- The parking brake is not released even if the emergency parking brake release valve is opened.
  The following causes are considered:
  a. Malfunction of emergency parking brake release valve
  b. Insufficient gas pressure of accumulator for brake or breakage of piston seal

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**

Testing 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?

No.	Diagnosis \ Remedy	Causes: Tank – Pump a: Clogging or air intake on pump suction side	Tank – Pump b: The PTO is defective	Tank – Pump c: Defective work equipment pump servo	Tank – Pump d: Defective work equipment pump	Tank – Pump e: Defective fan pump	Accumulator charge valve f: Malfunction of relief valve	PPC valve g: Malfunction of spool	Work equipment valve h: Malfunction of main relief valve	Work equipment valve i: Malfunction of unload valve	Work equipment valve j: Malfunction of lift arm pressure compensation valve	Cylinder k: Internal breakage of valve body (lift arm spool)	Cylinder l: Damaged lift arm cylinder piston seal
	Remedy	C △	△ x	△ x	△ 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	Hydraulic 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	Fan does not rotate	○	○			○							
9	When work equipment pump and servo assembly is replaced, lift arm moves normally			○									

H-20 Lift arm speed is low or rising force of lift arm is insufficient

Testing before troubleshooting

- Is the stroke of the lift arm control lever proper?
- Is the engine speed proper?
- Is the work equipment linkage bushing normal (Is abnormal sound made)?

Checking for abnormalities

- 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.

No.	Diagnosis \ Remedy	C △	△ x	△ x	△ x	x	△ x	A △ x	△ x	△ x	△ x	△ x	△ x	△ x	x	x	x
	Causes																
		Tank – Pump				Accumulator charge valve	PPC valve	Work equipment valve							Bypass valve	Cylinder	
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**	
		Clogging or air intake on pump suction side	Defective work equipment pump servo	Defective work equipment pump	Defective fan pump	Malfunction of relief valve	Malfunction of spool	Malfunction of main relief valve	Malfunction of unload valve	Malfunction of ECSS charge valve	Malfunction of lift arm pressure compensation valve	Malfunction of bucket pressure compensation valve	Malfunction back pressure valve	Internal wear or breakage of valve body (lift arm spool)	Malfunction of spool	Damaged lift arm cylinder piston seal	
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, tilting back speed lowers more in step 1.			○													
4	Hydraulic pump is making abnormal sound	○		○	○												
5	Hydraulic drift of the cylinder is large													○	○	○	
6	Relief pressure of relief valve of work equipment valve is low							○	○	○				○	○	○	
7	Relief pressure of relief valve of work equipment valve is too high												○				
8	When lift arm and bucket are operated simultaneously, rising speed of lift arm is too low										○						
9	When work equipment pump and servo assembly is replaced, lift arm moves normally		○														

H-21 When rising, the 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 The lift arm cylinder cannot hold down the 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 leakage from seal of lift arm cylinder piston
- Defective stroke of lift arm EPC lever (if equipped)

H-23 Hydraulic drifts of the lift arm is large

Ask the operator about the following:

- Have hydraulic drifts come to be large suddenly? → **Wastes pinched in valve or damage of parts**
- Have hydraulic drifts come to be large 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 lift arm spool

H-24 The 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 is large.”
2. When the lift arm cylinder cannot lift the machine, see “H-22. The lift arm cylinder cannot hold down the bucket (bucket floats).”
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**

Testing 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)**

		Causes														
		Tank – Pump					Accumulator charge valve	PPC valve	Work equipment valve						Cylinder	
		a	b	c	d	e	f	g	h	i	j	k	l	m	n
		Clogging or air intake on pump suction side	The PTO is defective	Defective work equipment pump servo	Defective work equipment pump	Defective fan pump	Malfunction of relief valve	Malfunction of spool	Malfunction of main relief valve	Malfunction of unload valve	Malfunction of bucket bottom safety valve (suction safety valve)	Malfunction of bucket bottom suction valve (suction safety valve)	Malfunction of bucket pressure compensation valve	Internal breakage of valve body (bucket spool)	Damaged bucket cylinder piston seal
No.	Diagnosis / Remedy	C △	△ x	△ x	△ x	△ x	x	△ x	△ x	△ x	△ x	C △ x	△ 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	Hydraulic 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	Fan does not rotate	○	○			○								—	
9	When work equipment pump and servo assembly is replaced, lift arm moves normally			○											

H-26 Bucket speed is low or tilting back force is insufficient

Testing 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)?

Checking for abnormalities

- Check by actual operation that the tilting back force is insufficient.
- Measure the operating speed of the bucket and check it with the standard values table.

		Causes																	
		Tank – Pump				Accumulator charge valve	PPC valve	Work equipment valve											Cylinder
		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p		
		Clogging or air intake on pump suction side	Defective work equipment pump servo	Defective work equipment pump	Defective fan pump	Malfunction of relief valve	Malfunction of spool	Malfunction and defective adjustment of main relief valve	Malfunction of unload valve	Malfunction of ECSS charge valve	Malfunction of bucket bottom safety valve (suction safety valve)	Malfunction of bucket bottom suction valve (suction safety valve)	Malfunction of lift arm pressure compensation valve	Malfunction of bucket pressure compensation valve	Malfunction back pressure valve	Internal breakage of valve body (bucket spool)	Damaged bucket cylinder piston seal		
No.	Diagnosis \ Remedy	C △	△ x	△ x	△ x	x	△ x	A △ x	△ x	△ x	△ x	C △ x	△ x	△ x	△ x	x	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	Hydraulic pump is making abnormal sound	○		○	○														
5	Hydraulic drift of the cylinder is large										○	○				○	○		
6	Relief pressure of relief valve of work equipment valve is low							○	○	○	○	○				○	○		
7	Relief pressure of relief valve of work equipment valve is too high														○				
8	When lift arm and bucket are operated simultaneously, tilting back speed of bucket is too low.													○					
9	When work equipment pump and servo assembly is replaced, bucket moves normally		○											—					

H-27 The 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 tilting back force is insufficient.”

H-28 The bucket cylinder cannot hold down the 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 suction safety valve on the bucket cylinder head side of work equipment valve
- Oil leak from bucket cylinder piston seal
- Defective stroke of bucket EPC lever (if equipped)

H-29 Hydraulic drifts of the bucket is large

Ask the operator about the following:

- Have hydraulic drifts come to be large suddenly? → **Wastes pinched in valve or damage of parts**
- Have hydraulic drifts come to be large 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 suction safety valve on the bottom side
- Improper oil tight of bucket spool

H-30 The bucket wobbles during travel with cargo (The work equipment valve is set to “HOLD”)

Checks before troubleshooting

- Pin of work equipment linkage and “play of bushing” (Is any abnormal noise heard?)

Cause

- Defective seal of bucket cylinder piston
- Defective operation of suction safety valve on bucket cylinder head side. For other abnormal phenomena, refer to diagnoses for relevant abnormal phenomena.

H-31 Lift arm and bucket control levers do not move smoothly and are heavy

Checking for abnormalities

- Refer to the standard value table and check if the lever operating efforts are large practically.

No.	Diagnosis \ Remedy	Causes: PPC valve a: The PPC valve spool is bent	b: Improper clearance between PPC valve body and spool	c: Improper roundness between PPC valve body and spool	d: Foreign matter pinched in PPC valve spool
		x	△ x	△ x	C △
1	When the machine is loaded and the oil pressure rises, the levers come not to move smoothly		○	○	
2	The levers come not to move smoothly as the oil temperature rises		○	○	
3	The levers totally come not to move smoothly during operation irrespective of oil pressure and oil temperature	○			○

H-32 During operation of the 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-33 Large shock is made when work equipment starts and stops

Cause

- Wastes in work equipment valve PPC line
- Defective PPC valve
- Defective operation of control valve spool
- Defect in electrical system of lift arm or bucket EPC lever (if equipped)

H-34 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-35 ECSS does not operate, and pitching, bouncing occur

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?

No.	Diagnosis \ Remedy	Cause: Solenoid valve (a)	Accumulator (b)	Controller (c)	Sensor (d)
		Defective ECSS solenoid valve	Gas leakage from accumulator, defective seal	Defective operation of work equipment controller	Defective transmission output shaft speed sensor
		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	○	○	○	○

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H6001 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 ... 7
S-3 Engine does not pick up smoothly ... 10
S-4 Engine stops during operations ... 11
S-5 Engine does not rotate smoothly ... 12
S-6 Engine lacks output (or lacks power) ... 13
S-7 Exhaust smoke is black (Incomplete combustion) ... 14
S-8 Oil consumption is excessive (or exhaust smoke is blue) ... 15
S-9 Engine oil becomes contaminated quickly ... 16
S-10 Fuel consumption is excessive ... 17
S-11 Coolant contains oil (blows back or reduces) ... 18
S-12 Oil pressure drops ... 19
S-13 Oil level rises (Water, fuel in oil) ... 20
S-14 Coolant temperature rises too high (Overheating) ... 21

S-15 Abnormal noise is made 22
S-16 Vibration is excessive 23

Troubleshooting of engine (S-mode)

Method of using troubleshooting chart

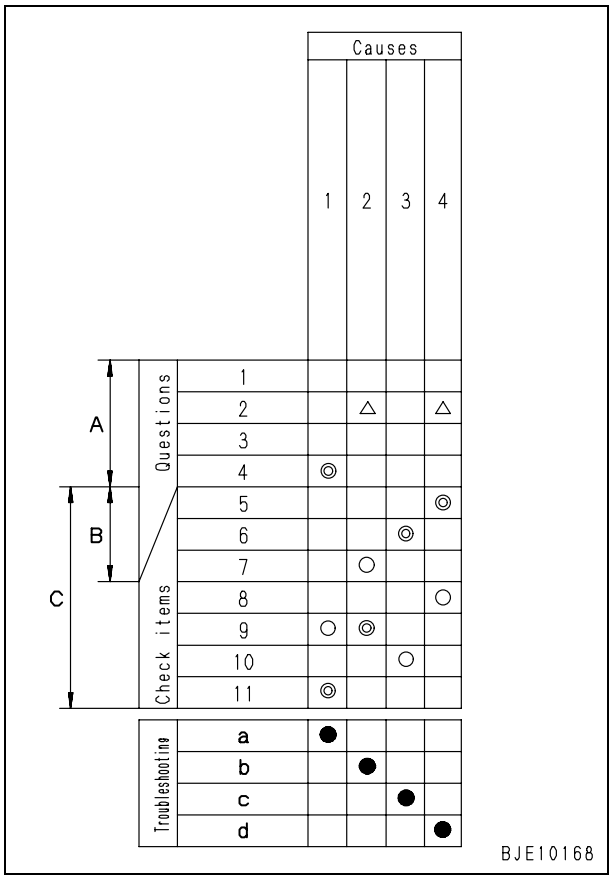
The troubleshooting chart consists of “questions”, “check items”, “causes”, and “troubleshooting” blocks.
The “questions” and “check items” narrow down the causes to highly probable “causes” by simple inspection or from symptoms without using a diagnostic tool.
Then, the final verifications of “causes” are carried out by checking the narrowed down “causes” in the order of their probability with diagnostic tools or by direct inspection following the “troubleshooting” procedure.

Questions:
Information to be obtained by questioning the user or operator, and which corresponds to the sections (A) and (B) in the right chart.
Section (A) includes basic information, and section (B) contains items which can be obtained depending on the level of the user or operator.

Check items:
Items checked by the serviceman in order to narrow down the causes, section (C) of the right chart is corresponding to them.

Causes:
Items to be narrowed down by the questions and check items.
The serviceman narrows down the causes to highly probable causes according to the information from (A), (B) and (C).

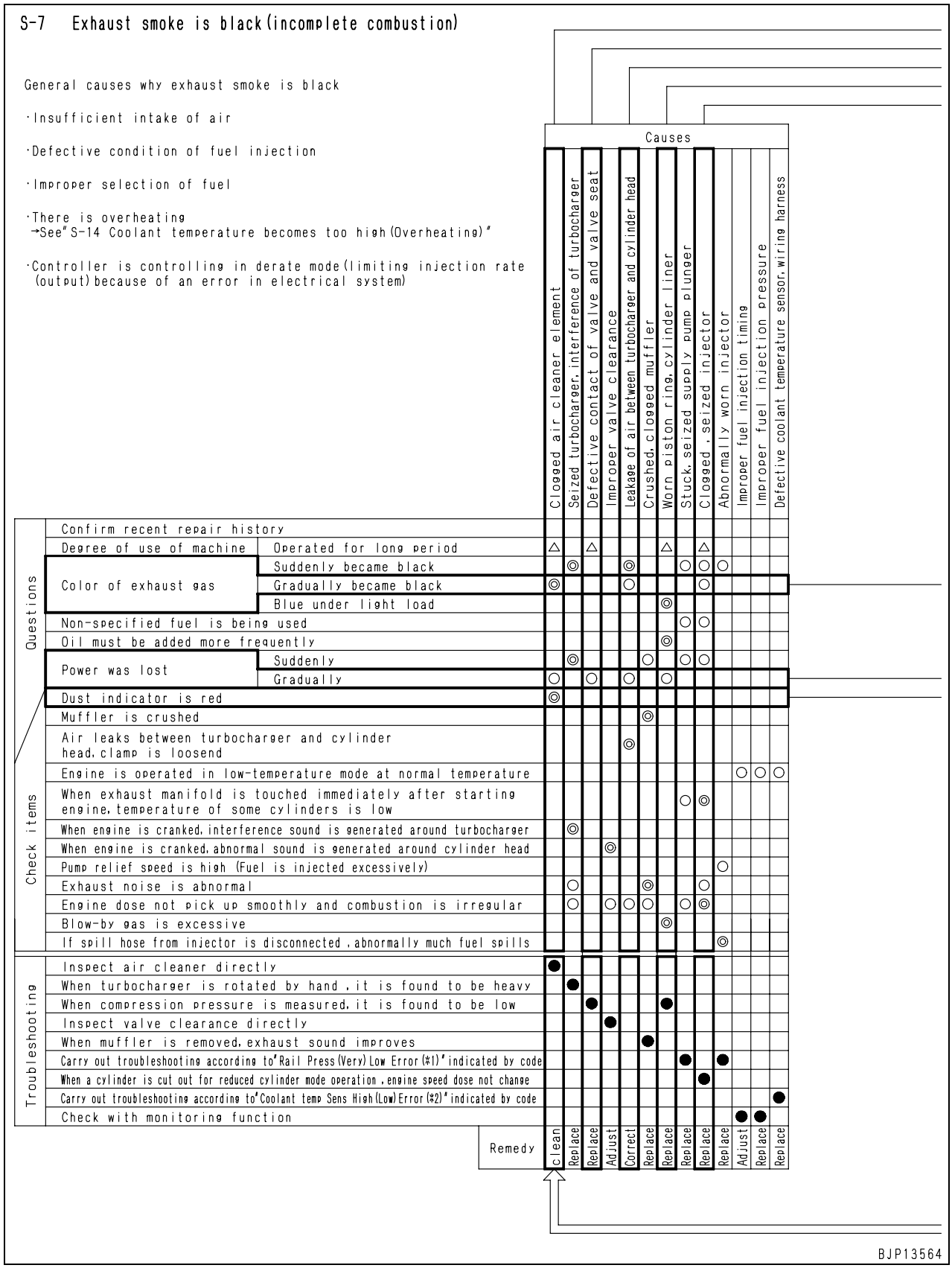
Troubleshooting:
Items to be verified at the end in order to check if the narrowed down causes are the true factors causing the failure. The verification is carried out by applying diagnostic tools or implementing direct inspection in the order of probability.



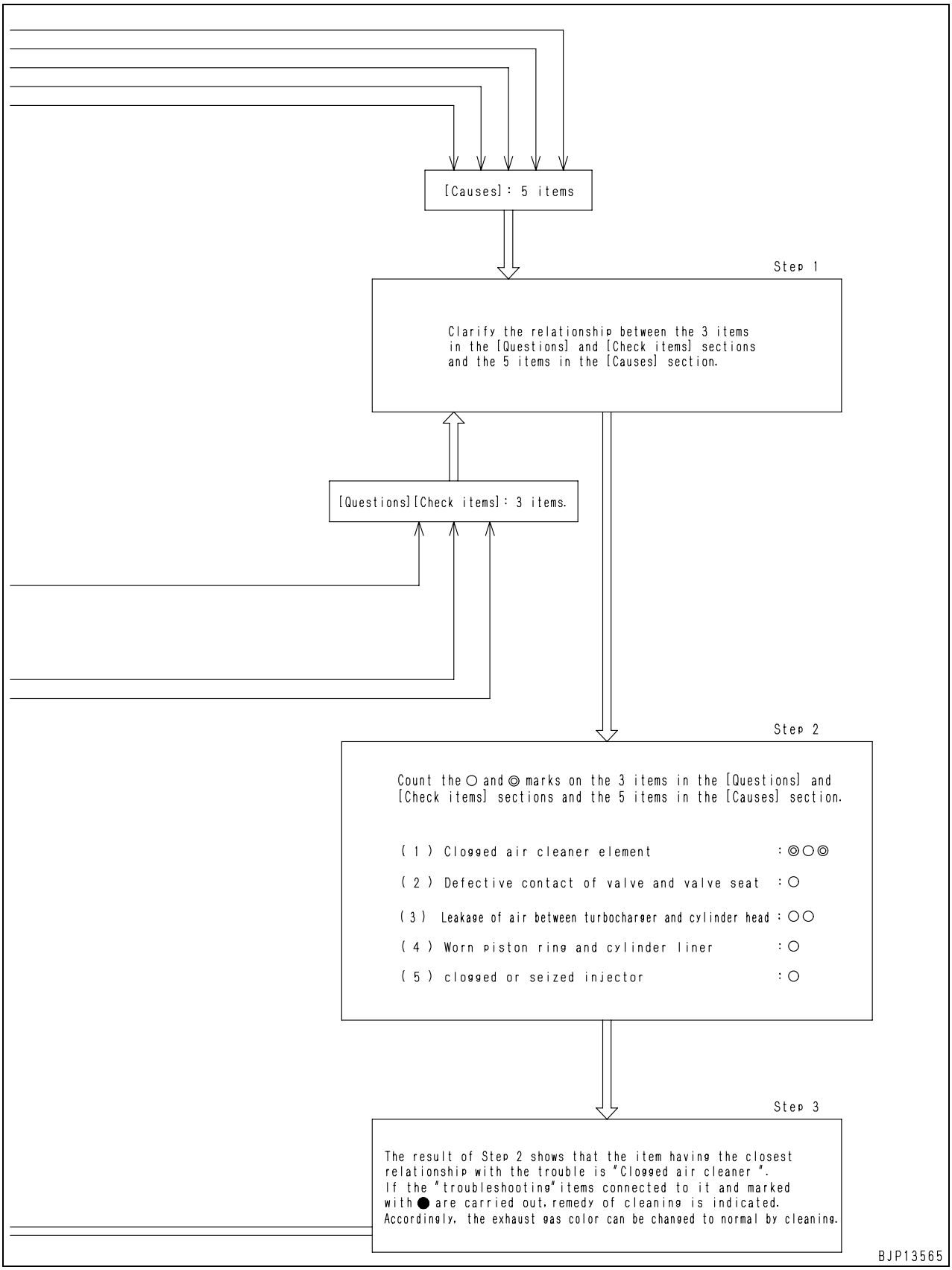
This troubleshooting chart marks the content of the questions and check items with △, ○ or ◎ according to their closer relationship with the causes.
△ : A cause that can be referred to in relation to the question or check item.
○ : A cause that is related to the question or check item.
◎ : A cause particularly 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 (incomplete combustion)

Let us now assume that a defect, “Color of exhaust smoke is black” occurs, the [questions] and [check items] are implemented, and the following 3 symptoms corresponds: [Color of exhaust gas gradually became black.], [Power was lost gradually.] and [Red dust indicator is displayed.].



The 5 items of [causes] and the 3 items of [questions] and [check items] have a cause-and-effect relationship.
The “Step 1” to “Step 3” in the below figure, will explain how to narrow down the [causes] from the cause-and effect relationship and lead to [troubleshooting].



S-1 Engine does not start easily.

General causes for poor startability include the following
- Electrical system is not normal
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel

★ The common rail fuel injection system (CRI) recognizes the fuel injection timing electrically. Accordingly, even if the starting operation is carried out, the engine may not start until the crankshaft revolves 2 turns at maximum. This phenomenon does not indicate a trouble, however.

			Causes												
			Clogged air cleaner element	Defective contact of valve or valve seat	Wear of piston ring or cylinder	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter, element	Stuck, seized supply pump plunger	Defective injector	Defective intake air heater system Questions	Defective alternator (regulator section)	Defective alternator (generator section)	Defective, deteriorated battery
Questions	Check recent repair history													
	Degree of machine operation	Machine operated for long period	△					△						△
	Starting performance	Became worse gradually	○	◎	◎			○						
		Engine starts easily when warm									◎			◎
	Non-specified fuel is being used							○	○	○				
	Replacement of filters has not been carried out according to Operation and Maintenance Manual		◎					◎	○	○				
	Engine oil replenishment is increasing				◎									
	Preheat monitor does not indicate normal operation during preheating or at low temperature										◎			
	Charge level monitor indicates abnormal charging during operation											◎	◎	
Check items	Dust indicator is red		◎											
	Air breather hole of fuel tank cap is clogged					◎								
	Fuel is leaking from fuel piping						◎		○					
	When priming pump is operated, it makes no reaction or it is heavy						◎	○						
	Starting motor cranks engine slowly													◎
	While engine is cranked with starting motor	And the air breathing plug is removed from the fuel filter, fuel fails to discharge						◎						
		If spill hose from injector is disconnected, little fuel spills							◎					
	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		●											
	When compression pressure is measured, the oil pressure is low			●	●									
	When air is bled from fuel system, air comes out						●							
	Inspect fuel filter, strainer directly							●						
	Carry out troubleshooting according to “No-pressure feed by supply pump (*1)” in the code display								●					
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change									●				
	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										●		
		None											●	
	When specific gravity of electrolyte and voltage of battery are measured, they are low													●
		Remedy	Clean	Replace	Replace	Clean	Correct	Clean	Replace	Replace	Replace	Replace	Replace	Replace

*1: Failure code [CA559] and [CA2249] on the display code

S-2 Engine does not start

a) Engine does not turn

General causes why engine does not turn
- Seized parts inside engine
  → See “S-4 Engine stops during operations”
- Defective electrical system
- Problem in drive devices on applicable machine side
  → Carry out troubleshooting for devices on applicable machine

			Causes							
			Broken flywheel ring gear	Defective or deteriorated battery	Defective connection of battery terminal	Defective battery relay	Defective starting switch	Defective safety relay	Defective starting motor (motor section)	Defective steering circuit wiring
Questions	Check recent repair history									
	Degree of use of machine	Operated for long period	△	△						
	Condition of horn when starting switch is turned ON	Horn does not sound			○		○			◎
		Horn volume is low		◎						
Check items	Battery electrolyte is low			◎						
	Battery terminal is loose				◎					
	When starting switch is turned ON, there is no operating sound from battery relay			○		◎				
	When starting switch is turned to START, starting pinion does not move out			○			○			◎
	When starting switch is turned to START, starting pinion moves out, but	Speed of rotation is low		◎						
		Makes grating noise	◎						◎	
		Soon disengages again						◎		
		Makes rattling noise and does not turn		○				○	○	
Troubleshooting	Inspect flywheel ring gear directly		●							Carry out troubleshooting on applicable machine
	When specific gravity of electrolyte and voltage of battery are measured, they are low			●						
	Turn starting switch OFF, connect cord, and carry out troubleshooting at ON	There is not voltage (20 – 30 V) between battery relay terminal B and terminal E				●				
		When terminal B and terminal C of starting switch are connected, engine starts					●			
		When terminal B and terminal C at safety relay outlet are connected, engine starts						●		
		Even if terminal B and terminal C at safety relay outlet are connected, engine does not start							●	
		When terminal at safety switch and terminal B at starting motor are connected, engine starts							●	
		Remedy	Replace	Replace	Correct	Replace	Replace	Replace	Replace	—

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)

			Causes												
			Use of improper fuel	Insufficient fuel in tank	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter element	Seized, abnormally worn feed pump	Broken supply pump shaft	Stuck, seized supply pump plunger	Defective supply pump MPROP	Defective operation of overflow valve (Does not close)	Defective common rail pressure limiter	Defective fuel injector
Questions	Check recent repair history													
Questions	Degree of machine operation	Machine operated for long period				△	△							
Questions	Exhaust smoke suddenly stopped coming out (when starting again)							◎	○	◎	◎			△
Questions	Replacement of filters has not been carried out according to Operation and Maintenance Manual						◎			△				○
Check items	When fuel tank is inspected, it is found to be empty			◎										
Check items	Air breather hole of fuel tank cap is clogged			○	◎									
Check items	Rust and water are found when fuel tank is drained						○	△		△	△			
Check items	When removed, no fuel is inside the fuel filter		◎			◎								
Check items	Fuel is leaking from fuel piping					◎								
Check items	When priming pump is operated, it makes no reaction or it is heavy					◎	○							
Check items	While engine is cranked with starting motor	And the air breathing plug is removed from the fuel filter, fuel fails to discharge		○		○		◎	○					
Check items	While engine is cranked with starting motor	Spill flow drops, when spill hose is separated from injector				○			◎	◎	◎			○
Troubleshooting	When air is bled from fuel system, air comes out					●								
Troubleshooting	Inspect fuel filter directly						●							
Troubleshooting	Inspect feed pump directly							●						
Troubleshooting	Carry out troubleshooting according to the displayed code, “No-pressure feed by supply pump (*1)”								●	●				
Troubleshooting	Carry out troubleshooting according to the displayed code, “Abnormality in supply pump PCV (*2)”										●			
Troubleshooting	Inspect overflow valve directly											●		
Troubleshooting	Engine can be started in reduced cylinder mode													●
Troubleshooting	Fuel flows out when pressure limiter return piping is disconnected												●	
		Remedy	Replace	Add	Correct	Correct	Replace	Replace	Replace	Replace	Replace	Replace	Replace	Replace

*1: Failure code [CA559] and [CA2249] on the display of code
*2: Failure code [CA271] and [CA272] in the display of code

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

			Causes											
			Clogged air cleaner element	Worn dynamic valve system (Valve, rocker lever, etc.)	Worn piston ring, cylinder liner	Use of improper fuel	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel system, entry of air	Clogging of fuel filter	Stuck, seized supply pump plunger	Clogged injector, defective spray	Defective, deteriorated battery	Defective coolant temperature sensor, wiring harness	Defective intake air heater system
Questions	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 has not been carried out according to Operation and Maintenance Manual		◎						◎					
	Engine oil replenishment is increasing				◎									
	Preheat monitor does not indicate normal operation during preheating or at low temperature													◎
Check items	Dust indicator is red		◎											
	Air breather hole of fuel tank cap is clogged						○							
	Rust and water are found when fuel tank is drained								◎					
	When removed, no fuel is inside the fuel filter					◎								
	Fuel is leaking from fuel piping							◎						
	When priming pump is operated, it makes no reaction or it is heavy							◎	○					
	Starting motor cranks engine slowly											◎		
	When engine is cranked, abnormal sound is generated around cylinder head			◎										
	While engine is cranked with starting motor	And the air breathing plug is removed from the fuel filter, fuel fails to discharge				○			◎					
		Spill flow drops when spill hose is disconnected from injector								◎				
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low										◎			
Troubleshooting	Inspect air cleaner directly		●											
	Inspect dynamic valve system directly			●										
	When compression pressure is measured, the oil pressure is low				●									
	When air is bled from fuel system, air comes out							●						
	Inspect fuel filter directly								●					
	Carry out troubleshooting according to the displayed code, “No-pressure feed by supply pump (*1)”									●				
	Engine can be started in reduced cylinder mode										●			
	When specific gravity of electrolyte and voltage of battery are measured, they are low											●		
	Coolant temperature gauge does not indicate normally												●	
	Intake air heater mount does not warm up during preheating operation													●
		Remedy	Clean	Replace	Replace	Replace	Clean	Correct	Clean	Replace	Replace	Replace	Replace	Replace

*1: Failure code [CA559] and [CA2249] on the display of code

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
  (limiting injection rate (output) because of an error in electrical system)

			Causes										
			Clogged air cleaner element	Defective contact of valve and valve seat	Improper valve clearance	Seizure or interference of turbocharger	Worn piston ring, cylinder liner	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogging of fuel filter	Stuck, seized supply pump plunger	Clogged injector, defective spray
Questions / Check items	Check recent repair history											
	Degree of machine operation	Machine operated for long period	△	△			△			△		
	Engine pick-up suddenly became worse					◎		○	○			○
	Non-specified fuel is being used									◎	◎	◎
	Replacement of filters has not been carried out according to Operation and Maintenance Manual		◎							◎		
	Oil must be added more frequently						◎					
	Dust indicator is red		◎									
	Air breather hole of fuel tank cap is clogged							◎				
	Rust and water are found when fuel tank is drained									◎		
	Fuel is leaking from fuel piping								◎			
	When priming pump is operated, it makes no reaction or it is heavy								◎	○		
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low										○	◎
	Color of exhaust smoke	Blue under light load					◎					
		Black	◎	○		◎						◎
	When engine is cranked, abnormal sound is generated around cylinder head				◎							
	When engine is cranked, interfering 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		●									
	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					●						
	When air is bled from fuel system, air comes out								●			
	Inspect fuel filter, strainer directly									●		
	Carry out troubleshooting according to the displayed code, “No-pressure feed by supply pump (*1)”										●	
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change											●
		Remedy	Clean	Replace	Adjusting	Replace	Replace	Clean	Correct	Clean	Replace	Replace

*1: Failure code [CA559] and [CA2249] on the display of code

S-4 Engine stops during operations

General causes why engine stops during operations
- Seizure inside engine
- Insufficient supply of fuel
- Overheating
- Defective drive unit on installed machine side
  → Carry out troubleshoot the installed machine.

			Causes												
			Breakage of valve system (valve, rocker lever, etc.)	Broken, seized piston, connecting rod	Broken, seized crankshaft bearing	Broken, seized gear train	Insufficient fuel in tank	Clogged air breather hole of fuel tank cap	Leaking, clogged fuel piping	Clogging of fuel filter	Broken, seized feed pump	Broken supply pump shaft	Stuck, seized supply pump plunger	Broken auxiliary equipment (pump, compressor, etc.)	Failure on power train
Questions	Check recent repair history														
	Degree of machine operation	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 has not been carried out according to Operation and Maintenance Manual									◎					
	Fuel level monitor indicates low fuel level (with monitor installed)						◎								
Check items	When fuel tank is inspected, it is found to be empty						◎								
	Air breather hole of fuel tank cap is clogged							◎							
	Fuel is leaking from fuel piping								◎						
	When priming pump is operated, it makes no reaction or it is heavy								◎	○					
	Rust and water are found when fuel tank is drained									◎					
	Metal particles are found when oil pan is drained		◎	◎	◎						○				
	When engine is cranked by hand	Does not turn at all		◎	◎										
		Turns in opposite direction	◎												
		Moves by amount of gear backlash				◎								◎	
		Supply pump shaft does not turn										◎			
	Engine turns, but stops when load is applied to machine														◎
Troubleshooting	Inspect dynamic valve system directly		●												Carry out troubleshooting from H-mode
	Inspect piston, connecting rod directly			●											
	Inspect crankshaft bearing directly				●										
	Inspect gear train directly					●									
	Inspect fuel filter, strainer directly									●					
	Inspect feed pump directly										●				
	Carry out troubleshooting according to the displayed code, “No-pressure feed by supply pump (*1)”											●	●		
	Engine rotates when pump auxiliary equipment (pump, compressor, etc.) is removed													●	
		Remedy	Replace	Replace	Replace	Replace	Add	Clean	Correct	Clean	Replace	Replace	Replace	Replace	—

*1: Failure codes [CA559] and [CA2249] in the display of code

S-5 Engine does not rotate smoothly

General causes why engine does not rotate smoothly
- Mixing of air in the fuel system
- Defective speed sensor (Error at degree that it is not indicated)

			Causes						
			Insufficient fuel in tank	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogging of fuel filter	Clogged injector, defective spray (dirt in injector)	Defective Ne speed sensor, wiring harness	Defective backup speed sensor or defective wiring harness
Questions	Check recent repair history								
	Degree of machine operation	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 slopes	◎						
	Replacement of filters has not been carried out according to Operation and Maintenance Manual					◎			
Check items	When fuel tank is inspected, it is found to be empty		◎						
	Air breather hole of fuel tank cap is clogged			◎					
	Rust and water are found when fuel tank is drained					○			
	Fuel is leaking from fuel piping				◎				
	When priming pump is operated, it makes no reaction or it is heavy				◎	○			
Troubleshooting	When air is bled from fuel system, air comes out				●				
	Inspect fuel filter, strainer directly					●			
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change						●		
	Carry out troubleshooting according to the displayed code, “Abnormality in Ne speed sensor (*1)”							●	
	Carry out troubleshooting according to the displayed code, “Abnormality in Bkup speed sensor (*2)”								●
		Remedy	Add	Clean	Replace	Replace	Replace	Replace	Replace

*1: Failure code [CA689] in the display of code

*2: Failure code [CA778] in the display of code

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 “S-14 Coolant temperature rises too high (overheating)” for the troubleshooting
- Controller in derate control mode
  (limiting injection rate (output) because of an error in electrical system)

			Causes															
			Clogged air cleaner element	Air leakage from air intake piping	Seizure or interference of turbocharger	Defective contact of valve and valve seat	Improper valve clearance	Worn piston ring, cylinder liner	Clogged air breather hole of fuel tank cap	Leaking, clogged fuel piping	Clogging of fuel filter	Stuck, seized supply pump plunger	Clogged injector, defective spray (dirt in injector)	Defective drive of injector (signal, solenoid)	Defective installation of boost pressure sensor (air leakage)	Defective boost pressure sensor, wiring harness	Clogged fuel spill piping
Questions	Check recent repair history																	
	Degree of machine operation	Machine operated for long period	△			△		△			△							
	Power was lost	Suddenly		○	◎									○	○	○	○	
		Gradually	○			○		○			○		○		○			
	Non-specified fuel is being used										○	○	○					
	Replacement of filters has not been carried out according to Operation and Maintenance Manual		◎								◎							
	Engine oil replenishment is increasing					○		○										
Check items	Dust indicator is red		◎	◎														
	Air breather hole of fuel tank cap is clogged				◎				◎									
	Fuel is leaking from fuel piping									◎								
	Output becomes insufficient after short stop of operation			◎														
	Color of exhaust smoke	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 sound is generated around cylinder head						◎											
	High idle speed is too high													○				
	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 air intake 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 piping									●								
	Inspect fuel filter, strainer directly										●							
	Inspect spill port check valve directly																	●
	Carry out troubleshooting according to the displayed code, “No-pressure feed by supply pump (*1)”											●						
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change												●	●				
	Inspect boost pressure sensor mount directly														●			
	Carry out troubleshooting according to the displayed code, “Abnormality in boost pressure sensor (*2)”															●		
		Remedy	Clean	Correct	Replace	Replace	Adjusting	Replace	Clean	Correct	Replace	Replace	Replace	Replace	Correct	Replace	Replace	

*1: Failure code [CA559] and [CA2249] on the display of code
*2: Failure codes [CA122] and [CA123] in the display of code

S-7 Exhaust smoke is black (Incomplete combustion)

General causes why exhaust smoke is black
- Insufficient intake of air
- Fuel injection condition not normal
- Improper selection of fuel
- Overheating
  → See “S-14 Coolant temperature rises too high (overheating)” for the troubleshooting
- Controller in derate control mode
  (limiting injection rate (output) because of an error in electrical system)

			Causes: Clogged air cleaner element	Seizure or interference of turbocharger	Defective contact of valve or valve seat	Improper valve clearance	Leakage of air between turbocharger and cylinder head	Crushed, clogged muffler	Worn piston ring, cylinder liner	Stuck, seized supply pump plunger	Clogged, seized injector	Abnormal wear of injector	Improper fuel injection timing	Improper fuel injection pressure	Defective coolant temperature sensor, wiring harness
Questions	Check recent repair history														
	Degree of machine operation	Machine operated for long period	△		△				△		△				
	Color of exhaust smoke	Suddenly became black		◎			◎			○	○	○			
		Gradually became black	◎				○				○				
		Blue under light load							◎						
	Non-specified fuel is being used									○	○				
	Oil must be added more frequently								◎						
	Power was lost	Suddenly		◎				○		○	○				
		Gradually	○		○		○		○						
Check items	Dust indicator is red		◎												
	Muffler is crushed							◎							
	Air leaks between turbocharger and cylinder head, clamp is loosened						◎								
	Engine is operated in low-temperature mode at normal temperature											○	○	○	
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low									○	◎				
	When engine is cranked, interference sound is generated around turbocharger		◎												
	When engine is cranked, abnormal sound is generated around cylinder head				◎										
	Pump relief speed is high (Fuel is injected excessively)										○				
	Exhaust noise is abnormal		○					◎			○				
	Engine does not pick up smoothly and combustion is irregular		○		○	○	○		○	◎					
	Blow-by gas is excessive							◎							
	If spill hose from injector is disconnected, abnormally much fuel spills										◎				
Troubleshooting	Inspect air cleaner directly		●												
	When turbocharger is rotated by hand, it is found to be heavy			●											
	When compression pressure is measured, the oil pressure is low				●				●						
	Inspect valve clearance directly					●									
	When muffler is removed, exhaust sound improves							●							
	Carry out troubleshooting according to the displayed code, “No-pressure feed by supply pump (*1)”									●		●			
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change										●				
	Carry out troubleshooting according to the displayed code, “Abnormality in coolant temperature sensor (*2)”														●
	Check by the monitoring function												●	●	
		Remedy	Clean	Replace	Replace	Adjusting	Correct	Replace	Replace	Replace	Replace	Replace	Adjusting	Replace	Replace

*1: Failure code [CA559] and [CA2249] on the display of code
*2: Failure codes [CA144] and [CA145] in the display of code

S-8 Oil consumption is excessive (or exhaust smoke is blue)

General causes why oil consumption is excessive
- Abnormal oil combustion
- Long-time operation of engine at low idle or high idle (Do not run engine at idle for more than 20 consecutive minutes)
- Oil leakage to outside
- Wear of pats in lubrication system

			Causes														
			Dust sucked in from intake system	Worn, damaged valve (stem, guide, seal)	Turbocharger: Worn seal at turbocharger end	Turbocharger: Worn seal at blower end	Clogged breather, breather hose	Broken piston ring	Worn piston ring, cylinder liner	Worn, damaged rear oil seal	Broken oil cooler	Oil leakage from oil cooler	Oil leakage from oil filter	Oil leakage from oil piping	Oil leakage from oil drain plug	Oil leakage from oil pan, cylinder head, etc.
Questions / Check items	Check recent repair history																
	Degree of machine operation	Machine operated for long period		△	△	△			△								
	Oil consumption suddenly increased							◎			○						
	Oil must be added more frequently								◎		○						
	Oil becomes contaminated quickly						○	○	◎								
	Outside of engine is dirty with oil											◎	◎	◎	◎	◎	
	There are loose piping clamps in intake system		◎														
	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 coolant										◎						
	Exhaust smoke is 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 found to be dirty abnormally			●													
	Excessive play of turbocharger shaft				●	●											
	Check breather and 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	Clean	Replace	Replace	Correct	Replace	Replace	Correct	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
- Operation under excessive load

			Causes									
			Defective seal at turbocharger turbine end	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 turbocharger lubrication drain tube	Exhaust smoke is bad
Questions / Check items	Check recent repair history										
	Degree of machine operation	Machine operated for long period	△	△	△						
	Non-specified fuel is being used				○			○			
	Engine oil replenishment increasing				◎						
	Metal particles are found when oil is drained			○	○			◎			
	Inside of exhaust pipe is contaminated with oil.			◎							
	Engine oil temperature rises quickly						◎				
	Color of exhaust smoke	Blue under light load			◎						
		Black									◎
	Amount of blow-by gas	Excessive	○	○	◎					○	
		None				◎					
Troubleshooting	Excessive play of turbocharger shaft		●								See S-7
	When compression pressure is measured, the oil pressure is low			●	●						
	Check breather and breather hose 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	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 injection of fuel

			Causes								
			Fuel leakage inside head cover	Fuel leakage from fuel filter, piping, etc.	Defective feed pump oil seal	Defective supply pump plunger	Defective common rail pressure	Defective spray by injector	Defective operation of injector	Improper fuel injection timing	Defective coolant temperature sensor, wiring harness
Questions	Check recent repair history										
	Degree of machine operation	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			◎							
	Combustion is irregular							◎			
	Engine oil level rises and oil smells of diesel fuel		◎		◎						
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low							◎			
	Low idling speed is too high								○		
	Pump relief speed is high								○		
	Color of exhaust smoke	Black					○	○		○	○
		White	○								
Troubleshooting	Remove head cover and check directly		●								
	Inspect feed pump oil seal directly				●						
	Carry out troubleshooting according to the displayed code, “No-pressure feed by supply pump (*1)”					●					
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change							●			
	If spill hose from injector is disconnected, much fuel spills								●		
	Carry out troubleshooting according to the displayed code, “Abnormality in coolant temperature sensor (*2)”										●
	Check by the monitoring function						●			●	
		Remedy	Correct	Correct	Replace	Replace	Correct	Replace	Replace	Replace	Replace

*1: Failure codes [CA559] and [CA2249] in the display of code
*2: Failure codes [CA144] and [CA145] in the display of code

S-11 Coolant contains oil (blows back or reduces)

General causes why coolant contains oil
- Internal leakage of lubricating system
- Internal leakage in cooling system

			Causes				
			Broken cylinder head, head gasket	Cracks inside cylinder block	Holes made by pitting	Broken oil cooler core, O-ring	Broken hydraulic oil cooler, power train oil cooler
Questions	Check recent repair history						
	Degree of machine operation	Machine operated for long period			△	△	
	Oil level	Suddenly increased	○			○	○
		Gradually increased		○	○		
	Hard water is being used as coolant				○	○	
Check items	Oil level has risen and oil is milky			○	○	◎	
	There are excessive air bubbles in radiator, coolant spurts back		◎				
	Hydraulic oil or power train oil is milky						◎
	When hydraulic oil or power train oil is drained, water is discharged						◎
Troubleshooting	Pressure-tightness test of cylinder head shows there is leakage		●				Carry out troubleshooting from H-mode
	Inspect cylinder block, liner directly			●	●		
	Pressure-tightness test of oil cooler shows there is leakage					●	
		Remedy	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)
- Deterioration of oil due to overheating

			Causes										
			Worn journal of bearing	Lack of oil in oil pan	Coolant, fuel in oil	Clogged strainer in oil pan	Clogged, broken pipe in oil pan	Defective oil pump	Defective regulator valve	Clogged oil filter	Leaking, crushed, clogged hydraulic piping	Defective oil level sensor, wiring harness
Questions	Check recent repair history											
	Degree of machine operation	Machine operated for long period	△					△		△		
	Oil pressure monitor indicates low pressure level								○	◎		
	Non-specified oil is being used		○							○		
	Replacement of filters has not been carried out according to Operation and Maintenance Manual									◎		
Check items	Oil pressure monitor (With monitor installed)	Indicates pressure drop at low idle	◎									
		Indicates pressure drop at low, high idle		○		◎	◎	◎	○			
		Indicates pressure drop on slopes		◎								
		Sometimes indicates pressure drop							◎			○
	Oil pressure monitor indicates low pressure level			◎								◎
	Oil level in oil pan is low			◎								
	External hydraulic piping is leaking, crushed										◎	
	Oil is milky or smells of diesel oil				◎							
	Metal particles are found when oil pan is drained		◎									
	Metal particles are found when oil filter is drained		◎					○				
Troubleshooting	Metal particles are found in oil filter		●		See S-13							
	Inspect oil pan strainer, pipe directly					●	●					
	Oil pump rotation is heavy, there is play in oil pump							●				
	Valve and spring of regulator valve are fatigued, damaged								●			
	Inspect oil filter directly									●		
	If oil level sensor is replaced, oil level monitor indicates normally											●
		Remedy	Clean	Add	—	Clean	Clean	Replace	Adjusting	Clean	Correct	Replace

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 in coolant, carry out troubleshooting for “S-11 Coolant contains oil (blows back or reduces)”

			Causes							
			Broken cylinder head, head gasket	Broken injector, O-ring	Cracks inside cylinder block	Holes made by pitting	Worn, damaged rear oil seal	Broken oil cooler core, O-ring	Defects in supply pump	Defective seal of auxiliary equipment (pump, compressor)
Check items	Questions	Check recent repair history								
		Degree of machine operation / Machine operated for long period		△		△	△			△
		Fuel must be added more frequently		◎					◎	
		Coolant must be added more frequently	○		○					
		There is oil in coolant	○	○	○	○		◎		
		Oil smells of diesel fuel		◎					◎	
		Oil is milky	○			○				
		When engine is started, drops of water come from muffler	○							
		When radiator cap is removed and engine is run at low idle, an abnormal number of bubbles appear, or coolant spurts back	◎			○				
		Exhaust smoke is white		○						
		Oil level goes down in hydraulic tank								◎
Troubleshooting		When compression pressure is measured, the oil pressure is low	●							
		Remove injector and inspect O-ring.		●						
		Inspect cylinder block, liner directly			●	●				
		Inspect rear oil seal directly					●			
		Pressure-tightness test of oil cooler shows there is leakage						●		
		Remove and inspect supply pump directly							●	
		Inspect the seal of auxiliary machine directly								●
		Remedy	Replace	Correct	Replace	Replace	Correct	Replace	Replace	Replace

S-14 Coolant temperature rises too high (Overheating)

General causes why coolant temperature rises too high
- Lack of cooling air (deformation, damages of fan)
- Drop in heat dissipation efficiency
- Defect in the coolant circulation system
- Hydraulic oil temperature on the applicable machine side is rising
  → Carry out troubleshooting from H-mode

			Causes												
			Broken cylinder head, head gasket	Holes made by pitting	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 fan belt, worn fan pulley	Defective coolant temperature gauge	Rise of hydraulic oil temperature
Questions	Check recent repair history													
	Degree of machine operation	Machine operated for long period	△	△					△	△				
	Condition overheating	Suddenly overheated				○	◎					○		
		Always tends to overheat						○	◎	◎		○		
	Coolant temperature gauge (when installed with coolant temperature gauge)	Rises quickly				○		◎						
		Does not go down from red range											◎	
Check items	Radiator coolant level monitor indicates drop of coolant level					◎								
	Engine oil level has risen, oil is milky			◎	○									
	Fan belt tension is low											◎		
	When fan pulley is turned, it has play						◎							
	Milky oil is floating on coolant				◎									
	There are excessive air bubbles in radiator, coolant spurts back		◎											
	When light bulb is held behind radiator core, no light passes through								◎					
	Radiator shroud and undercover are clogged with dirt or mud								◎			◎		
	Coolant is leaking because of cracks in hose or loose clamps					◎								
	Coolant flows out from radiator overflow hose										◎			
	Fan belt whines under sudden acceleration											◎		
	Hydraulic oil temperature gauge indicates the red range faster than engine coolant temperature gauge													◎
Troubleshooting	When compression pressure is measured, the oil pressure is low		●											Carry out troubleshooting from H-mode
	Inspect cylinder liner directly			●										
	Inspect oil cooler directly				●									
	Temperature difference between upper and lower tanks of radiator is large						●							
	When operation of thermostat is carried out, it does not open at cracking temperature							●						
	Temperature difference between upper and lower tanks of radiator is slight								●					
	Inspect radiator core directly									●				
	When operation of radiator cap is carried out, its cracking pressure is low										●			
	Inspect fan belt, pulley directly											●		
	When coolant temperature is measured, it is fount to be normal												●	
		Remedy	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

★ The engine is operated in the low-temperature mode while it is not warmed up sufficiently. Accordingly, the engine sound becomes a little larger. This does not indicate abnormality, however.

★ When the engine is accelerated, it is operated in the acceleration mode and its sound becomes a little larger for up to about 3 seconds. This does not indicate abnormality, however.

			Causes												
			Leakage of air between turbocharger and cylinder head	Interference of turbocharger, seized turbocharger	Broken dynamic valve system (valve, rocker lever)	Defective inside of muffler (dividing board out of position)	Improper valve clearance	Excessive wear of piston ring, cylinder liner	Improper gear train backlash	Removed, seized bushing	Deformed cooling fan and loosening and interference of fan belt	Clogged, seized injector	Dirt caught in injector	Improper fuel injection timing (abnormality in coolant temperature sensor, boost temperature sensor)
Questions / Check items	Check recent repair history													
	Degree of machine operation	Machine operated for long period						△						
	Condition of abnormal noise	Gradually occurred						○			○			
		Suddenly occurred		○	○					○				
	Non-specified fuel is being used											○		
	Oil must be added more frequently							◎						
	Metal particles are found when oil is drained							◎		◎				
	Air leaks between turbocharger and cylinder head		◎											
	When engine is cranked, interference sound is generated around turbocharger			◎										
	When engine is cranked, abnormal sound is generated around cylinder head				◎		◎							
	When engine is cranked, beat noise is generated around muffler					◎								
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low											◎	○	
	Color of exhaust smoke	Blue under light load						◎						
		Black	○	◎			○							
	Engine does not pick up smoothly and combustion is irregular											◎		
	Abnormal noise is loud when engine is accelerated						○		○		○	○		
	Blow-by gas is excessive							◎						
Troubleshooting	When turbocharger is rotated by hand, it is fount to be heavy			●										
	Inspect dynamic 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										●			
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change											●	●	
	Abnormal noise is heard only when engine is started												●	
	Check by the monitoring function													●
		Remedy	Replace	Replace	Correct	Replace	Adjusting	Replace	Replace	Replace	Correct	Replace	Replace	Replace

S-16 Vibration is excessive

General causes why vibration is excessive
- Defective parts (abnormal wear, breakage, etc.)
- Alignment with power train is not appropriate
- Abnormal combustion

★ If there is abnormal noise together with the vibration, carry out trouble-shooting also for “S-15 Abnormal noise is made”.

			Causes						
			Stuck dynamic valve system (valve, rocker lever)	Worn main metal, connecting rod metal	Improper gear train backlash	Worn camshaft bushing	Improper fuel injection timing (abnormality in coolant temperature sensor, boost temperature sensor)	Loose engine mounting bolts, broken cushions	Damages in power train
Questions / Check items	Check recent repair history								
	Degree of machine operation	Machine operated for long period		△		△		△	
	Condition of vibration	Suddenly increased	○						○
		Gradually increased		○		○		○	
	Non-specified oil is being used			○		○			
	Metal particles are found when oil is drained			◎		◎			
	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				○			○	○
	Color of exhaust smoke is black		◎				○		
Troubleshooting	Inspect dynamic valve system directly		●						
	Inspect main bearing and connecting rod bearing directly			●					
	Inspect gear train directly				●				
	Inspect camshaft bushing directly					●			
	Check by the monitoring function						●		
	Inspect engine mounting bolts and cushions directly							●	
	Inspect inside of power train directly								●
		Remedy	Replace	Replace	Replace	Replace	Replace	Replace	Replace

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

50 Disassembly and assembly

General information on disassembly and assembly

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How to read this manual 2
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General information on disassembly and assembly

How to read this manual

1. Removal and installation of assemblies

Special tools

- The special tools necessary for the removal and installation work are indicated by symbols as **A1 ••• X1** and their part Nos., part names, and quantity are described in the table.
- In the special tools table, the following information is described, as well as the above items.

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:
   - The 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 can not be supplied from Komatsu in Japan (i.e. locally made parts).

★ General tools that are necessary for removal or installation are described as [1],[2]•••etc. and their part names, part numbers and quantities are not described.

Removal

- The [Removal] section contains procedures and precautions for implementing the work, know how and the amount of oil or coolant to be drained.
- The common tools necessary for the removal work are indicated [1],[2]••• and their part Nos., part names, and quantity are not described.
- Various symbols used in the Removal Section are explained and listed below.

⚠ : **This mark indicates safety-related precautions that must be followed when implementing the work.**

★ : Know-how or precautions for work

[*1] : This mark shows that there are instructions or precautions for installing parts.

: This mark shows the amount of 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 Installation Section, identifying which step the instructions are intended for.
- The common tools necessary for the installation work are indicated [1],[2]••• and their part Nos., 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

- The special tools necessary for the disassembly and assembly work are indicated by symbols as **A1 ••• X1** and their part Nos., part names, and quantity are described in the table.
- Also the following information is described in the special tool list.

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:
   - The 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 can not be supplied from Komatsu in Japan (i.e. locally made parts).

★ General tools that are necessary for removal or installation are described as [1],[2]•••etc. and their part names, part numbers and quantities are not described.

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.
- The common tools necessary for the disassembly work are indicated [1],[2]••• and their part Nos., part names, and quantity are not described.
- The meanings of the symbols used in Disassembly section are as follows.

⚠ **: This mark indicates safety-related precautions that must be followed when implementing the work.**

★ : Know-how or precautions for work

: Quantity of oil or coolant 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.
- The common tools necessary for the assembly work are indicated [1],[2]••• and their part Nos., part names, and quantity are not described.
- The meanings of the symbols used in Assembly section are as follows.

⚠ **: 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 number	Q'ty	Container	Main features and applications
Adhesive	LT-1A	790-129-9030	150 g	Tube	• Used to prevent rubber gaskets, rubber cushions, and cork plugs from coming out.
	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: Resistance 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.
	Holtz MH 705	790-129-9120	75 g	Tube	• Heat-resistant seal used to repair engines.
	ThreeBond 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-setting type. (max. strength is obtained after 30 minutes) • Used mainly to stick rubbers, plastics, and metals.
	Loctite 648-50	79A-129-9110	50 cc	Polyethylene container	• Features: Resistance to heat and chemicals. • Used for fitted portions used at 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 piping.
	LG-6	790-129-9020	200 g	Tube	• Features: Silicon-based heat and cold-resistant sealant. • Used to seal flange 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-setting sealant. • Used to seal flywheel housing, intake manifold, oil pan, thermostat housing, etc.
	ThreeBond 1211	790-129-9090	100 g	Tube	• Gasket sealant used to repair engine.
	ThreeBond 1207B	419-15-18131	100 g	Tube	• Features: Silicon-based, heat and cold-resistant, vibration-resistant, impact-resistant sealant. • Used to seal transfer case, etc.

Category	Komatsu code	Part number	Q'ty	Container	Main features and applications
Molybdenum disulfide lubricant	LM-G	09940-00051	60 g	Can	• Used to lubricate sliding portions. (to prevent 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	SYG2-400LI SYG2-350LI SYG2-400LI-A SYG2-160LI SYGA-160CNLI	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 grease LM-G (G2-M)	SYG2-400M SYG2-400M-A SYGA-16CNM	400 g x 10 400 g x 20 16 kg	Bellows-type container Can	• Used for parts under heavy load.
	Hyper White Grease G2-T, G0-T (*) *: For cold district	SYG2-400T-A SYG2-16CNT SYG0-400T-A (*) SYG0-16CNT (*)	400 g 16 kg	Bellows-type container Can	• Seizure resistance and heat resistance higher than molybdenum disulfide grease. • Not conspicuous on machine since color is white.
	Biograese G2-B, G2-BT (*) *: For use at high temperature and under high load	SYG2-400B SYGA-16CNB SYG2-400BT (*) SYGA-16CNBT (*)	400 g 16 kg	Bellows-type container Can	• Since this grease is decomposed by natural bacteria in short period, it has less effects on micro-organisms, animals, and plants.
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	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 (Almite). (Using limit: 4 months after date of manufacture)

Category	Komatsu code	Part number	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 and “W” for low-temperature season as adhesive for glass. (Using limit: 4 months after date of manufacture)
	Sika 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 joints of glass parts. (Using limit: 4 months after date of manufacture)
	SEKISUI SILICONE SEALANT	20Y-54-55130	333 ml	Polyethylene container		• Used to seal front window. (Using limit: 6 months after date of manufacture)
	GE TOSHIBA SILICONES 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 tools list

★ Tools with part number 79○T-○○○-○○○○ cannot be supplied (they are items to be locally manufactured).

★ Necessity: ■ ..... Cannot be substituted, must always be installed (used)
● ..... Extremely useful if available or can be substituted with commercially available part

★ New/Remodel: N..... Tools with new part numbers, newly developed for this model
R:..... Tools with upgraded part numbers, remodeled from items already available for other models
Blank: ... Tools already available for other models, can be used without any modification

★ Tools marked ○ in the Sketch column are tools introduced in the sketches of the special tools (See Sketches of special tools).

Component	Symbol		Part number	Part name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks
Engine assembly	A	1	795-799-1131	Gear	■	1			Setting of stamp (TDC) on damper
		2	795-799-6700	Puller	■	1			Removal of fuel injector
Transmission assembly	B1		792-201-0200	Wrench	■	1			Removal of PTO gear nut
Torque converter assembly (Standard specification)	E		790-501-5000	Unit repair stand	●	1			Disassembly and assembly of torque converter assembly
			790-501-5200	Unit repair stand	●	1			
			790-901-2110	Bracket	●	1			
			790-901-2150	Plate	●	1			
Torque converter assembly (Lockup specification)	F1	1	790-501-5000	Unit repair stand	●	1			Disassembly and assembly of torque converter assembly
		2	790-901-2110	Bracket	●	1			
		3	790-901-4240	Plate	●	1			
	F2		793-647-1110	Wrench	●	1			Removal of stator shaft nut
Transmission clutch pack assembly	C	1	793-607-1110	Seal holder	■	1			Installation of piston seal
		2	792-607-1120	Seal holder	■	1			
Center hinge pin	D	1	790-101-2300	Push puller	■	1			Removal and installation of center hinge pin
		2	793-520-2370	Push tool	■	1			
		3	793-520-2350	Push tool	■	1			
		4	793-520-2540	Guide	■	1			
		5	793-520-2360	Bar	■	2			
		6	790-101-1102	Hydraulic pump	■	1			
		7	790-101-2102	Puller (294.2 kN {30 ton})	■	1			
Axle housing assembly	J	1	793T-522-1140	Push tool	■	1			Press fitting of bearing (wheel side)
			793T-522-1150	Spacer	■	1			
		2	797T-423-1290	Push tool	■	1			Press fitting of bearing (differential side)
		3	793T-522-1160	Push tool	■	2			Press fitting of oil seal
		4	793T-522-1171	Seal support	■	2			Installation of axle housing
			01016-30860	• Bolt	■	6			

Component	Symbol		Part number	Part name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks
Differential assembly	H1	1	790-501-5000 or 790-501-5200	Unit repair stand	●	1			Disassembly and assembly of differential assembly
		2	790-901-2110	Bracket	●	1			
		3	790-901-1331	Plate	●	1			
	H2	1	790-301-1720	Adapter	■	1			Check of brake oil leakage
		2	799-101-5002	Hydraulic kit	■	1			
		3	793-605-1001	Brake tester	■	1			
		4	790-101-1102	Hydraulic pump	■	1			
Hydraulic cylinder assembly	I	1	790-502-1003	Repair stand	●	1			Disassembly and assembly of hydraulic cylinder assembly
			790-101-1102	Hydraulic pump	●	1			
		2	790-102-2303 or 790-330-1100	Wrench assembly	●	1			Removal and installation of cylinder head (steering cylinder)
		3	790-302-1270	Socket (width across flats 50 mm)	●	1			Removal and installation of piston nut (steering cylinder)
		4	790-102-4300	Wrench assembly	●	1			Removal and installation of piston assembly (boom and bucket cylinders)
			790-102-4310	Pin	●	1			
		5	790-720-1000	Expander	●	1			Installation of piston ring
		6	796-720-1640	Ring	●	1			(Steering cylinder)
			07281-00909	Clamp	●	1			
			796-720-1670	Ring	●	1			(Boom cylinder)
			07281-01279	Clamp	●	1			
			796-720-1680	Ring	●	1			(Bucket cylinder)
			07281-01589	Clamp	●	1			
Air conditioner unit assembly	X		799-703-1200	Service tool kit	■	1			Charging with air conditioner refrigerant
			799-703-1100	Vacuum pump (100 V)	■	1			
			799-703-1110	Vacuum pump (220 V)	■	1			
			799-703-1120	Vacuum pump (240 V)	■	1			
			799-703-1401	Gas leak detector	■	1			
Operator's cab glass (stuck glass)	X2	1	793-498-1120	Clear plate	■	2			Installation of operator's cab glass
		2	793-498-1130	Plate	■	2			
		3	793-498-1110	Magnet	■	2			
	X3		793-498-1210	Lifter (Suction cup)	■	2			

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

50 Disassembly and assembly

Engine and cooling system

Engine and cooling system 2
Removal and installation of fuel supply pump assembly 2
Removal and installation of fuel injector assembly 4
Removal and installation of cylinder head assembly 9
Removal and installation of engine hood 18
Removal and installation of radiator assembly 20
Removal and installation of air aftercooler 22
Removal and installation of hydraulic oil cooler assembly 24
Removal and installation of engine assembly 26
Removal and installation of cooling fan and fan motor assembly 31
Removal and installation of fuel tank assembly 34

Engine and cooling system

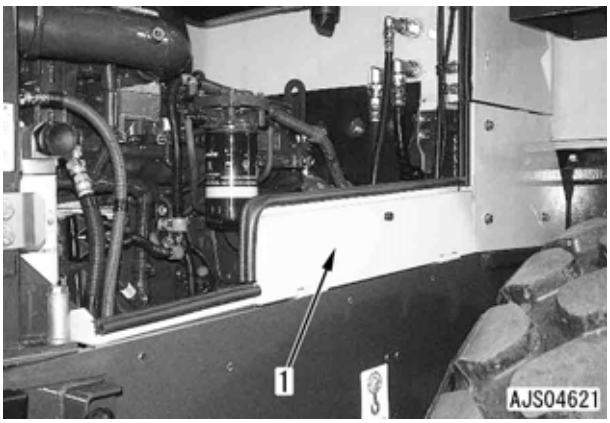
Removal and installation of fuel supply pump assembly

Removal

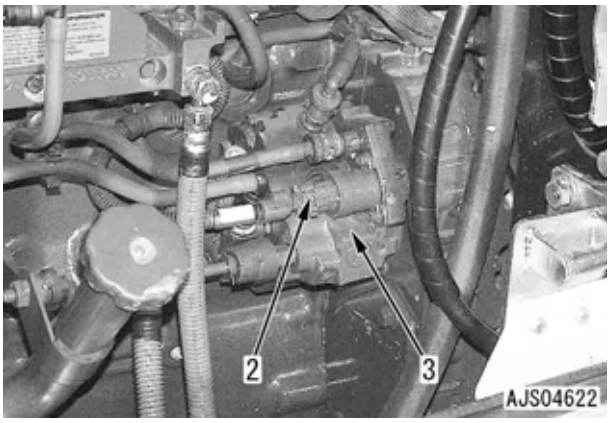
⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Open the right side of the engine hood.

2. Remove right cover (1).

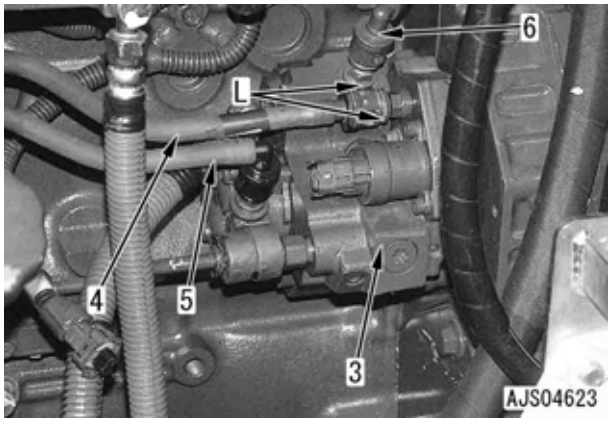


3. Disconnect connector (2) from fuel supply pump (3).



4. Disconnect fuel filter hoses (4) and (5) from fuel supply pump (3).
   - ★ Remove mud from each hose joint in advance (to prevent it from sticking lock (L)).
   - ★ Pull out lock (L) of each hose joint by pressing it from both sides.
   - ★ Put plugs in the adapters of the disconnected hoses to prevent fuel from flowing out.
   - ★ Do not use wooden plugs since chips may be left in the fuel line.

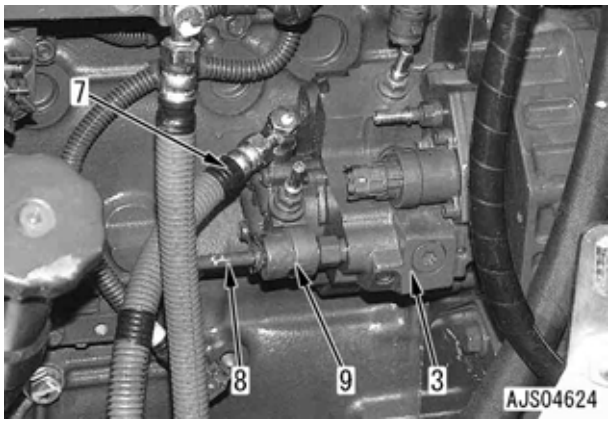
5. Disconnect fuel return hose (6) from fuel supply pump (3).



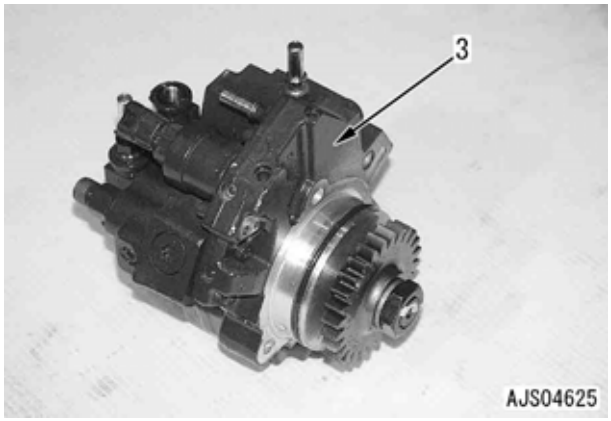
6. Disconnect fuel supply hose (7) from fuel supply pump (3).

7. Remove bellows (9) of high-pressure pipe (8). [*1]

8. Remove the 2 clamps of high-pressure pipe (8) and disconnect the pipe from fuel supply pump (3). [*2]
   - ★ Remove the bellows on the common rail side, too, and loosen the sleeve nut.



9. Remove the 3 nuts and fuel supply pump (3). [*3]
   ★ The fuel supply pump comes off together with the gear.



Installation

- Carry out installation in the reverse order to removal.

[*1] [*2]
- Procedure for installing high-pressure pipe (8)

1. Tighten the sleeve nuts on the fuel supply pump side and common rail side with the fingers.

2. Tighten the sleeve nut on the fuel supply pump side first and then that on the common rail side.
   Sleeve nut:
   35 ± 3.5 Nm {3.57 ± 0.36 kgm}

3. Install the 2 clamps of high-pressure pipe (8).
   Mounting bolt of clamp bracket:
   24 ± 4 Nm {2.45 ± 0.41 kgm}

4. Install bellows (9).
   ★ Install each bellows with the slits out and down.
   ★ The bellows are installed so that fuel will not spout over the hot parts of the engine and catch fire when it leaks for some reason.

[*3]
Fuel supply pump mounting nut:
24 ± 4 Nm {2.45 ± 0.41 kgm}

Bleeding air

- Bleed air from the fuel system. For details, see Testing and adjusting.

Removal and installation of fuel injector assembly

Special tools

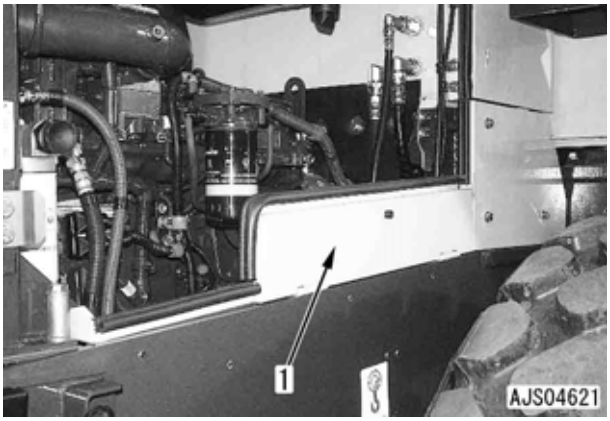
Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
A	1	795-799-1131	Gear	■	1		
	2	795-799-6700	Puller	■	1		

Removal

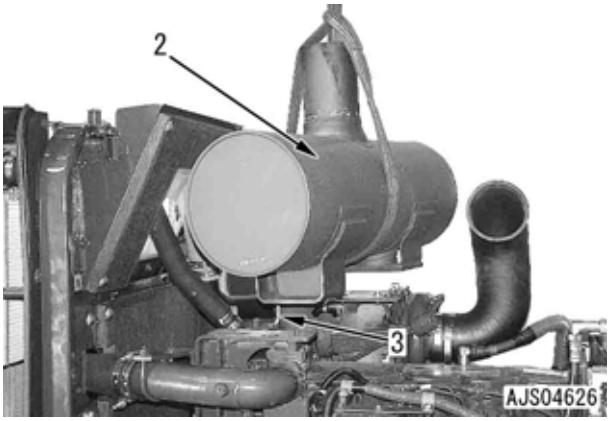
⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Remove the engine hood assembly. For details, see “Removal and installation of engine hood assembly”.

2. Remove right and left covers (1).



3. Remove the muffler heat insulation cover and lift off muffler (2).
   ★ Remove tube (3) in advance.
   Muffler: **33 kg**

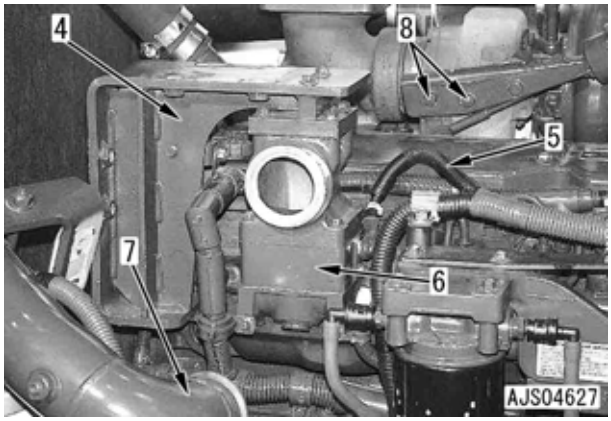


4. Remove muffler mounting bracket (4).

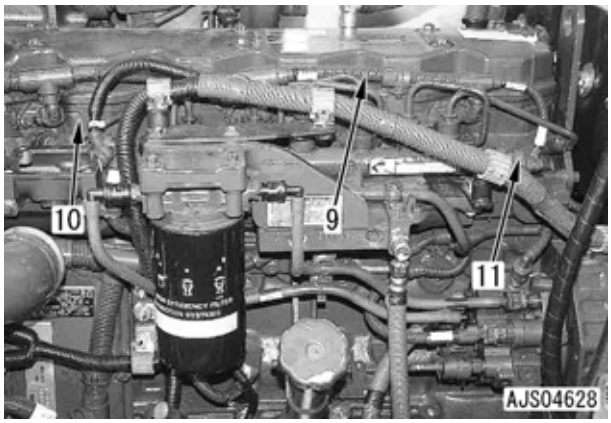
5. Disconnect wiring (5) from air intake connector (6).

6. Remove tube (7) and air intake connector (6). [*1]

7. Remove 2 bolts (8) so that the head cover will not interfere with them when the head cover is removed.

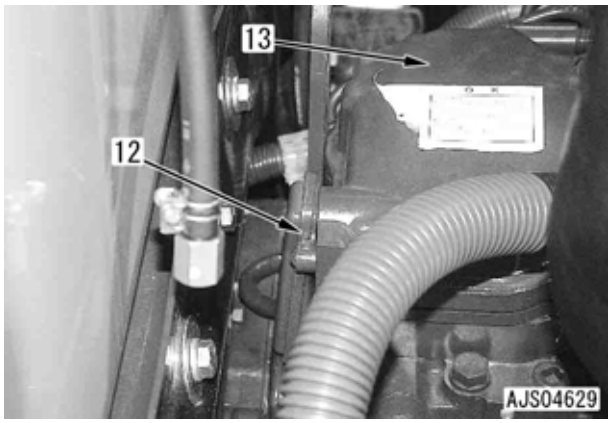


8. Disconnect the connector of wiring harness (9) from cylinder head (10) and common rail (11) and move it to the left. [*2]
   ★ While pressing the lock of the connector with a flat-head screwdriver, insert another screwdriver in the clearance of the connector and pry off the connector gradually.



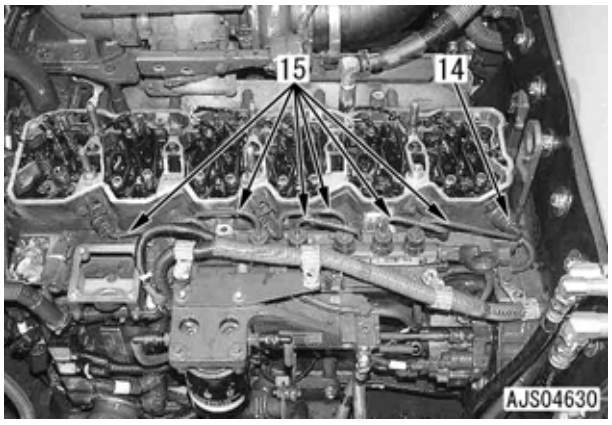
9. Using hexagonal wrench (3 mm), remove blow-by duct (12) from head cover (13). [*3]

10. Remove head cover (13). [*4]
    ★ Clean around the head cover in advance so that sticking mud etc. will not enter the engine.

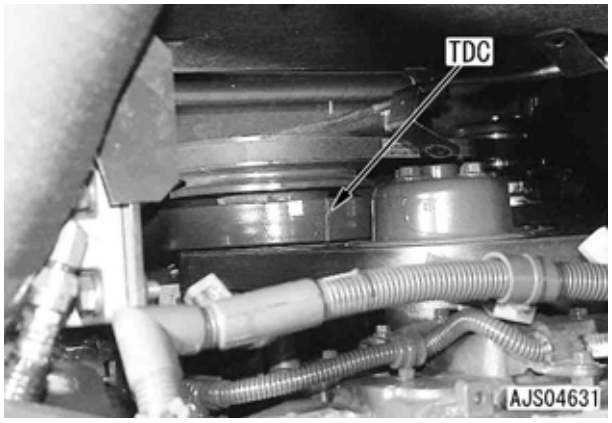


11. Remove bellows (14) of the high-pressure pipes. [*5]

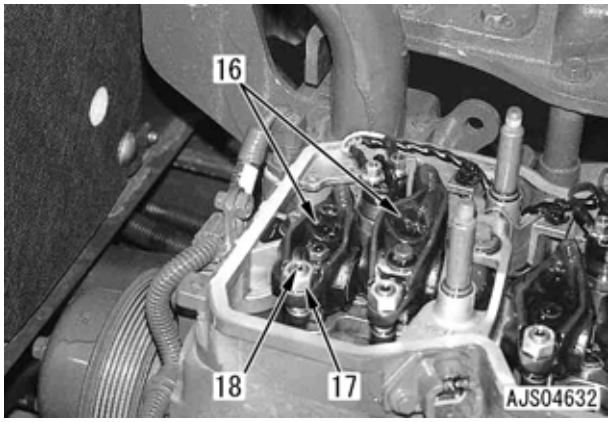
12. Disconnect 6 high-pressure pipes (15) from the cylinder head. [*6]
    ★ Remove the bellows on the common rail side, too, and loosen the sleeve nut.



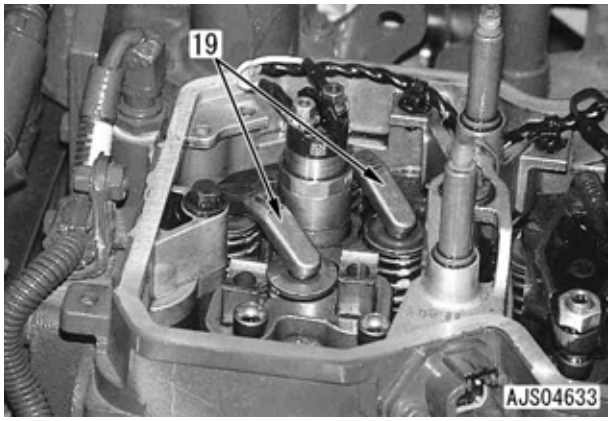
13. While watching the movement of the damper, rotate the engine and set the stamp (TDC) of the damper to the top and set the No. 1 cylinder to the compression top dead center.
    ★ If the No. 1 cylinder is not at the compression top dead center, rotate the engine one more turn.
    ★ See Testing and adjusting, “Adjusting valve clearance”.
    ★ Use gear **A1** to rotate the engine.

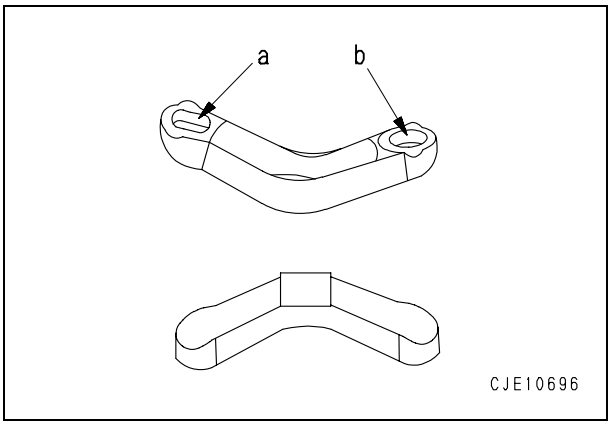


14. Remove the mounting bolts and rocker arms (16).
    ★ Loosen locknut (17) and then loosen adjustment screw (18) by 2 – 3 turns so that an excessive force will not be applied to the push rod when the rocker arm is installed.

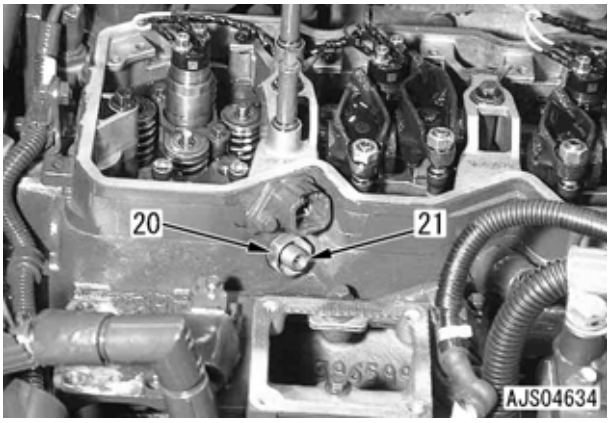


15. Remove crossheads (19).
    ★ Record the position and direction (shapes of holes (a) and (b)) of each crosshead. (Reinstall each crosshead in the same direction.)



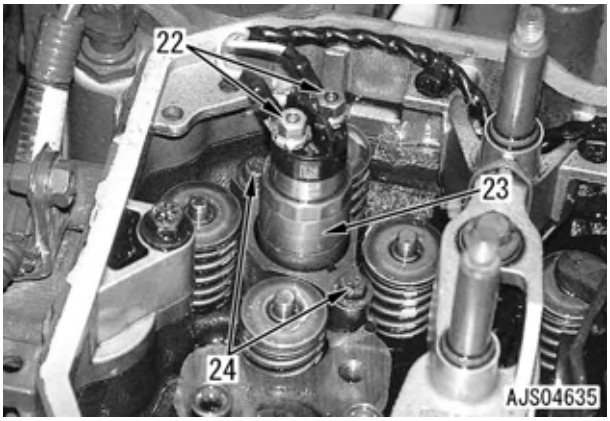


16. Remove retainer (20) and inlet connector (21).
    ★ Clean the inlet connector carefully so that mud, etc. sticking around it will not enter its hole.

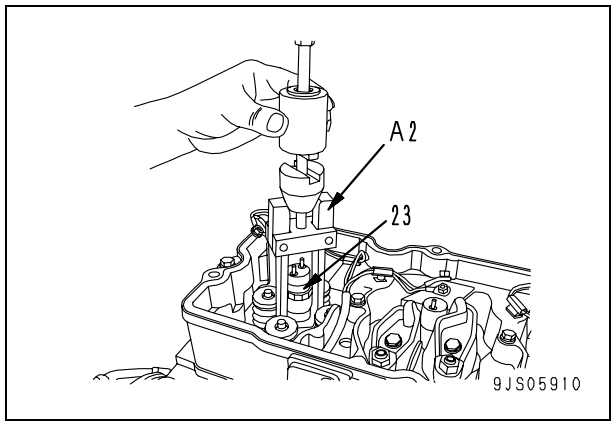


17. Remove nuts (22) of the wiring harness from fuel injector (23).

18. Remove mounting bolts (24) of fuel injector (23).



19. Using puller **A2**, remove fuel injector assembly (23).
    ★ Take care that dirt will not enter the mounting section of the fuel injector assembly.

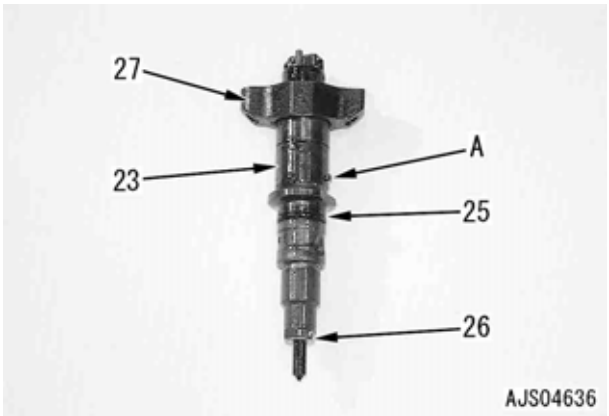


Installation

1. Fuel injector assembly

★ Check that the fuel injector sleeve is free from flaw and dirt.

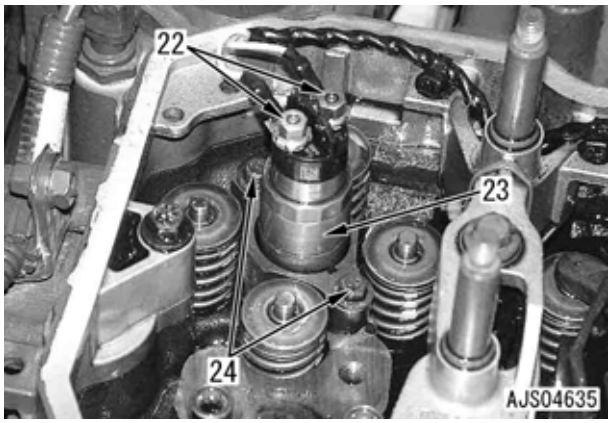
1) Fit O-ring (25) and gasket (26) to fuel injector (23).
2) Apply engine oil (EO15W-40) to the O-ring of fuel injector (23) and the mounting hole on the head side.
3) Matching convex and concave parts (A), install holder (27) to fuel injector (23).



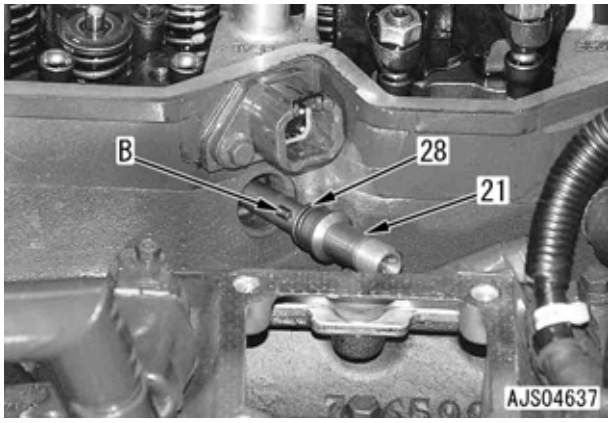
4) Insert fuel injector (23) in the cylinder head, directing its fuel inlet hole toward the air intake manifold.
5) Tighten mounting bolts (24) of fuel injector (23) by 3 – 4 turns.
6) Install the wiring harnesses to fuel injector (23) and tighten nuts (22).
   Wiring harness mounting nut:
   1.5 ± 0.25 Nm {0.15 ± 0.03 kgm}

★ Installed positions of wiring harnesses

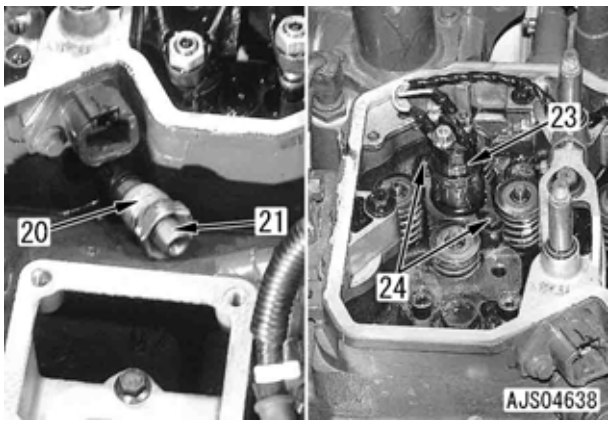
Wiring harness color	Cylinder No.
White	1, 3, 5
Black	2, 4, 6



7) Apply engine oil (EO15W-40) to the mounting hole of inlet connector (21) on the head side.
8) Apply engine oil (EO15W-40) to O-ring (28) of inlet connector (21) and insert inlet connector (21) perfectly, matching part (B) to the groove on the head side.

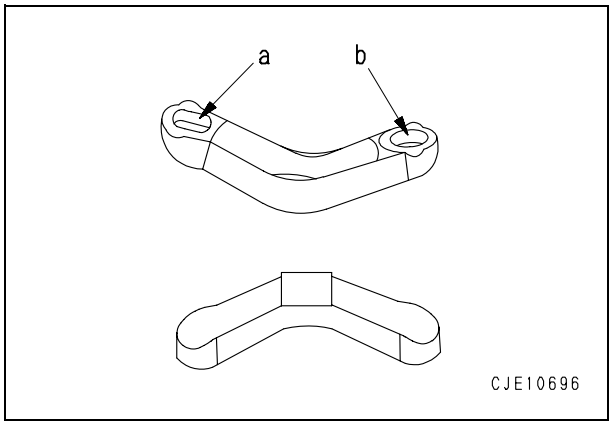


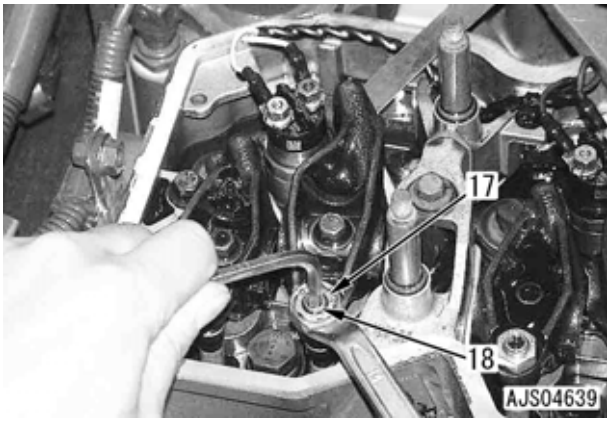
9) Secure inlet connector (21) by tightening retainer (20) with the fingers. (Push the inlet connector into the hole of the injector.)
10) Tighten mounting bolts (24) of fuel injector (23) alternately.
Fuel injector mounting bolt
1st time:
3.5 ± 0.35 Nm {0.35 ± 0.035 kgm}
2nd time: **75 ± 5°**
(Tighten with angle tightening tool)
11) Tighten retainer (20).
Retainer:
50 ± 5 Nm {5.1 ± 0.5 kgm}



2. Crosshead and rocker arm

1) Install the crosshead and rocker arm.
★ The shapes of holes (a) and (b) of each crosshead are different. Accordingly, when reusing the crossheads, install each of them to the same intake/exhaust valve in the same direction as it has been installed.
★ Before tightening the mounting bolts, check that the ball of adjustment screw (18) is set in the push rod socket securely.
Rocker arm mounting bolt:
36 ± 5 Nm {3.7 ± 0.5 kgm}
2) Adjust the valve clearance. For details, see Testing and adjusting, “Adjusting valve clearance”.
Locknut (17):
24 ± 4 Nm {2.4 ± 0.4 kgm}





- Carry out the following installation in the reverse order to removal.

[*1]
Tube mounting band:
7 ± 1 Nm {0.7 ± 0.1 kgm}
Air intake connector mounting bolt:
24 ± 4 Nm {2.4 ± 0.4 kgm}

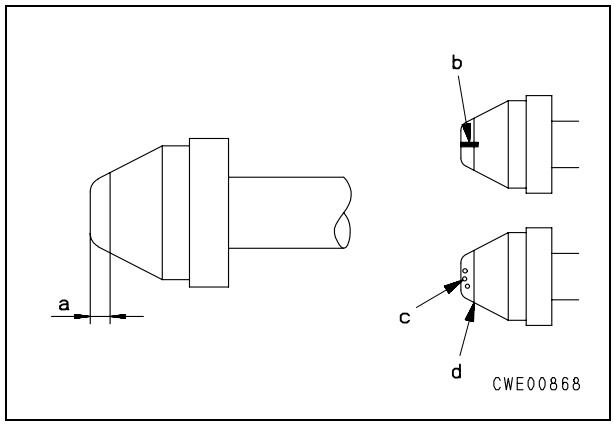
[*2]
Install each high-pressure pipe and wiring harness at least 10 mm apart from each other.

[*3]
Blow-by duct mounting bolt:
7 ± 2 Nm {0.7 ± 0.2 kgm}

[*4]
Head cover mounting nut:
24 ± 4 Nm {2.4 ± 0.4 kgm}

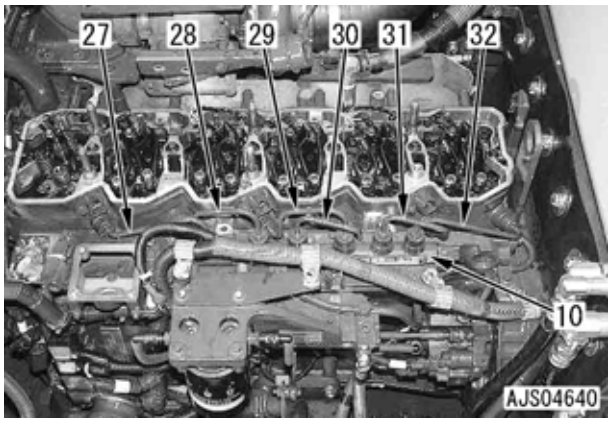
[*5] [*6]
- **High-pressure pipe**

Do not bend the high-pressure pipe to correct before installing.
Be sure to use the genuine high-pressure pipe clamps and observe the tightening torque.
★ When installing each high-pressure pipe, check the taper seal of its joint (Part (a): Part of 2 mm from the end) for visible lengthwise slit (b) and spot (c) and check part (d) (End of taper seal: Part at 2 mm from the end) for stepped-type wear caused by fatigue which your nail can feel. If there is any of those defects, it can cause fuel leakage. In this case, replace the high-pressure pipe.



1. Temporarily install high-pressure pipes (27) – (32) between common rail (10) and cylinder head.
   Sleeve nut:
   0.2 – 0.8 Nm {0.02 – 0.08 kgm}

2. Tighten high-pressure pipes (27) – (32) in the following order.
   Sleeve nut:
   35 ± 3.5 Nm {3.6 ± 0.4 kgm}
   1) Tighten head side of high-pressure pipes (27) and (32).
   2) Tighten common rail side of high-pressure pipes (32) and (27).
   3) Tighten head side of high-pressure pipes (28), (29), (30), and (31) in this order.
   4) Tighten common rail side of high-pressure pipes (28), (29), (30), and (31) in this order.



3. Install bellows (9) to each high-pressure pipe.
   ★ Install each bellows with the slits out and down.
   ★ The bellows are installed so that fuel will not spout over the hot parts of the engine and catch fire when it leaks for some reason.

Removal and installation of cylinder head assembly

Special tools

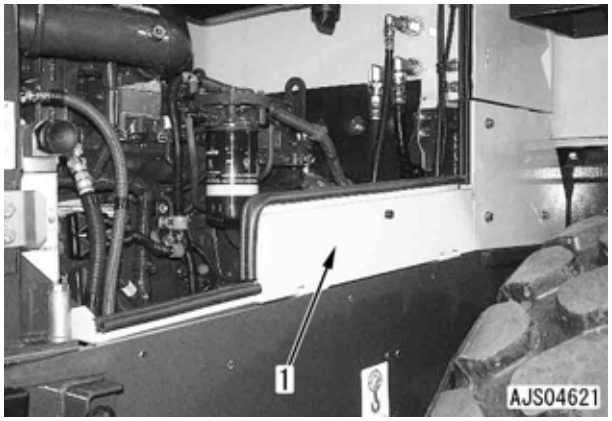
Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
A	1	795-799-1131	Gear	■	1		
	2	795-799-6700	Puller	■	1		

Removal

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

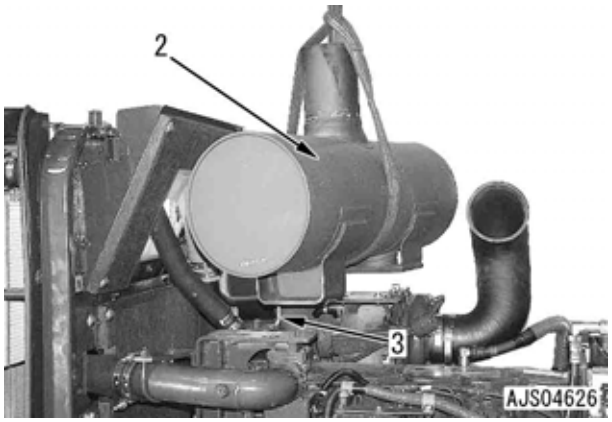
1. Remove the engine hood assembly. For details, see “Removal and installation of engine hood assembly”.

2. Remove right and left covers (1).

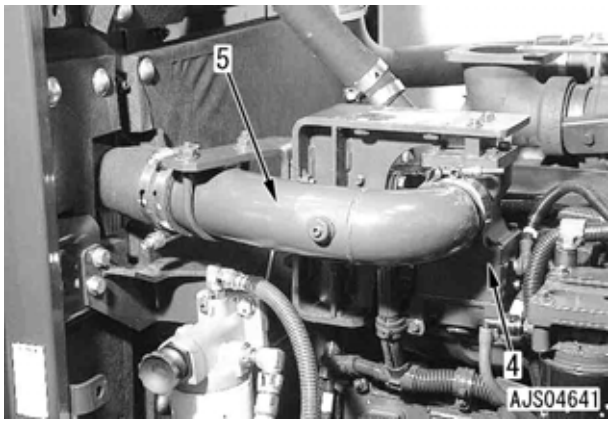


3. Drain the coolant.
   Coolant: **Approx. 30.5 ℓ**

4. Remove the muffler heat insulation cover and lift off muffler (2).
   ★ Remove tube (3) in advance.
   Muffler: **33 kg**



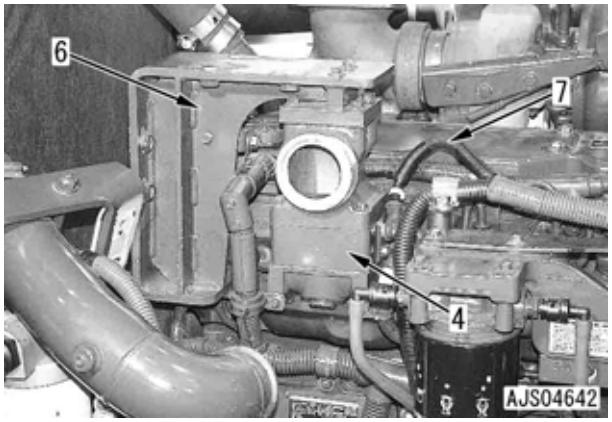
5. Disconnect tube (5) from air intake connector (4). [*1]



6. Remove muffler mounting bracket (6).

7. Disconnect wiring harness (7) from air intake connector (4).

8. Remove air intake connector (4). [*2]

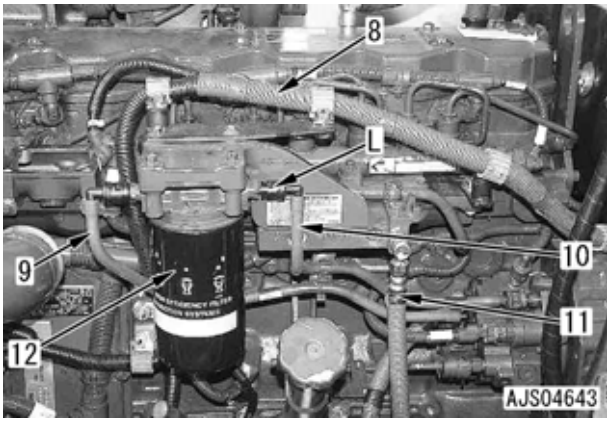


9. Remove the 3 clamps of wiring harness (8).

10. Remove fuel filter hoses (9) and (10).
    ★ Remove mud from each hose joint in advance (to prevent it from sticking lock (L)).
    ★ Pull out lock (L) of each hose joint by pressing it from both sides.
    ★ Put plugs in the adapters of the disconnected hoses to prevent fuel from flowing out.
    ★ Do not use wooden plugs since chips may be left in the fuel line.

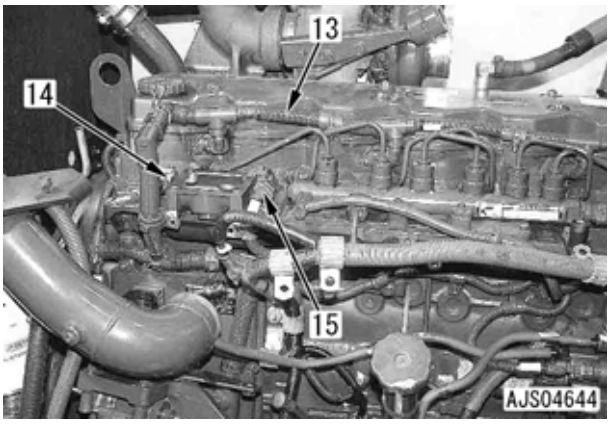
11. Disconnect fuel return hose (11).

12. Remove fuel filter (12) and bracket together. [*3]

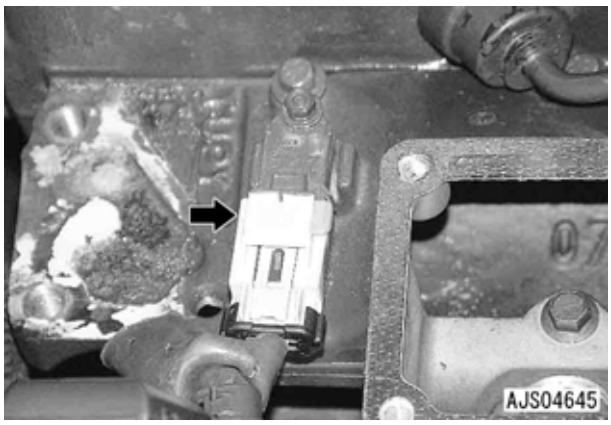


13. Remove the 2 clamps of wiring harness (13) and disconnect the connector from the cylinder head and common rail. [*4]
    ★ While pressing the lock of the connector with a flat-head screwdriver, insert another screwdriver in the clearance of the connector and pry off the connector gradually.

14. Disconnect ambient pressure sensor connector (14) and boost pressure sensor connector (15).

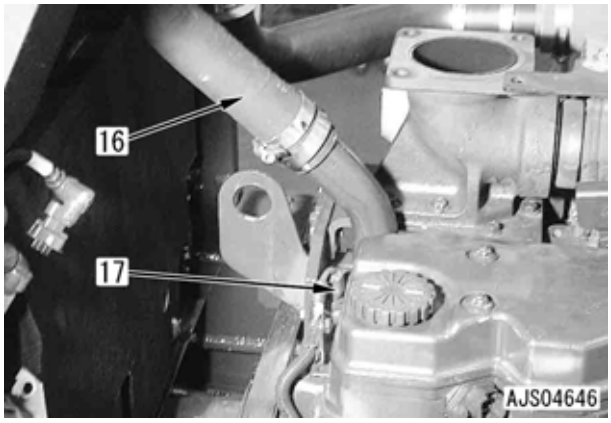


    ★ Disconnect ambient pressure sensor connector (14) by moving the lock to the right and press the claw.
    ★ Move wiring harness (13) to the left.



15. Remove radiator hose (16).

16. Disconnect coolant temperature sensor connector (17).

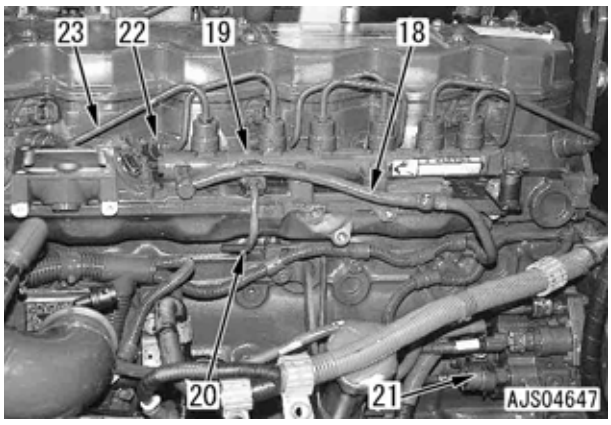


17. Remove fuel return hose (18) from common rail (19).

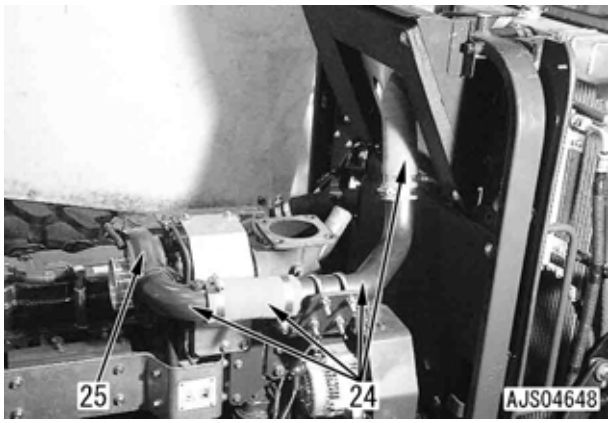
18. Remove the 2 clamps of high-pressure pipe (20) between the common rail and fuel supply pump. [*5]

19. Remove bellows (21) and high-pressure pipe (20). [*6]

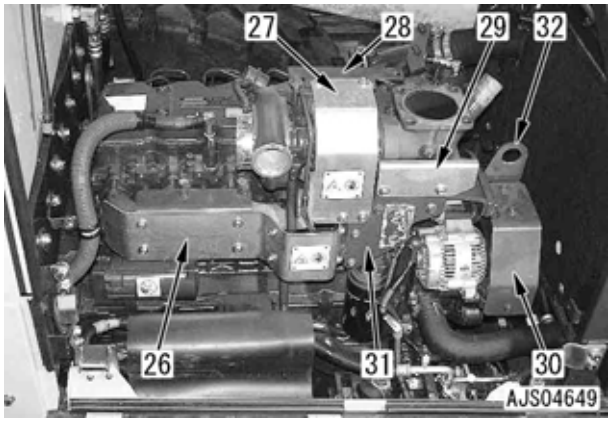
20. Remove bellows (22) and 6 high-pressure pipes (23). [*7]



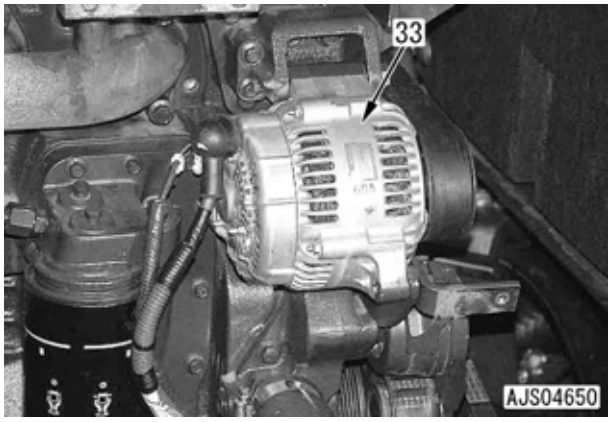
21. Disconnect tube and hose assembly (24) from turbocharger (25). [*8]



22. Remove covers (26), (27), (28), (29), (30), and (31) and bracket (32).

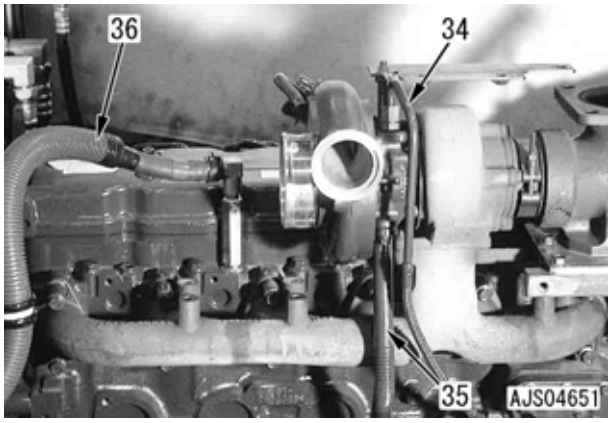


23. Remove alternator assembly (33).



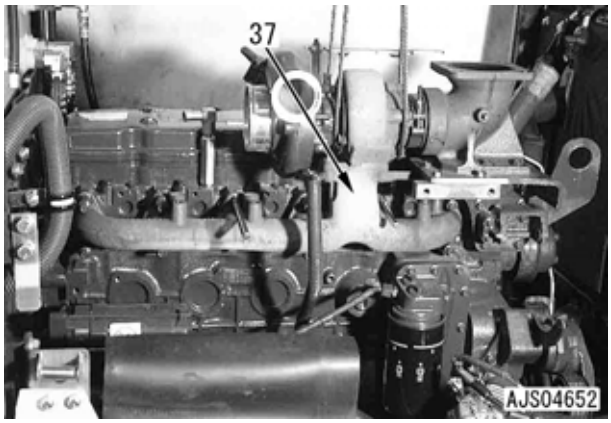
24. Remove turbocharger lubricating oil inlet hose (34) and lubricating oil outlet hose (35).

25. Remove heater hose (36).



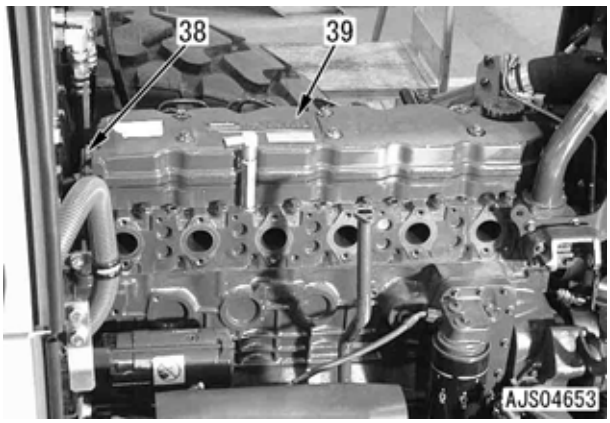
26. Sling exhaust manifold and turbocharger assembly (37) temporarily, remove the mounting bolts, and lift off the assembly. [*9]

    Exhaust manifold and turbocharger assembly: **35 kg**

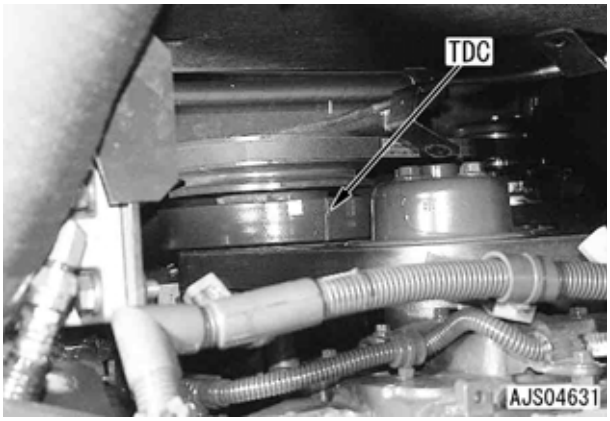


27. Using hexagonal wrench (3 mm), remove blow-by duct (38) from head cover (39). [*10]

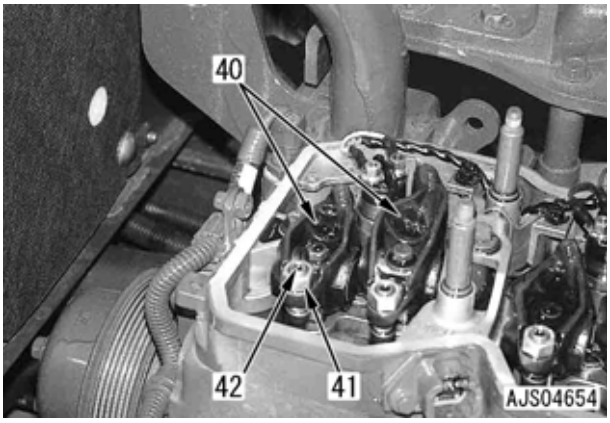
28. Remove head cover (39). [*11]
    ★ Clean around the head cover in advance so that sticking mud etc. will not enter the engine.



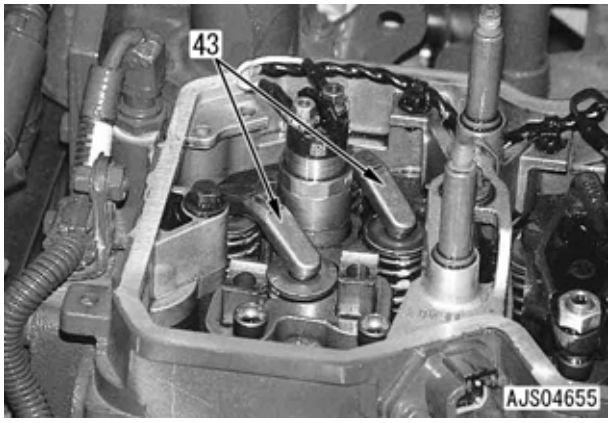
29. While watching the movement of the damper, rotate the engine and set the stamp (TDC) of the damper to the top and set the No. 1 cylinder to the compression top dead center.
    ★ If the No. 1 cylinder is not at the compression top dead center, rotate the engine one more turn.
    ★ See Testing and adjusting, “Adjusting valve clearance”.
    ★ Use gear **A1** to rotate the engine.

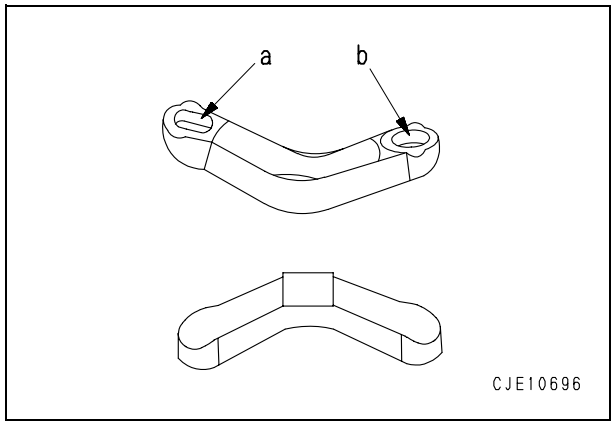


30. Remove the mounting bolts and rocker arms (40).
    ★ Loosen locknut (41) and then loosen adjustment screw (42) by 2 – 3 turns so that an excessive force will not be applied to the push rod when the rocker arm is installed.

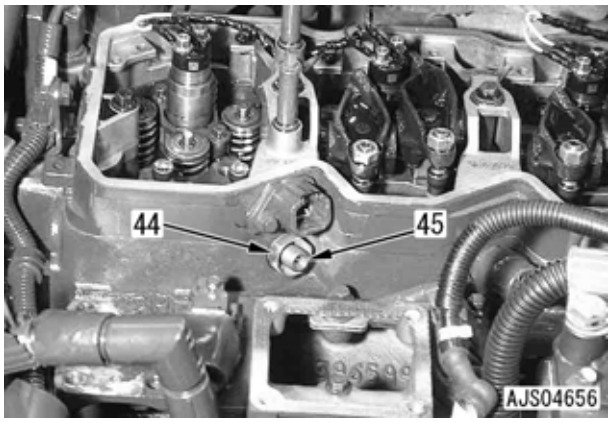


31. Remove crossheads (43).
    ★ Record the position and direction (shapes of holes (a) and (b)) of each crosshead. (Reinstall each crosshead in the same direction.)



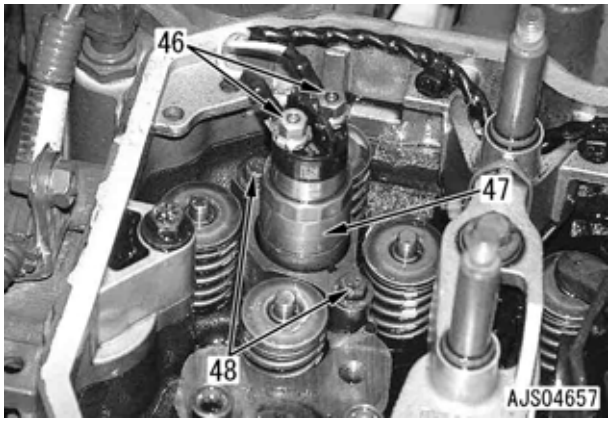


32. Remove retainer (44) and inlet connector (45).
    ★ Clean the inlet connector carefully so that mud, etc. sticking around it will not enter its hole.

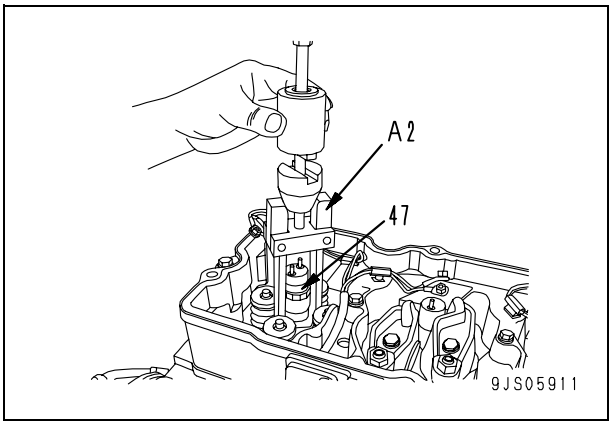


33. Remove nuts (46) of the wiring harness from fuel injector (47). [*11]

34. Remove mounting bolts (48) of fuel injector (47).

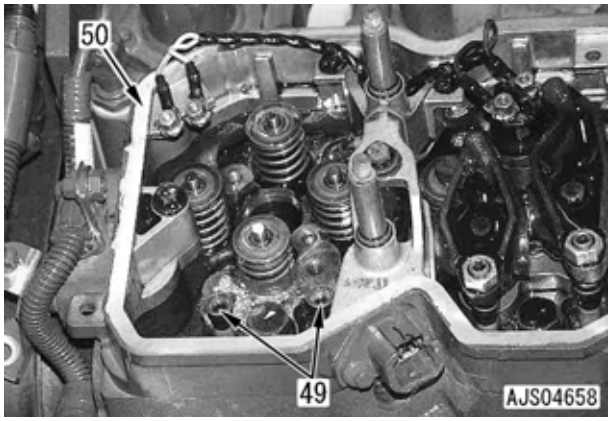


35. Using puller **A2**, remove fuel injector assembly (47).
    ★ Take care that dirt will not enter the mounting section of the fuel injector assembly.



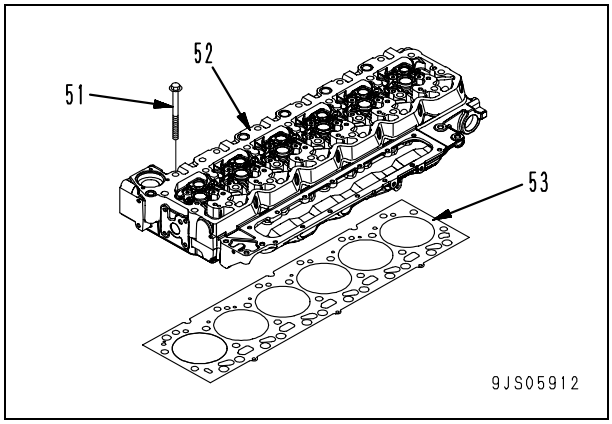
36. Remove push rods (49).

37. Remove rocker housing assembly (50).



38. Remove mounting bolts (51) and lift off cylinder head assembly (52).
    Cylinder head assembly: **75 kg**

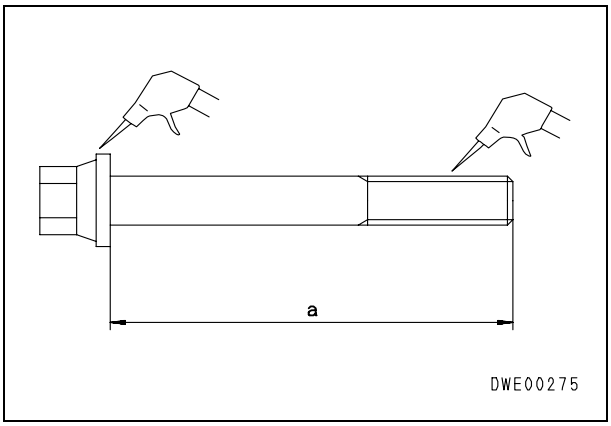
39. Remove cylinder head gasket (53).



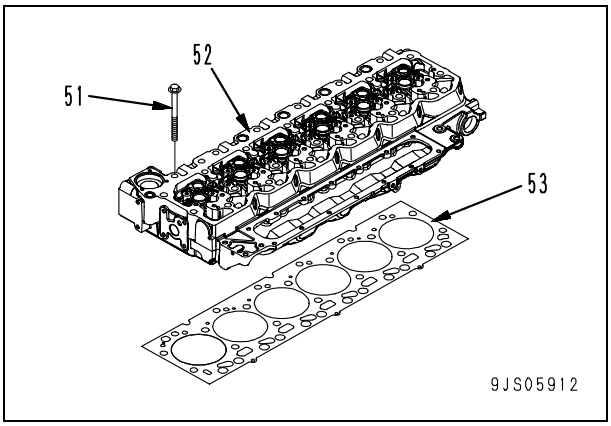
Installation

1. Fuel injector assembly

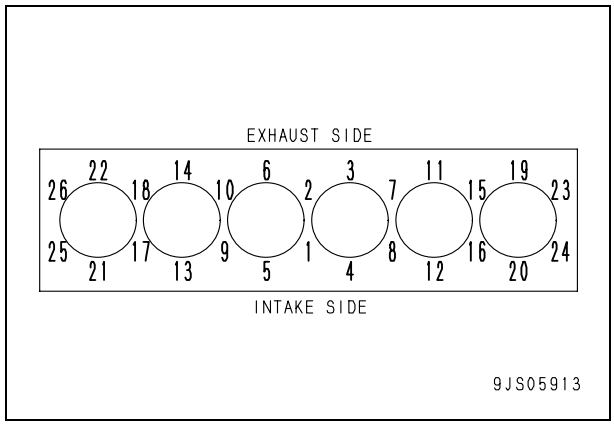
1) Measure stem length “a” of each cylinder head mounting bolt and check that it is shorter than the using limit.
   - Using limit length of bolt: **132.1 mm**
   - ★ If a bolt is longer than the using limit, do not reuse it but replace it.



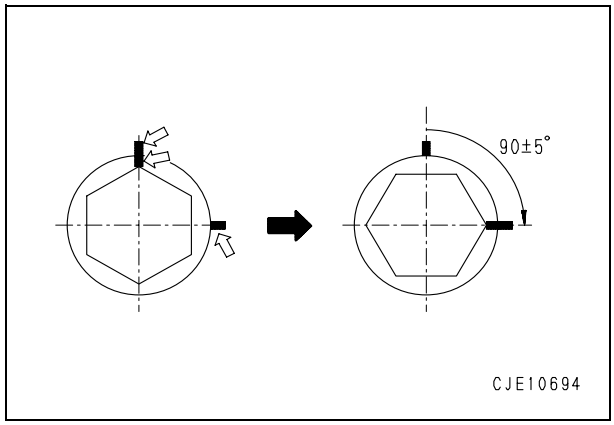
2) Set cylinder head gasket (53) to the cylinder block.
   - ★ Check that there is no dirt and foreign matter on the cylinder head mounting surface and in the cylinders.
   - ★ Check that the holes of the cylinder head gasket are matched to the holes of the cylinder head.
3) Sling cylinder head assembly (52), set it on the cylinder block, and tighten mounting bolts (51) at least 2 – 3 turns with the fingers.



4) Tighten the cylinder head mounting bolts in the order of [1] to [26] according to the following procedure.
   - Apply engine oil (EO15W-40) to the threads and seats of the mounting bolts.
   1] Tighten to **70 ± 6 Nm {7 ± 0.6 kgm}**
   2] Return all the bolts by **360° ± 5°**
   3] Tighten to **105 ± 3 Nm {10.7 ± 0.3 kgm}**
   4] Tighten by **90° ± 5°**
   - ★ Use the angle tightening tool for 2] and 4].

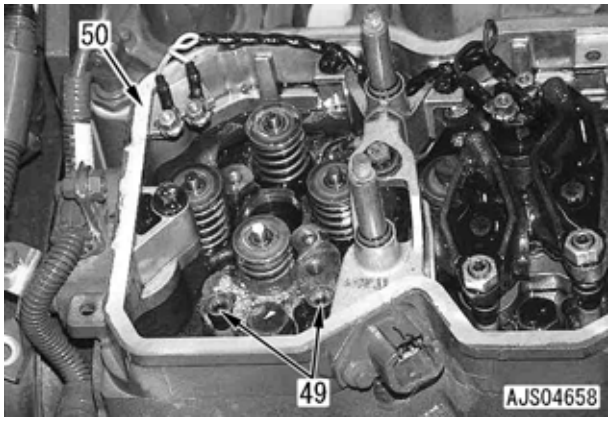


- When not using angle tightening tool
  Make a mark on the cylinder head and each bolt with a marker and then tighten the bolt by 90° ± 5°.



2. Install rocker housing assembly (50).
   Rocker housing mounting bolt:
   24 ± 4 Nm {2.4 ± 0.4 kgm}

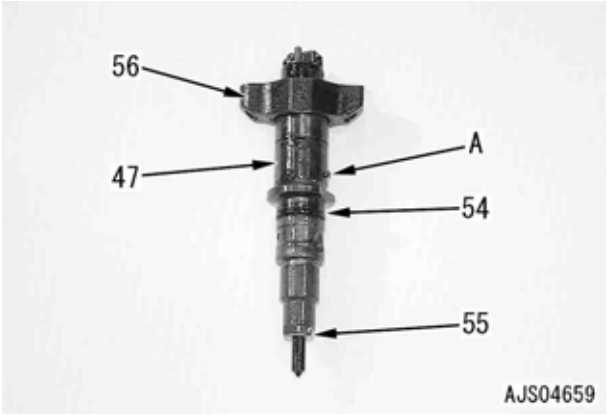
3. Install push rods (49).



4. Fuel injector assembly

★ Check that the fuel injector sleeve is free from flaw and dirt.

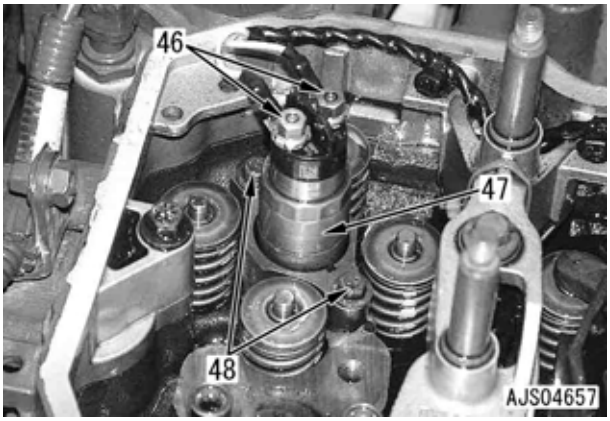
1) Fit O-ring (54) and gasket (55) to fuel injector (47).
2) Apply engine oil (EO15W-40) to the O-ring of fuel injector (47) and the mounting hole on the head side.
3) Matching convex and concave parts (A), install holder (56) to fuel injector (47).



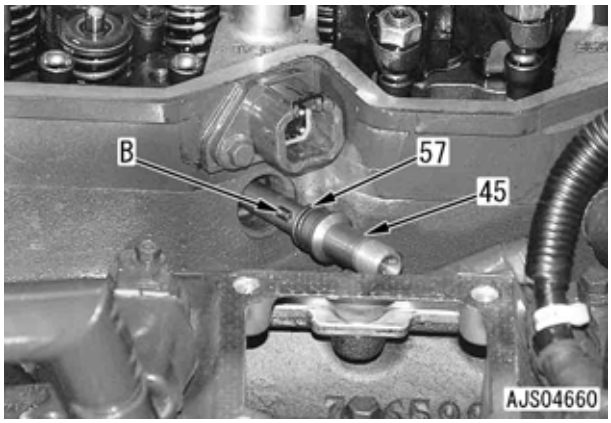
4) Insert fuel injector (47) in the cylinder head, directing its fuel inlet hole toward the air intake manifold.
5) Tighten mounting bolts (48) of fuel injector (47) by 3 – 4 turns.
6) Install the wiring harnesses to fuel injector (47) and tighten nuts (46).
   Wiring harness mounting nut:
   1.5 ± 0.25 Nm {0.15 ± 0.03 kgm}

★ Installed positions of wiring harnesses

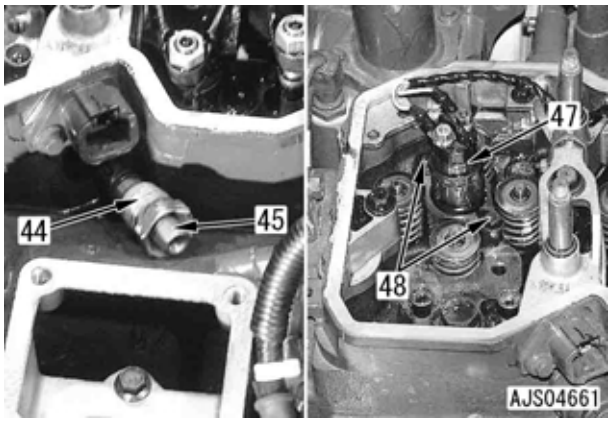
Wiring harness color	Cylinder No.
White	1, 3, 5
Black	2, 4, 6



7) Apply engine oil (EO15W-40) to the mounting hole of inlet connector (45) on the head side.
8) Apply engine oil (EO15W-40) to O-ring (57) of inlet connector (45) and insert inlet connector (45) perfectly, matching part (B) to the groove on the head side.



9) Secure inlet connector (45) by tightening retainer (44) with the fingers. (Push the inlet connector into the hole of the injector.)
10) Tighten mounting bolts (48) of fuel injector (47) alternately.
    Fuel injector mounting bolt
    1st time:
    3.5 ± 0.35 Nm {0.35 ± 0.035 kgm}
    2nd time: **75 ± 5°**
    (Tighten with angle tightening tool)
11) Tighten retainer (44).
    Retainer:
    50 ± 5 Nm {5.1 ± 0.5 kgm}

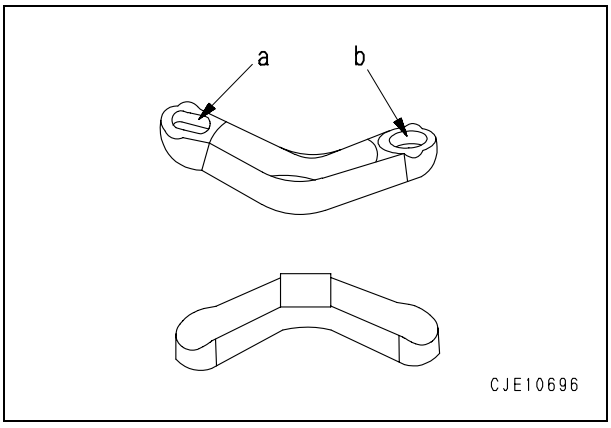


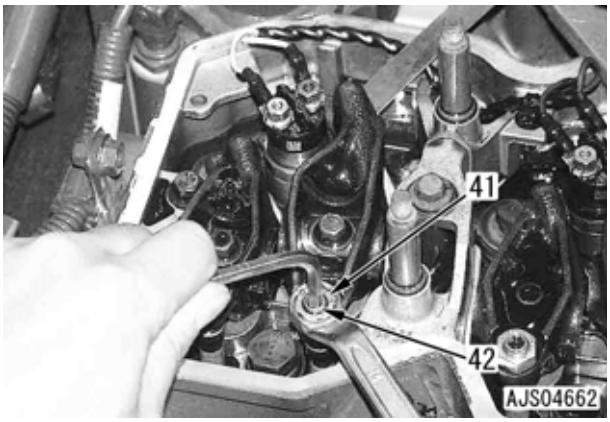
5. Crosshead and rocker arm

1) Install the crosshead and rocker arm.
   - ★ The shapes of holes (a) and (b) of each crosshead are different. Accordingly, when reusing the crossheads, install each of them to the same intake/exhaust valve in the same direction as it has been installed.
   - ★ Before tightening the mounting bolts, check that the ball of adjustment screw (42) is set in the push rod socket securely.

   Rocker arm mounting bolt:
   36 ± 5 Nm {3.7 ± 0.5 kgm}
2) Adjust the valve clearance. For details, see Testing and adjusting, “Adjusting valve clearance”.

   Locknut (41):
   24 ± 4 Nm {2.4 ± 0.4 kgm}





- Carry out the following installation in the reverse order to removal.

[*1]
Tube mounting band:
7 ± 1 Nm {0.7 ± 0.1 kgm}

[*2]
Air intake connector mounting bolt:
24 ± 4 Nm {2.4 ± 0.4 kgm}

[*3]
Fuel filter bracket mounting bolt:
24 ± 4 Nm {2.4 ± 0.4 kgm}

[*4]
⚠ **Install each high-pressure pipe and wiring harness at least 10 mm apart from each other.**

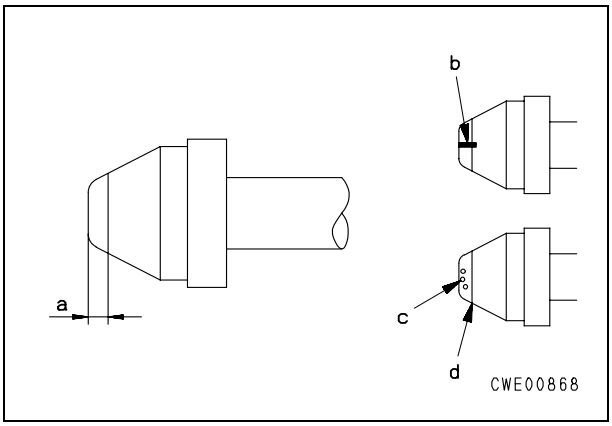
[*5]
Mounting bolt of high-pressure pipe clamp bracket: **24 ± 4 Nm {2.45 ± 0.41 kgm}**

[*6] [*7]
- **High-pressure pipe**

⚠ **Do not bend the high-pressure pipe to correct before installing.**

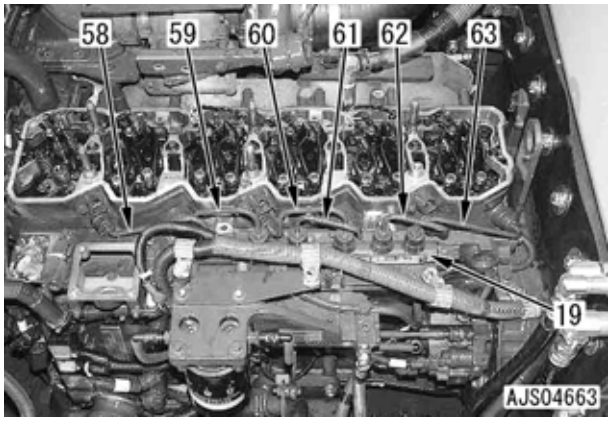
⚠ **Be sure to use the genuine high-pressure pipe clamps and observe the tightening torque.**

★ When installing each high-pressure pipe, check the taper seal of its joint (Part (a): Part of 2 mm from the end) for visible lengthwise slit (b) and spot (c) and check part (d) (End of taper seal: Part at 2 mm from the end) for stepped-type wear caused by fatigue which your nail can feel. If there is any of those defects, it can cause fuel leakage. In this case, replace the high-pressure pipe.



1. Temporarily install high-pressure pipes (58) – (63) between common rail (19) and cylinder head.
   Sleeve nut:
   0.2 – 0.8 Nm {0.02 – 0.08 kgm}

2. Tighten high-pressure pipes (58) – (63) in the following order.
   Sleeve nut: **35 ± 3.5 Nm {3.6 ± 0.4 kgm}**
   1) Tighten head side of high-pressure pipes (58) and (63).
   2) Tighten common rail side of high-pressure pipes (63) and (58).
   3) Tighten head side of high-pressure pipes (59), (60), (61), and (62) in this order.
   4) Tighten common rail side of high-pressure pipes (59), (60), (61), and (62) in this order.



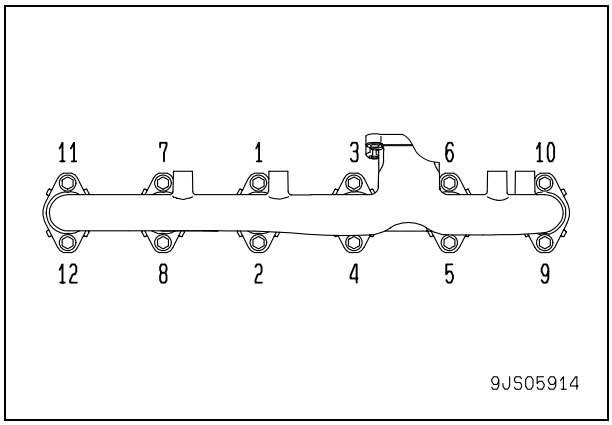
3. Install the high-pressure pipes between the common rail and fuel supply pump according to the following procedure.
   1) Tighten the sleeve nuts on the fuel supply pump side and common rail side with the fingers.
   2) Tighten the sleeve nut on the fuel supply pump side first and then that on the common rail side.
      Sleeve nut:
      35 ± 3.5 Nm {3.57 ± 0.36 kgm}

4. Install the bellows to each high-pressure pipe.
   ★ Install each bellows with the slits out and down.
   ★ The bellows are installed so that fuel will not spout over the hot parts of the engine and catch fire when it leaks for some reason.

[*8]
Tube mounting band:
7 ± 1 Nm {0.7 ± 0.1 kgm}

[*9]
- Tighten the mounting bolts in the order shown below.

Exhaust manifold mounting bolts
1st time: Tighten all the bolts to **24 ± 4 Nm {2.4 ± 0.4 kgm}** in the order of [1] to [12].
2nd time: Tighten all the bolts to **53 ± 6 Nm {5.4 ± 0.6 kgm}** in the order of [1] to [12].
3rd time: Tighten only bolts [1] – [4] to **53 ± 6 Nm {5.4 ± 0.6 kgm}** in the order of [1] to [4].



[*10]
Blow-by duct mounting bolt:
7 ± 2 Nm {0.7 ± 0.2 kgm}

[*11]
Head cover mounting nut:
24 ± 4 Nm {2.4 ± 0.4 kgm}

- **Refilling with coolant**
  Add coolant through the coolant filler to the specified level. Run the engine to circulate the coolant through the system. Then, check the coolant level again.

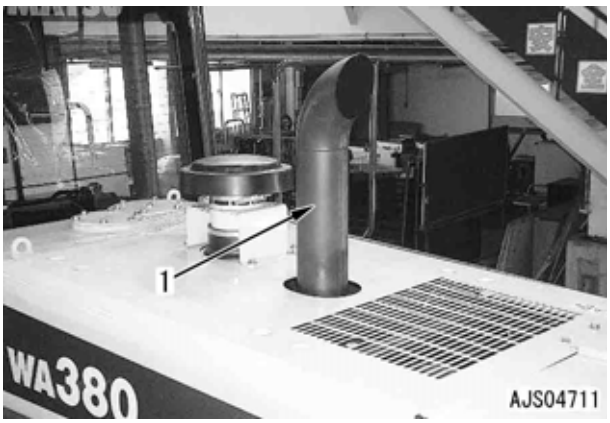
Coolant: **Approx. 30.5 ℓ**

Removal and installation of engine hood

Removal

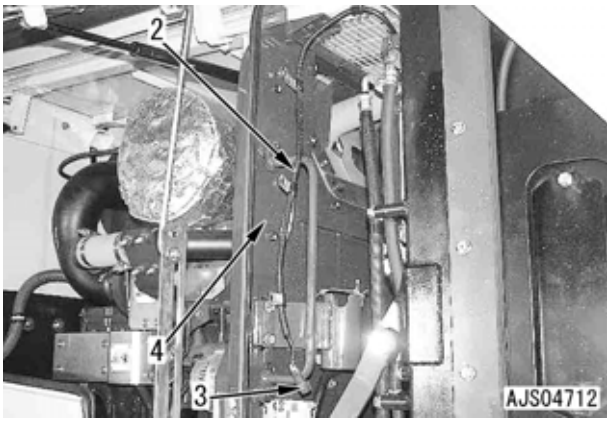
⚠ Disconnect the cable from the negative (–) terminal of the battery.

1. Remove exhaust pipe (1).



2. Disconnect connector GR1 (3) of wiring (2).

3. Remove the 3 clamps and remove wiring (2) from divider board (4).
   ★ Remove wiring (2) and engine hood together.



4. Remove hose (5) between the air cleaner and turbocharger. [*1]

5. Remove hose (6) of the evaporator from the air cleaner.

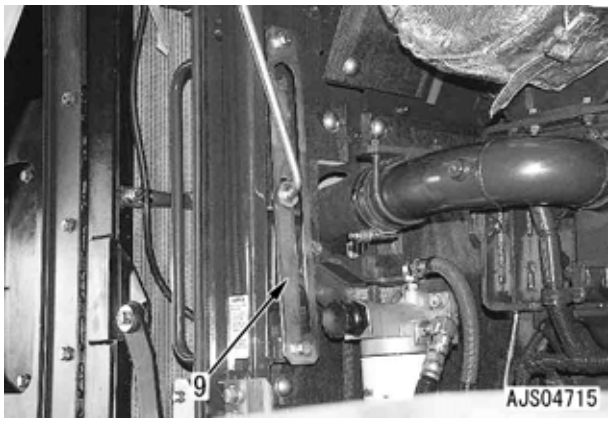


6. Remove evaporator assembly (7).

7. Remove the clamp of tube (8).

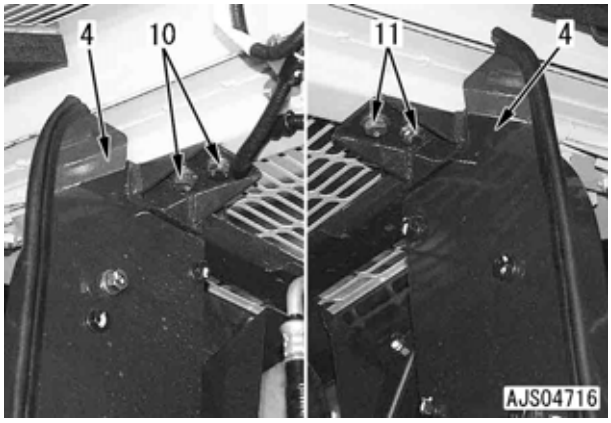


8. Remove right and left engine hood stopper brackets (9).

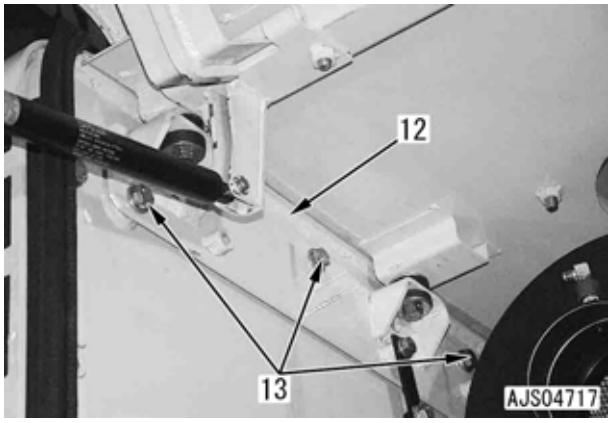


9. Sling the engine hood assembly temporarily.

10. Remove 2 left mounting bolts (10) and 2 right mounting bolts (11) of the engine hood and divider board (4).



11. Remove 4 mounting bolts (13) of engine hood mounting bracket (12).
    ★ Remove the engine hood assembly and bracket (12) together.



12. Lift off engine hood assembly (14). [*2]
    ★ Remove the engine hood assembly and air cleaner together.

    Engine hood assembly (including air cleaner assembly): **240 kg**



Installation

- Carry out installation in the reverse order to removal.

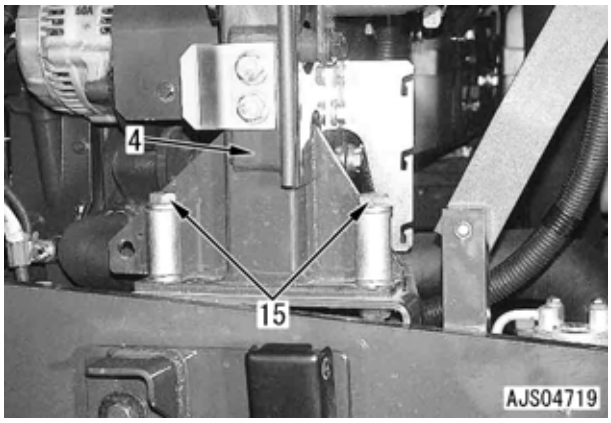
[*1]

Hose clamp:
10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}

[*2]

- When installing the engine hood, loosen right and left mounting bolts (15) of divider board (4).

Divider board mounting bolt:
153 – 190 Nm {15.5 – 19.5 kgm}



Removal and installation of radiator assembly

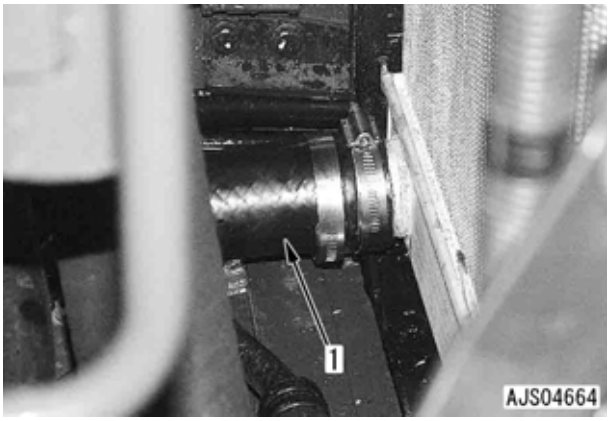
Removal

1. Remove the engine hood assembly. For details, see “Removal and installation of engine hood assembly”.

2. Drain the coolant.

   Coolant: **Approx. 30.5 ℓ**

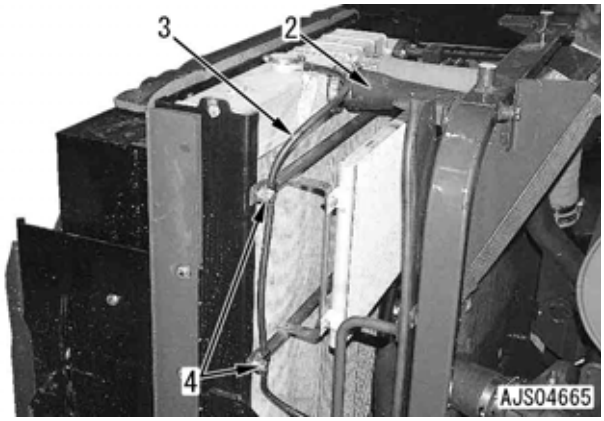
3. Disconnect radiator outlet hose (1). [*1]



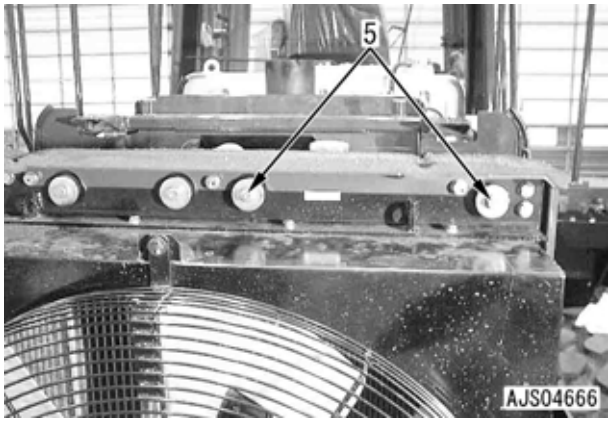
4. Disconnect radiator inlet hose (2). [*2]

5. Disconnect aeration hose (3).

6. Remove 2 bolts (4) of the air conditioner condenser mounting bracket and loosen the bolts on the opposite side.

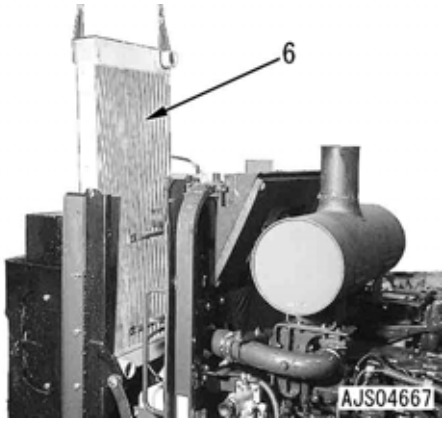


7. Remove 2 radiator mounting bolts (5).



8. Lift off radiator assembly (6). [*3]
   ★ When removing the radiator assembly, take care that it will not interfere with the air conditioner condenser mounting bracket.

   Radiator assembly: **22 kg**

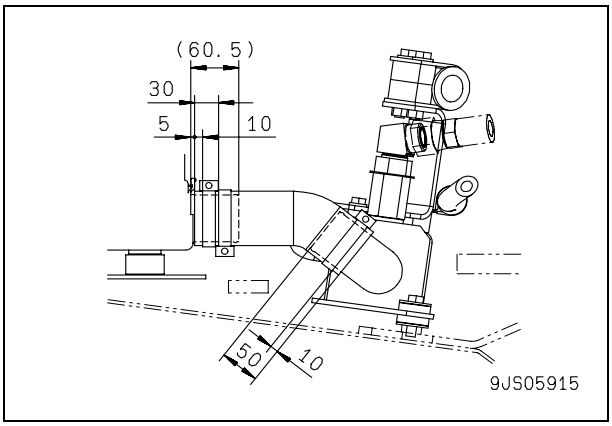


Installation

- Carry out installation in the reverse order to removal.

[*1]

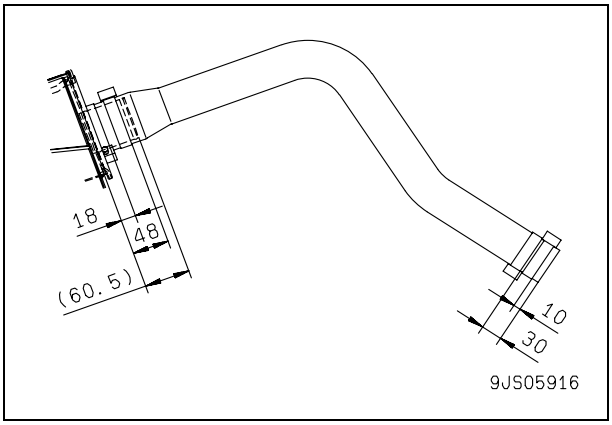
- Install the radiator outlet hose to the following dimensions.



Radiator outlet hose clamp:
8.8 ± 0.5 Nm {0.9 ± 0.05 kgm}

[*2]

- Install the radiator inlet hose to the following dimensions.



Radiator inlet hose clamp:
8.8 ± 0.5 Nm {0.9 ± 0.05 kgm}

[*3]

- Sling the radiator and check that the concave part of the radiator mounting portion is matched to the convex part.
- Take care that the radiator will not interfere with the air conditioner condenser mounting bracket.

- **Refilling with coolant**
  Add coolant through the coolant filler to the specified level. Run the engine to circulate the coolant through the system. Then, check the coolant level again.

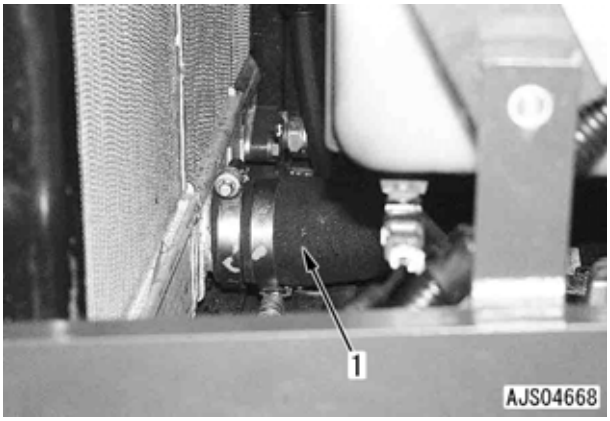
Coolant: **Approx. 30.5 ℓ**

Removal and installation of air aftercooler

Removal

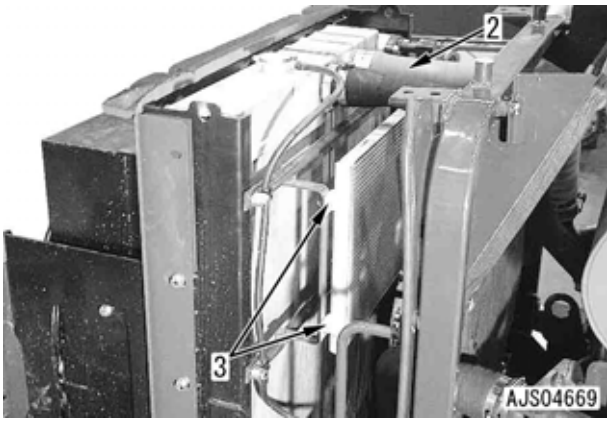
1. Remove the engine hood assembly. For details, see “Removal and installation of engine hood assembly”.

2. Disconnect air aftercooler outlet hose (1). [*1]

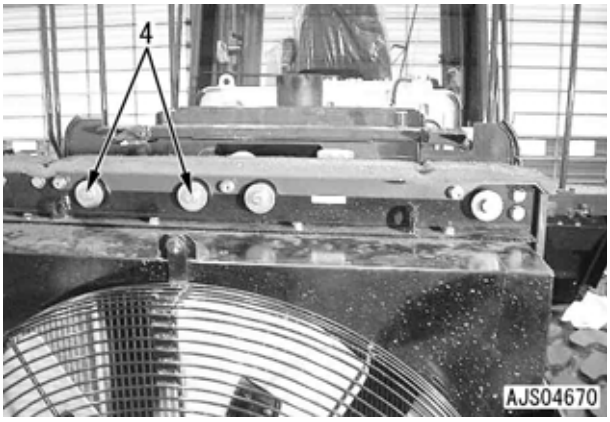


3. Disconnect air aftercooler inlet hose (2). [*2]

4. Remove 2 bolts (3) of the air conditioner condenser mounting bracket and loosen the bolts on the opposite side.

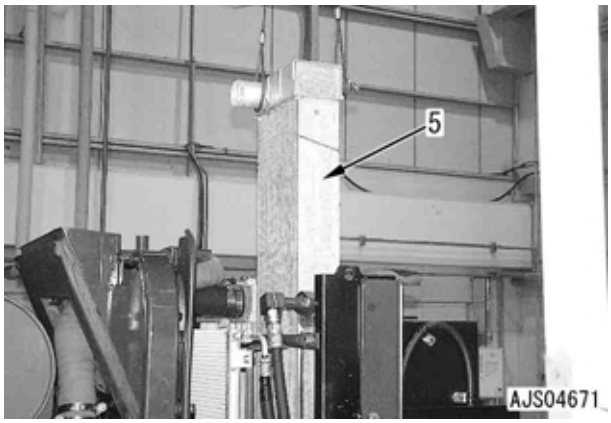


5. Remove 2 air aftercooler mounting bolts (4).



6. Lift off air aftercooler assembly (5). [*3]
   ★ When removing the air aftercooler assembly, take care that it will not interfere with the air conditioner condenser mounting bracket.

   Air aftercooler assembly: **14 kg**

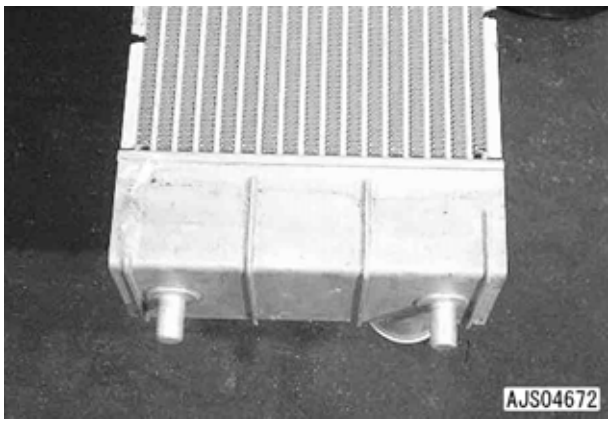


Installation

- Carry out installation in the reverse order to removal.

[*1] [*2]
Air aftercooler hose clamp:
10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}

[*3]
- Sling the air aftercooler and check that the concave part of the air aftercooler mounting portion is matched to the convex part.



- Take care that the air aftercooler will not interfere with the air conditioner condenser mounting bracket.

Removal and installation of hydraulic oil cooler assembly

Removal

⚠ **Lower the work equipment to the ground, stop the engine, and lock the tires with chocks.**

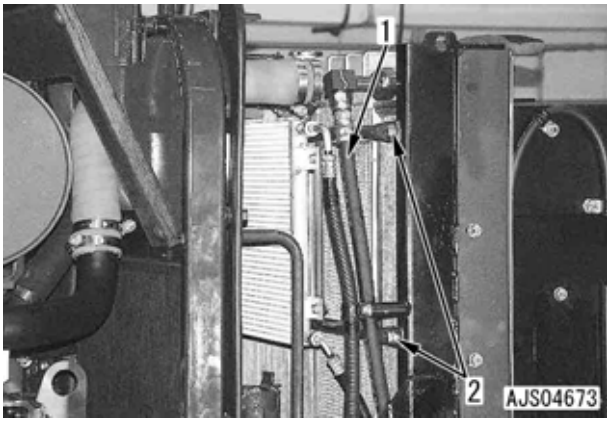
⚠ **Loosen the hydraulic tank cap gradually to release the internal pressure of the hydraulic tank.**

1. Remove the engine hood assembly. For details, see “Removal and installation of engine hood assembly”.

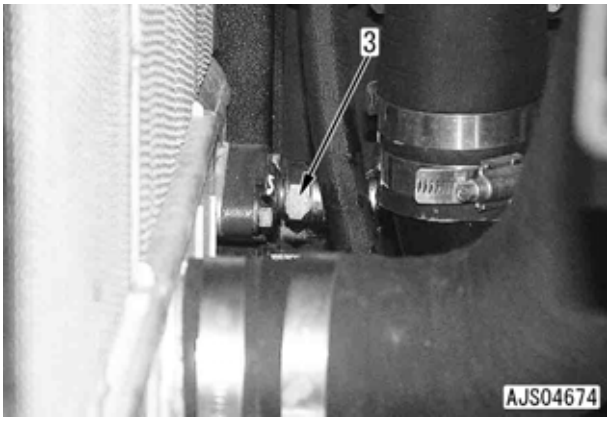
2. Drain the oil from the hydraulic tank.
   Hydraulic tank: **Approx. 139 ℓ**

3. Disconnect hydraulic oil cooler hose (1).
   ★ Stop the oil with a plug.

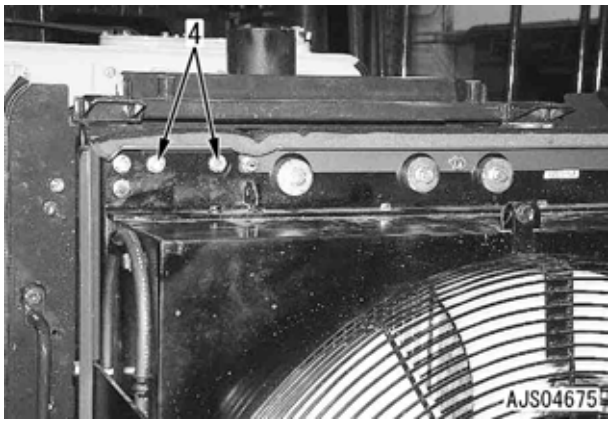
4. Remove 2 bolts (2) of the air conditioner condenser mounting bracket and loosen the bolts on the opposite side.



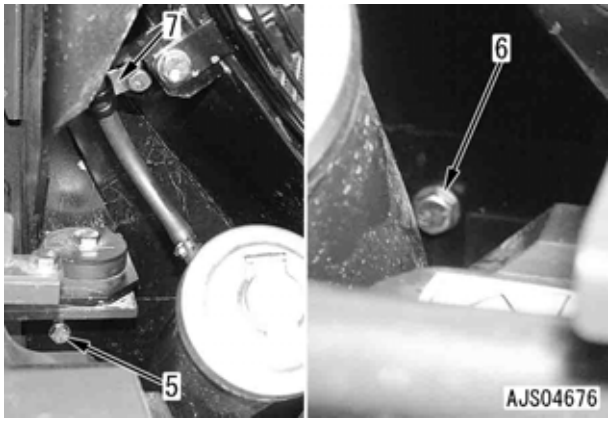
5. Disconnect hydraulic oil cooler hose (3).
   ★ Stop the oil with a plug.



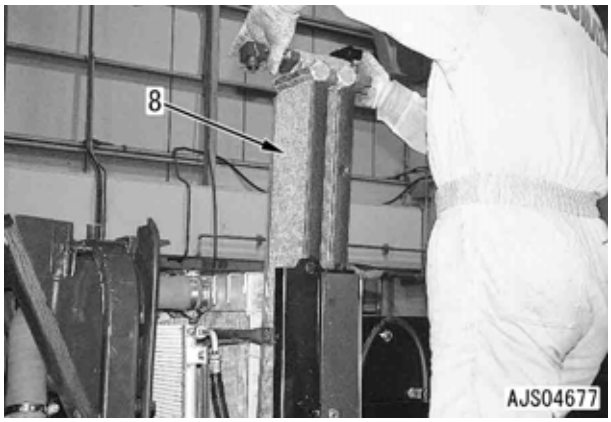
6. Remove 2 mounting bolts (4) on the upper side of the hydraulic oil cooler.

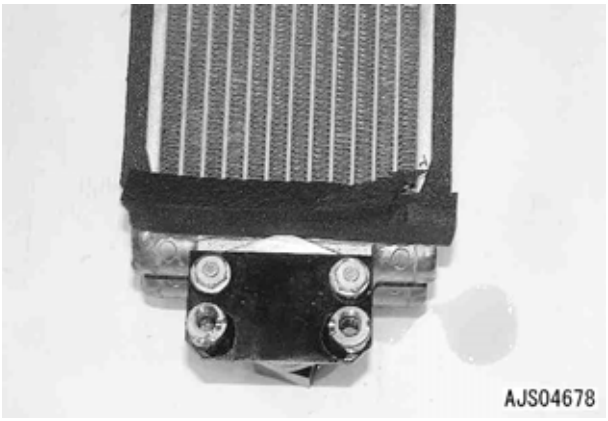


7. Remove 1 left mounting bolt (5) and 1 right mounting bolt (6) on the lower side of the hydraulic oil cooler.
   ★ Remove clamp (7) on the left side and move the wiring harness aside.



8. Remove hydraulic oil cooler assembly (8). [*1]
   ★ When removing the hydraulic oil cooler assembly, take care that it will not interfere with the air conditioner condenser mounting bracket.
   Hydraulic oil cooler assembly: **12 kg**





Installation

- Carry out installation in the reverse order to removal.

[*1]

- Take care that the hydraulic oil cooler will not interfere with the air conditioner condenser mounting bracket.

- **Refilling with oil (Hydraulic tank)**
  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.

  Hydraulic tank: **139 ℓ**

Removal and installation of engine assembly

Removal

⚠ Stop the machine on a level place, set the safety bar to the frame, lower the work equipment to the ground, stop the engine, apply the parking brake, and lock the tires with chock.

⚠ Disconnect the cable from the negative (–) terminal of the battery.

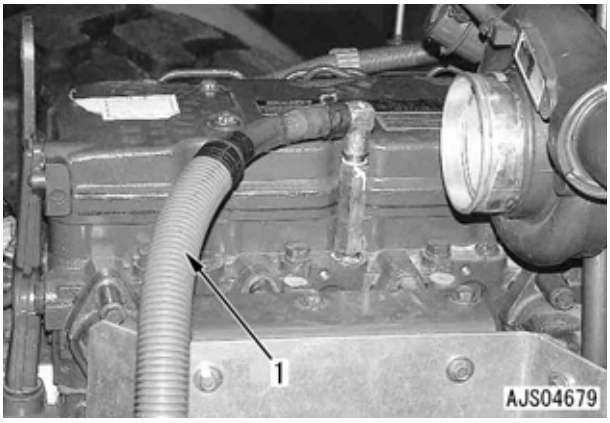
1. Drain the coolant.

Coolant: **Approx. 30.5 ℓ**

2. Remove the engine hood assembly. For details, see “Removal and installation of engine hood assembly”.

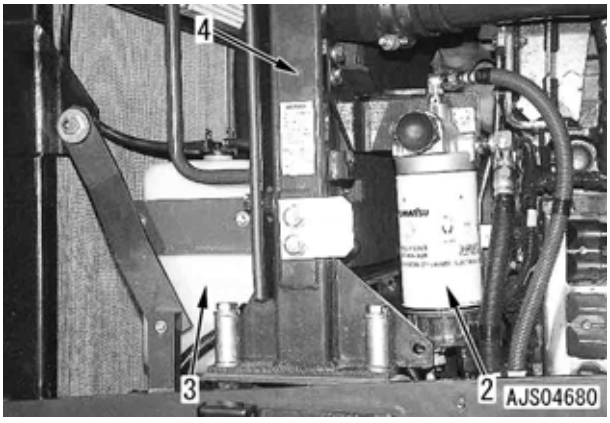
3. Remove the hydraulic tank assembly. For details, see “Removal and installation of hydraulic tank assembly”.

4. Remove heater hose (1).

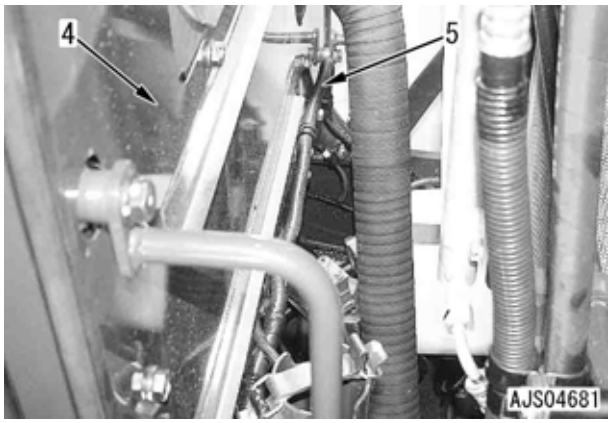


5. Divider board assembly

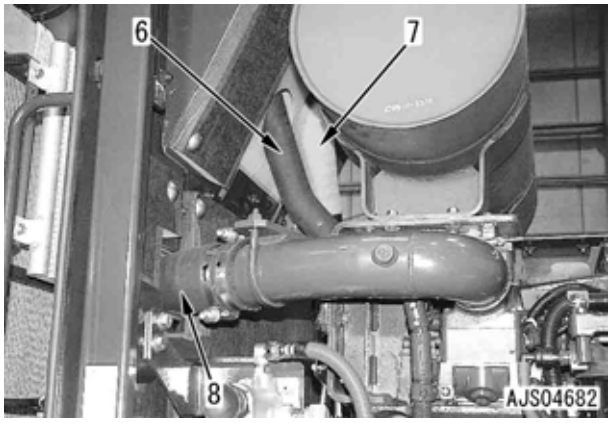
1) Remove water separator assembly (2) and reservoir tank assembly (3) from divider board (4).



2) Remove the clamp and then remove wiring (5) from divider board (4).

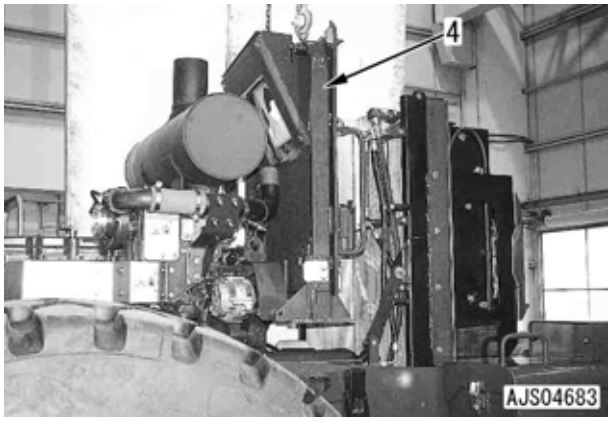


3) Remove radiator inlet hose (6), air aftercooler inlet hose (7), and air aftercooler outlet hose (8). [*1]

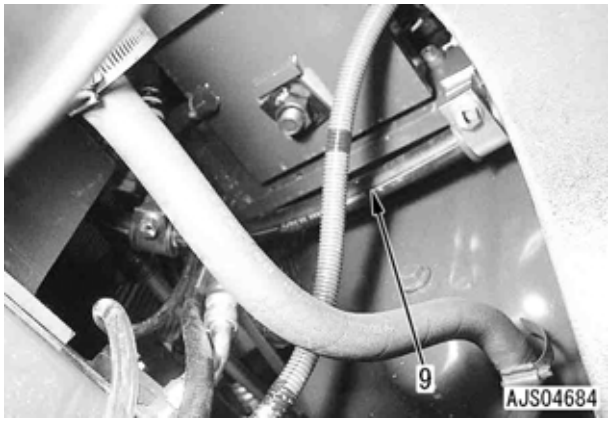


4) Using eyebolts, sling divider board (4) and remove the mounting bolts, then remove divider board assembly (4). [*2]

Divider board assembly: **39 kg**

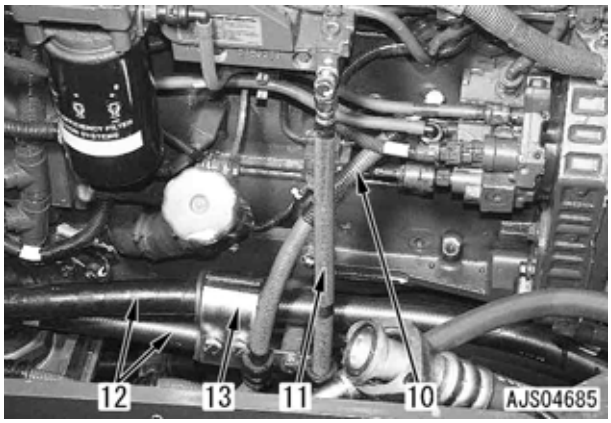


6. Remove the 3 clamps of fuel return hose (9).

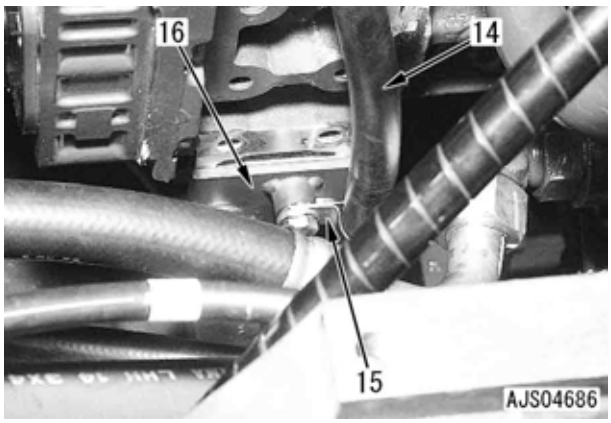


7. Disconnect fuel supply hose (10) and fuel return hose (11).

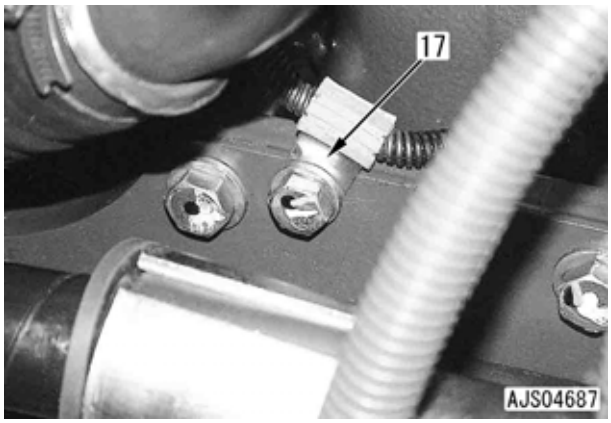
8. Remove clamp (13) of torque converter oil cooler hose (12).



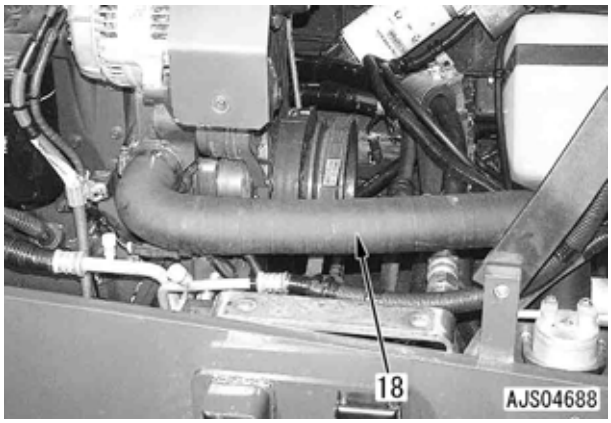
9. Remove clamp (15) of blow-by hose (14) and remove bracket (16).



10. Remove wiring clamp (17) on the right side of the engine bracket.



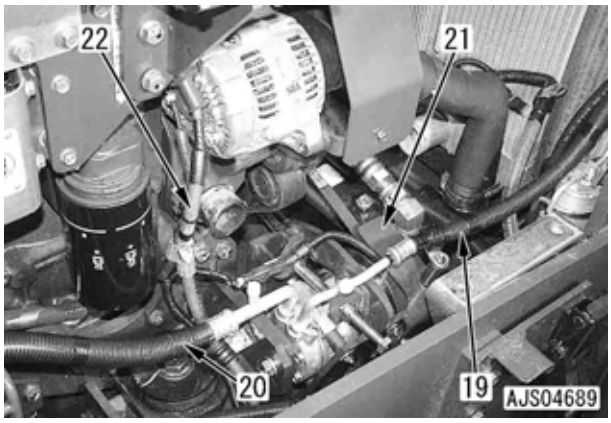
11. Remove radiator hose (18). [*3]



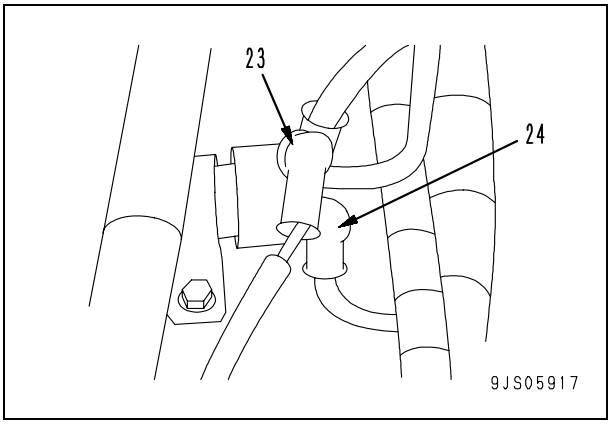
12. Remove the clamps of air conditioner hoses (19) and (20).

13. Remove compressor cover (21).

14. Remove the clamp of alternator wiring (22) and disconnect the wiring form the alternator.

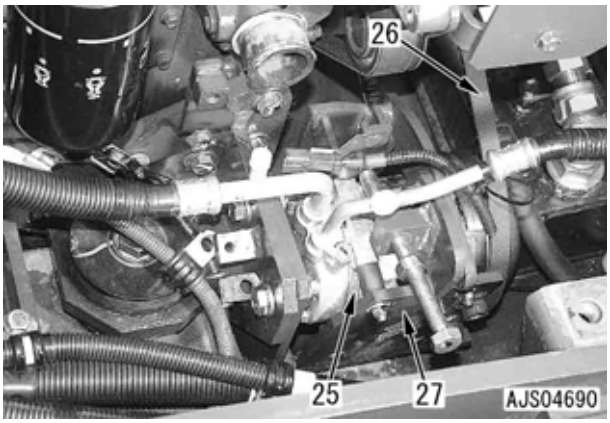


15. Disconnect electrical intake air heater wirings E06 (23) and E06A (24).



16. Loosen the mounting bolts of air conditioner compressor (25), remove belt (26), and remove the air conditioner compressor. [*4]
★ Move the air conditioner compressor to this side.

17. Remove air conditioner compressor bracket (27).

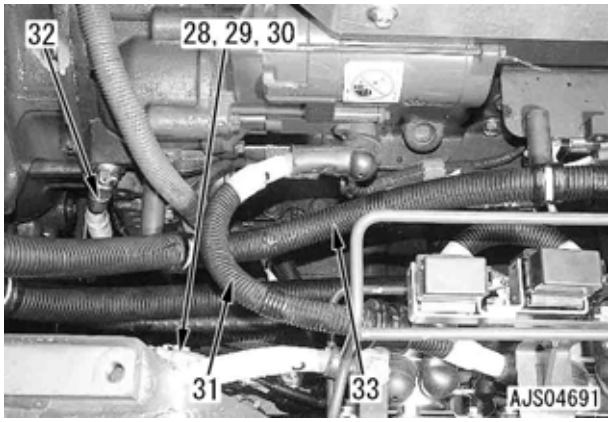


18. Remove 3 connectors (28), (29), and (30).
Upper: ER3 (28), Center: ER2 (29), Lower: ER1 (30)

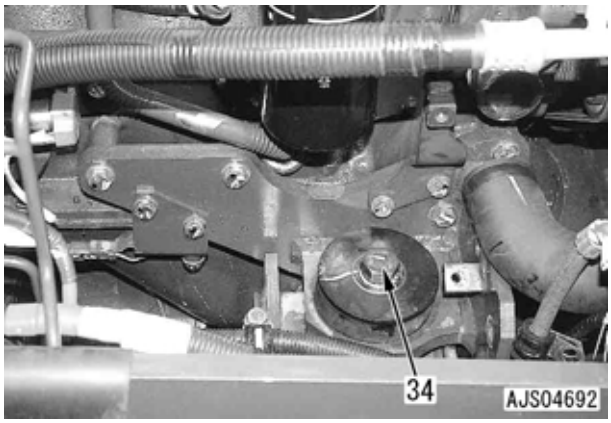
19. Disconnect starting motor wiring (31).

20. Disconnect ground wiring E07A (32).

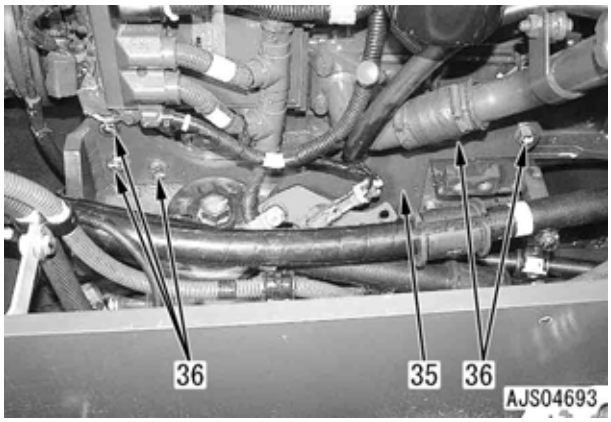
21. Disconnect the 2 clamps of air conditioner hose (33).



22. Remove left engine mounting bolt (34). [*5]
★ Secure the lower nut with a spanner to prevent it from turning.

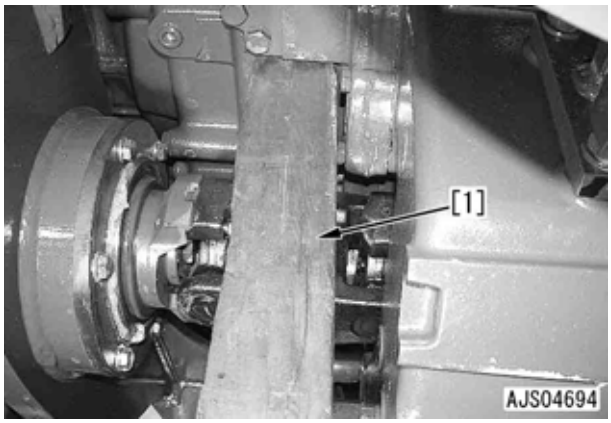


23. Remove 5 mounting bolts (36) of right engine mount (35) and engine assembly. [*6]
★ When removing the engine assembly, leave the right engine mount.

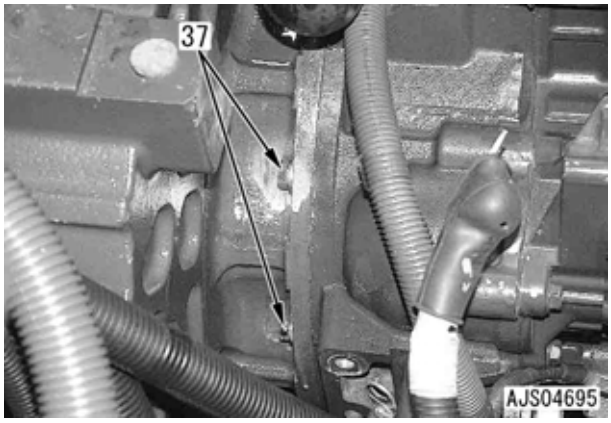


24. Using a lever block, sling the engine assembly temporarily.

25. Using a hydraulic jack and block [1], support the torque converter side of the torque converter and transmission assembly from underside.



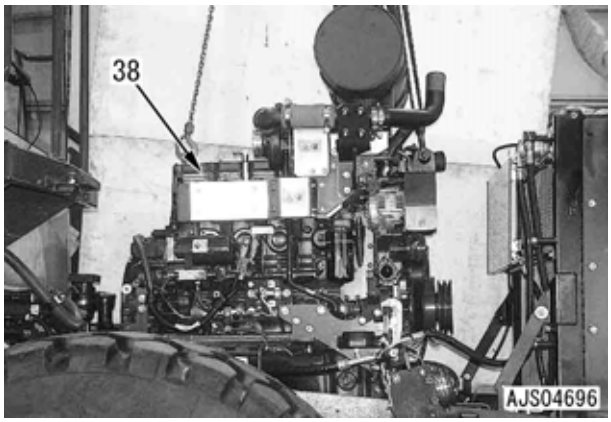
26. Remove 12 mounting bolts (37) on the flywheel case side and torque converter side.



27. While adjusting the height and angle of engine assembly (38) with the lever block and crane, disconnect the engine assembly from the torque converter and transmission. [*7]

★ Check that all the wiring and piping are disconnected.

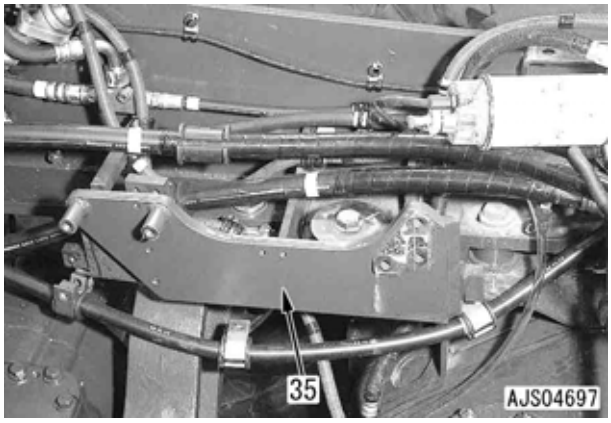
Engine assembly: **650 kg**



28. Remove right engine mount (35). [*8]

★ Secure the lower nut with a spanner to prevent it from turning.

Right engine mount: **21 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]
- Radiator inlet hose clamp: **8.8 ± 0.5 Nm {0.9 ± 0.05 kgm}**
- Air aftercooler inlet hose clamp: **10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}**
- Air aftercooler outlet hose clamp: **10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}**

[*2]
- Divider board assembly mounting bolt: **153 – 190 Nm {15.5 – 19.5 kgm}**

[*3]
- Radiator hose clamp: **8.8 ± 0.5 Nm {0.9 ± 0.05 kgm}**

[*4]
- Adjust the tension of the air conditioner belt. For details, see Testing and adjusting.

[*5]
- Engine mount mounting bolt: **610 – 765 Nm {62.5 – 78 kgm}**

[*6]
- Mounting bolt of right engine mount and engine: **98 – 123 Nm {10 – 12.5 kgm}**

[*7]
- Check that the O-ring is fitted in the torque converter housing.

★ When installing the engine, take care that the O-ring will not be caught.

[*8]

★ When installing the engine, tighten the engine mount mounting bolts temporarily.
- Engine mount mounting bolt: **610 – 765 Nm {62.5 – 78 kgm}**

- **Refilling with coolant**
  Add coolant through the coolant filler to the specified level. Run the engine to circulate the coolant through the system. Then, check the coolant level again.
  - Coolant: **Approx. 30.5 ℓ**

Removal and installation of cooling fan and fan motor assembly

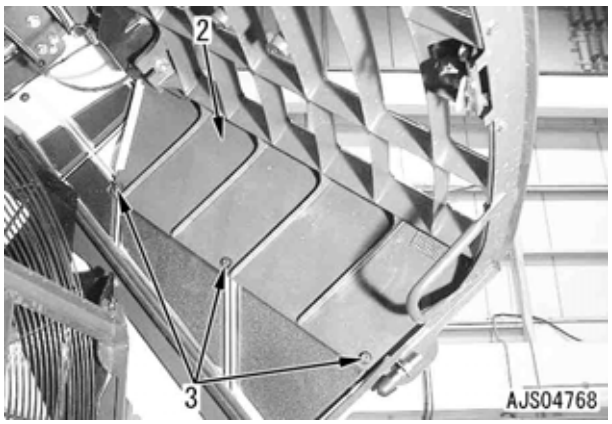
Removal

⚠ Disconnect the cable from the negative (–) terminal of the battery.

1. Open the grille and disconnect left connector G04 and right connector G05 (1) of the rear working lamp.

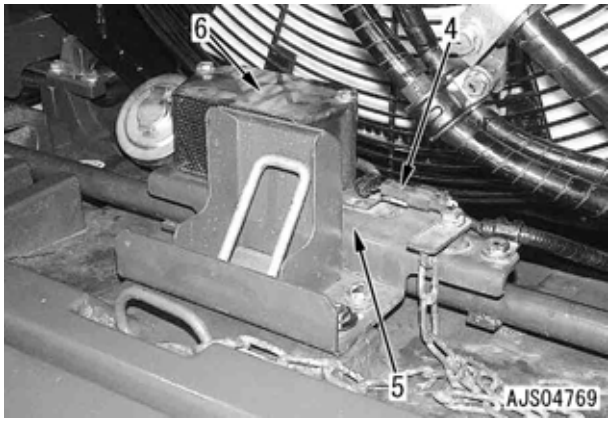


2. Remove mounting bolts (3) of grille (2), 3 pieces each from the right and left sides, 3 pieces from the upper side, and 6 pieces from the lower side, and then remove grille (2).

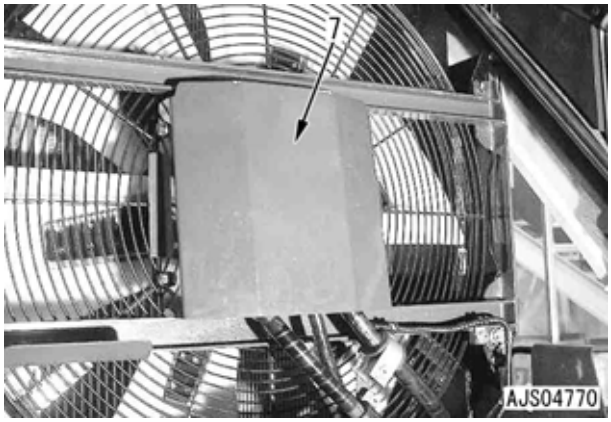


3. Disconnect connector R58 (4).

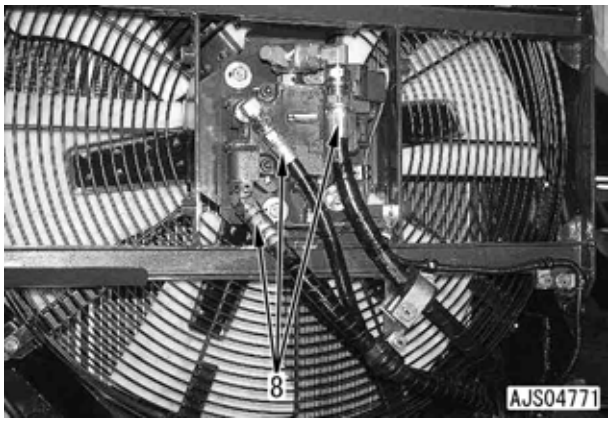
4. Remove bracket (5) and backup buzzer (6) together. [*1]



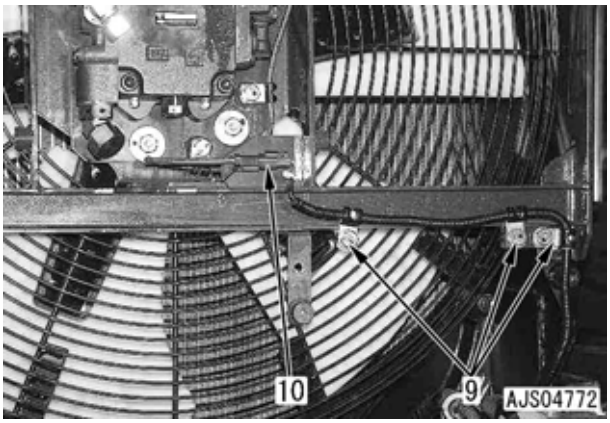
5. Remove cooling fan cover (7).



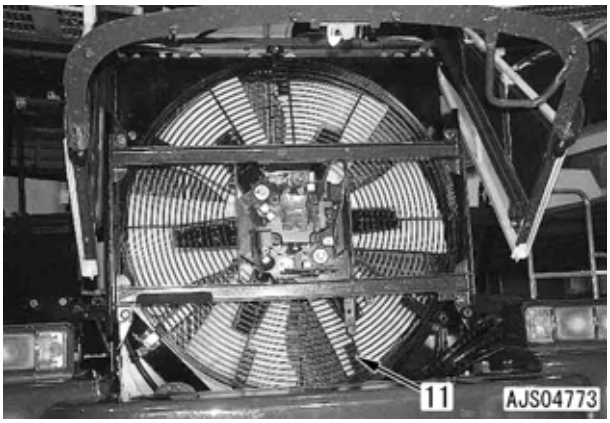
6. Remove the clamp and 3 hoses (8).



7. Remove 3 clamps (9) and disconnect connector R59 (10).



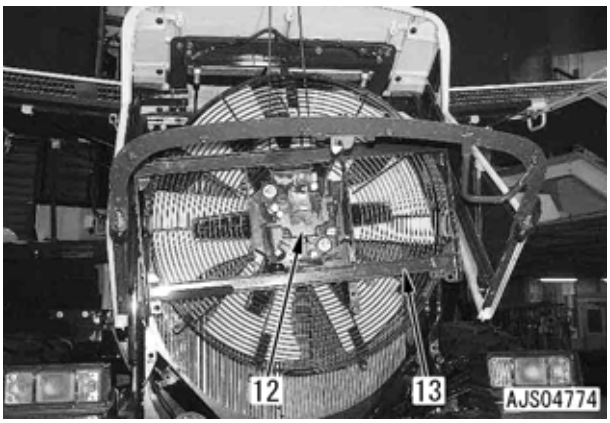
8. Remove the 7 bolts of fan guard (11).



9. Sling cooling fan and fan motor assembly (12) temporarily.

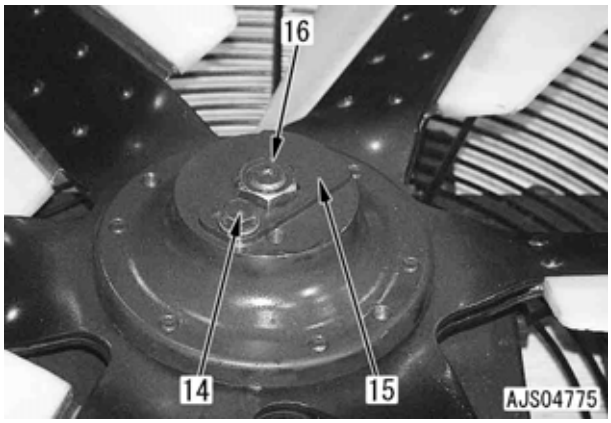
10. Remove the 4 bolts of mounting bracket (13) and lift off cooling fan and fan motor assembly (12).

Cooling fan and fan motor assembly (including fan guard): **55 kg**

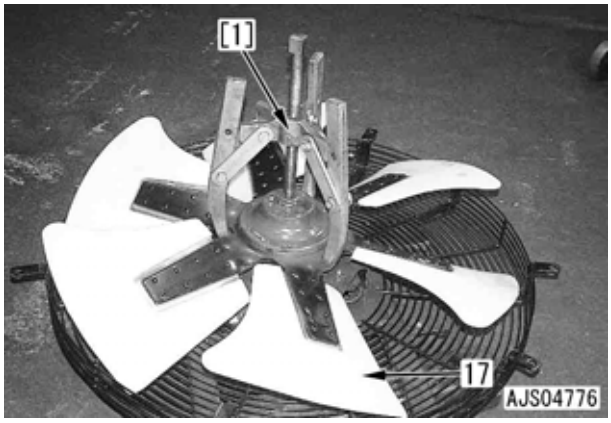


11. Remove bolt (14) and lock washer (15).

12. Remove nut (16). [*2]

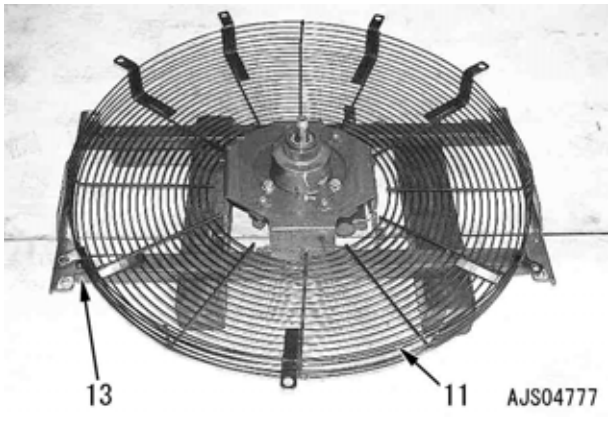


13. Using puller [1], pull out cooling fan (17). [*3]

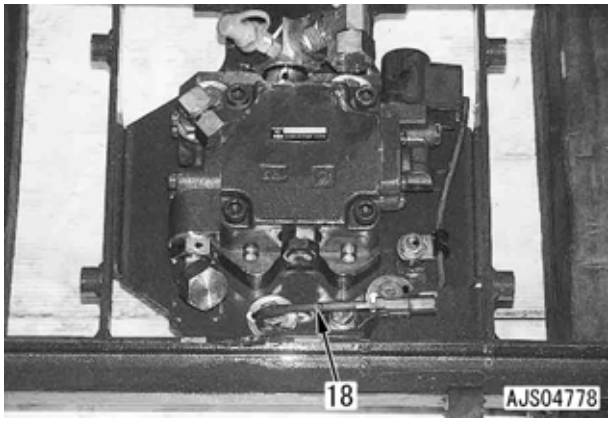


14. Remove fan guard (11) from mounting bracket (13). [*4]

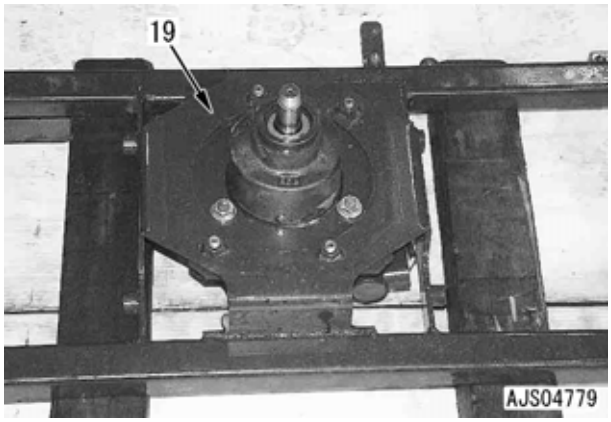
★ Make a mark at the mounting position of the fan guard.



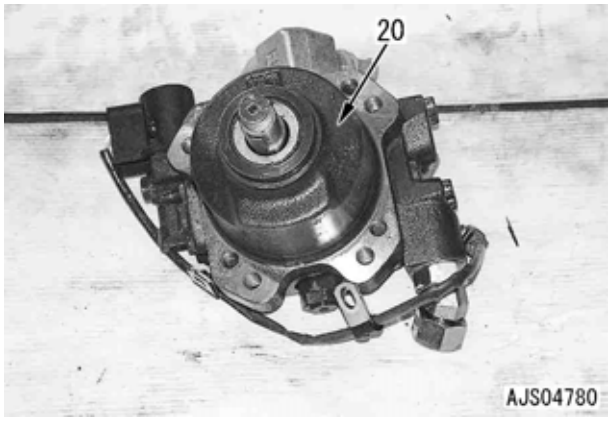
15. Remove the 2 clamps of wiring (18).



16. Remove the cooling fan motor mounting bolts from bracket (19).



17. Remove cooling fan motor assembly (20).



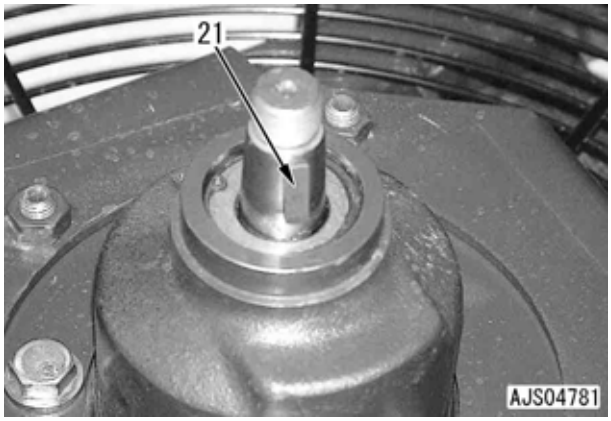
Installation

- Carry out installation in the reverse order to removal.

[*1]
★ Match the bracket to the lock position of the grille.

[*2]
Fan mounting nut:
132 – 157 Nm {13.5 – 16.0 kgm}

[*3]
★ Match the cooling fan to key (21).



[*4]
★ Match the fan guard to the mark made when the fan guard was removed.

- **Bleeding air**
  Bleed air. For details, see Testing and adjusting.

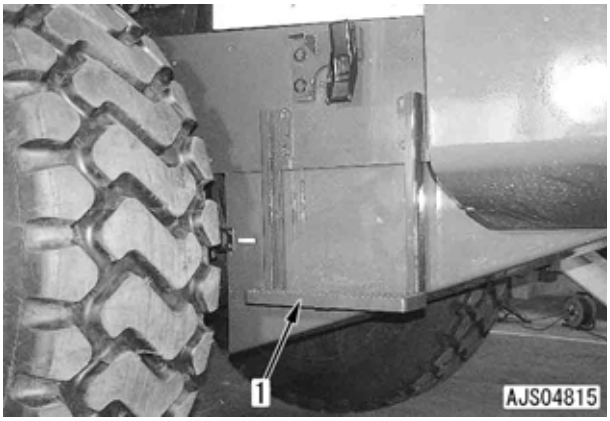
Removal and installation of fuel tank assembly

Removal

⚠ **Stop the machine on a level place, set the safety bar to the frame, lower the work equipment to the ground, stop the engine, apply the parking brake, and lock the tires with chock.**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

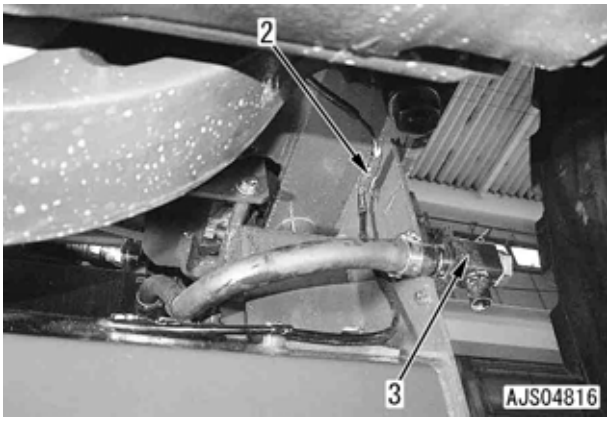
1. Remove right and left steps (1).



2. Drain the fuel.

3. Disconnect fuel level sensor connector R33 (2).

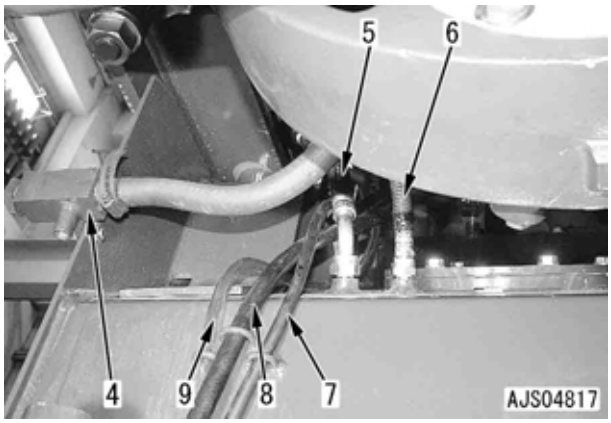
4. Remove coolant drain valve (3) from the fuel tank.



5. Remove engine oil drain valve (4) from the fuel tank.

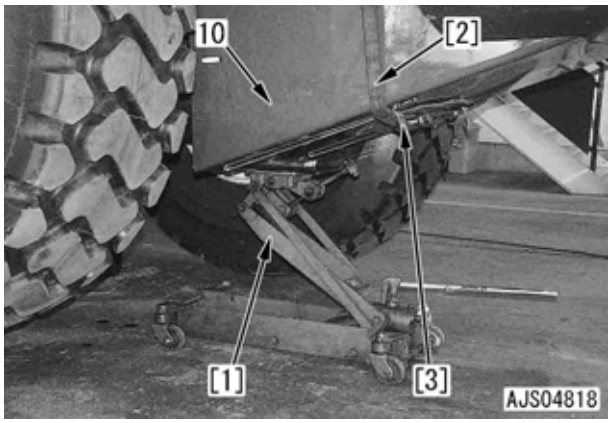
6. Remove fuel hoses (5) and (6) from the fuel tank.

7. Remove hoses (7), (8), and (9) from the tank.

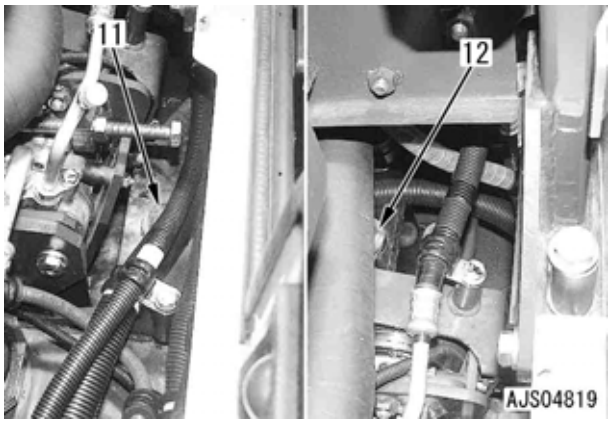


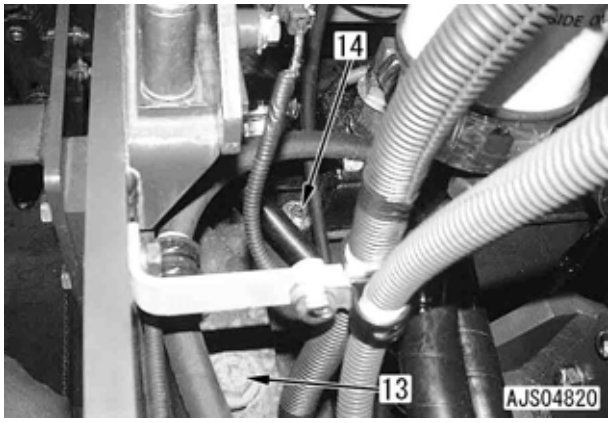
8. Fuel tank assembly

1) Support the front part of fuel tank (10) with transmission jack [1] from underside.
2) Sling the rear part of fuel tank (10) with nylon sling [2] etc.
   ★ Install lock [3] to prevent the nylon sling from slipping toward the rear.

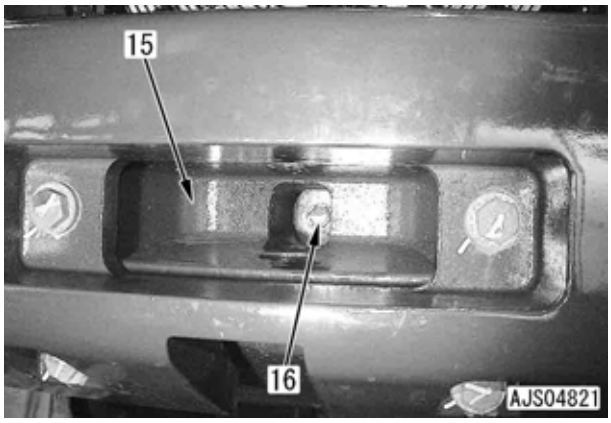


3) Remove left mounting bolts (11) and (12) and right mounting bolts (13) and (14) of the fuel tank. [*1]
   ★ Left mounting bolt (12) and right mounting bolt (14) are used to secure the torque converter oil cooler, too.

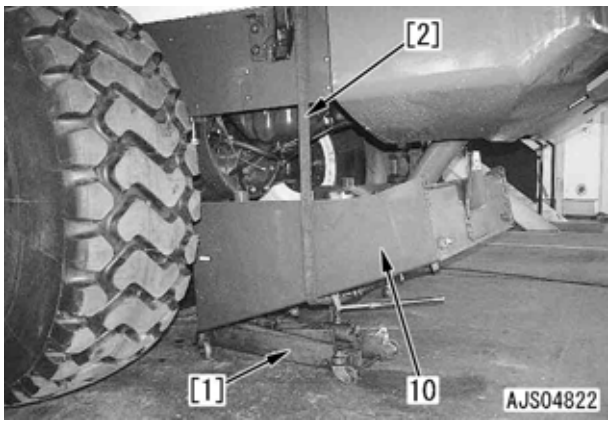




4) Remove fuel tank mounting bolt (16) from rear of counterweight (15). [*2]



5) Lower transmission jack [1] and nylon sling [2] simultaneously and remove fuel tank assembly (10).
   Fuel tank assembly: **185 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1] [*2]
Fuel tank mounting bolts (11), (13), and (16):
785 – 980 Nm {80 – 100 kgm}

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

50 Disassembly and assembly

Power train

Power train 2
Removal and installation of torque converter and transmission assembly 2
Disassembly and assembly of torque converter assembly (Standard specification) 8
Disassembly and assembly of torque converter assembly (Lockup specification) 12
Disassembly and assembly of transmission assembly 18
Disassembly and assembly of transmission clutch pack assembly 33
Disassembly and assembly of parking brake assembly 49
Removal and installation of front axle assembly 54
Removal and installation of rear axle assembly 56
Disassembly and assembly of axle housing 59
Disassembly and assembly of differential assembly 68

Power train

Removal and installation of torque converter and transmission assembly

Removal

⚠ **Stop the machine on a level place, set the safety bar to the frame, lower the work equipment to the ground, stop the engine, apply the parking brake, and lock the tires with chocks.**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Remove the engine hood assembly. For details, see “Removal and installation of engine hood assembly”.

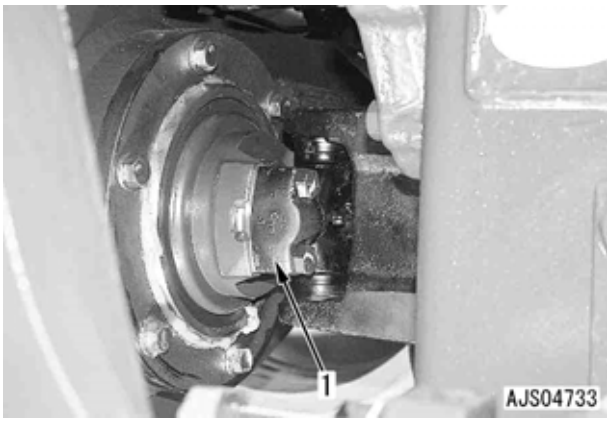
2. Remove the hydraulic tank assembly. For details, see “Removal and installation of hydraulic tank assembly”.

3. Remove the operator's cab and floor frame assembly. For details, see “Removal and installation of operator's cab and floor frame assembly”.

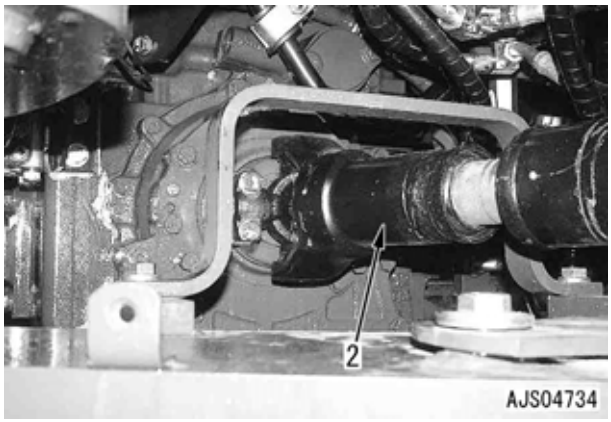
4. Drain the oil from the transmission case.

   Transmission case: **38 ℓ**

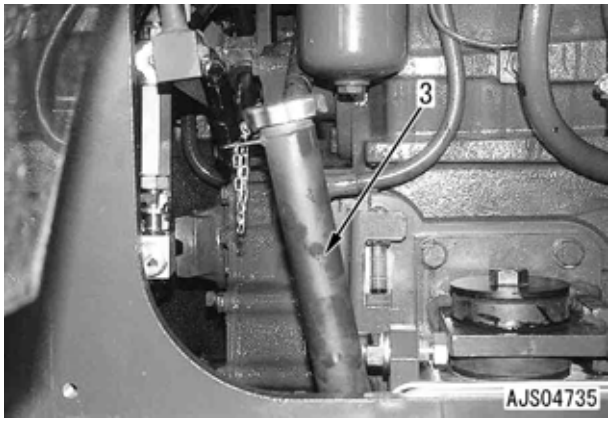
5. Disconnect rear drive shaft (1). [*1]



6. Disconnect center drive shaft (2). [*2]

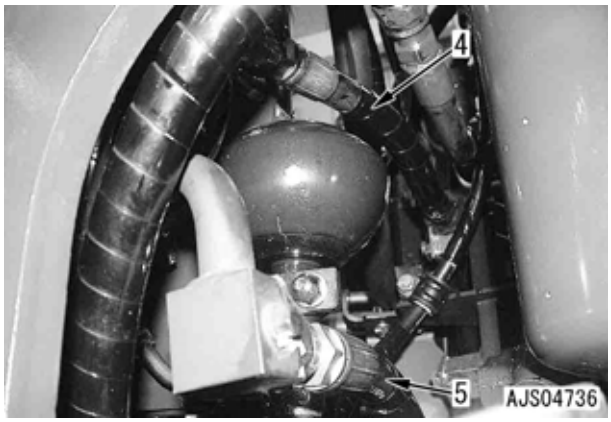


7. Remove oil filler (3).



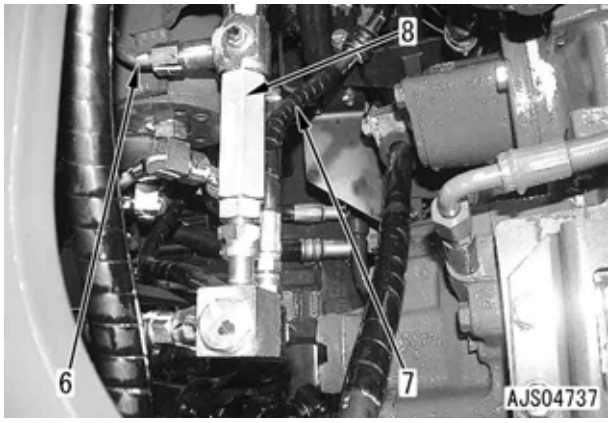
8. Remove fan motor hose (4).

9. Remove cooling fan pump hose (5).

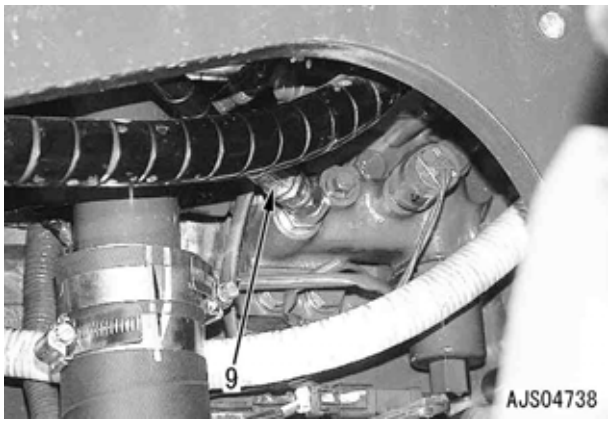


10. Remove hoses (6) and (7).

11. Remove the U-bolt and accumulator assembly (8).



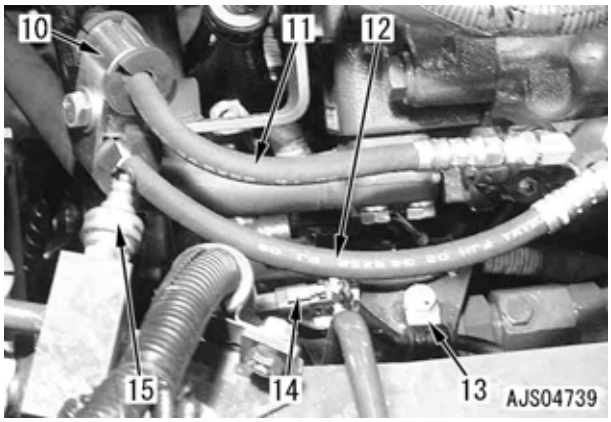
12. Remove parking brake emergency release valve hose (9).



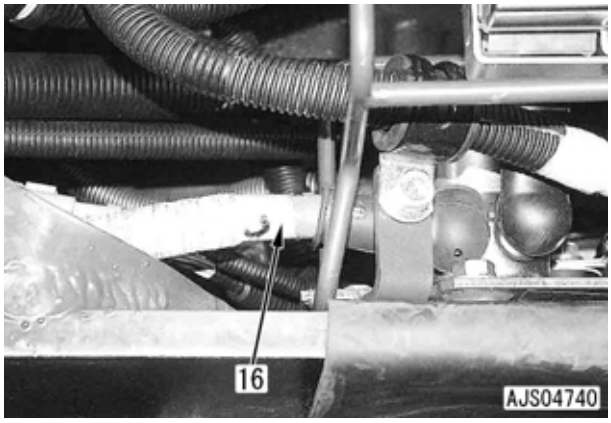
13. Remove clamp (10) and hoses (11) and (12).

14. Remove clamp (13) and disconnect connector R71 (14).

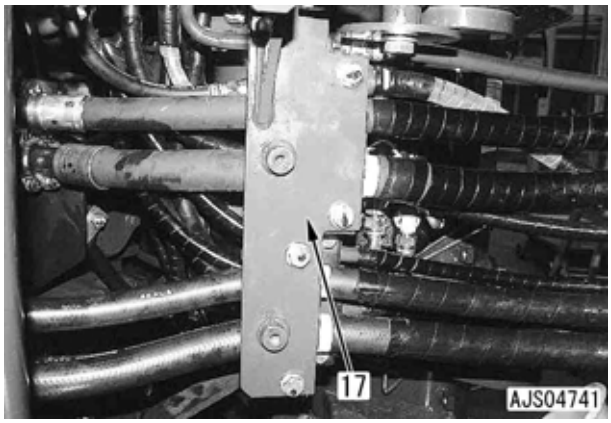
15. Remove brake sensor (15).
    ★ The brake sensor must be removed to prevent interference when the transmission is removed.



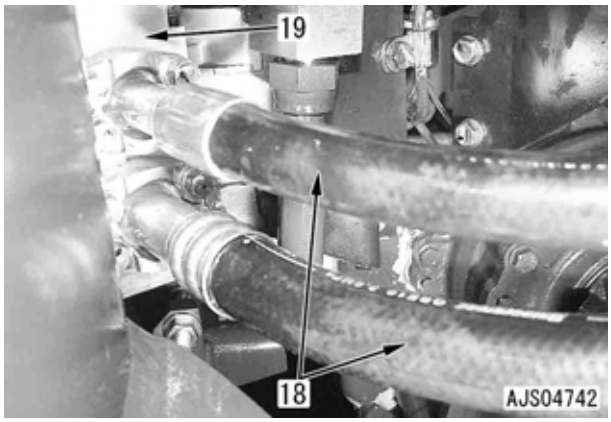
16. Disconnect battery relay wiring (16).



17. Remove hose mounting bracket (17).

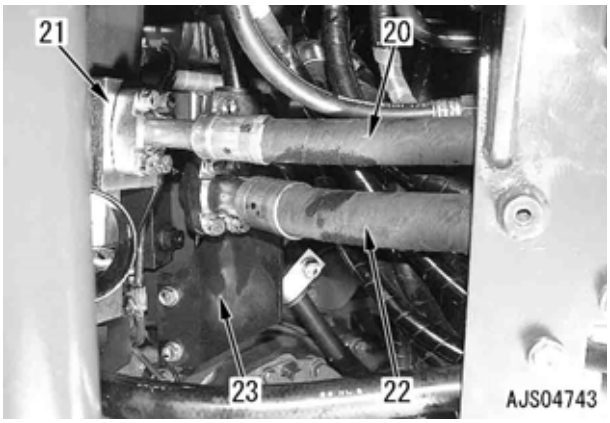


18. Remove 2 hoses (18) from block (19).

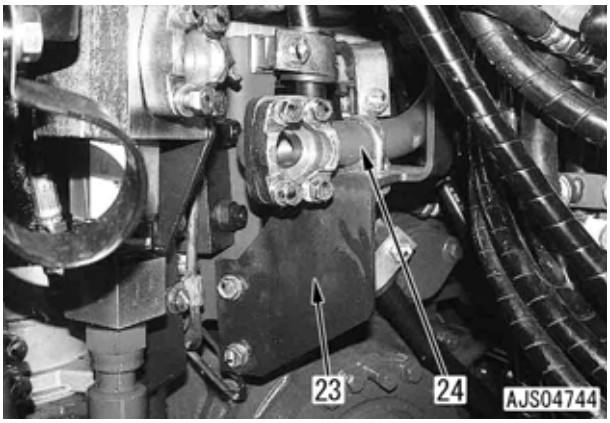


19. Remove hose (20) from block (21).

20. Remove hose (22) from bracket (23).

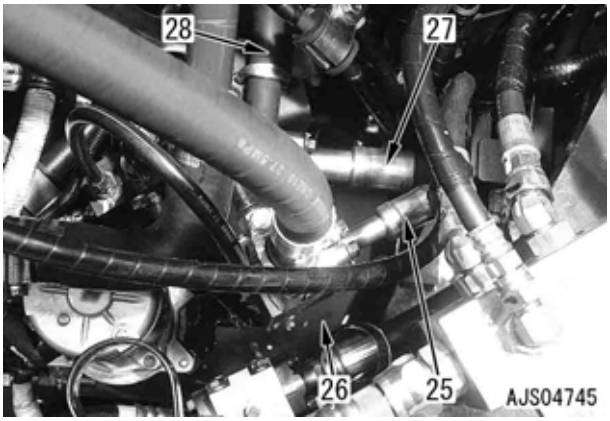


21. Remove the set of bracket (23) and tube (24).



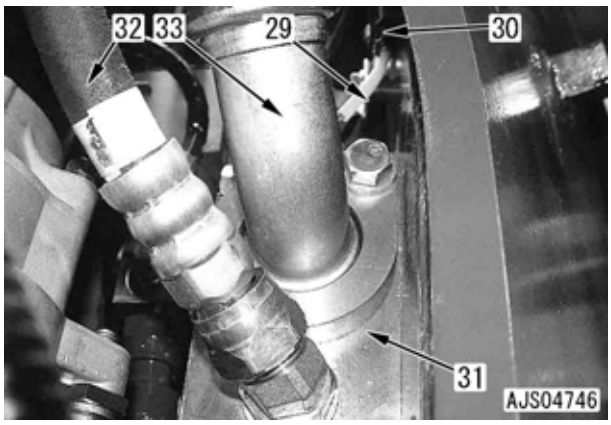
22. Remove hose (25) from block (26).

23. Remove hose (27) and tube (28).

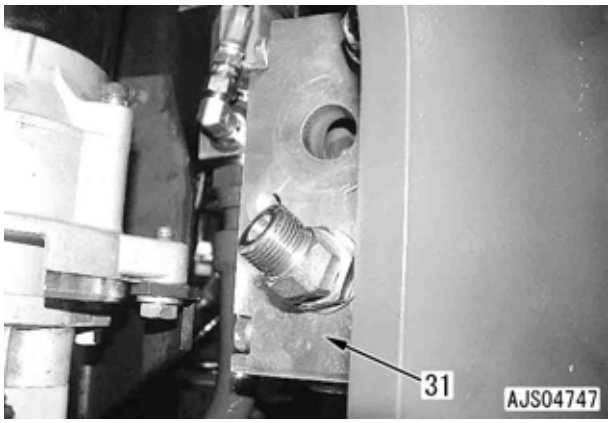


24. Remove the clamp of wiring (29) and disconnect connector R47 (30).

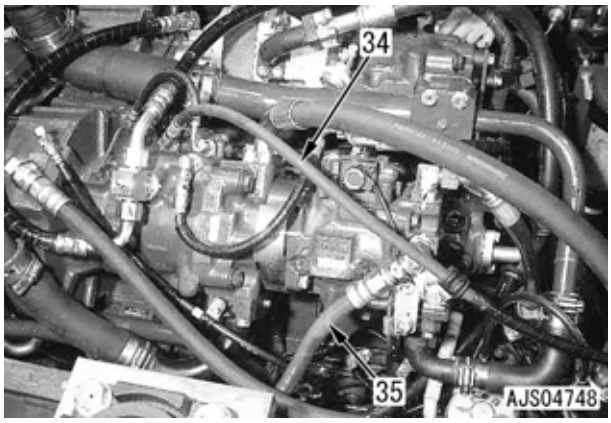
25. Remove hoses (32) and (33) from block (31).



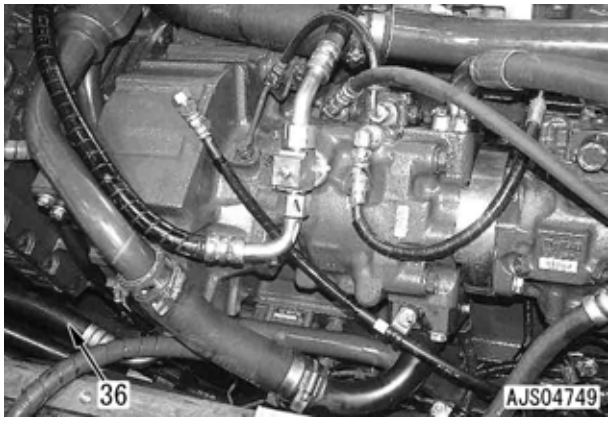
26. Remove block (31).



27. Remove the clamp and hoses (34) and (35).

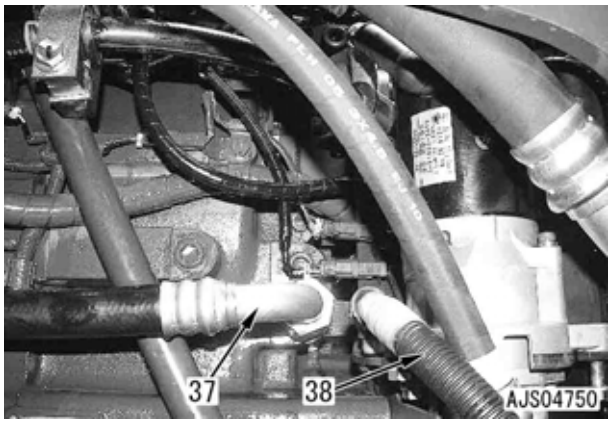


28. Remove cooler hose (36).

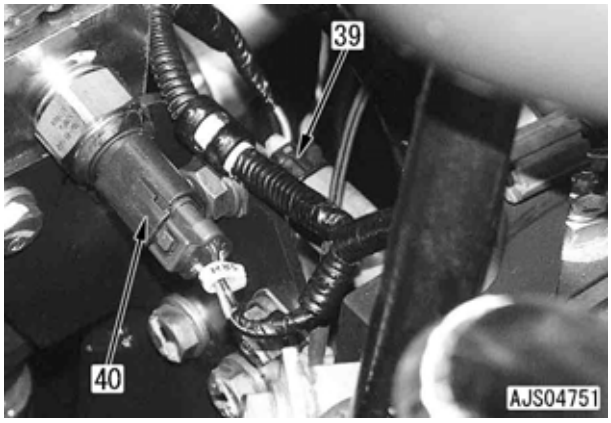


29. Remove hose (37).

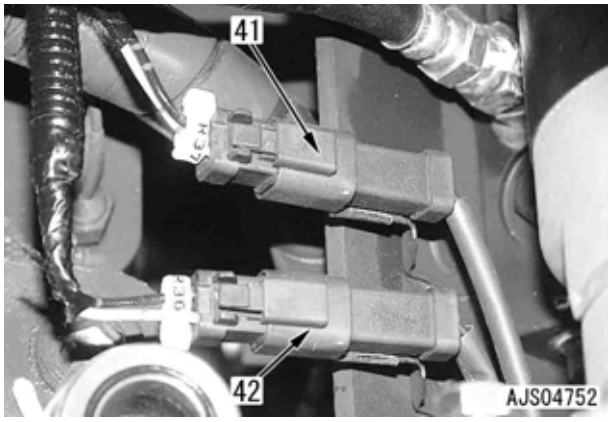
30. Disconnect ground wire (38).



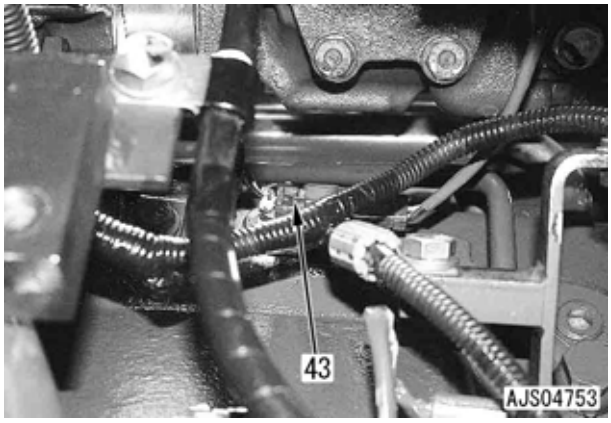
31. Disconnect connectors R40 (39) and R86 (40).



32. Disconnect connectors R37 (41) and R36 (42).

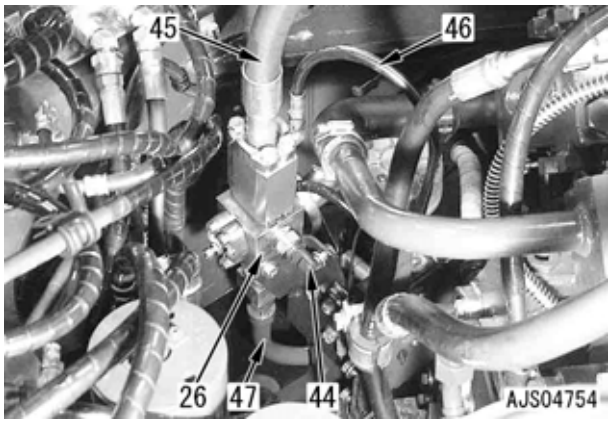


33. Disconnect connector R29 (43).

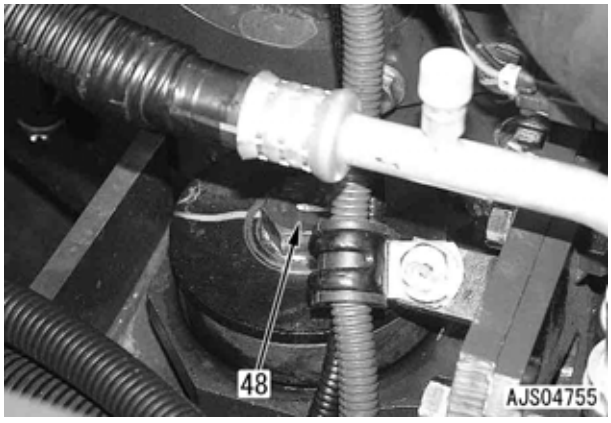


34. Disconnect connector (44) of the pressure sensor.

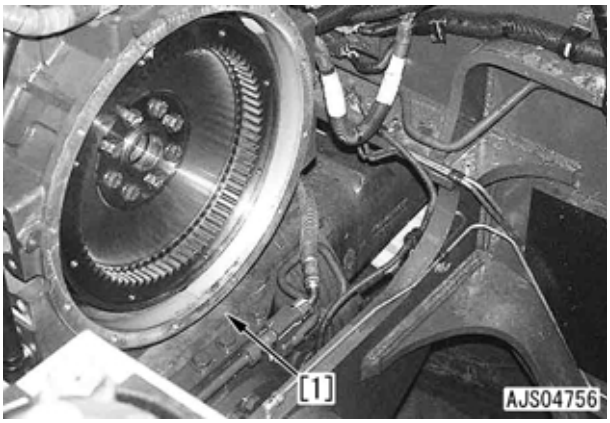
35. Remove the assembly of hoses (45) and (46), block (26), and tube (47).



36. Loosen right and left engine mount mounting bolts (48). [*3]

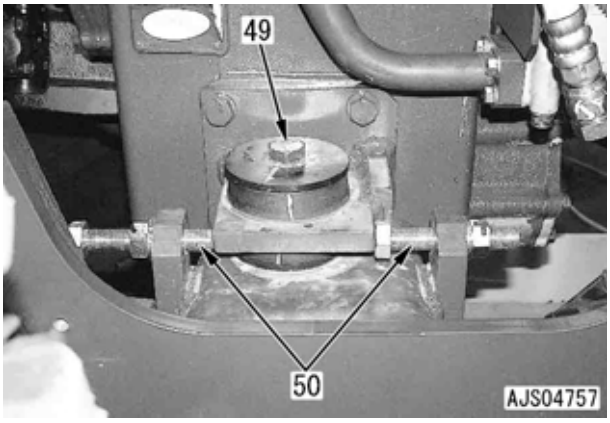


37. Set block [1] between the rear axle and engine and support the engine on it.
(Reference) Height of block: Approx. 75 mm

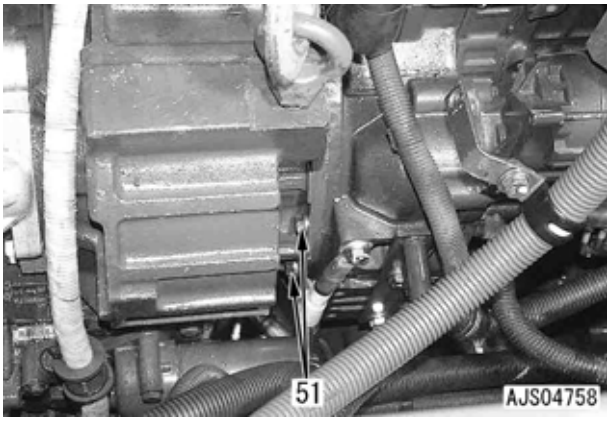


38. Using a lever block and a crane, sling the torque converter and transmission assembly temporarily.

39. Remove right and left mounting bolts (49) of the torque converter and transmission assembly. [*4]
★ Take a record of the dimensions of adjustment bolts (50) to position the assembly when installing it.

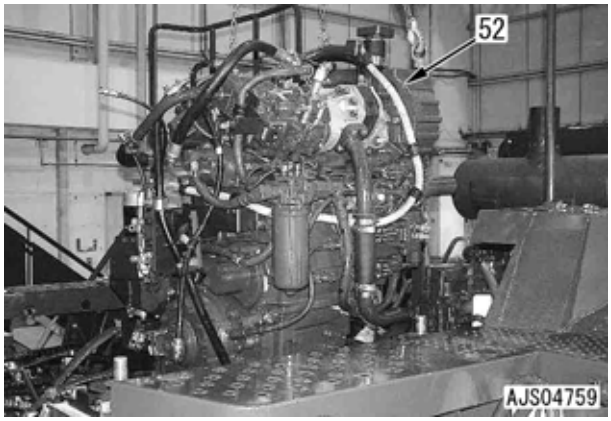


40. While slinging the torque converter and transmission assembly temporarily, remove 12 engine connecting bolts (51).



41. While adjusting the slinging height and angle of torque converter and transmission assembly (52) with the lever block and crane, remove the assembly from the engine. [*5]
★ Before removing the assembly, check that all the wirings and pipings are disconnected.

Torque converter and transmission assembly: **1,110 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1] [*2]

★ When installing the drive shaft, check that the key of the spider cap is fitted to the key way of the mating yoke and then tighten the mounting bolts.

Drive shaft mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}

[*3]

Engine mount mounting bolt:
610 – 765 Nm {62.5 – 78 kgm}

[*4]

★ Adjust the adjustment bolts to the dimensions recorded when they were removed.

Torque converter and transmission mount mounting bolt: **610 – 765 Nm {62.5 – 78 kgm}**

[*5]

★ When installing the torque converter and transmission assembly, check that the O-ring is fitted to the torque converter housing.

★ When installing the torque converter and transmission assembly, take care that the O-ring will not be caught in them.

- **Refilling with oil**
  Pour oil into the transmission case up to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

Transmission case: **38 ℓ**

Disassembly and assembly of torque converter assembly (Standard specification)

Special tools

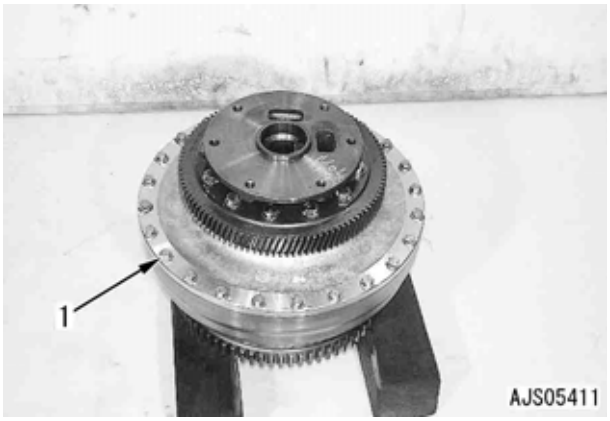
Symbol	Part number	Part name	Necessity	Q'ty	N/R	Sketch
E	790-501-5000	Unit repair stand	●	1		
	790-501-5200	Unit repair stand	●	1		
	790-901-2110	Bracket	●	1		
	790-901-2150	Plate	●	1		

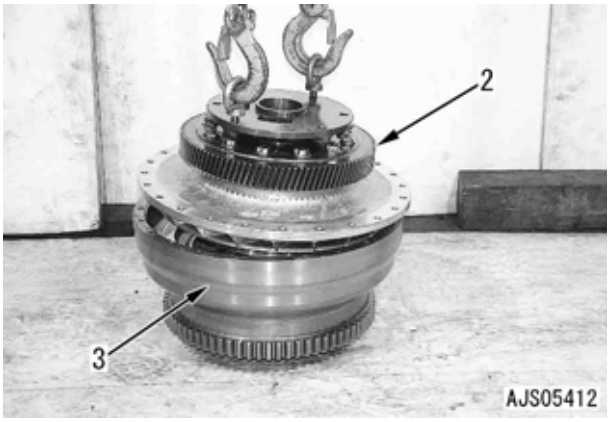
Disassembly

1. Remove the torque converter assembly and set it on the block according to “Disassembly and assembly of transmission assembly”, up to step 27, or install it to tool **E**.

2. Turbine and case assembly

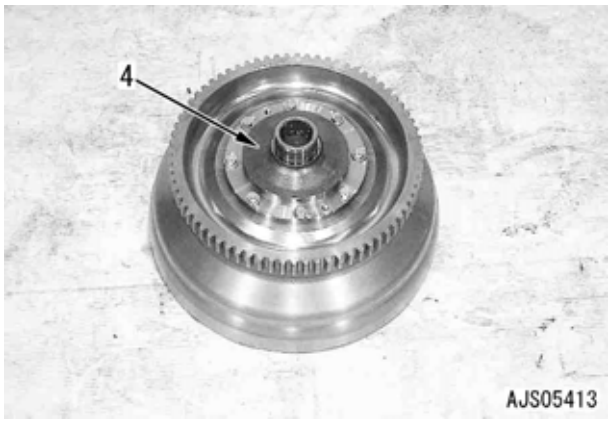
1) Install eyebolts to the stator shaft and remove bolts (1) and stator shaft and pump assembly (2) from turbine and case assembly (3).



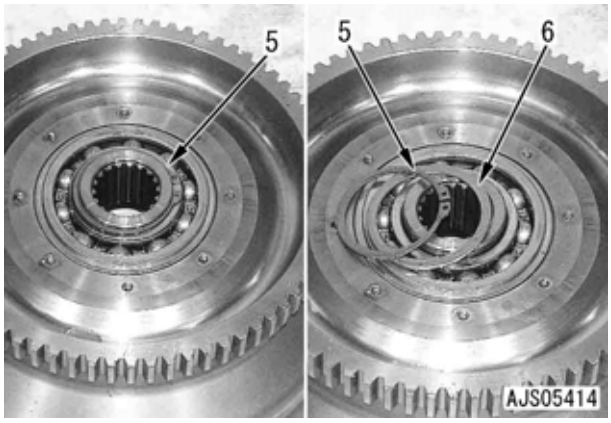


2) Disassemble the turbine and case assembly according to the following procedure.

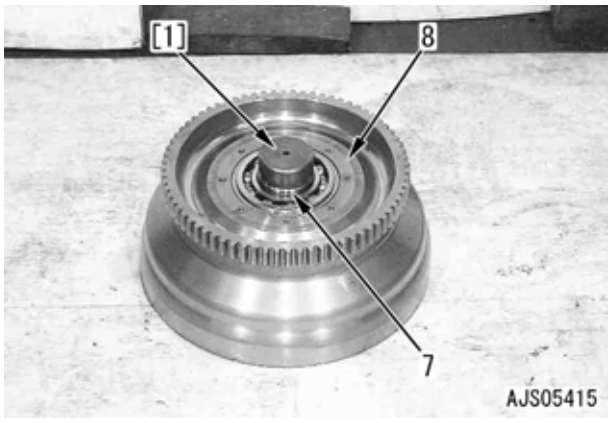
1] Remove pilot (4).

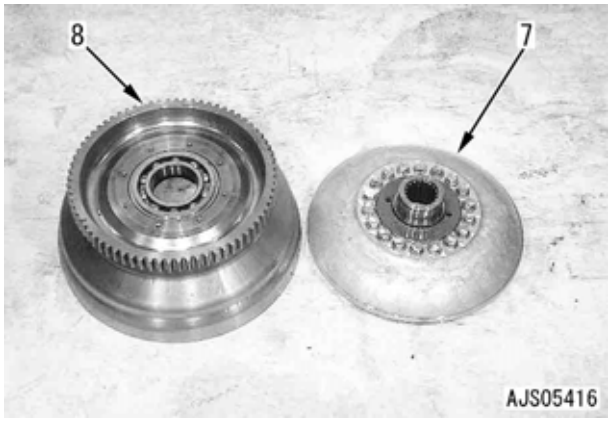


2] Remove snap ring (5) and plate (6).

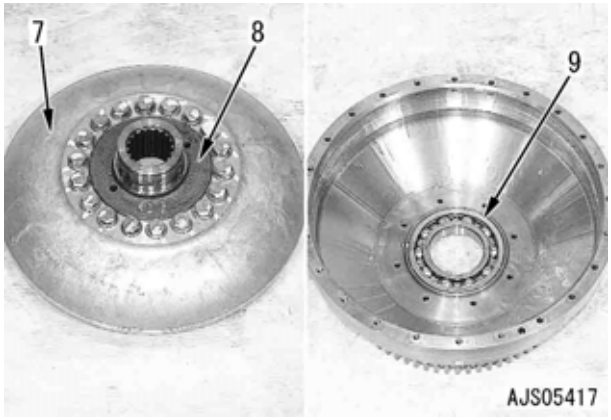


3] Push tool [1] at the boss of turbine (7) to remove the turbine from case (8).

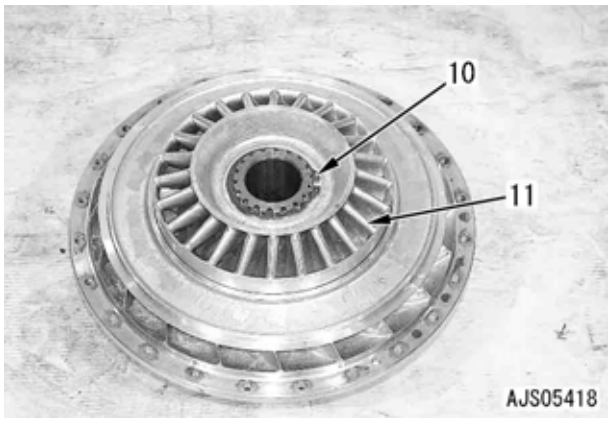




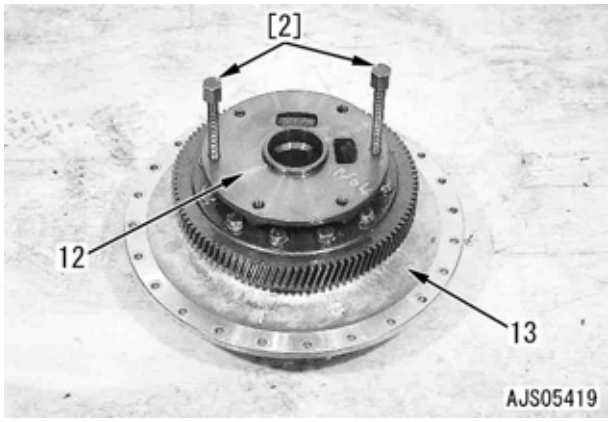
4] Remove the mounting bolt and disconnect turbine (7) from boss (8).
5] Remove bearing (9) from the case.



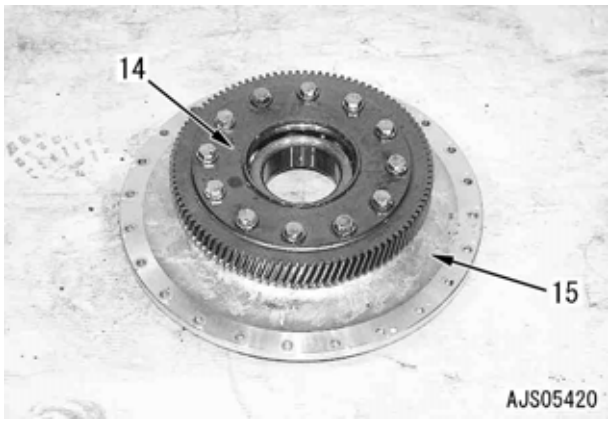
3. Stator
1) Remove snap ring (10).
2) Remove stator (11).



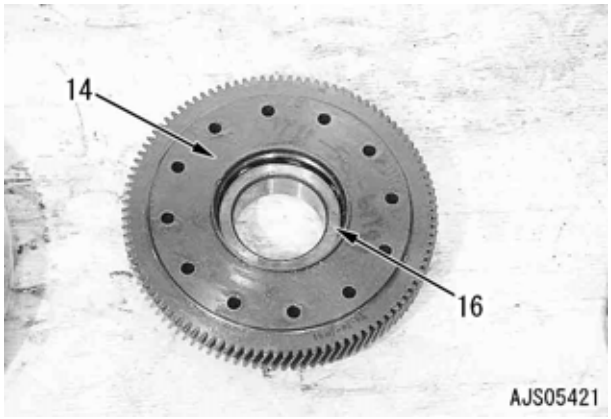
4. Stator shaft
Using forcing screws [2], push pump assembly (13) from stator shaft (12) side to disconnect them from each other.



5. Gear
Remove gear (14) from pump (15).



6. Bearing
Remove bearing (16) from gear (14).

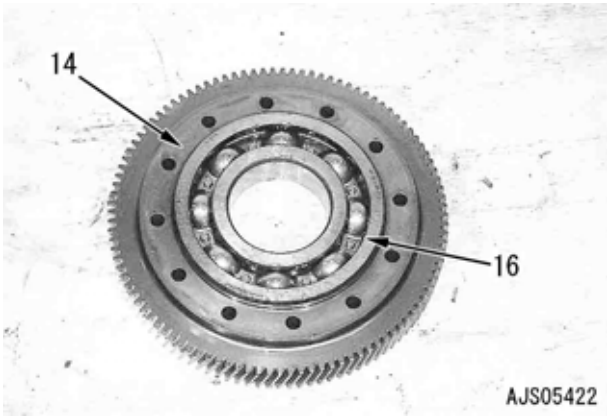


Assembly

1. Bearing

Install bearing (16) to gear (14).

Bearing: **Engine oil**

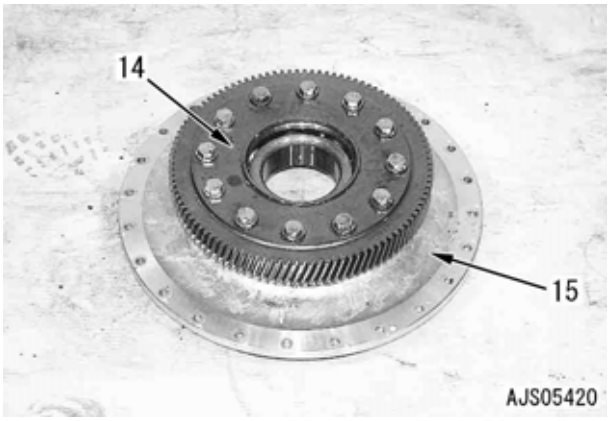


2. Gear

Install gear (14) to pump (15).

Mounting bolt:

58.8 – 73.5 Nm {6.0 – 7.5 kgm}

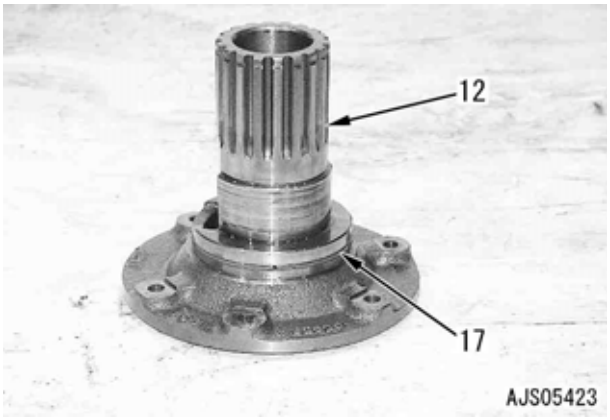


3. Stator shaft

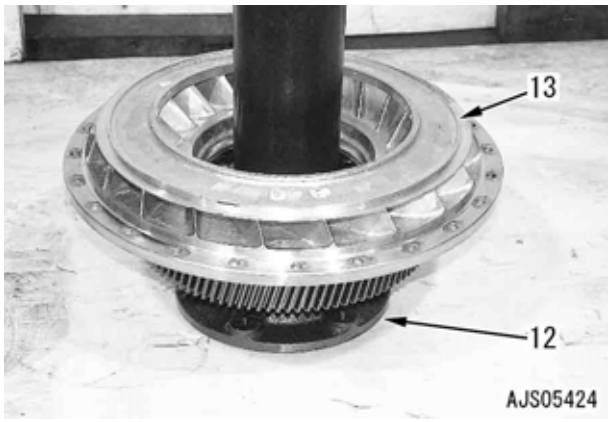
1) Install seal ring (17) to stator shaft (12).

Seal ring: **Grease (G2-LI)**

★ Project the seal ring evenly.

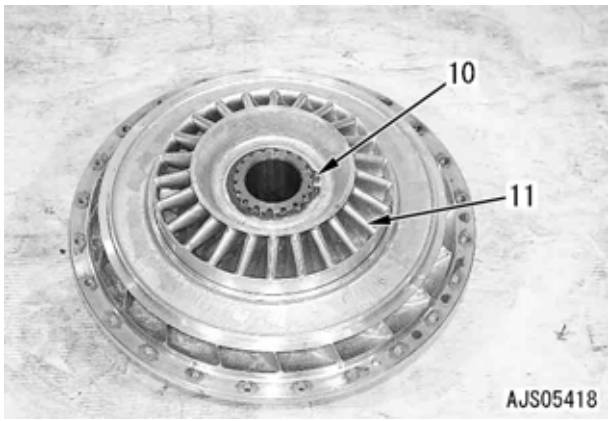


2) Push the inner race side of the bearing to install pump assembly (13) to stator shaft (12).



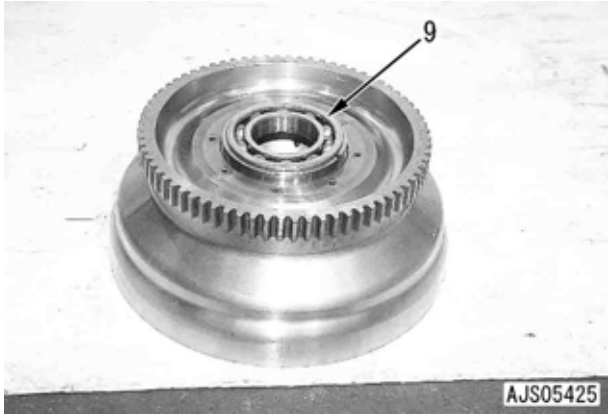
4. Stator

1) Install stator (11).
2) Install snap ring (10).

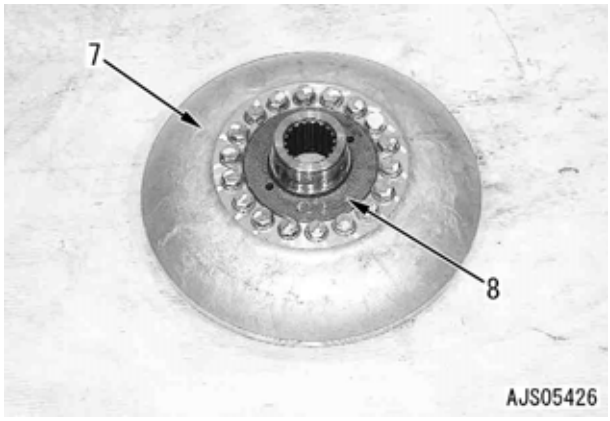


5. Turbine and case assembly

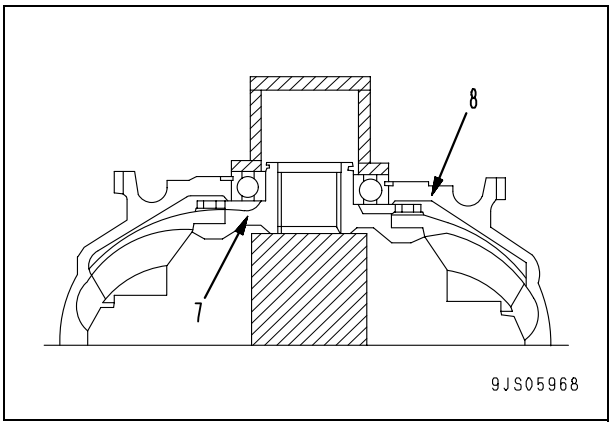
1) Assemble the turbine and case assembly according to the following procedure.
   1] Install bearing (9) to the case.
      ★ Press fit the bearing until the ring touches the case.



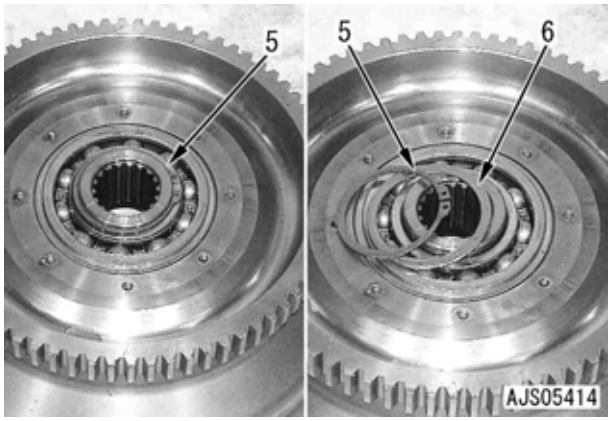
2] Install boss (8) to turbine (7).
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt:
58.8 – 73.5 Nm {6.0 – 7.5 kgm}



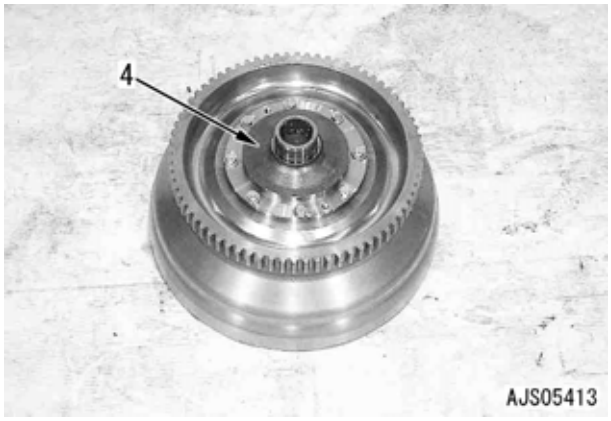
3] Push the inner race side of the bearing to install turbine (7) to case (8).



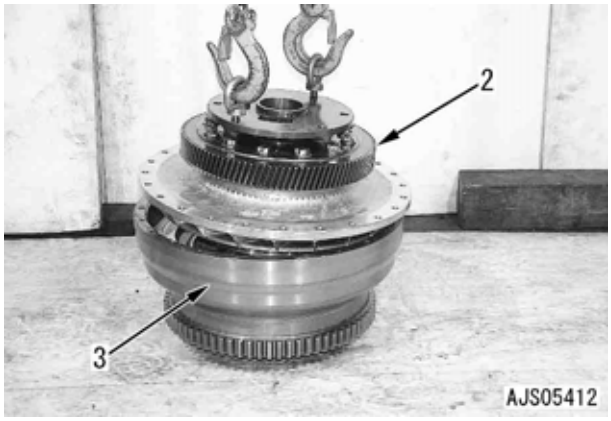
4] Install plate (6) and snap ring (5).



5] Install pilot (4).
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt:
27.5 – 34.3 Nm {2.8 – 3.5 kgm}



2) Install stator shaft and pump assembly (2) to turbine and case assembly (3).
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt:
21.6 – 28.4 Nm {2.2 – 2.9 kgm}



Disassembly and assembly of torque converter assembly (Lockup specification)

Special tools

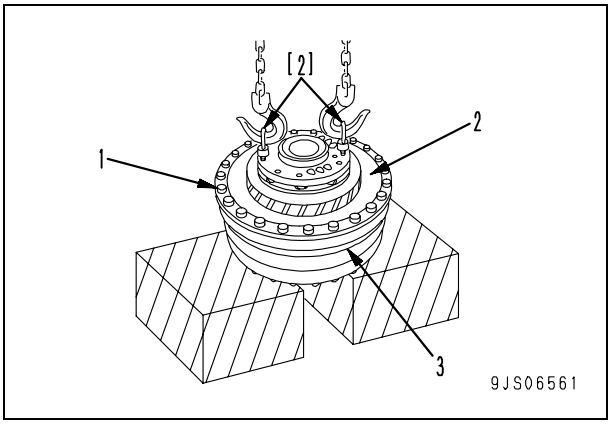
Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
F1	1	790-501-5000	Unit repair stand	●	1		
	2	790-901-2110	Bracket	●	1		
	3	790-901-4240	Plate	●	1		
F2		793-647-1110	Wrench	●	1		

Disassembly

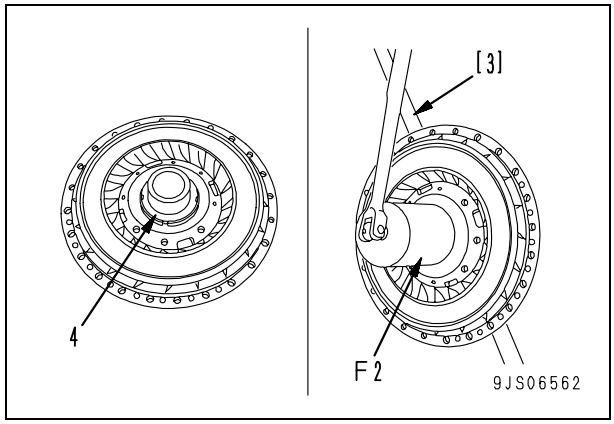
1. Remove the torque converter assembly and set it on the block according to “Disassembly and assembly of transmission assembly”, up to step 27, or install it to tool **F1**.

2. Stator shaft and pump assembly

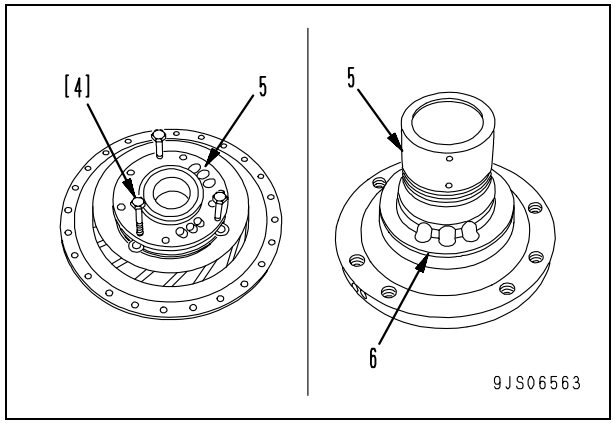
1) Remove pump mounting bolts (1).
2) Using eyebolts [2], lift off stator shaft and pump assembly (2) from turbine and case assembly (3).



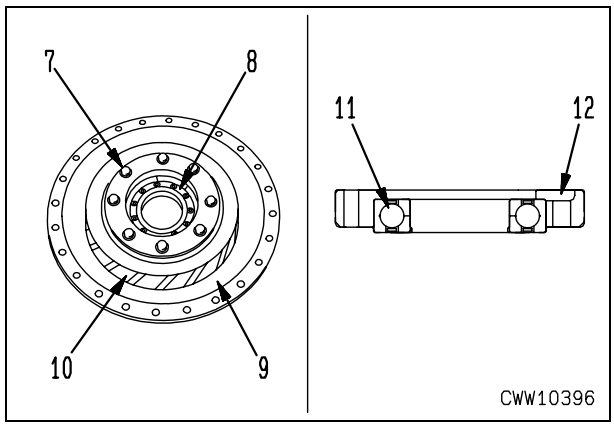
3) Disassembly of stator shaft and pump assembly
   1] Using tool **F2**, remove nut (4).
      ★ When loosening the nut, tighten the bolt into the stator shaft and lock the stator shaft with bar [3].



   2] Using forcing screws [4], pull out stator shaft (5).
   3] Remove seal ring (6) from stator shaft (5).

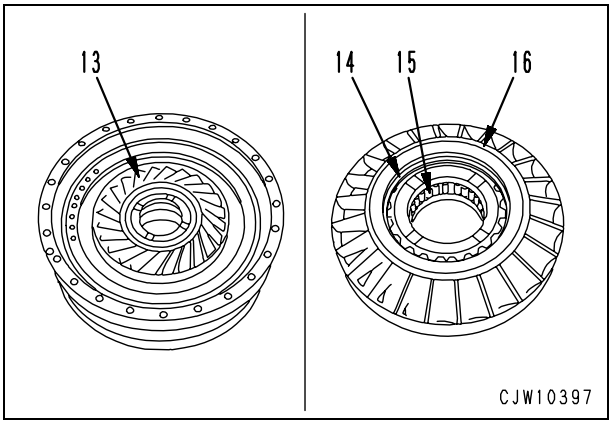


   4] Remove mounting bolts (7) and remove gear (10) and guide and bearing assembly (8) from pump (9).
   5] Remove bearing (11) from guide (12).

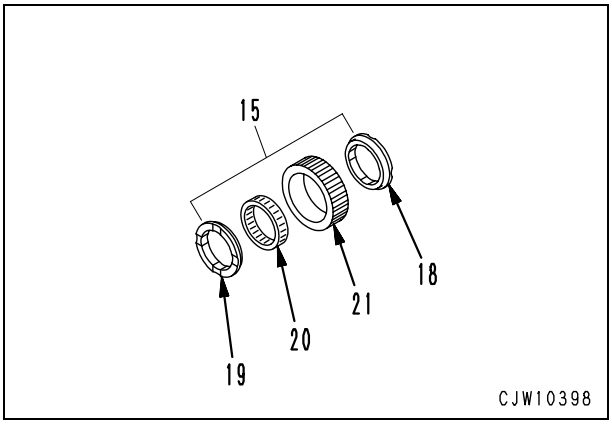


3. Stator assembly

1) Remove stator assembly (13).
2) Disassembly of stator assembly
   1] Remove the upper and lower snap rings (14) and remove race and free wheel assembly (15) from stator (16).

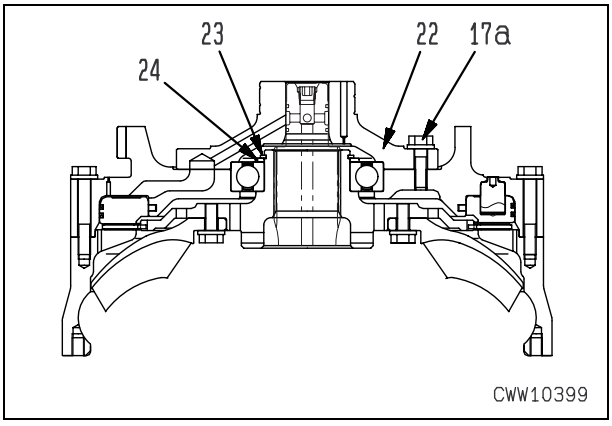


   2] Remove bushings (18) and (19) from race and free wheel assembly (15) and remove free wheel (20) from race (21).

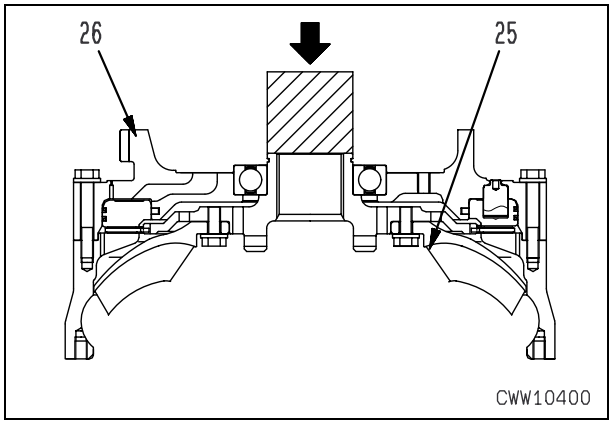


4. Disassembly of turbine and case assembly

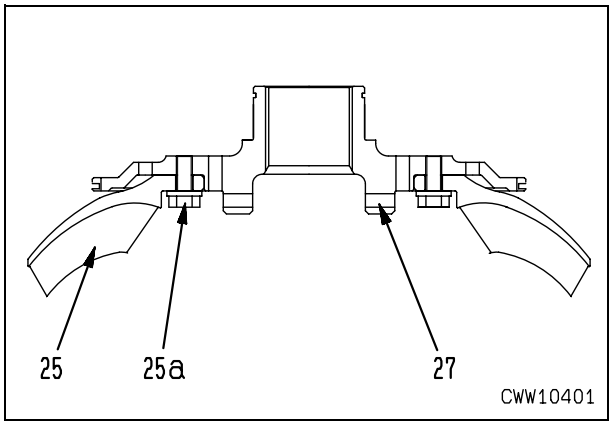
1) Remove bolt (17a) and pilot (22).
2) Remove snap ring (23) and plate (24).



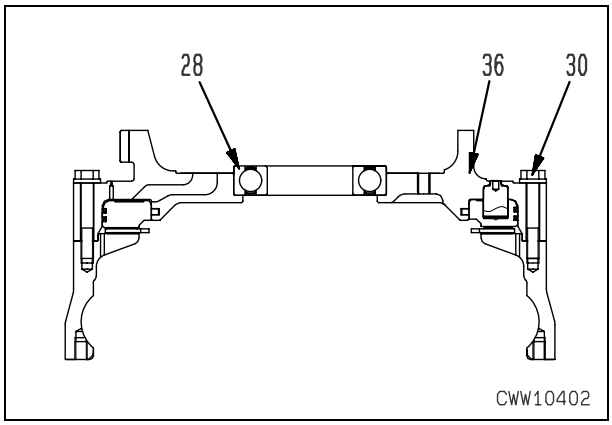
3) Push the boss at turbine (25) to remove the turbine from case (26).



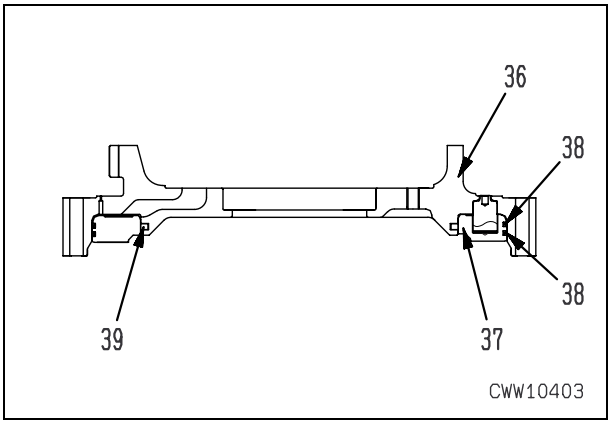
4) Remove bolts (25a) and disconnect turbine (25) from boss (27).



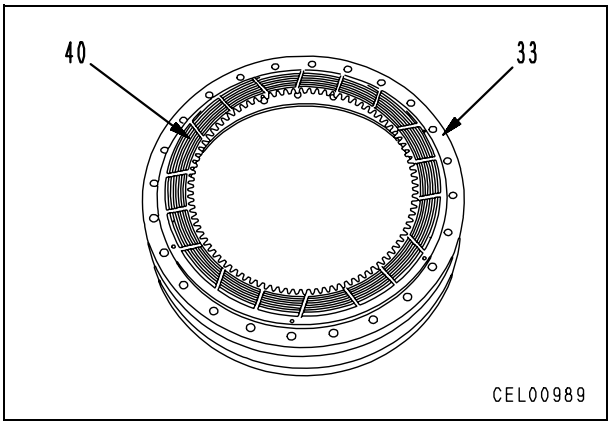
5) Remove bearing (28) from complete housing (36).
6) Remove complete housing mounting bolts (30).



7) Disassembly of complete housing assembly
   1] Remove piston (37) from complete housing (36).
   2] Remove seal ring (38) from piston (37).
   3] Remove seal ring (39) from complete housing (36).



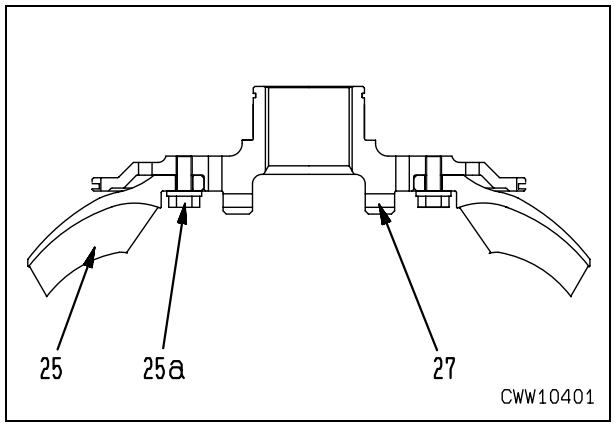
8) Remove disc (40) from drive case (33).



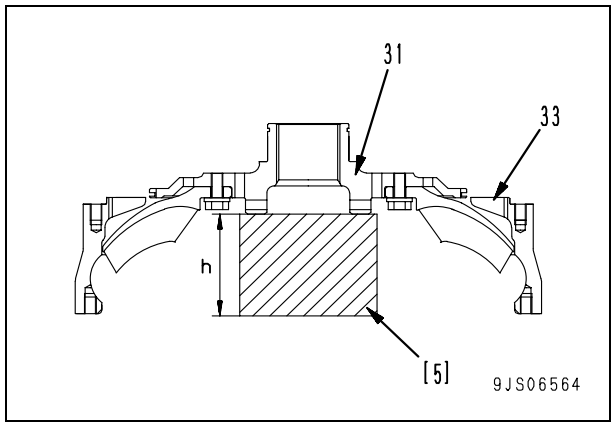
Assembly

★ Clean all the parts and check them for dirt or damage. Coat their sliding surfaces with engine oil before installing.
★ Check that each snap ring is fitted to the groove securely.

1. Complete turbine
Install turbine (25) to boss (27) and tighten bolt (25a).
Bolt: **Adhesive (LT-2)**
Bolt: **58.8 – 73.5 Nm {6.0 – 7.5 kgm}**



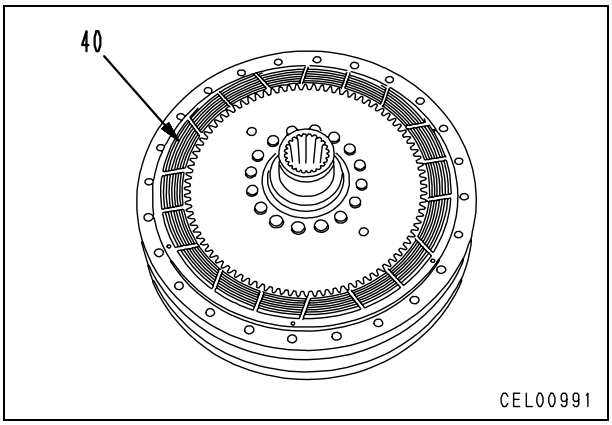
2. Turbine and case
Set complete turbine (31) to block [5] and set drive case (33).
★ Height (h) of block [5]: **Approx. 90 mm**



3. Disc

Install disc (40).

★ Before installing the disc, apply engine oil to its sliding surfaces.



4. Complete housing assembly

1) Assembly of complete housing

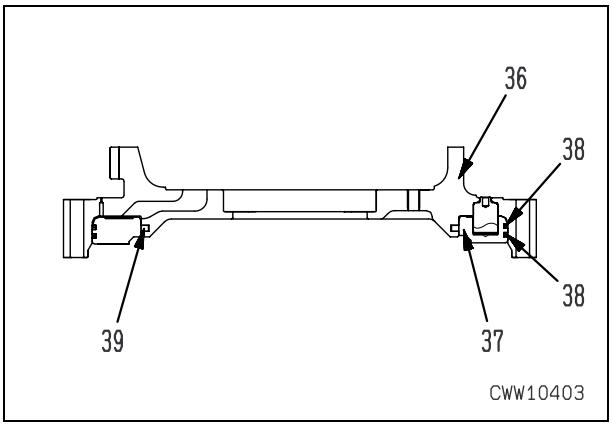
1] Install seal ring (39) to complete housing (36).

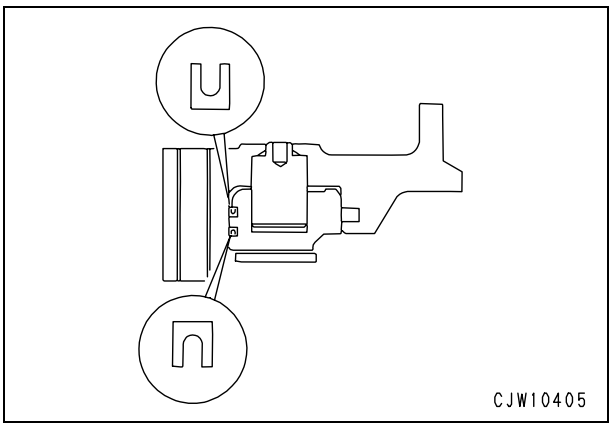
Periphery of seal ring: **Grease (G2-LI)**

2] Install seal ring (38) to piston (37) and install them to complete housing (36).

★ Install seal ring (38) in the correct direction as shown below.

Periphery of seal ring: **Grease (G2-LI)**



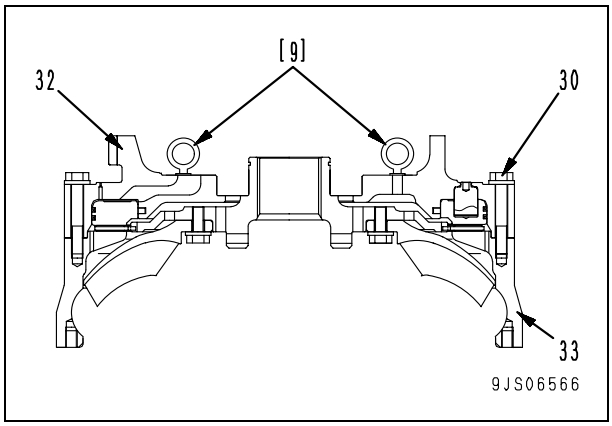


2) Using eyebolts [9], sling complete housing assembly (32) and set it to drive case (33).

3) Tighten mounting bolts (30).

Mounting bolt: **Adhesive (LT-2)**

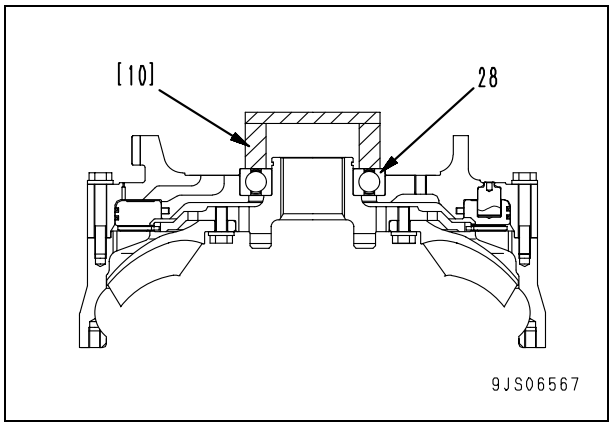
Mounting bolt: **27.5 – 34.3 Nm {2.8 – 3.5 kgm}**



5. Bearing

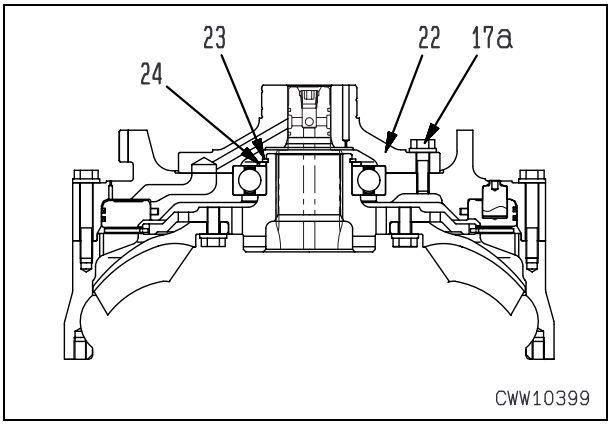
Using push tool [10], press fit bearing (28).

★ After press fitting the bearing, drop 6 cc of engine oil onto it and rotate it 10 turns.

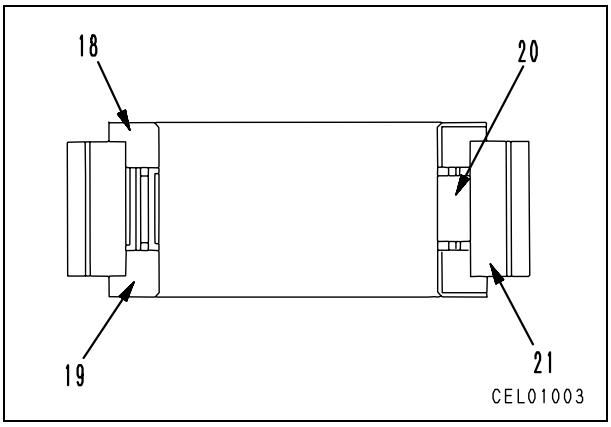


6. Plate and snap ring
Install spacer (24) and snap ring (23).

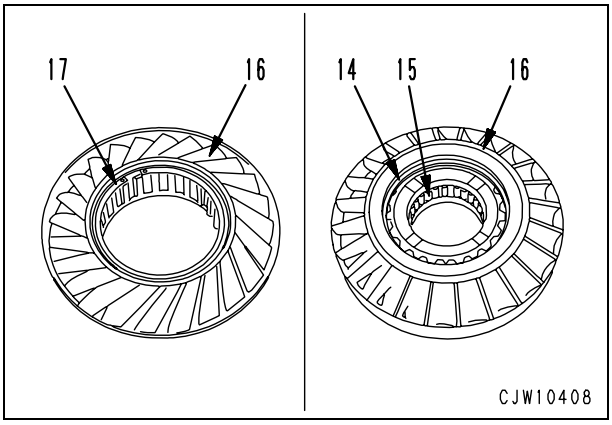
7. Pilot
Install pilot (22) and tighten bolt (17a).
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt:
58.8 – 73.5 Nm {6.0 – 7.5 kgm}



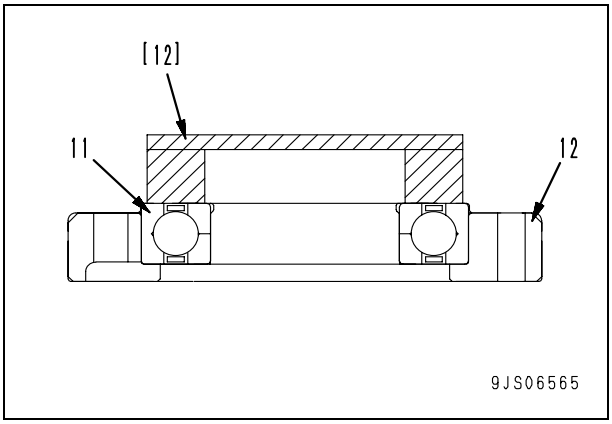
8. Stator assembly
1) Assembly of stator assembly
1] Install free wheel (20) to race (21) and then install bushings (18) and (19) by expansion fit.
★ Apply engine oil to the sliding surfaces of the bushing and free wheel.
★ Take care not to scratch the sprag of the free wheel.
★ When installing the free wheel, direct the arrow stamped on the cage end toward the turbine (input side).



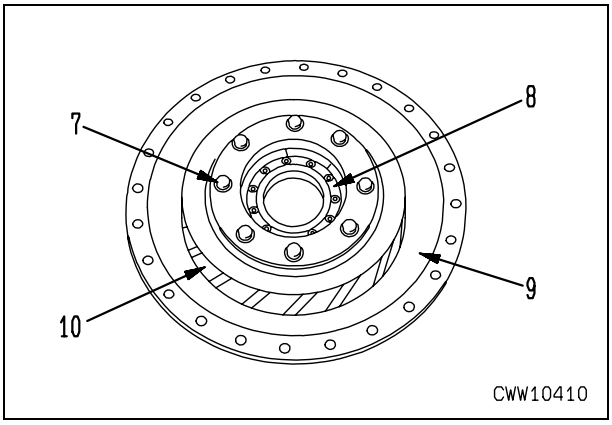
2] Install snap ring (17) to stator (16).
3] Install race and wheel assembly (15) to stator (16) and install snap ring (14).



9. Stator shaft and pump assembly
1) Assembly of stator shaft and pump assembly
1] Using push tool [12], press fit bearing (11) to guide (12).
★ After press fitting the bearing, drop 6 cc of engine oil onto it and rotate it 10 turns.

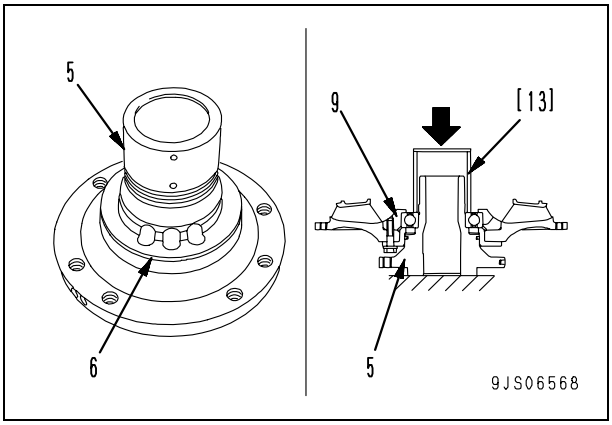


2] Set guide and bearing assembly (8) and gear (10) to pump (9) and tighten mounting bolts (7).
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt:
58.8 – 73.5 Nm {6.0 – 7.5 kgm}

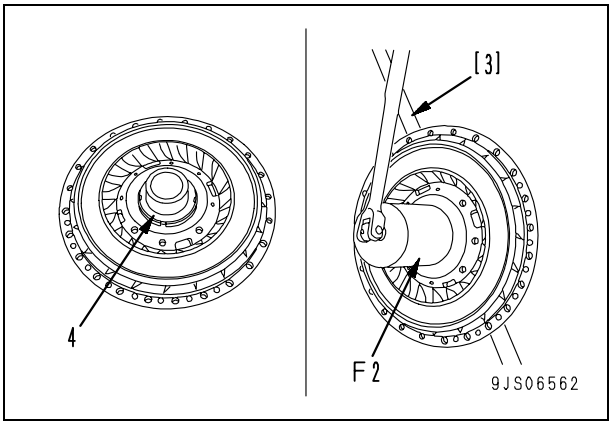


3] Install seal ring (6) to stator shaft (5).
Periphery of seal ring:
Grease (G2-LI)

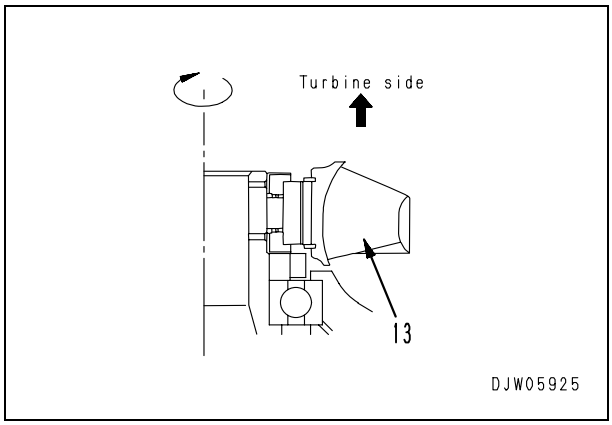
4] Using push tool [13], push the inner race side of the bearing to install pump assembly (9) to stator shaft (5).



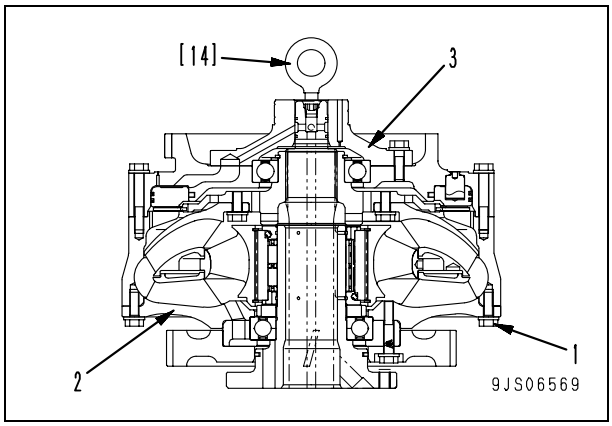
5] Using tool **F2**, tighten nut (4).
★ When tightening the nut, tighten the bolt into the stator shaft and lock the stator shaft with bar [3].
Nut: **Adhesive (LT-2)**
Nut:
147.1 – 176.5 Nm {15 – 18 kgm}



6] While rotating stator assembly (13) to the right (clockwise), install it.
★ Check the rotation direction of the stator seen from the turbine (input) side.
Clockwise: Free rotation
Counterclockwise: Lock
★ If the rotation direction is opposite to the above, install the race and free wheel assembly to the stator reversely and check the rotation direction again.



2) Using eyebolts [14], place turbine and case assembly (3) on stator shaft and pump assembly (2) and tighten mounting bolts (1) temporarily.
3) Reverse the whole assembly and tighten the mounting bolts.
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt:
27.3 – 34.3 Nm {2.8 – 3.5 kgm}



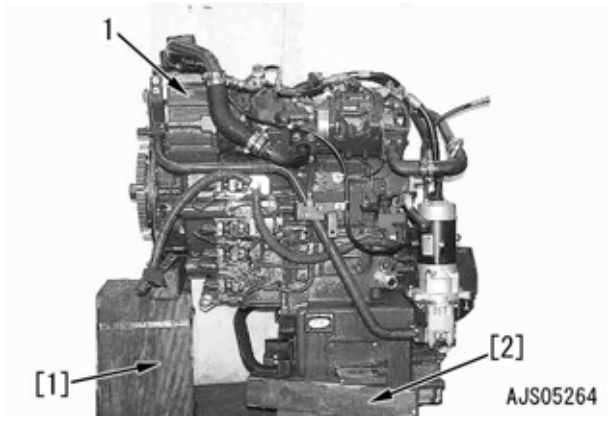
Disassembly and assembly of transmission assembly

Special tools

Symbol	Part number	Part name	Necessity	Q'ty	N/R	Sketch
B1	792-201-0200	Wrench	■	1		

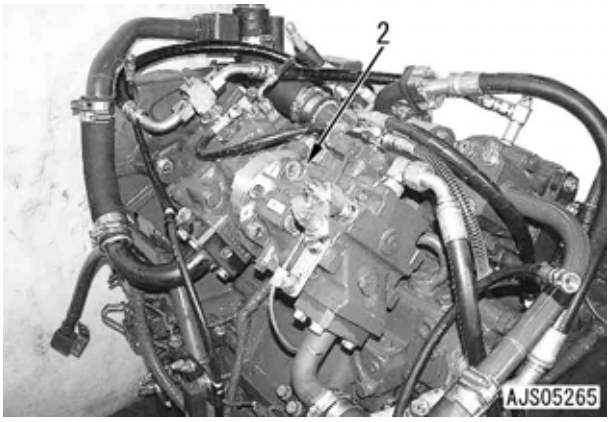
Disassembly

1. Set torque converter and transmission assembly (1) on blocks [1] and [2].

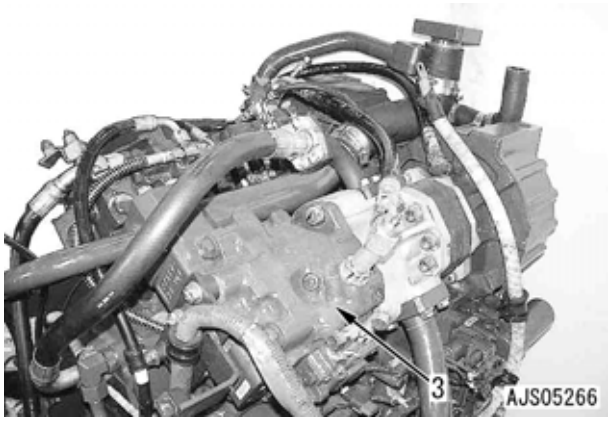


2. Hydraulic pump assembly

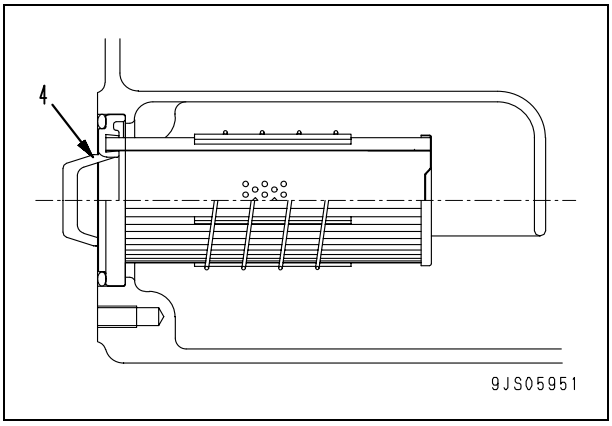
1) Remove the hoses and tubes from steering and cooling fan pump (2).



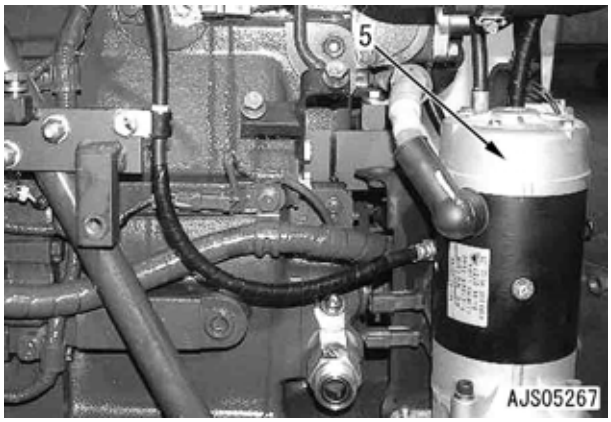
2) Remove hoses and tubes from power train and work equipment pump assembly (3).



3. Remove strainer (4).



4. Remove the wirings and hoses from emergency steering pump and motor (5) and then remove the pump and motor and bracket together.

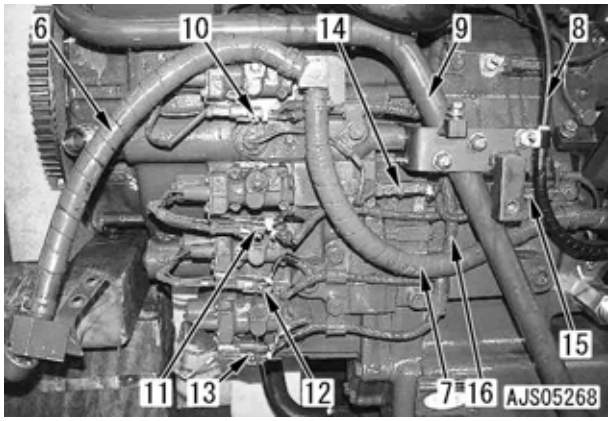


5. Remove hoses (6), (7), and (8) and tube (9).

6. Disconnect the following connectors from the ECMV.
- (10): Forward clutch connector
- (11): L/C connector
- (12): 4th clutch connector
- (13): 3rd clutch connector

★ L/C connector is installed to only the machine of torque converter lockup specification.

7. Disconnect torque converter oil temperature sensor connector (14) and transmission oil temperature sensor (15) and remove wiring assembly (16).



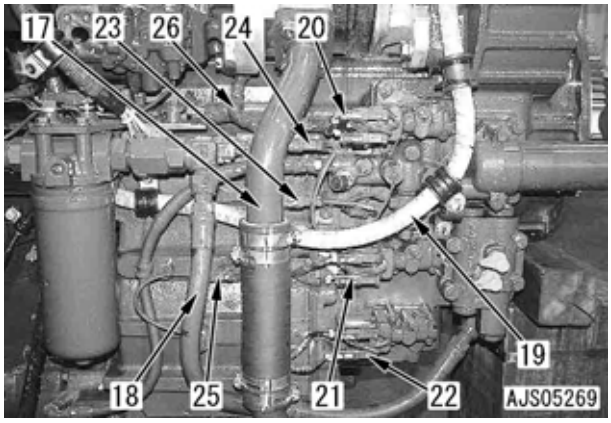
8. Remove transmission pump piping assembly (17).

9. Remove hose (18) from the oil filter.

10. Remove wiring (19).

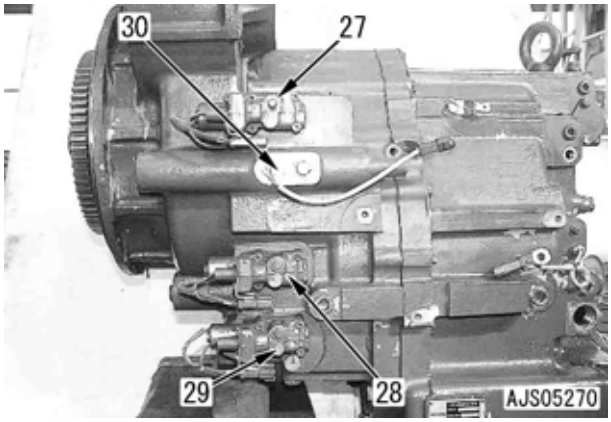
11. Disconnect the following connectors from the ECMV.
- (20): Reverse clutch connector
- (21): 1st clutch connector
- (22): 2nd clutch connector

12. Disconnect parking brake solenoid connector (23), parking brake indicator switch connector (24), and speed sensor connector (25) and remove wiring assembly (26).

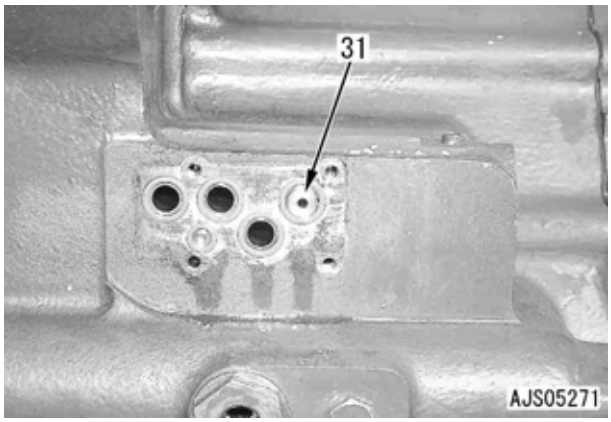


13. Remove forward ECMV (27), 4th ECMV (28), and 3rd ECMV (29).

14. Remove torque converter oil temperature sensor (30).

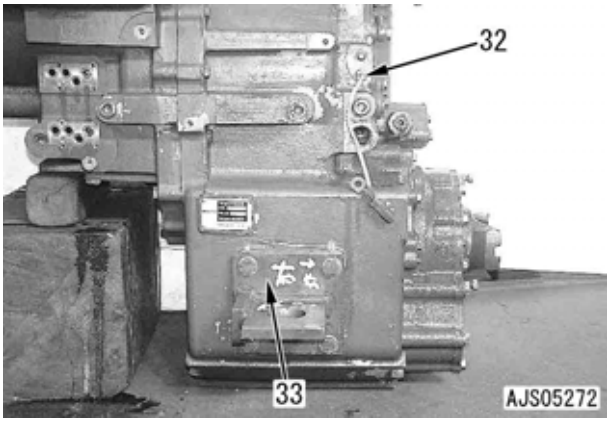


★ After removing the ECMV, remove orifice (31) so that it will not be lost.



15. Remove transmission oil temperature sensor (32).

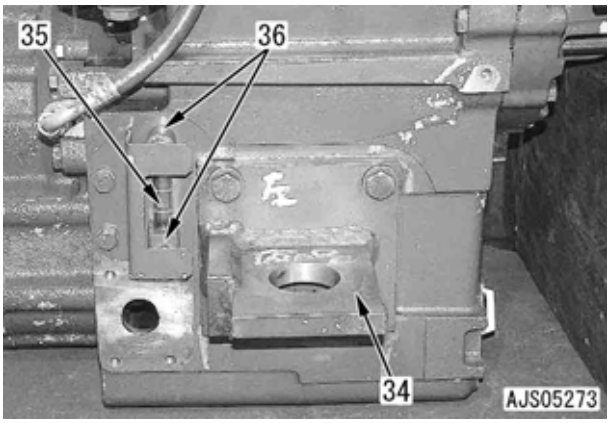
16. Remove right transmission mount (33).



17. Remove left transmission mount (34).

18. Remove transmission case oil level gauge (35).

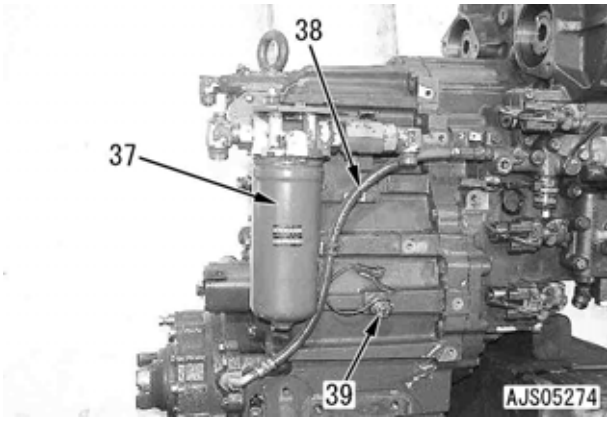
★ When removing the bolt, lock upper and lower holders (36) with a spanner.



19. Remove transmission filter (37) and bracket together.

20. Remove parking brake hose (38).

21. Remove transmission speed sensor (39).

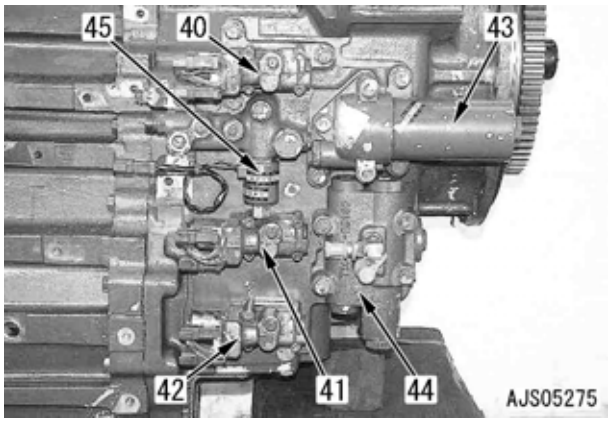


22. Remove reverse ECMV (40), 1st ECMV (41), and 2nd ECMV (42).

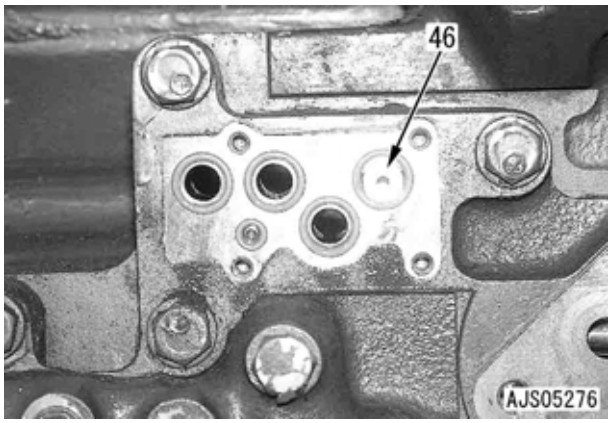
23. Remove last chance filter (43).

24. Remove main relief and torque converter relief valve assembly (44).

25. Remove parking brake solenoid (45).

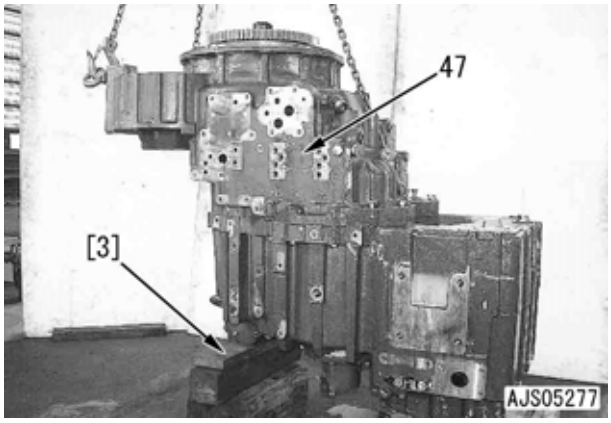


★ After removing the ECMV, remove orifice (46) so that it will not be lost.

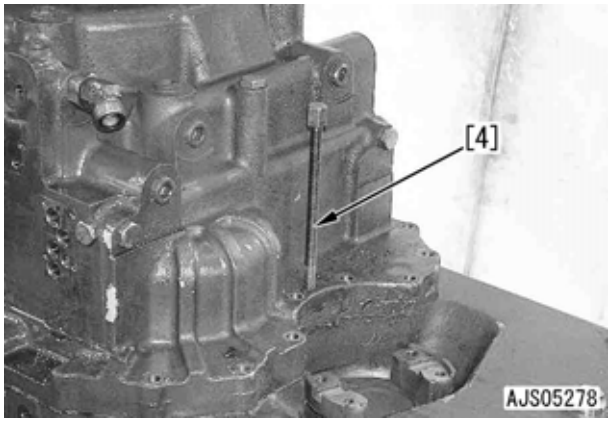


26. Torque converter and transmission case assembly

1) Set torque converter and transmission assembly (47) on block [3] with the torque converter side up.

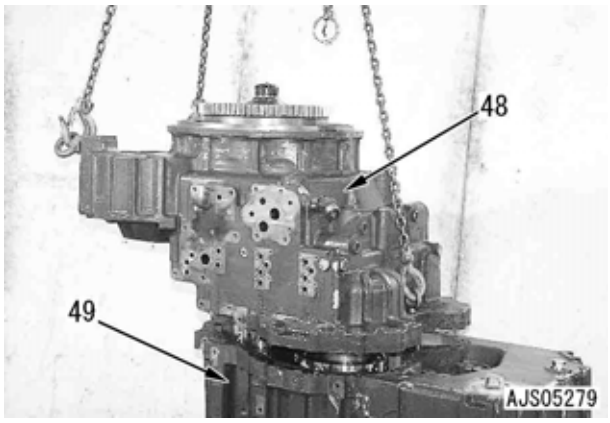


2) Remove 21 mounting bolts of the torque converter and transmission case.
3) Using a lever block, sling the torque converter and transmission assembly temporarily and disconnect the torque converter case and transmission case with forcing screw [4].



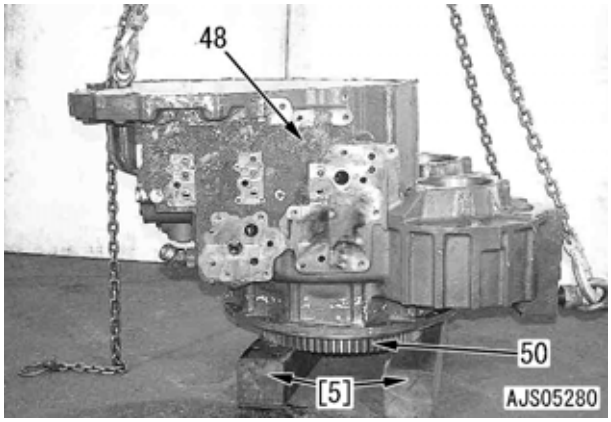
4) Sling torque converter case assembly (48) and remove it from transmission case assembly (49).

Torque converter case assembly: **178 kg**

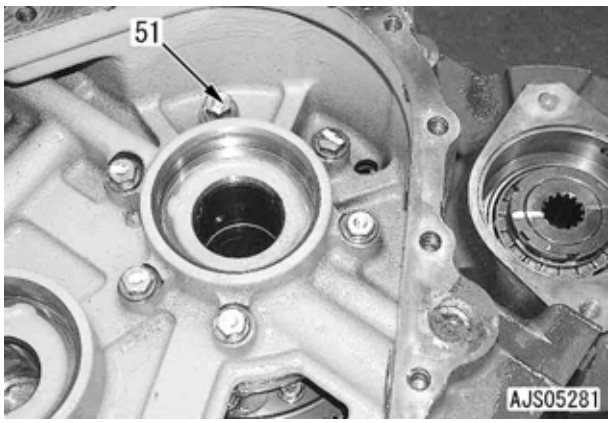


27. Torque converter assembly

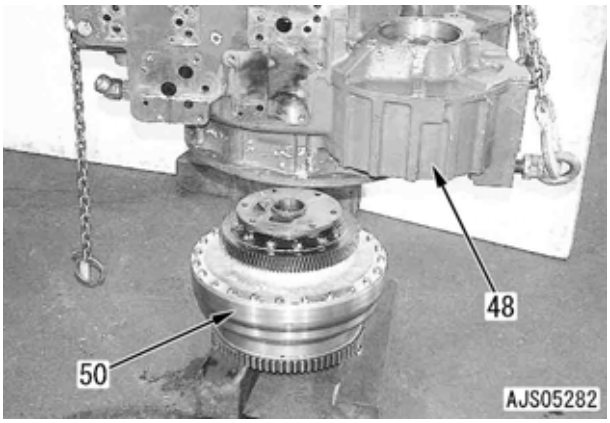
1) Sling torque converter case (48) with the torque converter (50) side down and set block [5] under the torque converter.
★ Keep the torque converter case slung.



2) Remove 6 stator shaft mounting bolts (51).

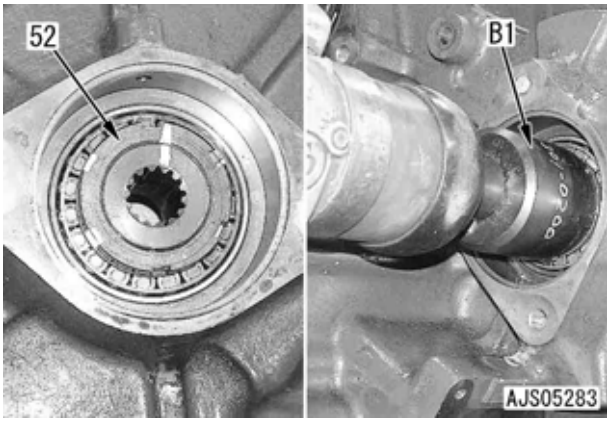


3) Sling torque converter case (48) and remove torque converter assembly (50).

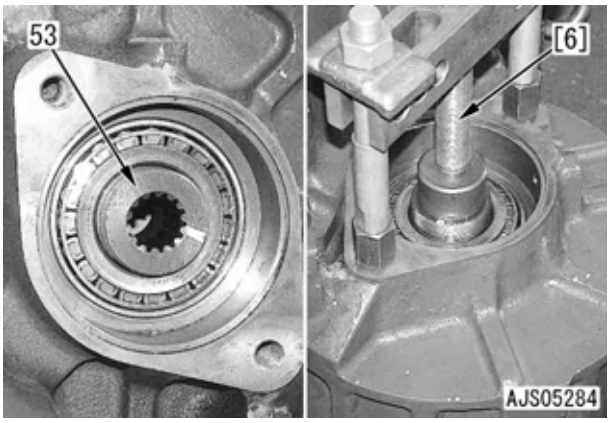


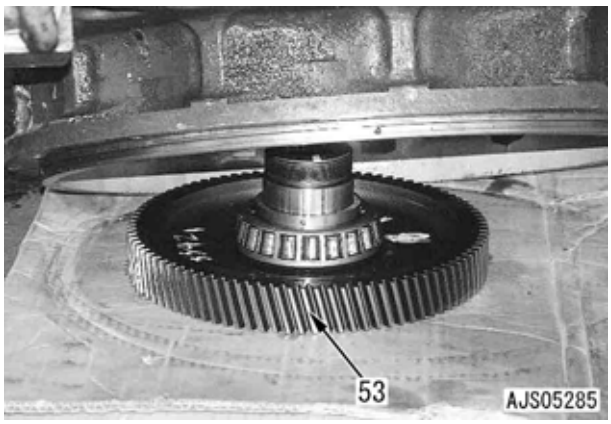
28. PTO gear

1) Using tool **B1**, remove nut (52).

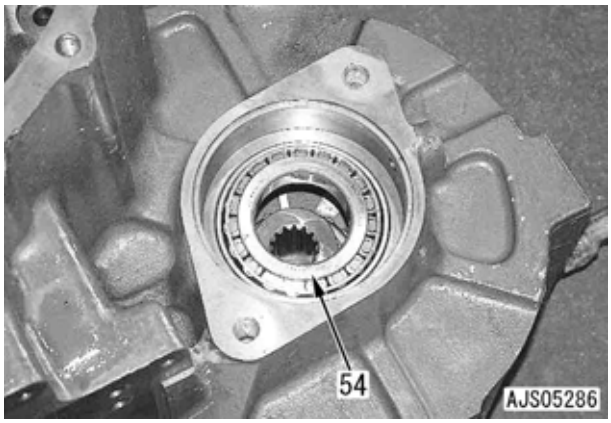


2) Using tool [6], pull out the shaft of PTO gear (53) and remove the PTO gear.

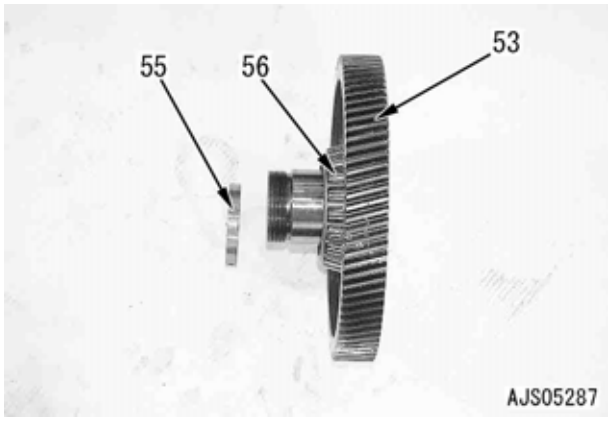




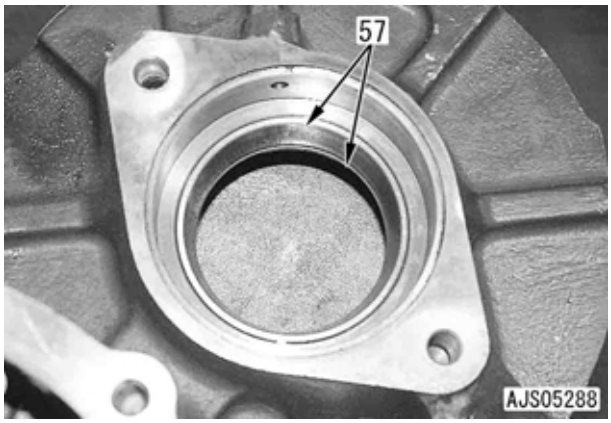
3) Remove bearing (54) of the PTO gear from the torque converter case.



4) Remove collar (55) and bearing (56) from PTO gear (53).



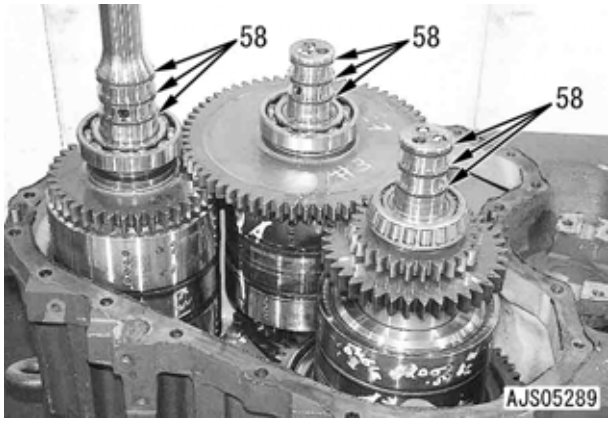
5) Remove outside and inside outer races (57) from the torque converter case.



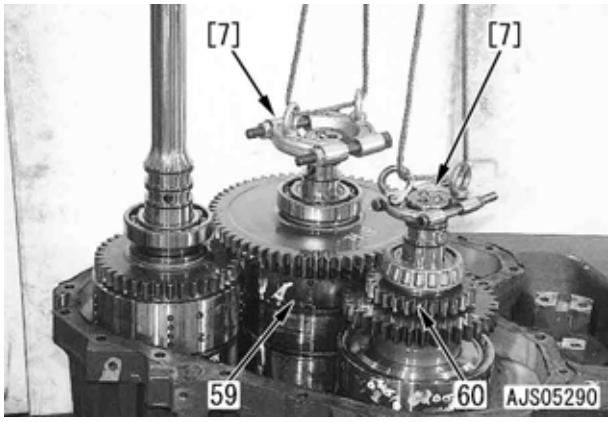
★ Remove the PTO gear on the opposite side similarly.

29. Clutch pack

1) Remove seal rings (58) from the shafts.

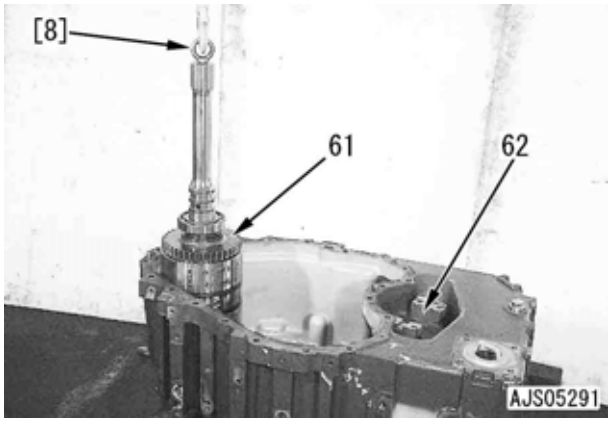


2) Using tools [7], lift off 1st and 4th clutch assembly (59) and 2nd and 3rd clutch assembly (60) simultaneously.

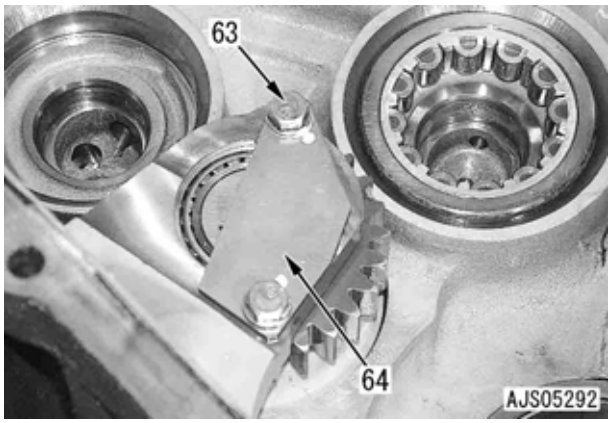


3) Using eyebolt [8], lift off forward and reverse clutch assembly (61).

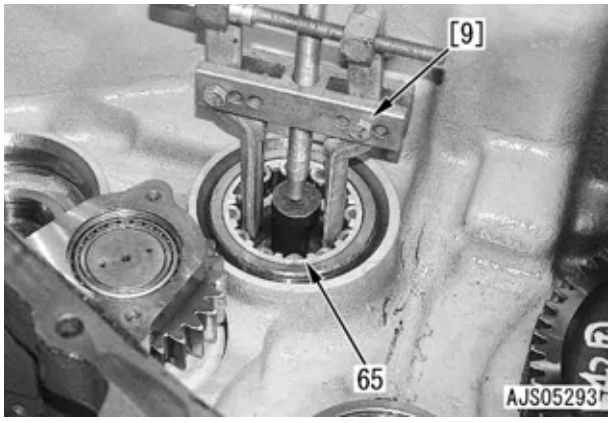
30. Remove yoke (62).



31. Remove 2 bolts (63) from the reverse idler gear side of the case and remove plate (64).



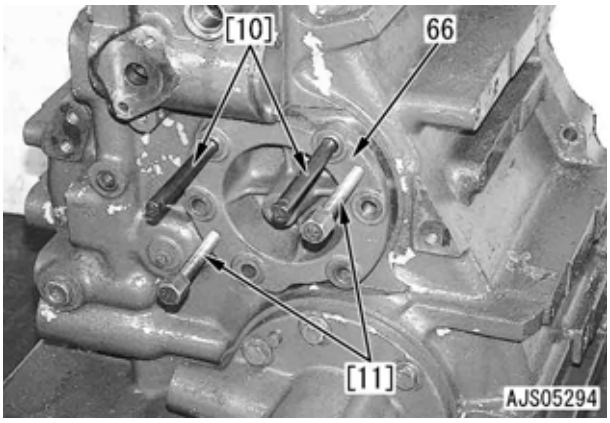
32. Using tool [9], remove bearing (65) on the 1st clutch side.



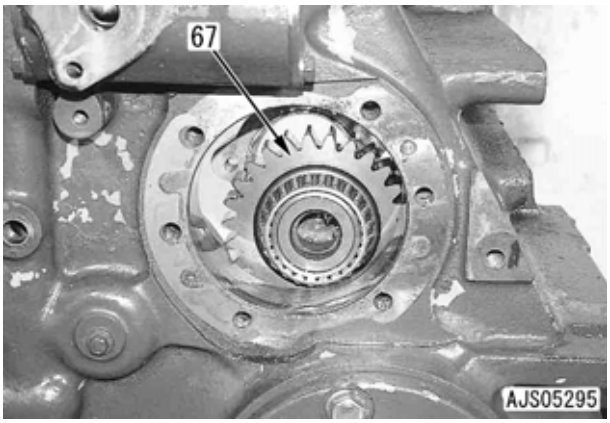
33. Erect the transmission case.

34. Reverse idler gear

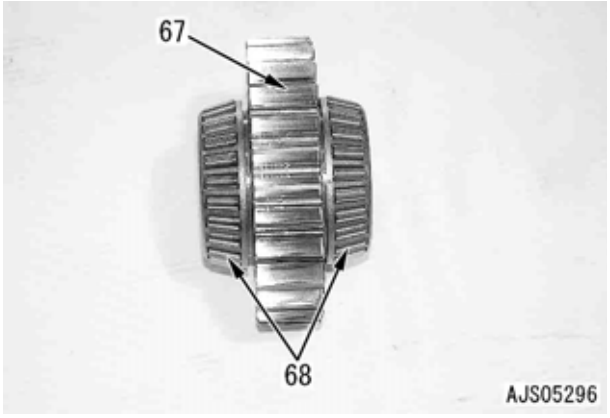
1) Install guide bolts [10] and forcing screws [11] to cover (66) on the reverse idler gear side and remove cover (66).
   - ★ While holding the reverse idler gear on the opposite side, remove the cover.
   - ★ Check the thickness and quantity of the inserted shims.



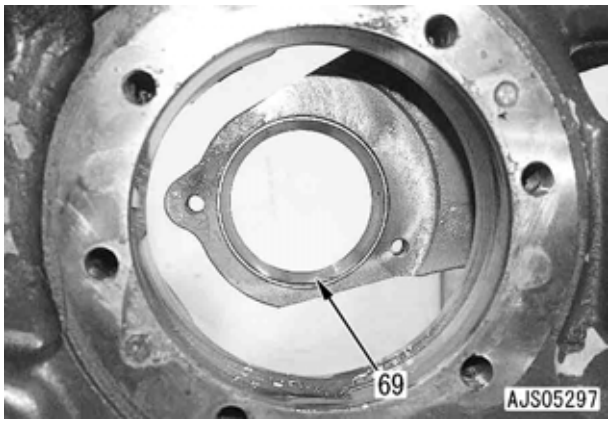
2) Remove reverse idler gear (67).



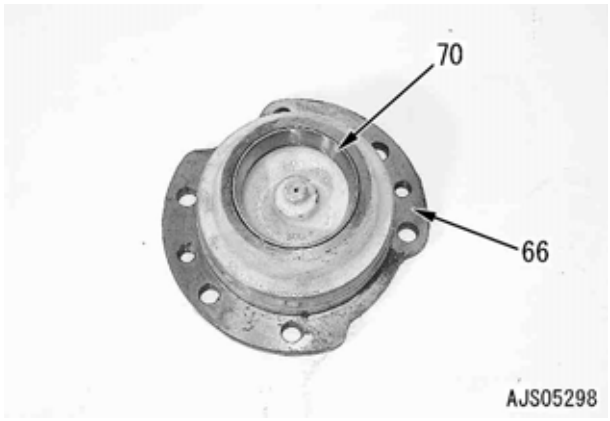
3) Remove bearings (68) from reverse idler gear (67).



4) Remove outer race (69) of the reverse idler gear bearing from the case.

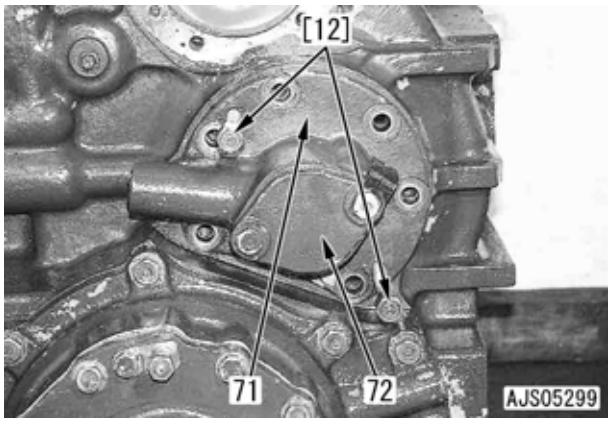


5) Remove outer race (70) from cover (66) on the reverse idler gear side.

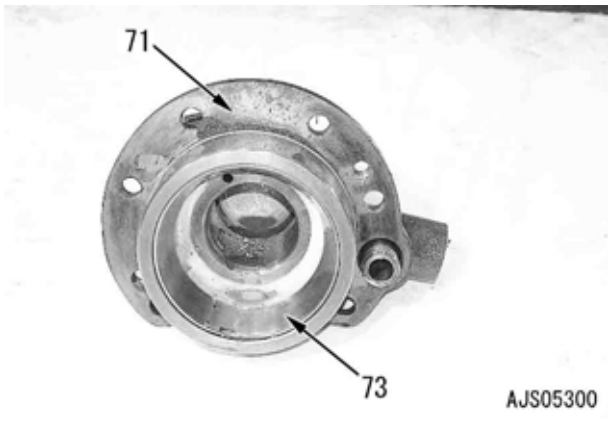


35. Cover on 2nd clutch side

1) Using forcing screws [12], remove cover (71) on the 2nd clutch side.
   - ★ Check the thickness and quantity of the inserted shims.
2) Remove cover (72).



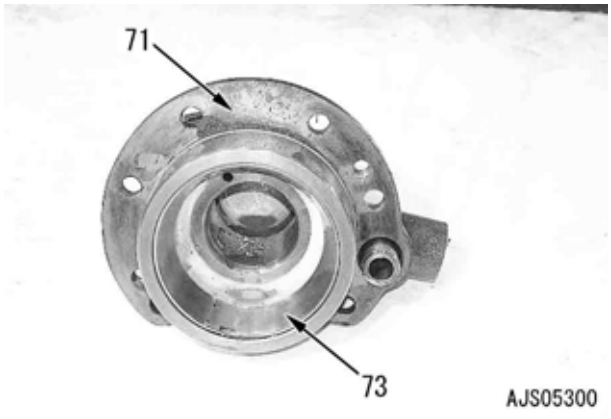
3) Remove outer race (73) from cover (71) on the 2nd clutch side.



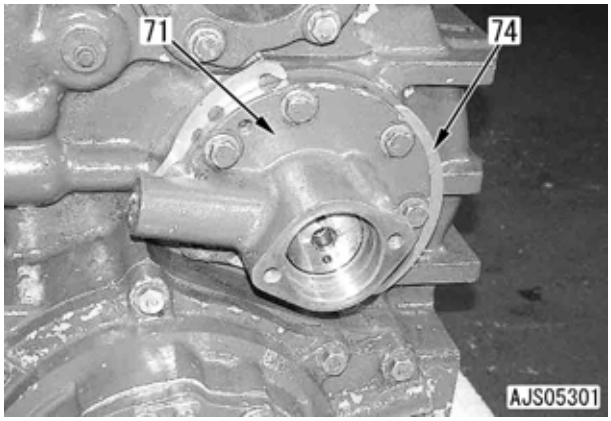
Assembly

1. Cover on 2nd clutch side

1) Press fit outer race (73) to cover (71) on the 2nd clutch side.

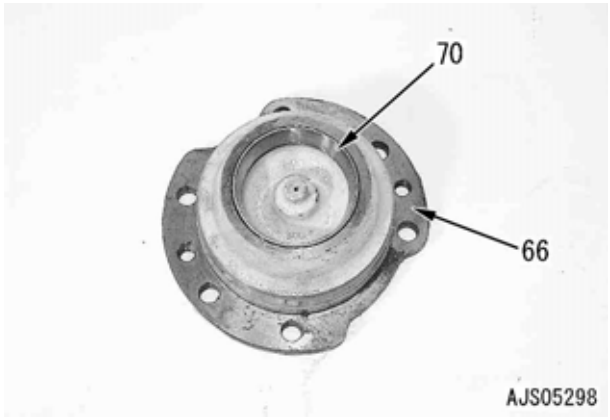


2) Install removed shim (74) and install cover (71) temporarily.
   ★ After assembling the clutch assembly, the shim needs to be adjusted.

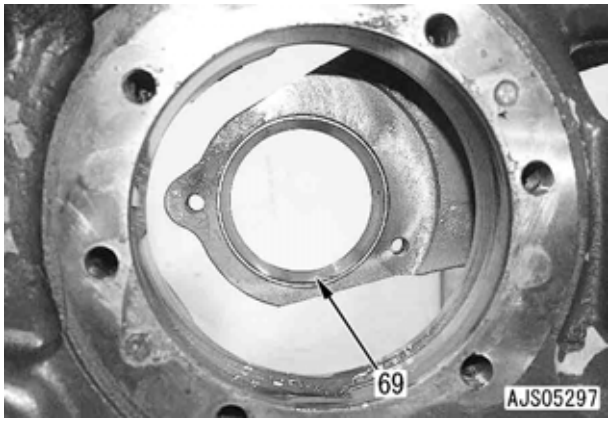


2. Reverse idler gear

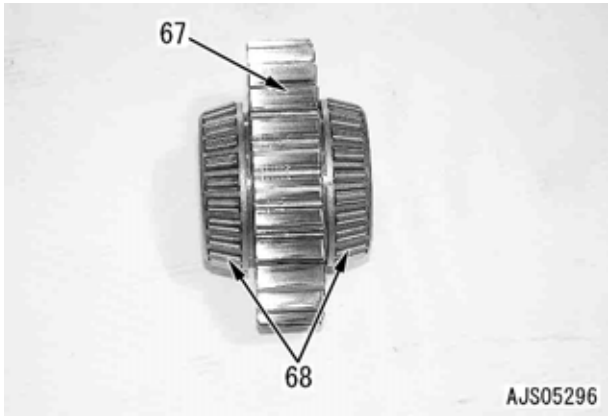
1) Press fit outer race (70) to cover (66) on the reverse idler gear side.



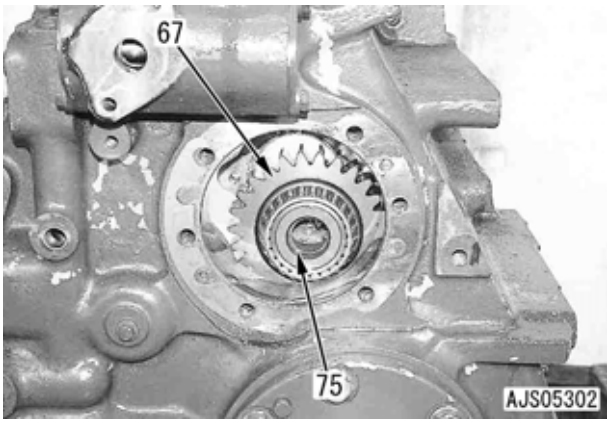
2) Press fit outer race (69) of the reverse idler gear bearing to the case.



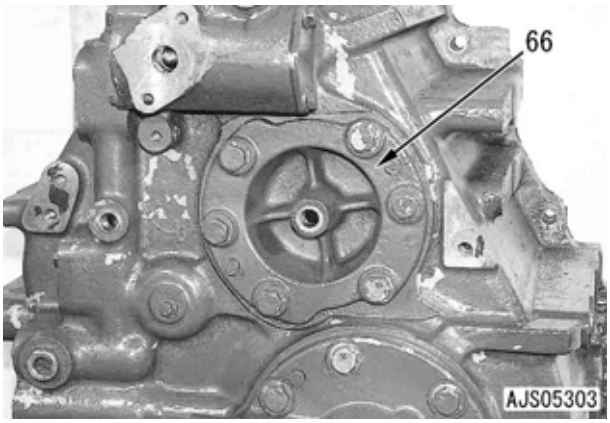
3) Press fit bearings (68) to reverse idler gear (67).



4) Install reverse idler gear (67) to the case.
★ Set the side of snap ring (76) on this side.

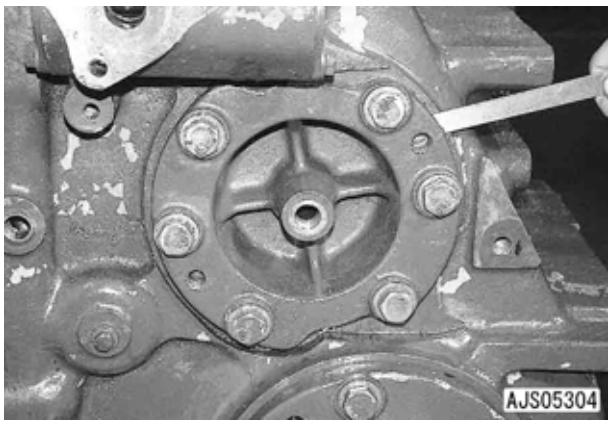


5) Tighten the mounting bolts of cover (66) on the reverse idler gear side without setting the shim.
Cover mounting bolt:
9.8 ± 0.98 Nm {1.0 ± 0.1 kgm}



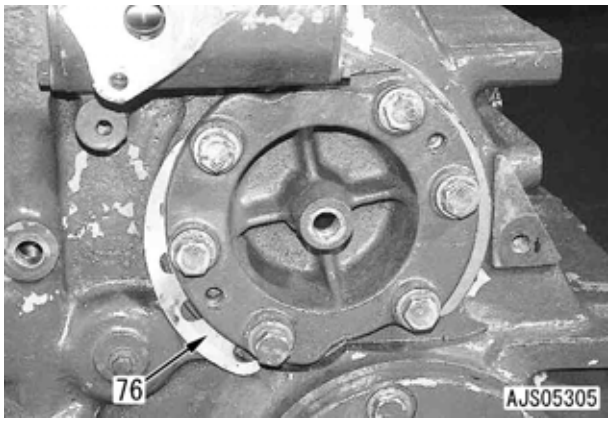
6) Rotate the reverse idler gear 10 turns to the right and 10 turns to the left and then check the tightening torque.
★ If the tightening torque has changed, repeat 5) and 6).

7) If the tightening torque has not changed, measure the clearance at 4 places (equally spaced on the periphery) (or 3 paces equally spaced) and calculate the average clearance.
● Clearance: **1.15 – 1.91 mm**



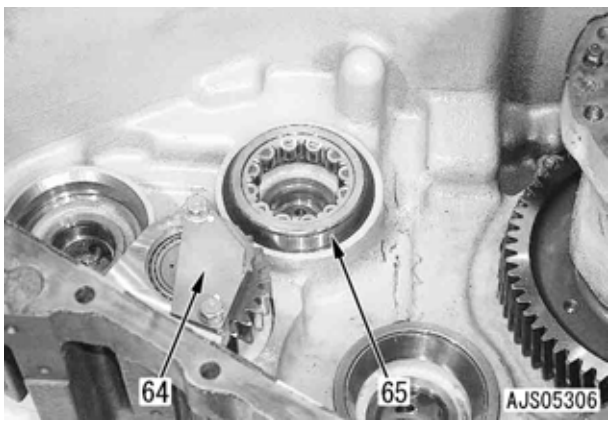
8) Insert selected shim (76) and tighten the mounting bolts.
Mounting bolt:
98.0 – 122.5 Nm {10 – 12.5 kgm}

9) After adjusting the shim, check that the free rotation torque is in the following range.
● Free rotation torque:
0.49 – 0.98 Nm {0.05 – 0.1 kgm}
★ After the shim is adjusted, the reverse idler gear must not have end play.



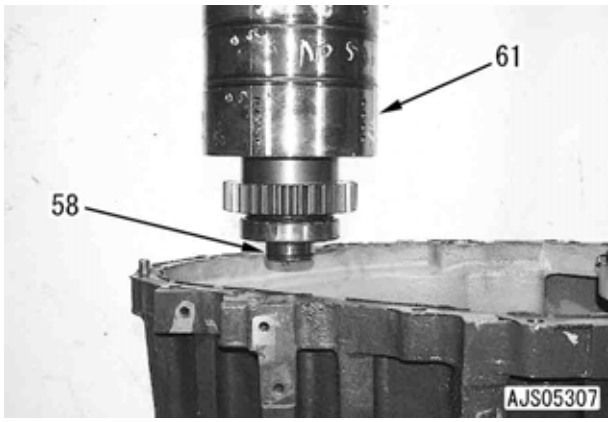
3. Install plate (64) to the reverse idler gear side.

4. Press fit bearing (65) on the 1st clutch side.

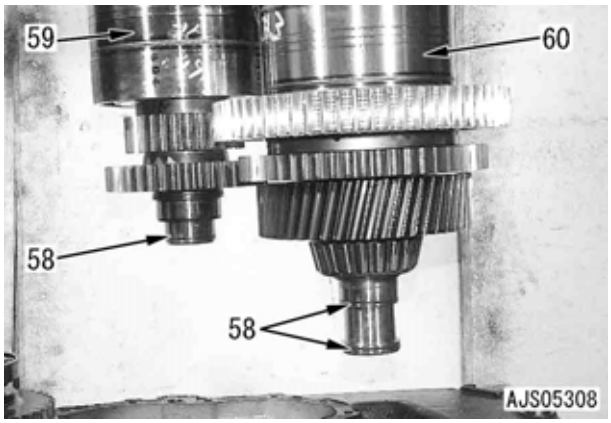


5. Clutch assembly

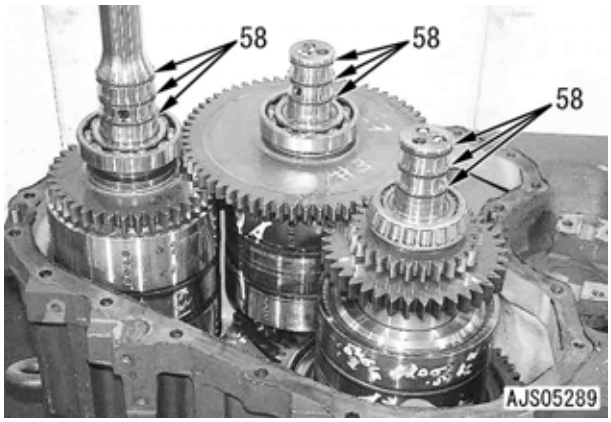
1) Set the transmission case on the block with the brake side down.
2) Install seal rings (58) to the forward and reverse clutches and then sling and install forward and reverse clutch assembly (61).
   ★ Take care not to damage the seal rings.



3) Install seal rings (58) and then sling and install 1st and 4th clutch assembly (59) and 2nd and 3rd clutch assembly (60) simultaneously.
   ★ Take care not to damage the seal rings.

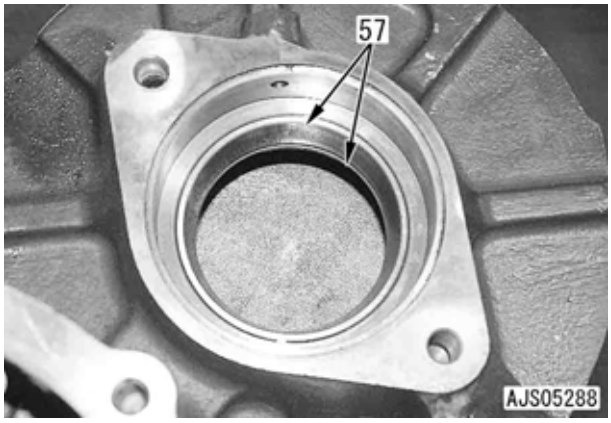


4) Install seal rings (58) to each clutch shaft.

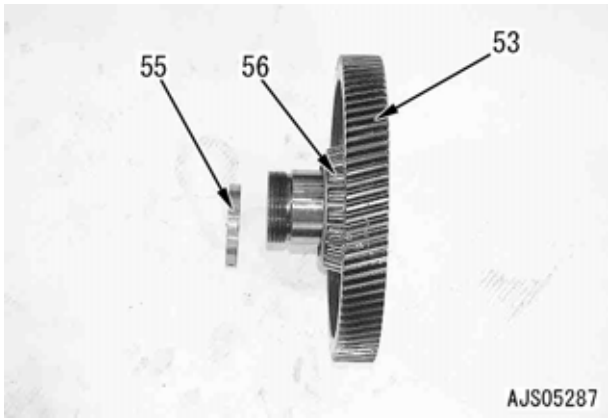


6. PTO gear

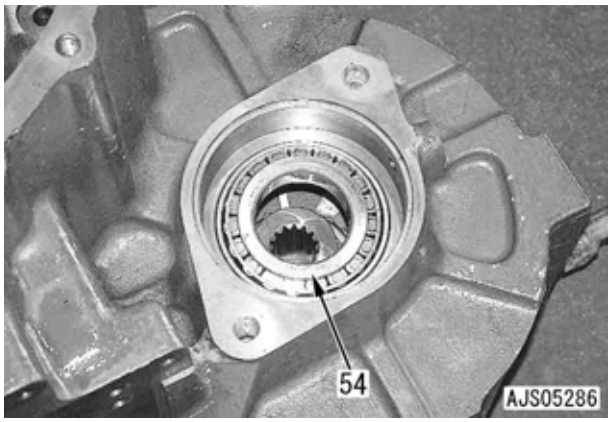
1) Press fit outside and inside outer races (57) of the PTO gear bearing to the torque converter case.



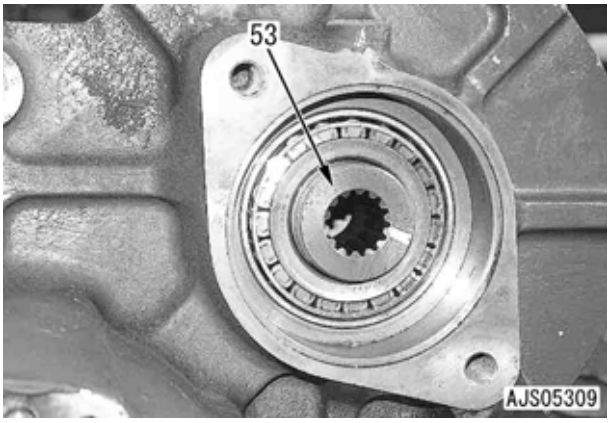
2) Press fit bearing (56) to PTO gear (53).



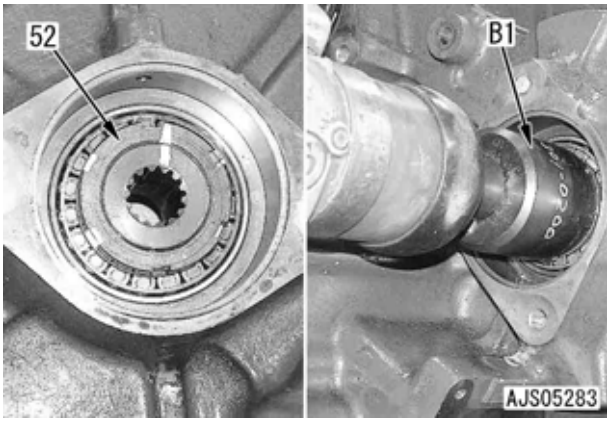
3) Press fit bearing (54) of the PTO gear to the torque converter case.



4) Install collar (55) to PTO gear (53) and install them to the torque converter case.
   ★ Before tightening nut (52), rotate the PTO gear at least 10 turns to fit it.

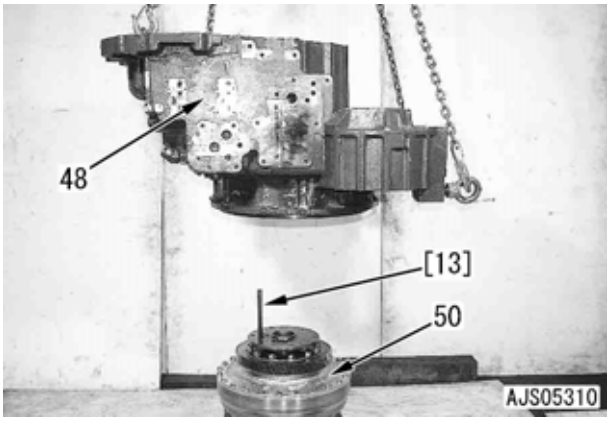


5) Using tool **B1**, tighten nut (52).
★ After tightening the nut to the specified torque, rotate the bearing at least 10 turns to the right and at least 10 turns to the left and then tighten the nut to the specified torque again.
Nut:
392.3 – 441.3 Nm {40 – 45 kgm}

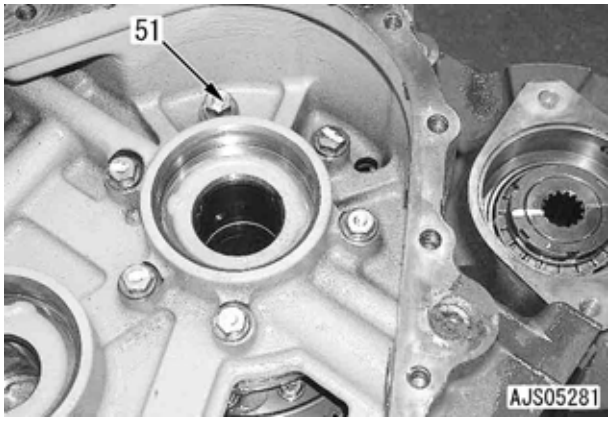


★ Install the PTO gear on the opposite side similarly.

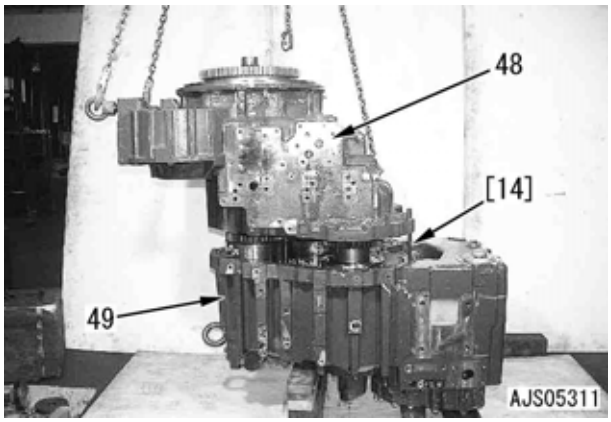
7. Torque converter assembly
1) Set torque converter assembly (50) on the block and install 1 guide bolt [13].
2) Sling torque converter case (48) and install it to the torque converter, matching it to guide bolt [13].



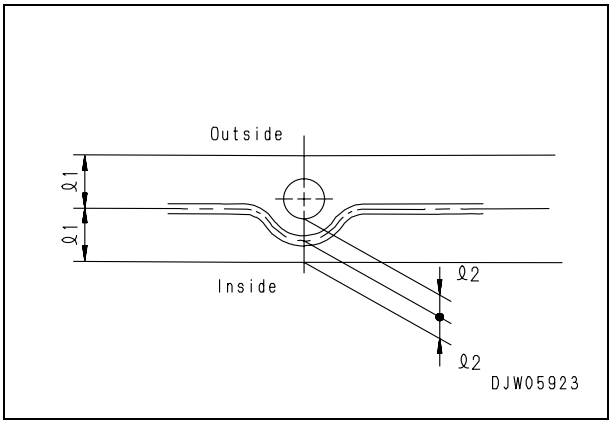
3) Tighten 6 stator shaft mounting bolts (51).
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}



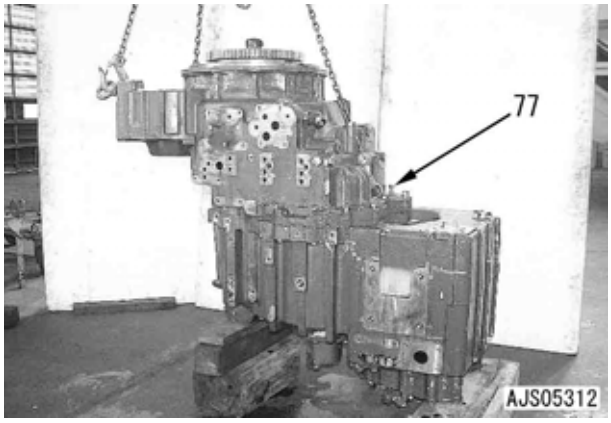
8. Torque converter and transmission case
1) Evenly adjust the projection of the seal rings from the shafts of each clutch assembly.
2) Install guide bolts [14] to transmission case (49).
3) Using a lever block, sling and install torque converter case assembly (48), matching it to the shafts of each clutch assembly.
★ Take care not to damage the seal rings.
Mating face of case:
Gasket sealant (LG-4)



- Apply the gasket sealant as shown in the following figure.



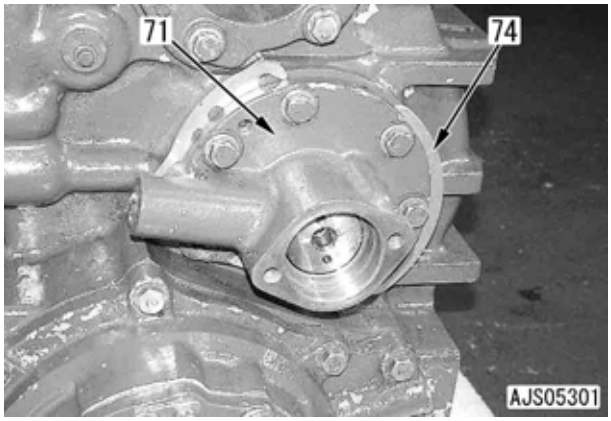
4) Tighten 21 mounting bolts (77).
   Mounting bolt:
   98 – 123 Nm {10 – 12.5 kgm}



9. Procedure for adjusting shim of 2nd and 3rd clutch assembly tapered roller bearing

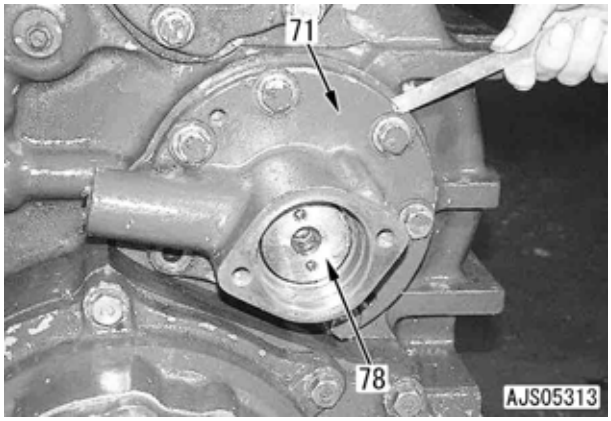
★ Release the parking brake.

1) Remove shim (74) installed temporarily in assembly steps 1) and 2) and tighten the mounting bolts of cover (71) to the following torque.
   Mounting bolt:
   9.8 ± 0.98 Nm {1 ± 0.1 kgm}

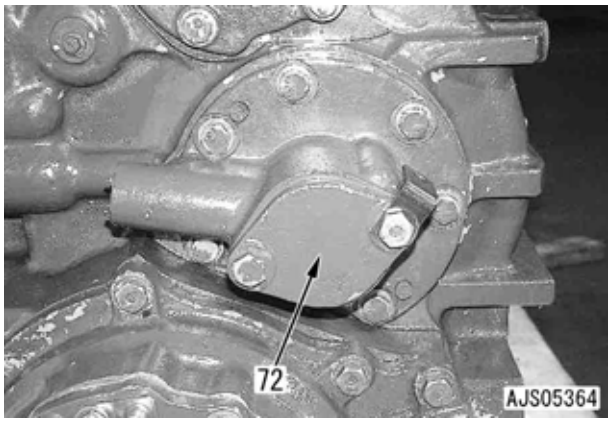


2) Utilizing the hole on the end of shaft (78) or output shaft coupling, rotate the shaft 10 turns to the right and 10 turns to the left and then check the tightening torque of the cover mounting bolt.
   ★ If the tightening torque has changed, repeat 1) and 2).
3) If the tightening torque has not changed, measure the clearance at 4 places (equally spaced on the periphery) (or 3 paces equally spaced) and calculate the average clearance.
   - Clearance: **1.19 – 1.95 mm**

   ★ If the dispersion of the measured clearances is larger than 0.15 mm, however, check to see if the bearing is leaning or there is another reason, and then take a remedy to set bearing normally.
4) Install a shim thicker than the measured clearance by “0.31 mm – below 0.36 mm”.
5) Insert the selected shim and tighten the mounting bolts of cover (71).
   Cover mounting bolt:
   98 – 122.5 Nm {10 – 12.5 kgm}



6) Install cover (72).

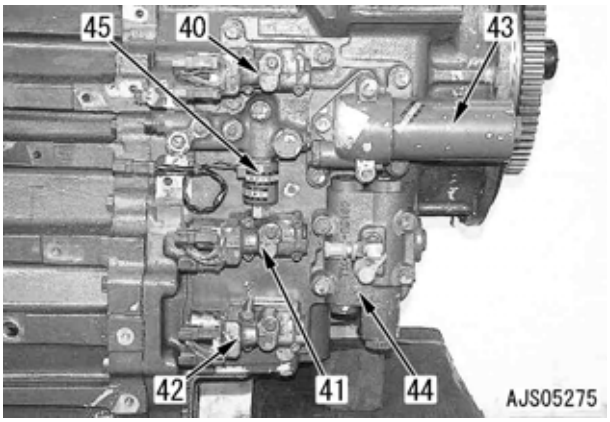


10. Install parking brake solenoid (45).
Mounting bolt: **59 – 74 Nm {6 – 7.5 kgm}**

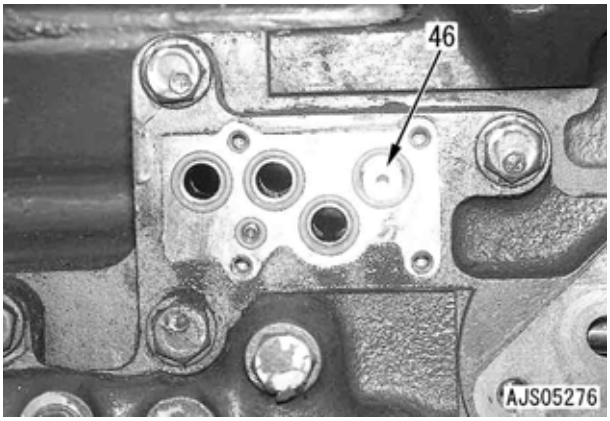
11. Install main relief and torque converter relief valve (44).
Mounting bolt:
44.1 – 53.9 Nm {4.5 – 5.5 kgm}

12. Install last chance filter (43).

13. Install reverse ECMV (40), 1st ECMV (41), and 2nd ECMV (42).
ECMV mounting bolt:
7.8 – 9.8 Nm {0.8 – 1.0 kgm}



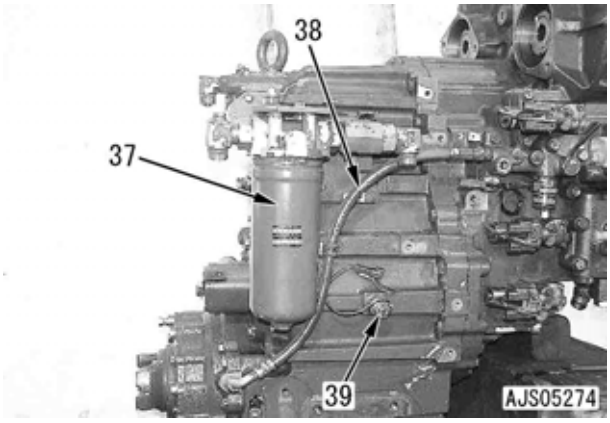
★ When installing each ECMV, be sure to install orifice (46).



14. Install transmission speed sensor (39).
★ See Testing and adjusting, “Adjusting transmission speed sensor”.

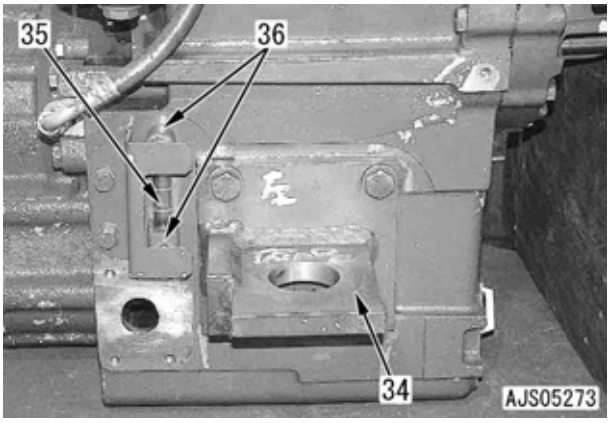
15. Install parking brake hose (38).
Brake hose: **35 – 63 Nm {3.5 – 6.5 kgm}**

16. Install transmission filter assembly (37).



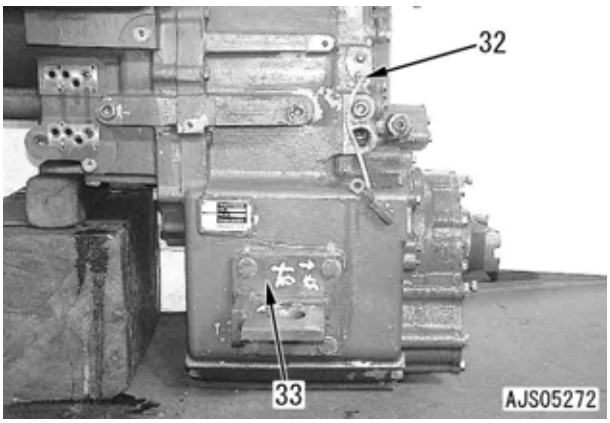
17. Install transmission case oil level gauge (35).
★ When removing the bolt, lock upper and lower holders (36) with a spanner.
Mounting bolt:
12.7 – 13.7 Nm {1.3 – 1.4 kgm}

18. Install left transmission mount (34).



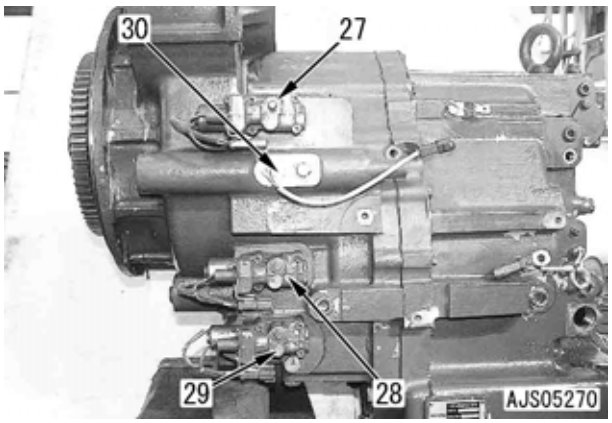
19. Install right transmission mount (33).

20. Install transmission oil temperature sensor (32).
Transmission oil temperature sensor:
29.4 – 49 Nm {3 – 5kgm}

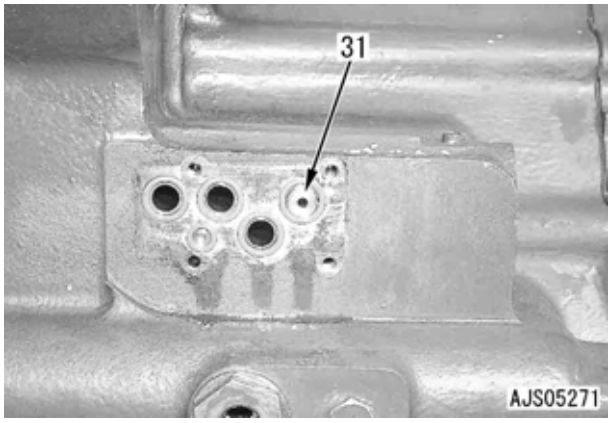


21. Install torque converter oil temperature sensor (30).

22. Install forward ECMV (27), 4th ECMV (28), and 3rd ECMV (29).
ECMV mounting bolt:
7.8 – 9.8 Nm {0.8 – 1.0 kgm}



★ When installing each ECMV, be sure to install orifice (31).



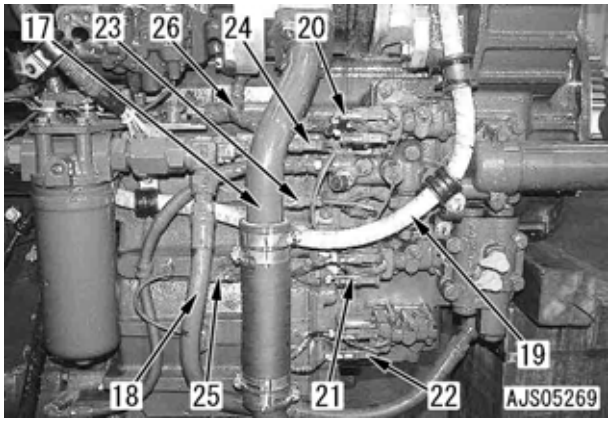
23. Connect parking brake solenoid connector (23), parking brake indicator switch connector (24), and speed sensor connector (25) and install wiring assembly (26).

24. Connect the following connectors to the ECMV's.
- (20): Reverse clutch connector
- (21): 1st clutch connector
- (22): 2nd clutch connector

25. Install wiring (19).

26. Install hose (18) to the oil filter.

27. Install transmission pump piping assembly (17).

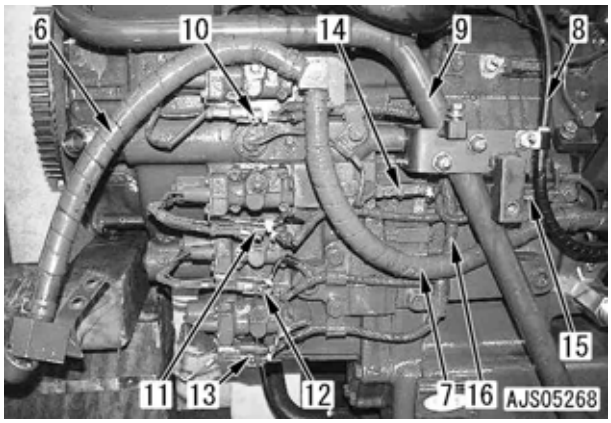


28. Install torque converter oil temperature sensor connector (14), transmission oil temperature sensor connector (15) and install wiring assembly (16).

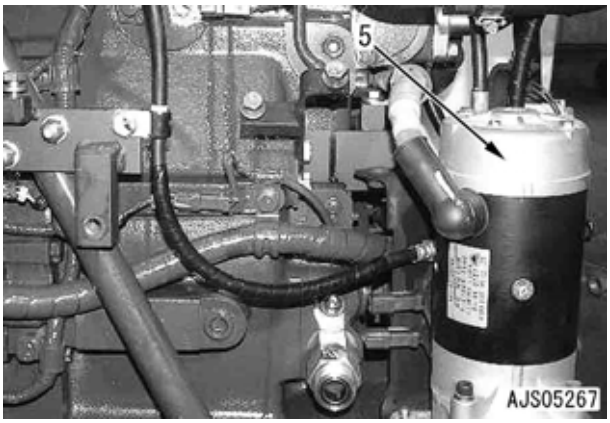
29. Connect the following connectors to the ECMV's.
- (10): Forward clutch connector
- (11): L/C connector
- (12): 4th clutch connector
- (13): 3rd clutch connector

★ L/C connector (11) is installed to only the machine of torque converter lockup specification.

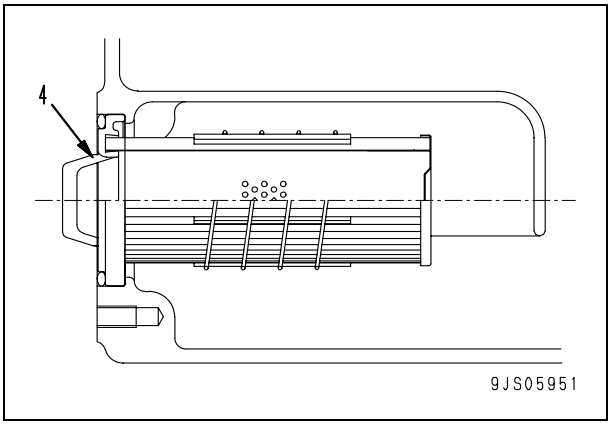
30. Install hoses (6), (7), and (8) and tube (9).



31. Install the wiring, hoses, and bracket together to emergency steering pump and motor (5).

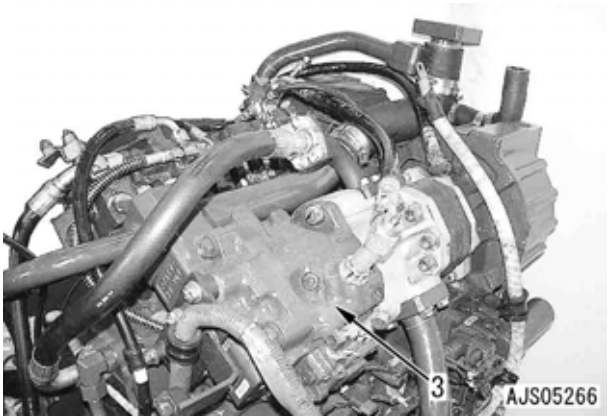


32. Install strainer (4).

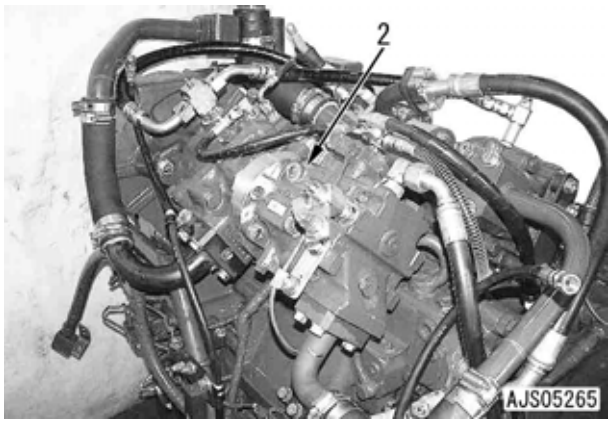


33. Hydraulic pump assembly

1) Install power train and work equipment pump assembly (3) and connect the hoses and tubes.



2) Install steering and cooling fan pump (2) and connect the hoses and tubes.



Disassembly and assembly of transmission clutch pack assembly

Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
C	1	793-607-1110	Seal holder	■	1		
	2	793-607-1120	Seal holder	■	1		

Disassembly

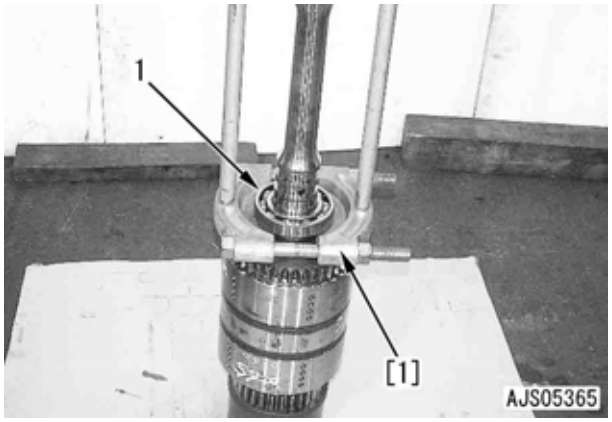
⚠ **When placing the clutch pack on the block, take care that your hands will not slip on oil and will not be caught between the block and clutch pack.**

Disassembly of forward and reverse clutch pack

[Forward clutch side]

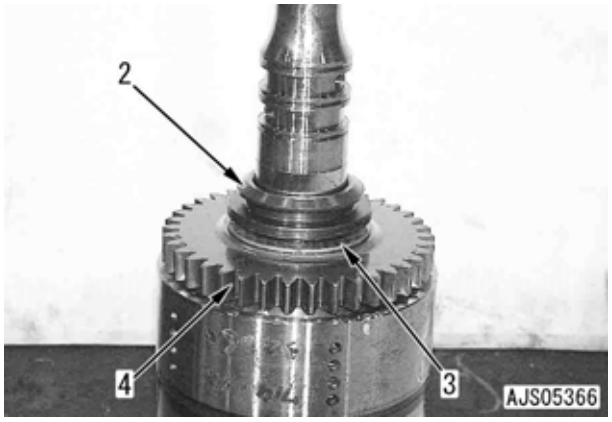
1. Bearing

Install puller [1] to bearing (1) and remove bearing (1).

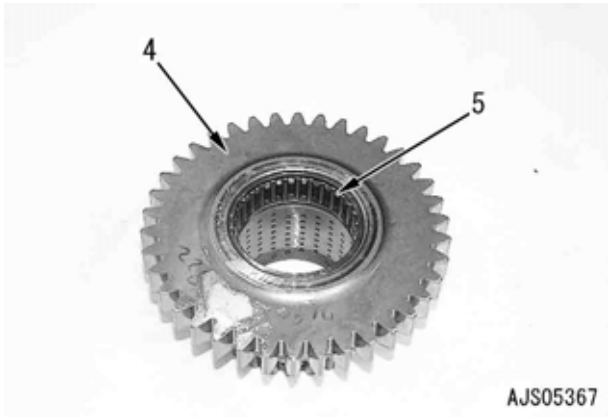


2. Forward gear

1) Remove spacer (2), thrust washer (3), and forward gear (4).

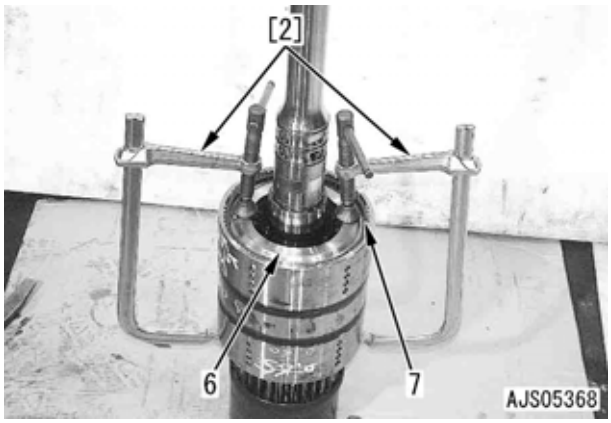


2) Remove needle roller bearing (5) from forward gear (4).



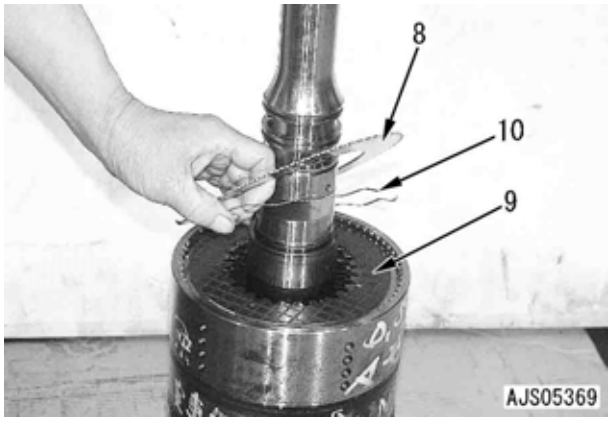
3. End plate

1) Press end plate (6) with C-clamps [2] and remove snap ring (7).
2) Remove end plate (6).



4. Clutch plate

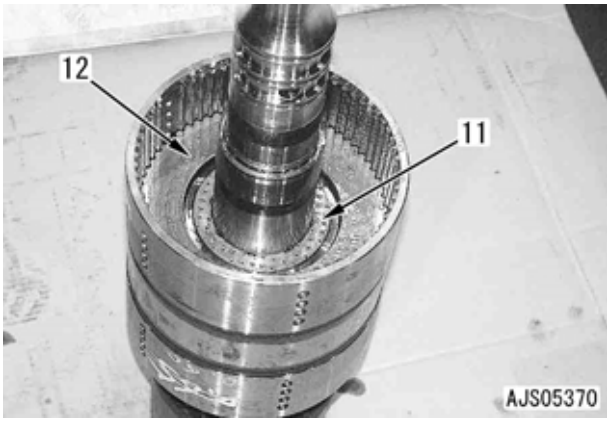
1) Remove plate (8), disc (9), and spring (10) from the housing.



2) Remove thrust washer (11).

5. Piston

Supply compressed air into the oil hole on the forward gear side of the shaft and remove piston (12).





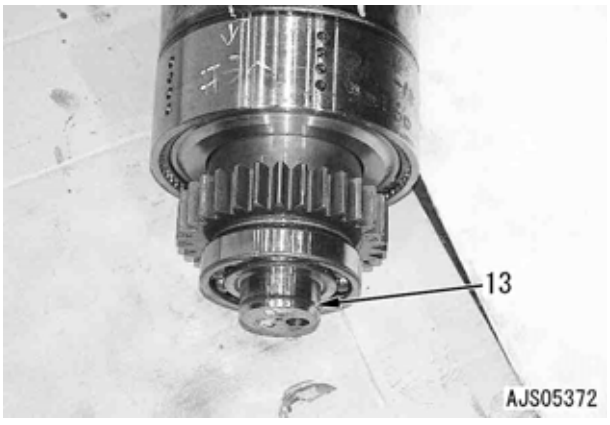
★ If the piston is leaning and cannot be removed, push it in again and then remove it.

★ If the piston is removed forcibly, the inside wall of the cylinder is scratched. Take care.

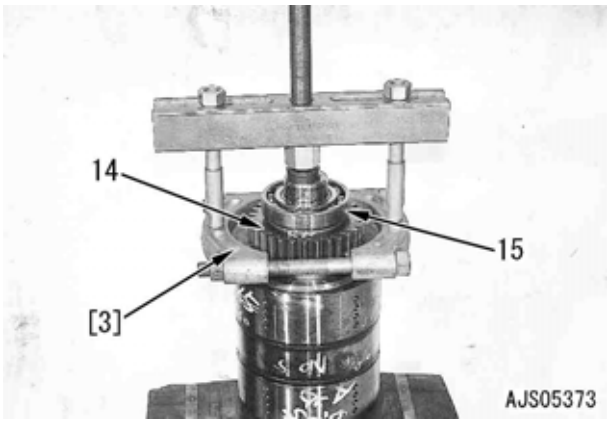
[Reverse clutch side]

6. Bearing

1) Remove seal ring (13).

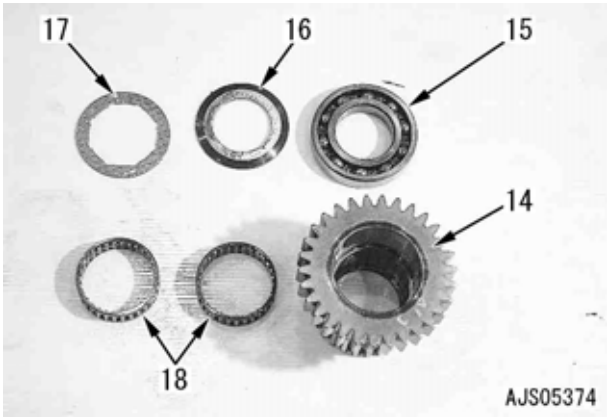


2) Install bearing race puller [3] to reverse gear (14) and remove bearing (15).



7. Reverse gear

1) Remove spacer (16), thrust washer (17), and reverse gear (14).
2) Remove needle roller bearing (18) from the reverse gear.



8. End plate

9. Clutch plate

10. Piston

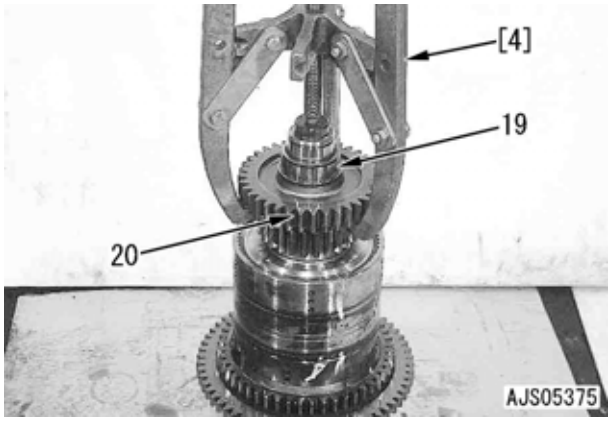
★ Steps 8 – 10 are the same as steps 3 – 5 on the forward clutch side.

Disassembly of 1st and 4th clutch pack

[1st clutch side]

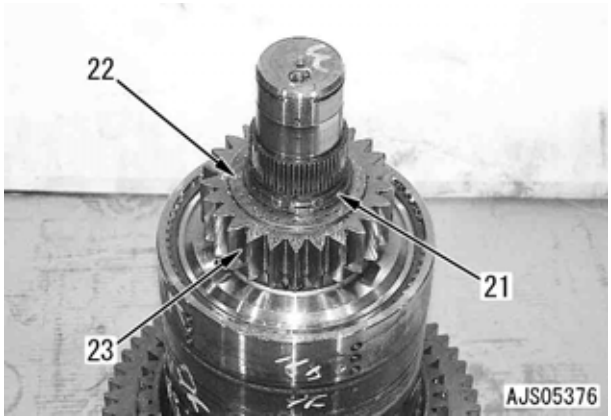
1. Idler gear

Using puller [4], remove inner race (19) and idler gear (20).

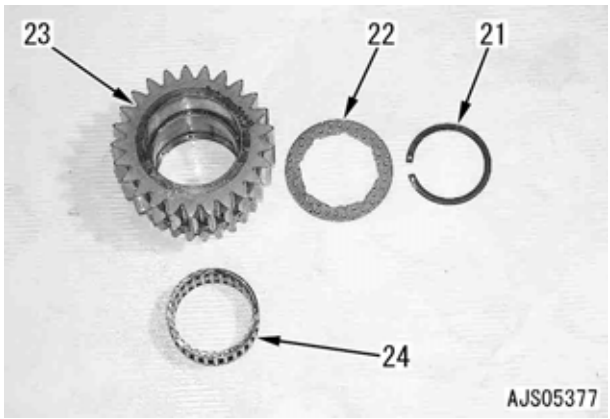


2. 1st gear

1) Remove snap ring (21), thrust washer (22), and 1st gear (23).

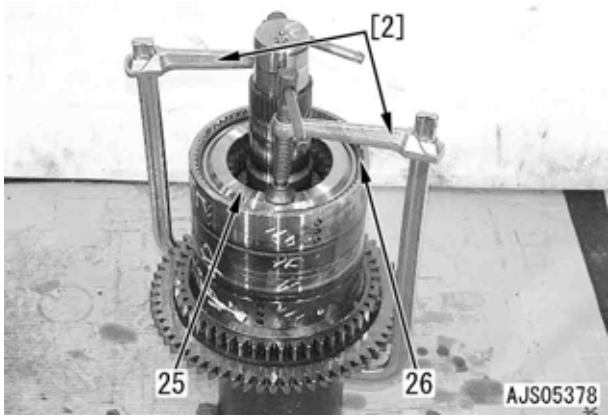


2) Remove needle roller bearing (24) from the 1st gear.



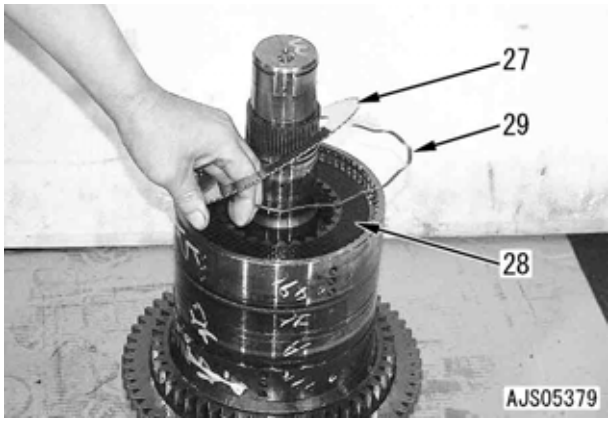
3. End plate

1) Press end plate (25) with C-clamps [2] and remove snap ring (26).
2) Remove end plate (25).



4. Clutch plate

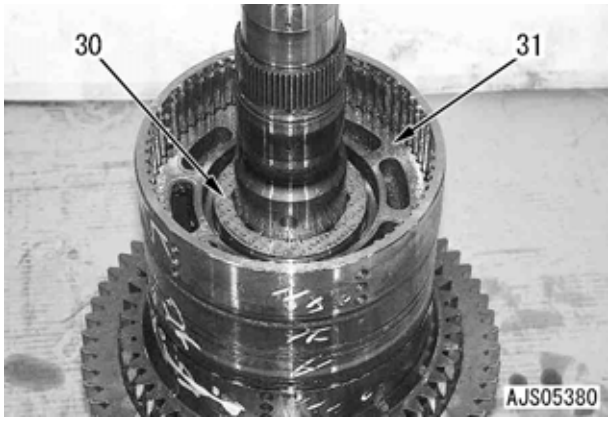
1) Remove plate (27), disc (28), and spring (29) from the housing.



2) Remove thrust washer (30).

5. Piston

Supply compressed air into the oil hole on the 1st gear side of the shaft and remove piston (31).



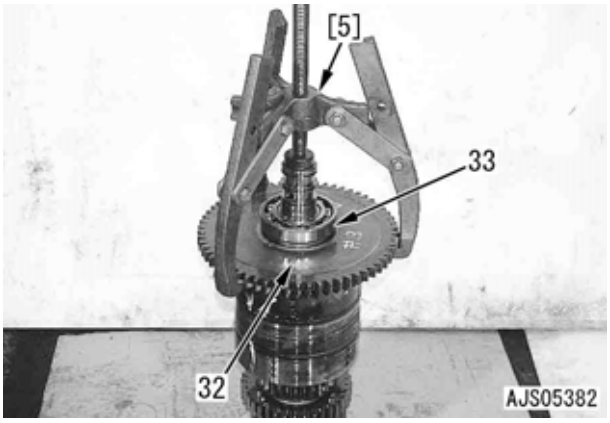


★ If the piston is leaning and cannot be removed, push it in again and then remove it.
★ If the piston is removed forcibly, the inside wall of the cylinder is scratched. Take care.

[4th clutch side]

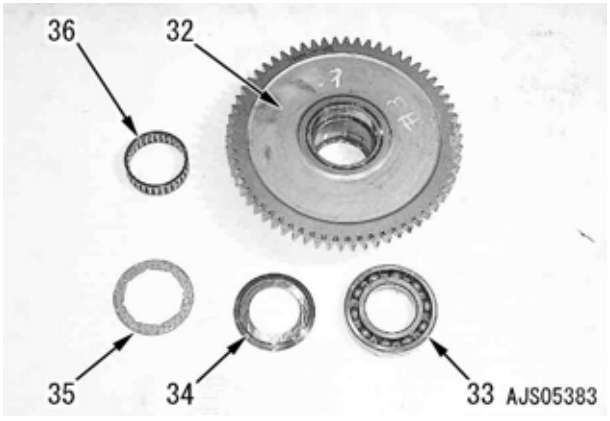
6. Bearing

Using puller [5], pull out 4th gear (32) and remove bearing (33).



7. 4th gear

1) Remove spacer (34), thrust washer (35), and reverse gear (32).
2) Remove needle roller bearing (36) from the 4th gear.



8. End plate

9. Clutch plate

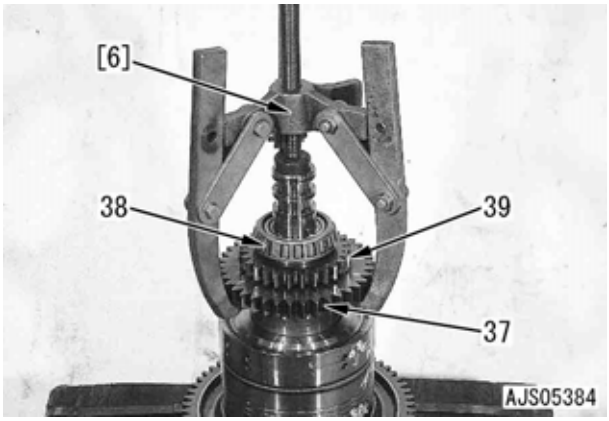
10. Piston

★ Steps 8 – 10 are the same as steps 3 – 5 on the 1st clutch side.

Disassembly of 2nd and 3rd gear clutch pack [3rd clutch side]

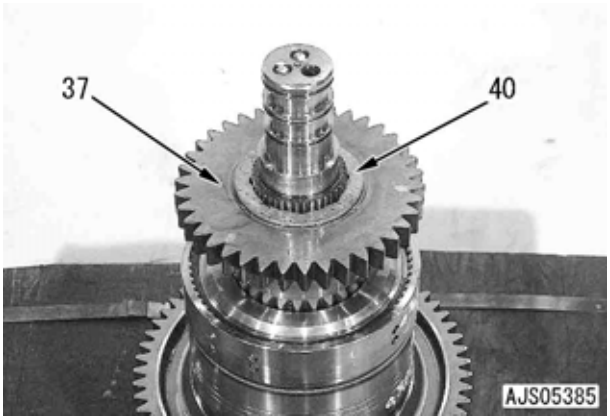
1. Bearing

1) Install puller [6] to 3rd gear (37) and remove bearing (38) and idler gear (39).

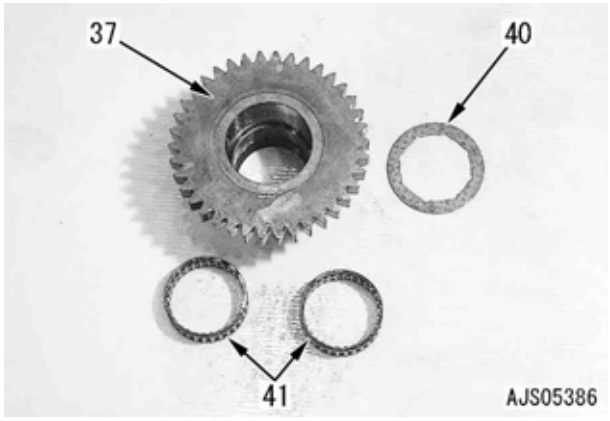


2. 3rd gear

1) Remove thrust washer (40) and 3rd gear (37).

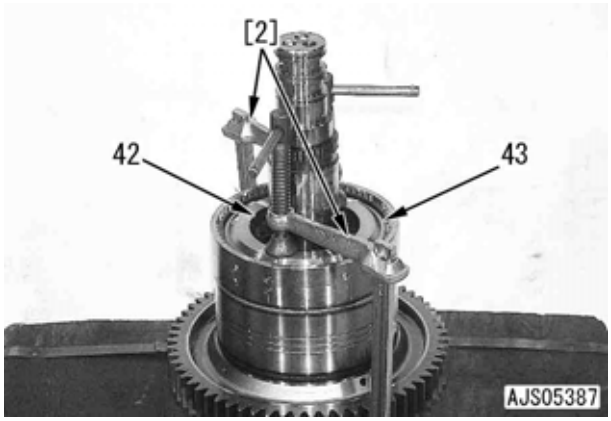


2) Remove needle roller bearings (41) from 3rd gear (37).



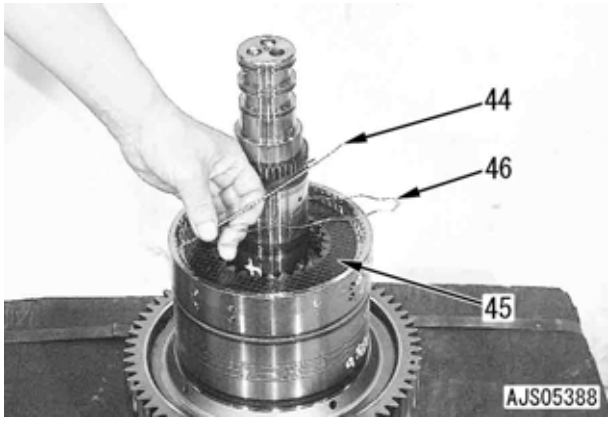
3. End plate

1) Press end plate (42) with C-clamps [2] and remove snap ring (43).
2) Remove end plate (42).



4. Clutch plate

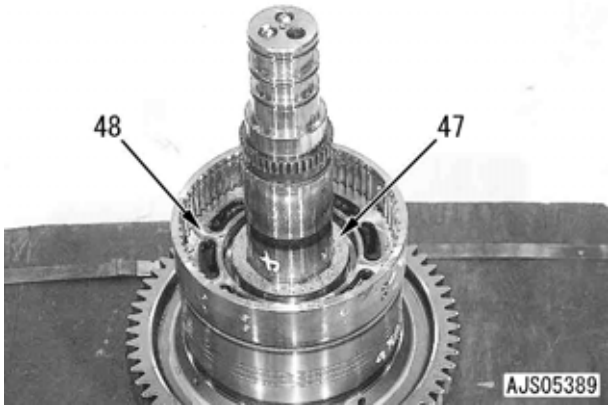
1) Remove plate (44), disc (45), and spring (46) from the housing.

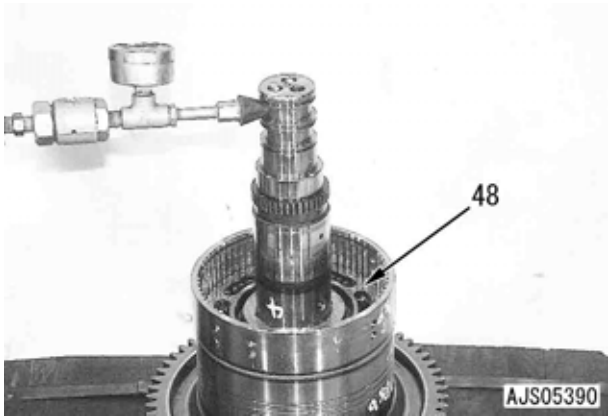


2) Remove thrust washer (47).

5. Piston

Supply compressed air into the oil hole on the 3rd gear side of the shaft and remove piston (48).



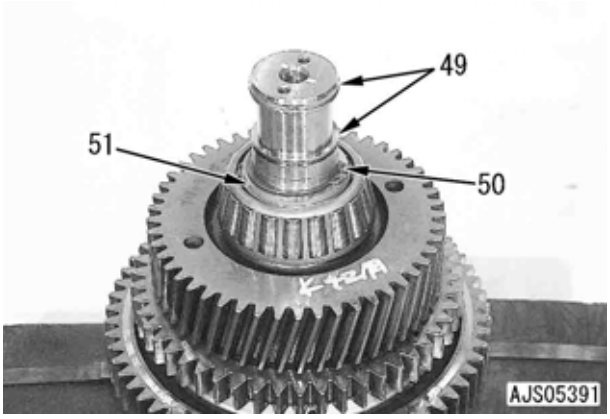


★ If the piston is leaning and cannot be removed, push it in again and then remove it.
★ If the piston is removed forcibly, the inside wall of the cylinder is scratched. Take care.

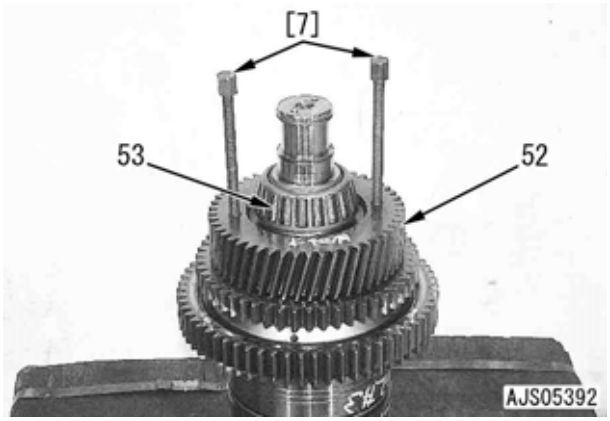
[2nd clutch side]

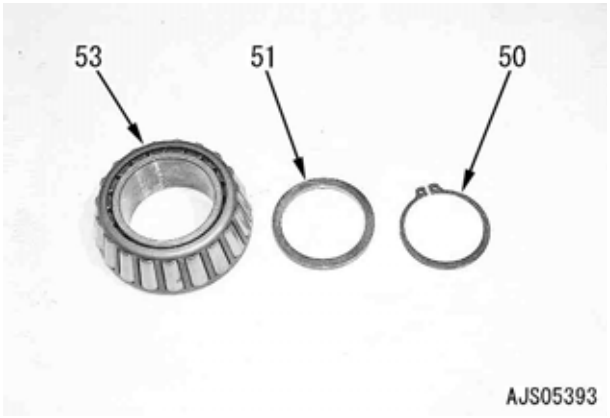
6. Output gear

1) Remove seal rings (49).
2) Remove snap ring (50) and spacer (51).

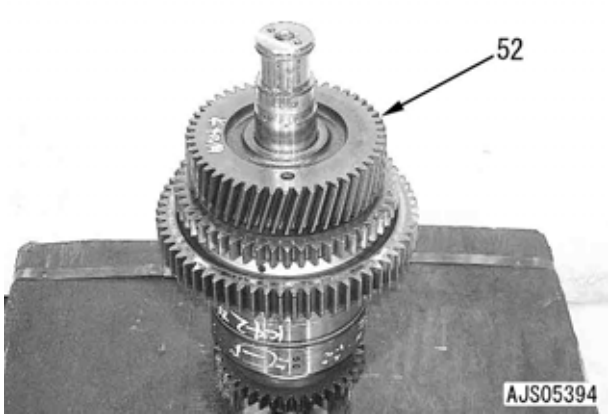


3) Using forcing screws [7], pull out output gear (52) and remove bearing (53).



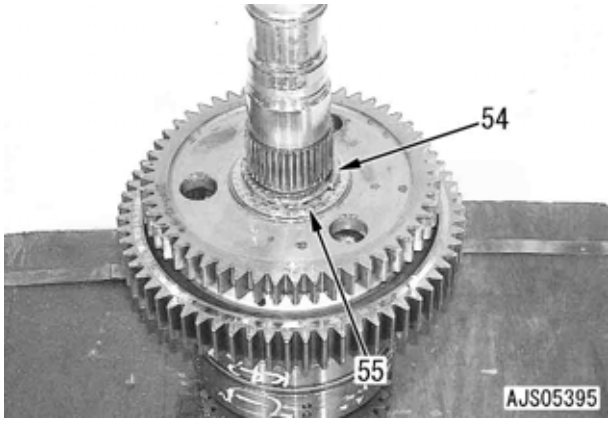


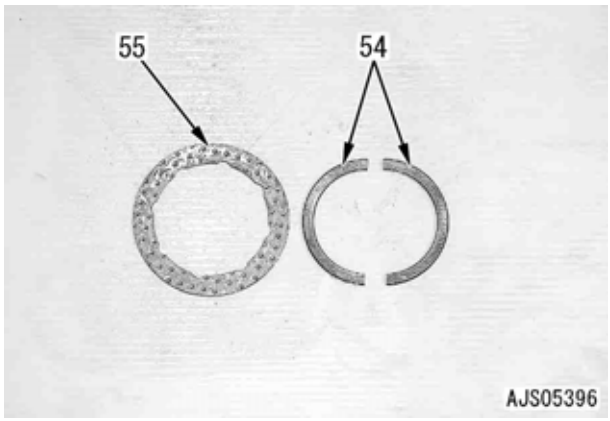
4) Remove output gear (52).



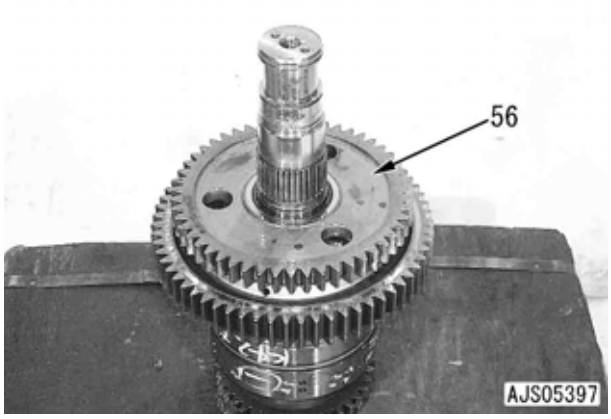
7. 2nd gear

1) Remove split collar (54) and thrust washer (55).

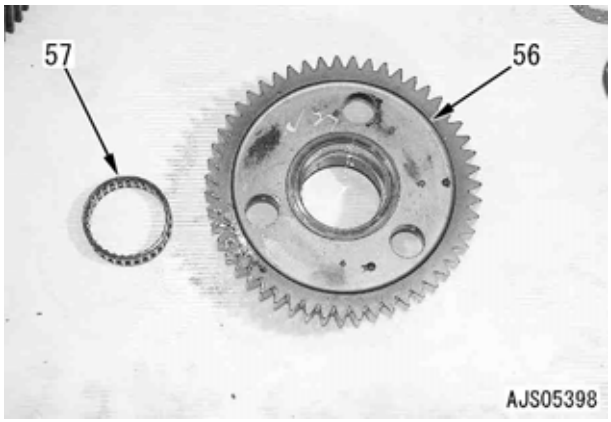




2) Remove 2nd gear (56).



3) Remove needle roller bearing (57) from 2nd gear (56).



8. End plate

9. Clutch plate

10. Piston

★ Steps 8 – 10 are the same as steps 3 – 5 on the 3rd clutch side.

Assembly

Assembly of forward and reverse clutch pack

[Reverse clutch side]

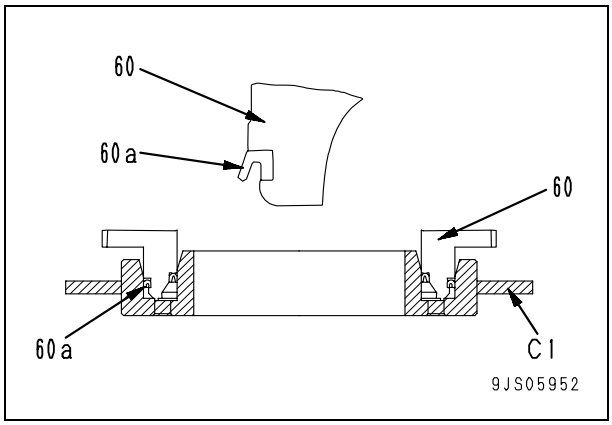
1. Piston seal

Install piston seal (60a) to piston (60).

★ When using a new piston seal, fit it for the cylinder with tool **C1** (for about 2 – 3 minutes) before installing.

★ If a new piston seal is installed to the cylinder without being fitted for the cylinder, it will be damaged.

Inside of tool **C1**: **Transmission oil**



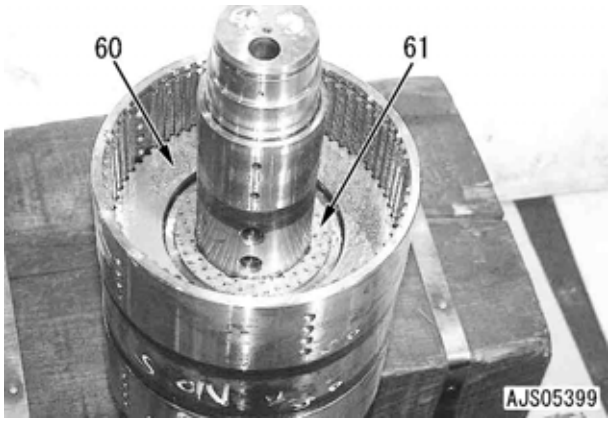
2. Reverse piston

1) Install reverse piston (60).

★ Take care not to damage the piston seal.

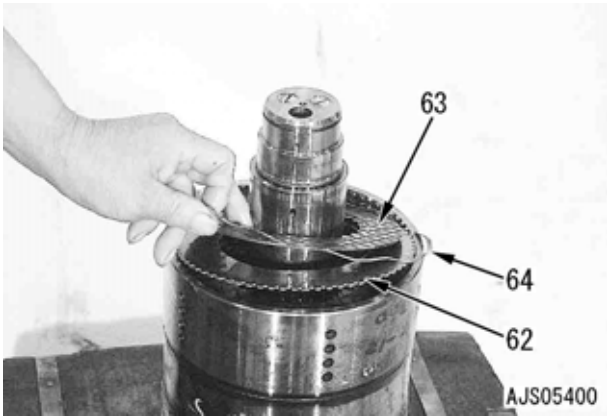
Sliding surfaces of piston seal: **Transmission oil**

2) Install thrust washer (61).



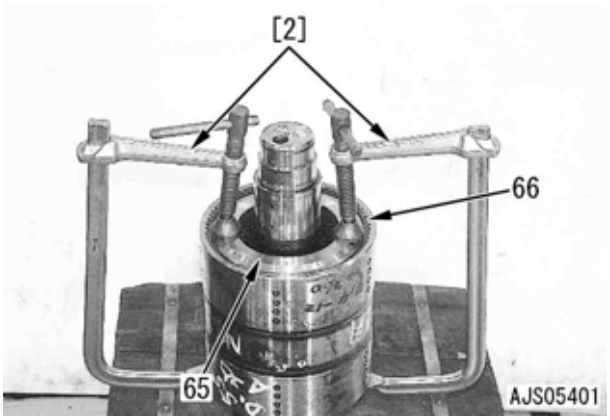
3. Clutch plate

- Install plate (62), disc (63), and spring (64) in order alternately.
- ★ Before installing disc (63), soak it in clean transmission oil for at least 2 minutes.
- ★ Take care not lap spring (64) over disc (63).
- ★ Take care that the plate or spring will not be caught in the ring groove of the clutch housing.



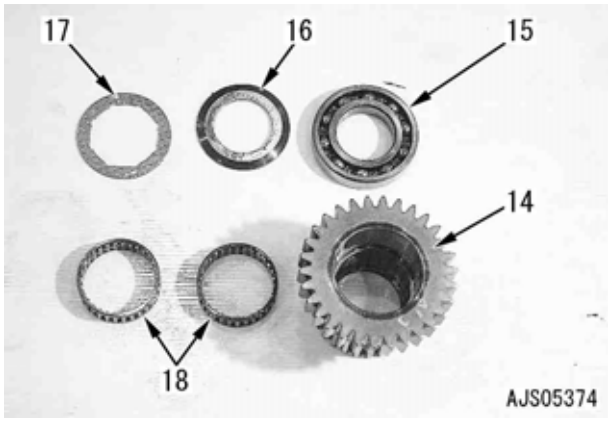
4. End plate

1) Install end plate (65).
2) Press end plate (65) with C-clamps [2].
3) Install snap ring (66).

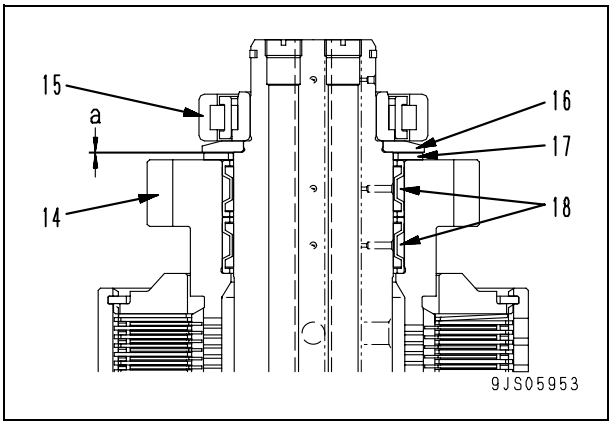


5. Reverse gear and bearing

1) Install needle roller bearing (18) to reverse gear (14) and install them, meshing the gear with the internal teeth of the disc.
2) Install thrust washer (17), spacer (16), and bearing (15) in order.



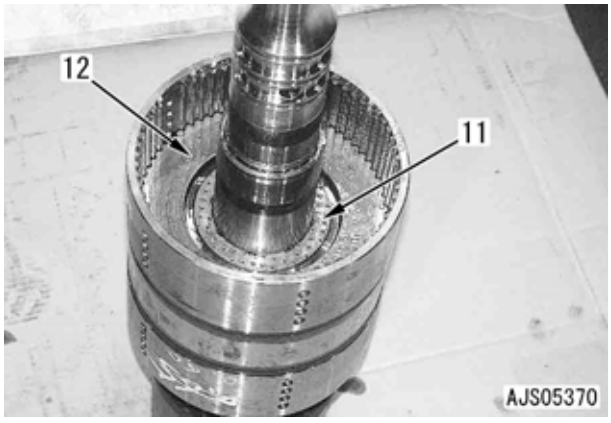
3) Check that clearance (a) between spacer (16) and thrust washer (17) is in the standard range.
   Standard value (a): **0.3 – 0.7 mm**
   - ★ Measure clearance (a) with a dial gauge or a thickness gauge.



[Forward clutch side]

6. Forward piston

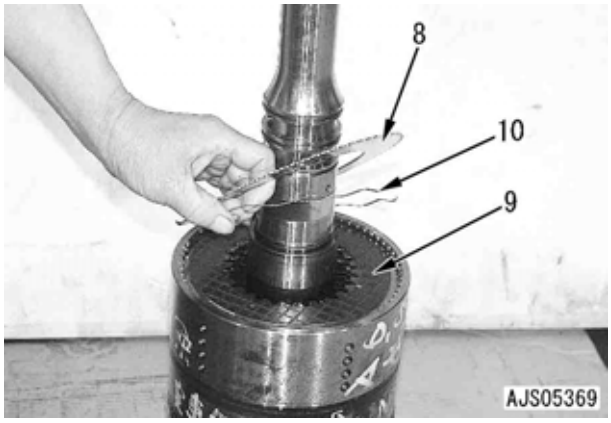
1) Similarly to the reverse clutch, fit the piston seal for the piston and install it to piston (12).
2) Similarly to the piston on the reverse clutch side, install piston (12).
   Sliding surfaces of piston seal: **Transmission oil**
3) Install thrust washer (11).



7. Clutch plate

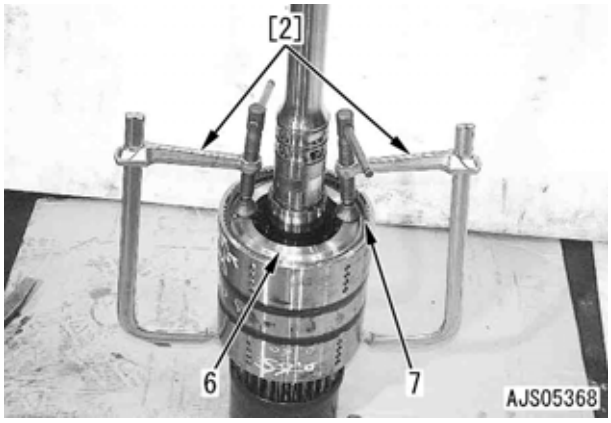
- Install plate (8), disc (9), and spring (10) in order alternately.

★ Install these parts similarly to those on the reverse clutch side.



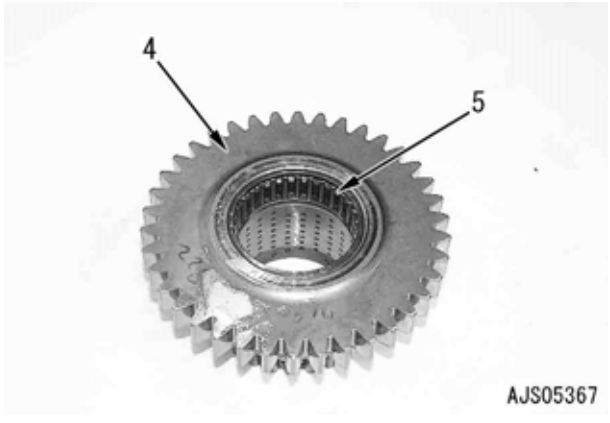
8. End plate

1) Install end plate (6).
2) Press end plate (6) with C-clamps [2] and install snap ring (7).

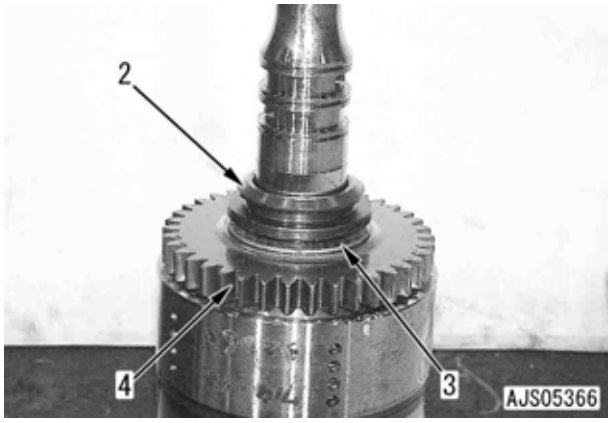


9. Forward gear and bearing

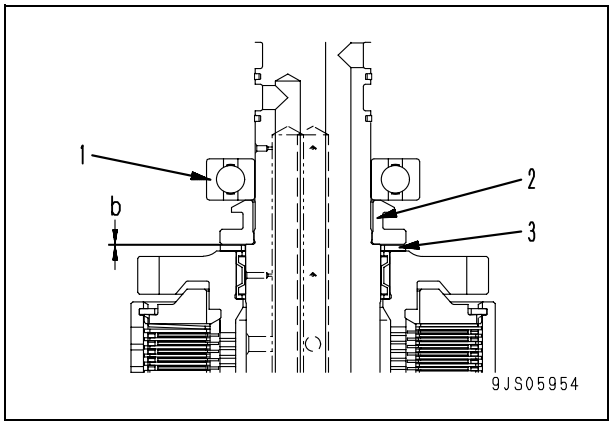
1) Install needle roller bearing (5) to forward gear (4) and install them, meshing the gear with the internal teeth of the disc.



2) Install thrust washer (3) and spacer (2).



3) Press fit bearing (1) and check that clearance (b) between spacer (2) and thrust washer (3) is in the standard range.
Standard value (b): **0.24 – 0.76 mm**

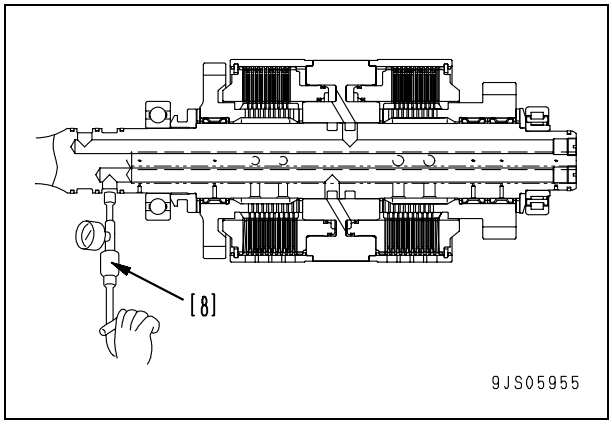


★ Measure clearance (b) with a dial gauge or a thickness gauge.

10. Operation test of clutch pack

Using oil leak tester [8], supply compressed air into the oil hole of the shaft and check that each clutch operates.

★ If the gear on the compressed air receiving side is fixed, the clutch is operating normally.



Assembly of 1st and 4th clutch pack

[4th clutch side]

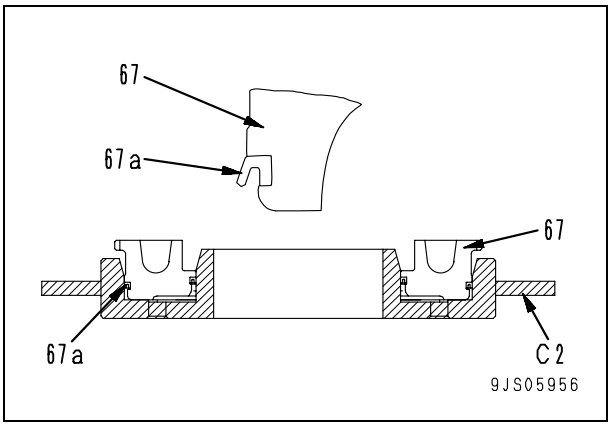
1. Piston seal

Install piston seal (67a) to piston (67).

★ When using a new piston seal, fit it for the cylinder with tool **C2** (for about 2 – 3 minutes) before installing.

★ If a new piston seal is installed to the cylinder without being fitted for the cylinder, it will be damaged.

Inside of tool **C2**: **Transmission oil**



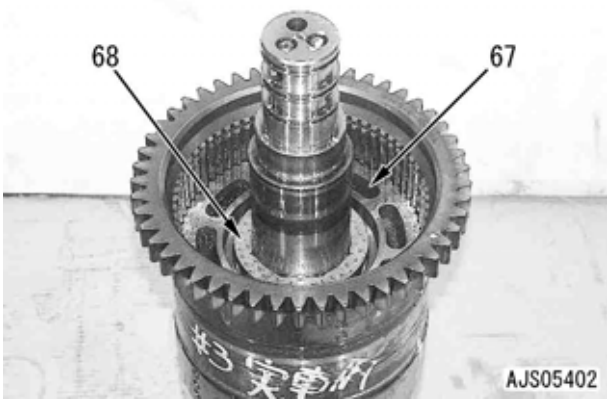
2. 4th piston

1) Install 4th piston (67).

★ Take care not to damage the piston seal.

Sliding surfaces of piston seal: **Transmission oil**

2) Install thrust washer (68).



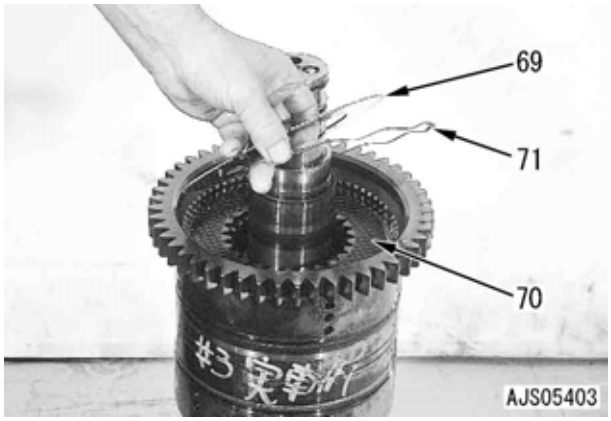
3. Clutch plate

Install plate (69), disc (70), and spring (71) in order alternately.

★ Before installing disc (70), soak it in clean transmission oil for at least 2 minutes.

★ Take care not lap spring (71) over disc (70).

★ Take care that plate (69) or spring (71) will not be caught in the ring groove of the clutch housing.

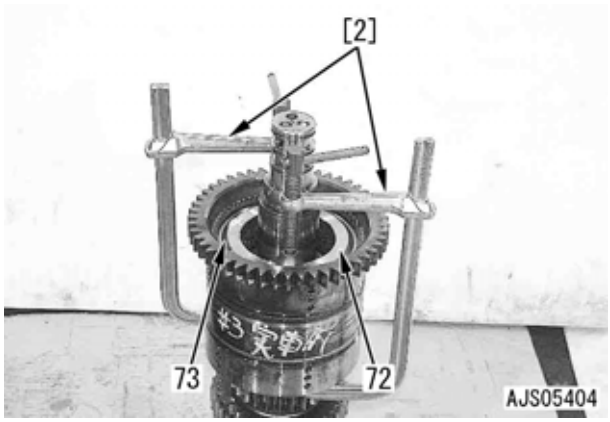


4. End plate

1) Install end plate (72).

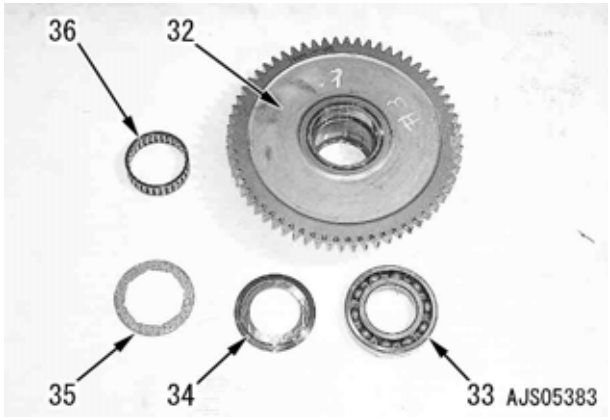
2) Press end plate (72) with C-clamps [2] and install snap ring (73).

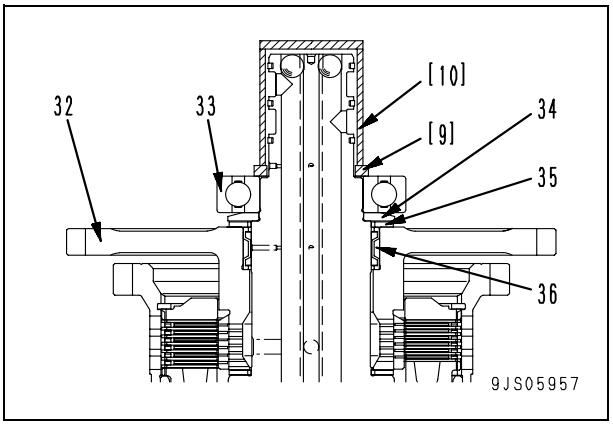
★ Check that snap ring (73) is fitted to the groove securely.



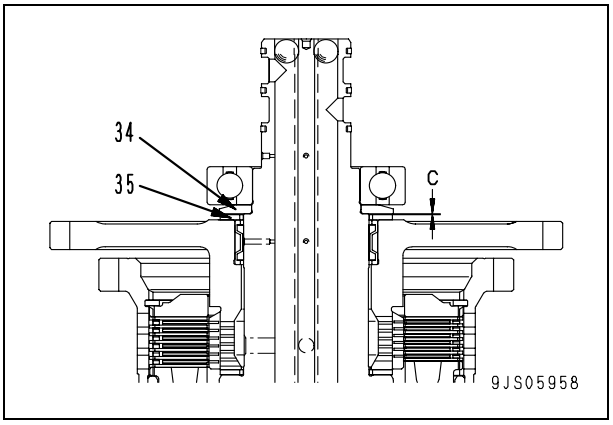
5. 4th gear and bearing

1) Install needle roller bearing (36) to 4th gear (32) and install them, meshing the gear with the internal teeth of the disc.
2) Install thrust washer (35) and spacer (34) and press fit bearing (33) with tools [9] and [10].





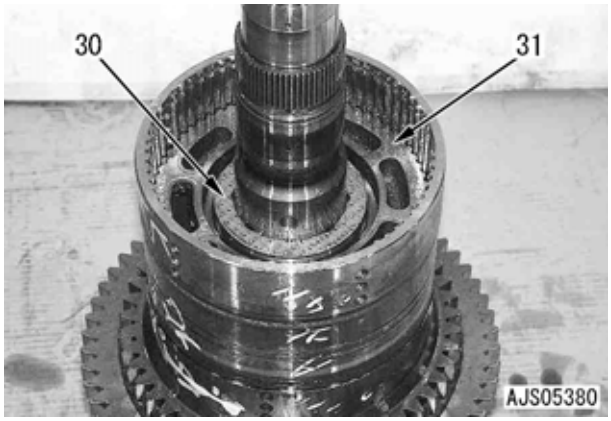
3) Check that clearance (c) between spacer (34) and thrust washer (35) is in the standard range.
Standard value (c): **0.28 – 0.72 mm**
★ Measure clearance (c) with a dial gauge or a thickness gauge.



[1st clutch side]

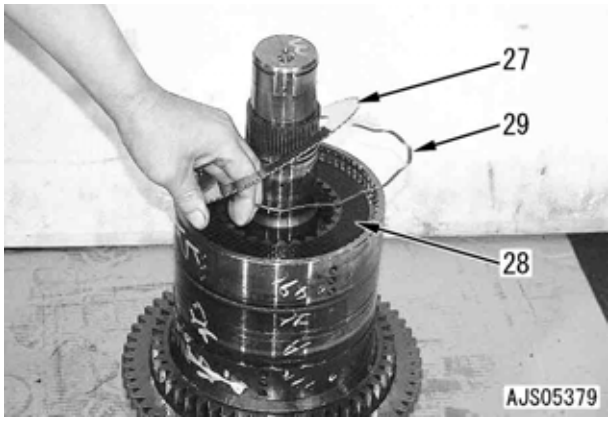
6. 1st piston

1) Similarly to the 4th clutch, fit the piston seal for the piston and install it to piston (31).
2) Similarly to the piston on the 4th clutch side, install piston (31).
Sliding surfaces of piston seal: **Transmission oil**
3) Install thrust washer (30).



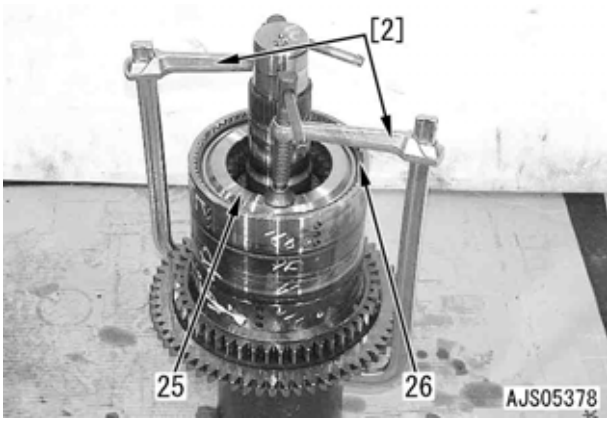
7. Clutch plate

Install plate (27), disc (28), and spring (29) in order alternately.
★ Install these parts similarly to those on the 4th clutch side.



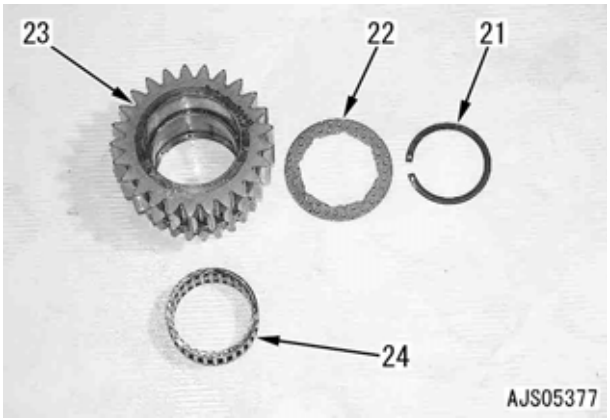
8. End plate

1) Install end plate (25).
2) Press end plate (25) with C-clamps [2] and install snap ring (26).

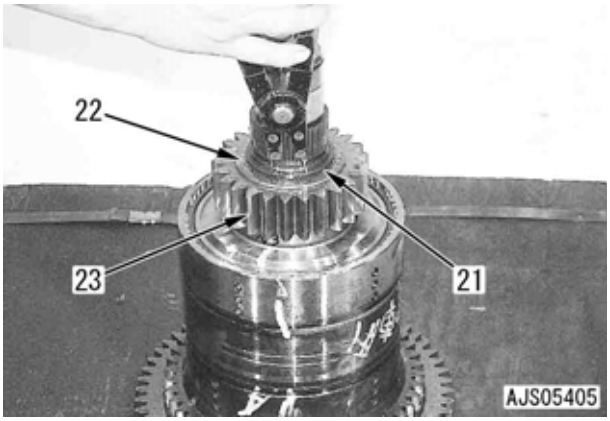


9. 1st gear

1) Install needle roller bearing (24) to 1st gear (23).
2) Install the 1st gear, meshing it with the internal teeth of the disc.

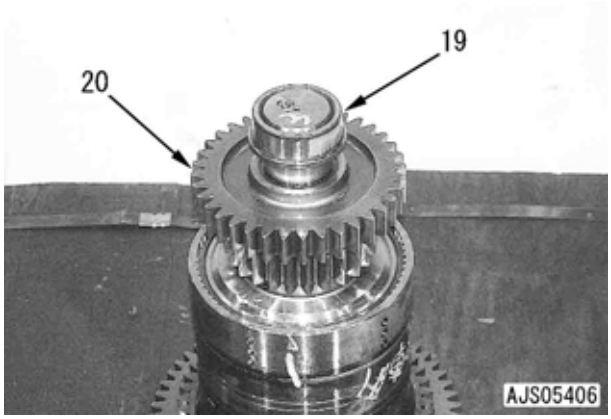


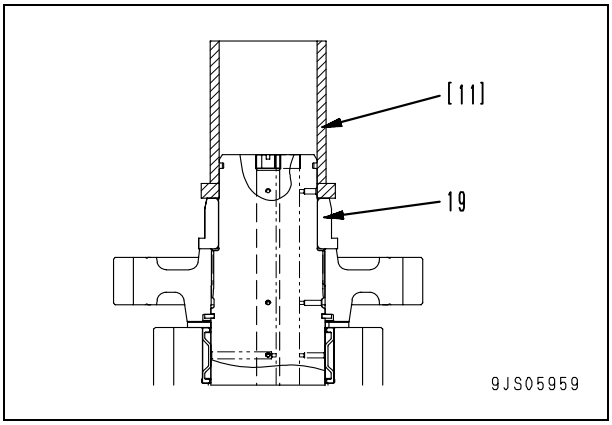
3) Install thrust washer (22) and snap ring (21).



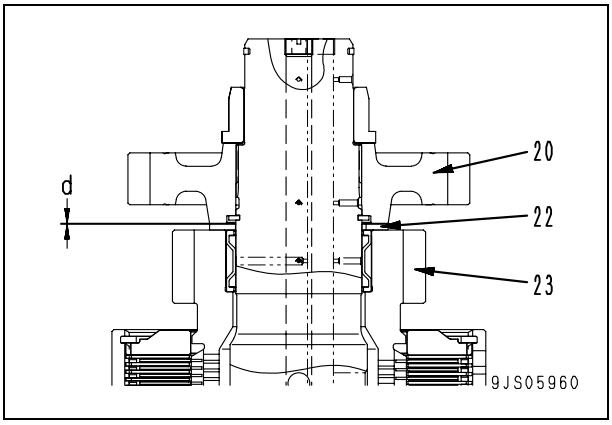
10. Idler gear

1) Install idler gear (20) and press fit inner race (19) with tool [11].





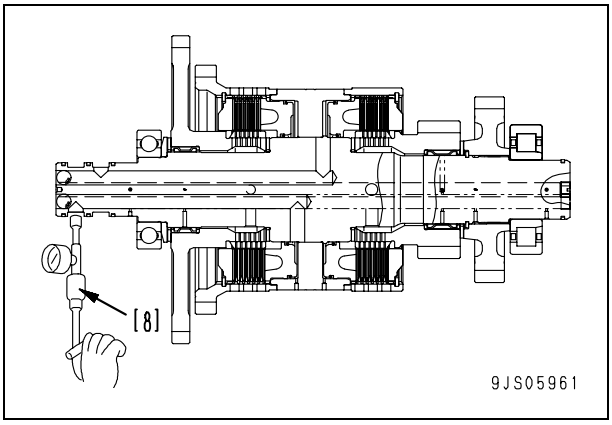
2) Check that clearance (d) between idler gear (20) and thrust washer (22) is in the standard range.
Standard value (d): **0.25 – 0.75 mm**
★ Measure clearance (d) with a dial gauge or a thickness gauge.



11. Operation test of clutch pack

Using oil leak tester [8], supply compressed air into the oil hole of the shaft and check that each clutch operates.

★ If the gear on the compressed air receiving side is fixed, the clutch is operating normally.



Assembly of 2nd and 3rd clutch pack

[2nd clutch side]

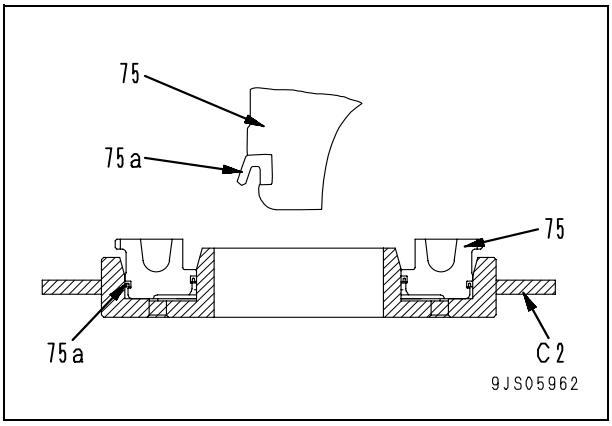
1. Piston seal

Install piston seal (75a) to piston (75).

★ When using a new piston seal, fit it for the cylinder with tool **C2** (for about 2 – 3 minutes) before installing.

★ If a new piston seal is installed to the cylinder without being fitted for the cylinder, it will be damaged.

Inside of tool **C2**: **Transmission oil**



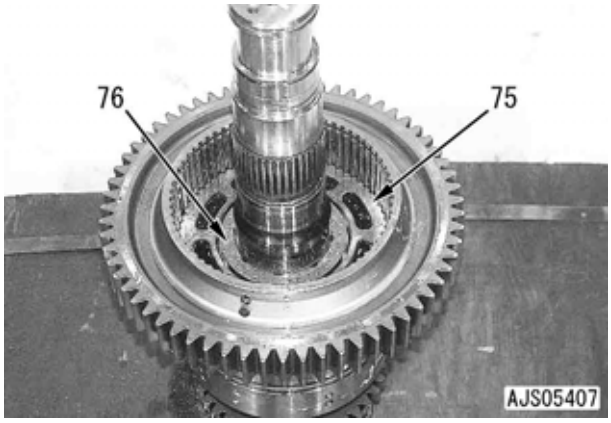
2. 2nd piston

1) Install 2nd piston (75).

★ Take care not to damage the piston seal.

Sliding surfaces of piston seal: **Transmission oil**

2) Install thrust washer (76).



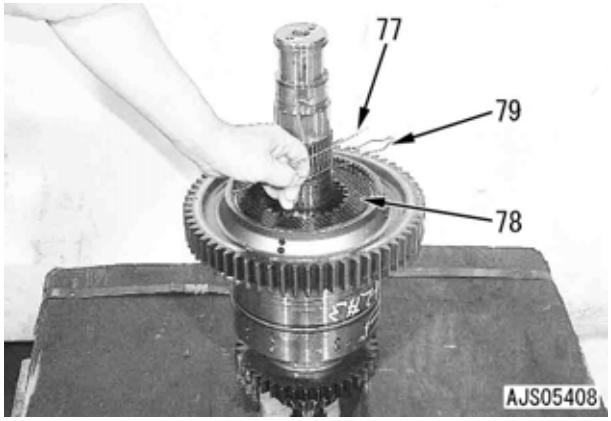
3. Clutch plate

Install plate (77), disc (78), and spring (79) to the housing in order alternately.

★ Before installing disc (78), soak it in clean transmission oil for at least 2 minutes.

★ Take care not lap spring (79) over disc (78).

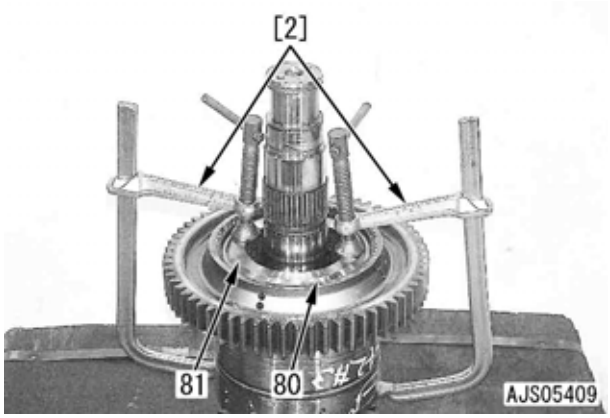
★ Take care that the plate or spring will not be caught in the ring groove of the clutch housing.



4. End plate

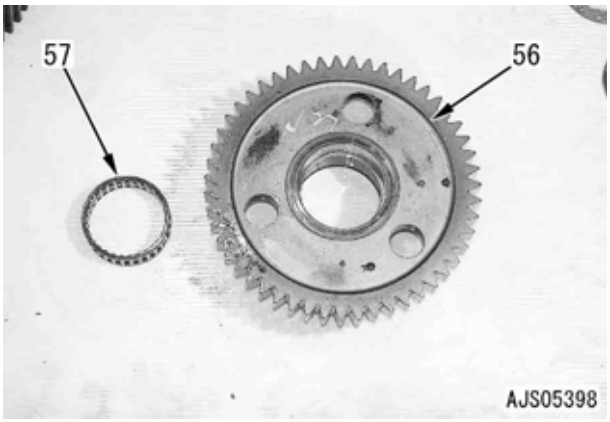
1) Install end plate (80).

2) Press end plate (80) with C-clamps [2] and install snap ring (81).

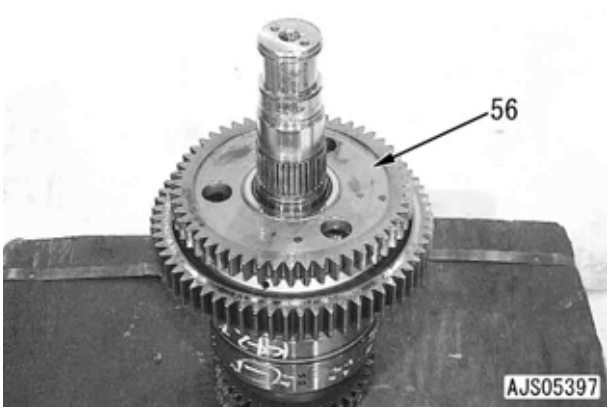


5. 2nd gear

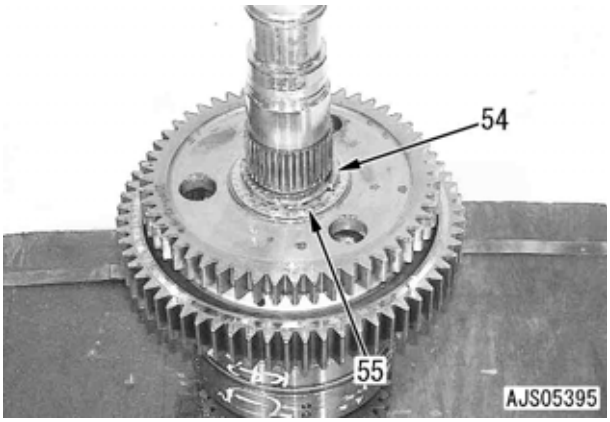
1) Install needle roller bearing (57) to 2nd gear (56).



2) Install 2nd gear (56), meshing it with the internal teeth of the disc.
   ★ If the 2nd gear is not meshed with the internal teeth of the disc, install it while turning it lightly. Never press it strongly.

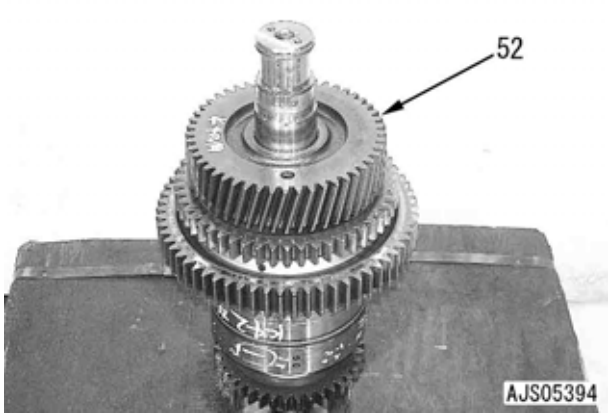


3) Install thrust washer (55) and split collar (54).

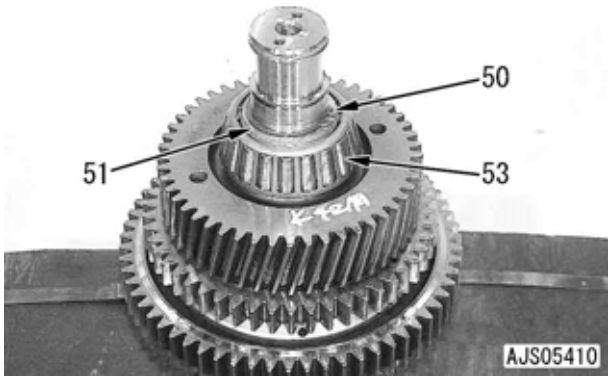


6. Output gear

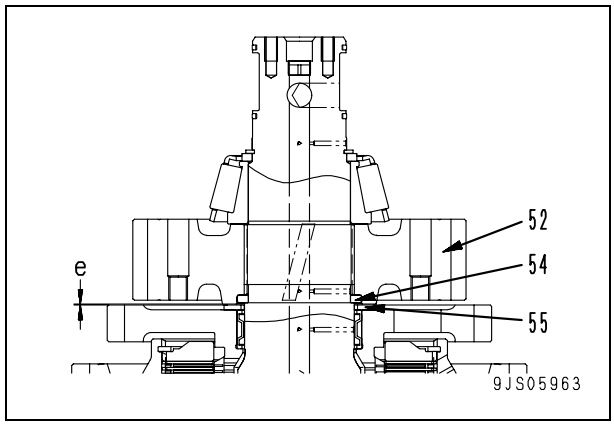
1) Install output gear (52).
   ★ Check that split collar (54) is in the output gear.



2) Press fit bearing (53) and install spacer (51) and snap ring (50).



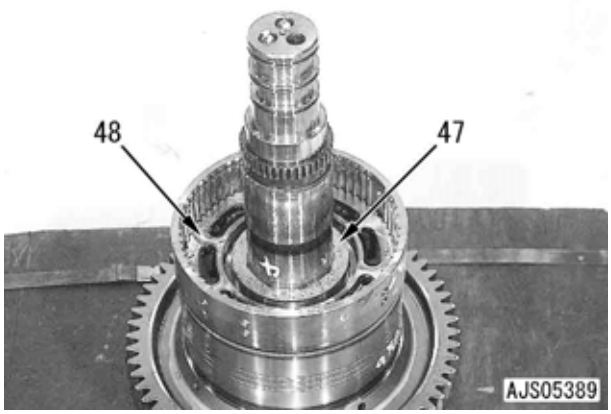
3) Check that clearance (e) between output gear (52) and thrust washer (55) is in the standard range.
   Standard value (e): **0.26 – 0.74 mm**
   ★ Measure clearance (e) with a dial gauge or a thickness gauge.



[3rd clutch side]

7. 3rd piston

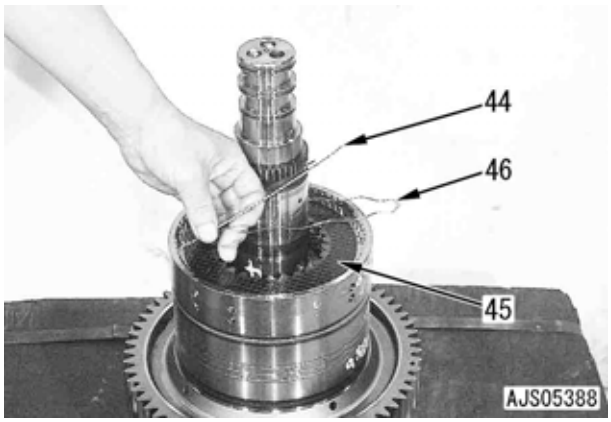
1) Similarly to the 2nd clutch, fit the piston seal for the piston and install it to piston (48).
2) Similarly to the piston on the 2nd clutch side, install piston (48).
   Sliding surfaces of piston seal: **Transmission oil**
3) Install thrust washer (47).



8. Clutch plate

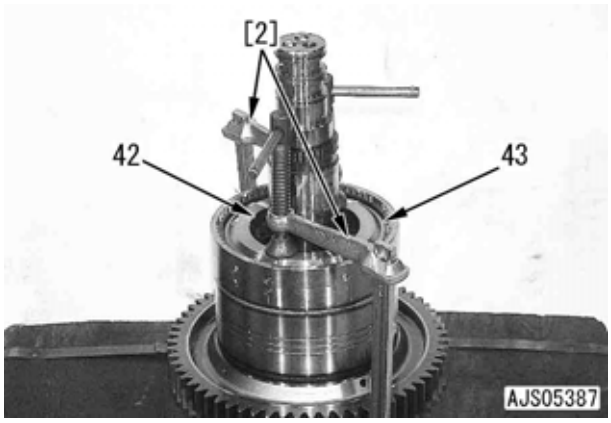
Install plate (44), disc (45), and spring (46) in order alternately.

★ Install these parts similarly to those on the 2nd clutch side.



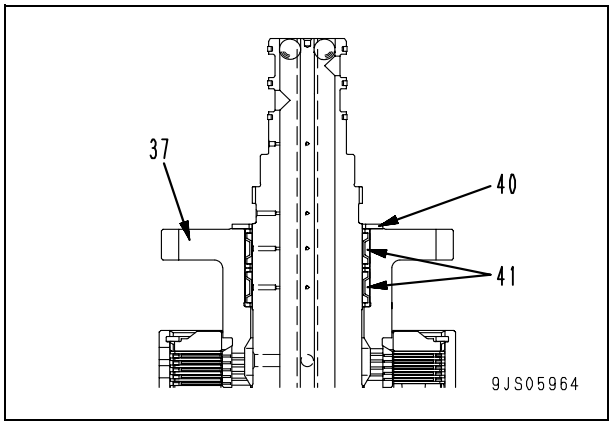
9. End plate

1) Install end plate (42).
2) Press end plate (42) with C-clamps [2] and install snap ring (43).



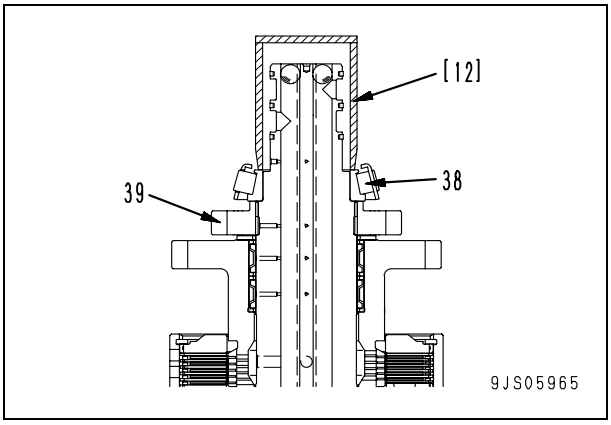
10. 3rd gear

1) Install needle roller bearings (41) to 3rd gear (37) and install them, meshing the gear with the internal teeth of the disc.
2) Install thrust washer (40).

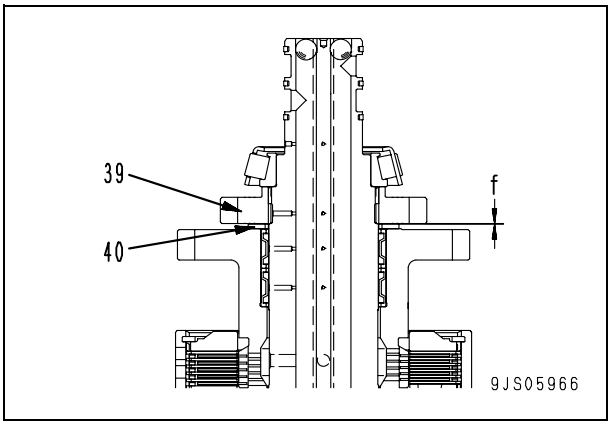


11. Idler gear and bearing

1) Install idler gear (39).
2) Using tool [12], press fit bearing (38).



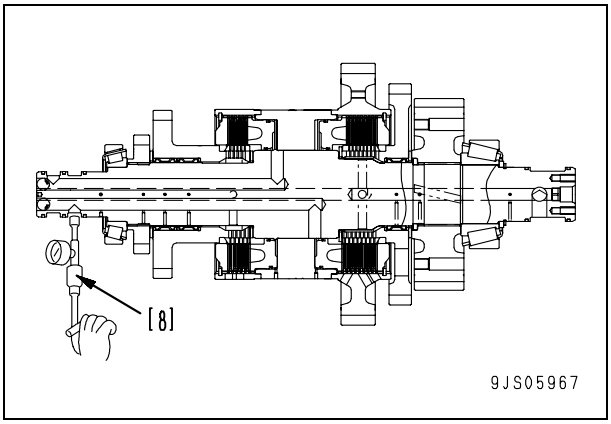
3) Check that clearance (f) between idler gear (39) and thrust washer (40) is in the standard range.
   Standard value (f): **0.47 – 1.03 mm**
   ★ Measure clearance (f) with a dial gauge or a thickness gauge.



12. Operation test of clutch pack

Using oil leak tester [8], supply compressed air into the oil hole of the shaft and check that each clutch operates.

★ If the gear on the compressed air receiving side is fixed, the clutch is operating normally.

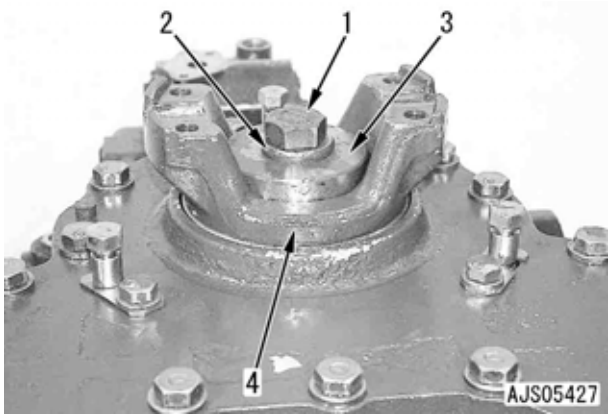


Disassembly and assembly of parking brake assembly

Disassembly

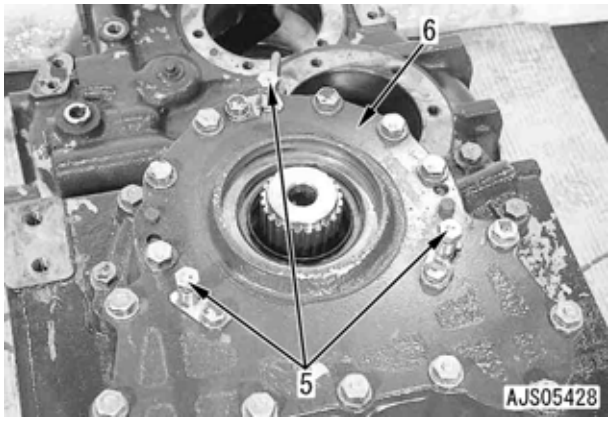
1. Coupling (center drive shaft side)

1) Remove bolt (1), washer (2), and holder (3).
2) Remove coupling (4).



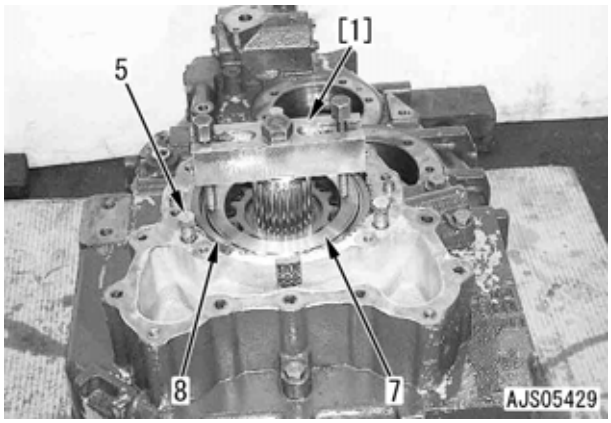
2. Cover

1) Remove 3 emergency reset bolts (5).
   ★ Since the cover is pushed back by the brake spring, loosen the bolts evenly.
2) Remove the mounting bolts and cover (6).

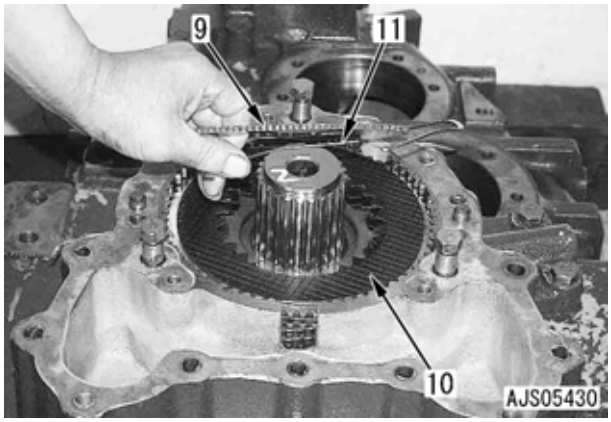


3. Plate and disc

1) Tighten 3 emergency reset bolts (5) again.
   ★ Tighten the bolts evenly to push in the brake spring.
2) Using tool [1], push end plate (7).
3) Remove snap ring (8) and end plate (7).

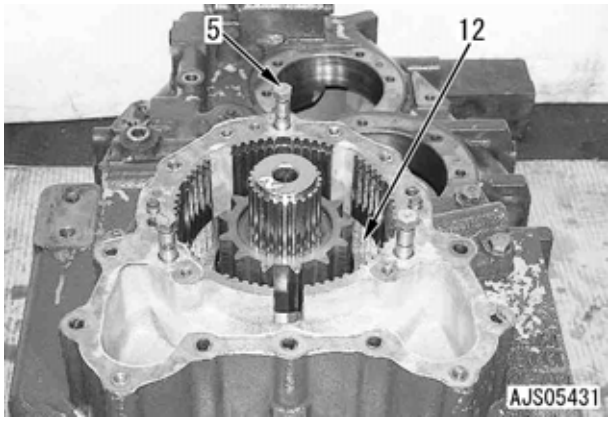


4) Remove plates (9), discs (10), and springs (11).

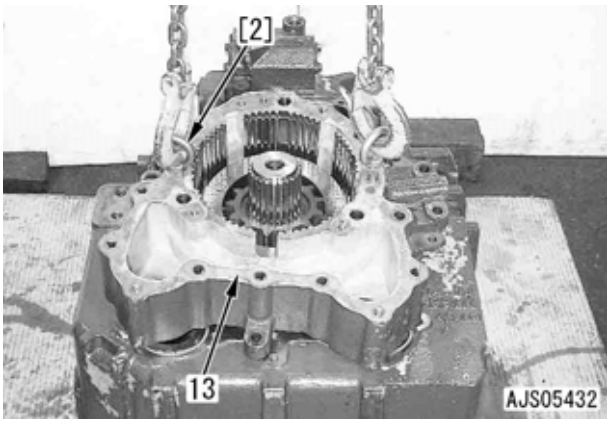


4. Case and piston

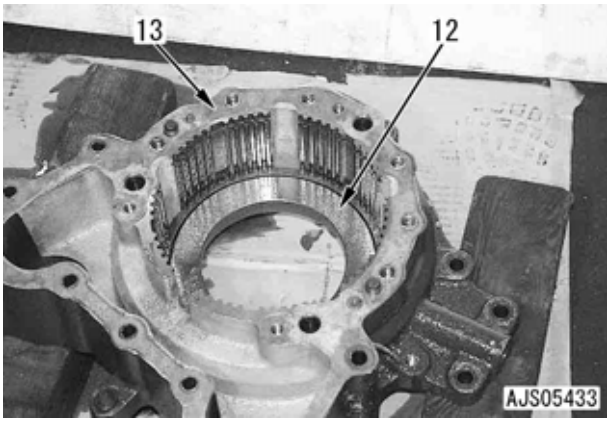
1) Remove 3 emergency reset bolts (5).
   ★ Since piston (12) is pushed and floated by the brake spring, loosen the bolts evenly.



2) Remove the mounting bolts of parking brake case (13). Then, using eyebolts [2], remove parking brake case (13).

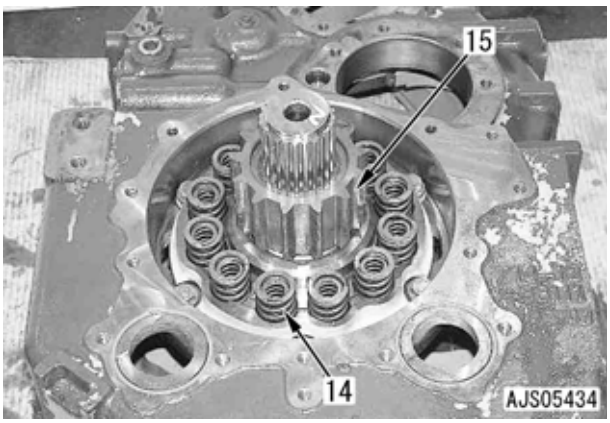


3) Remove piston (12) from parking brake case (13).

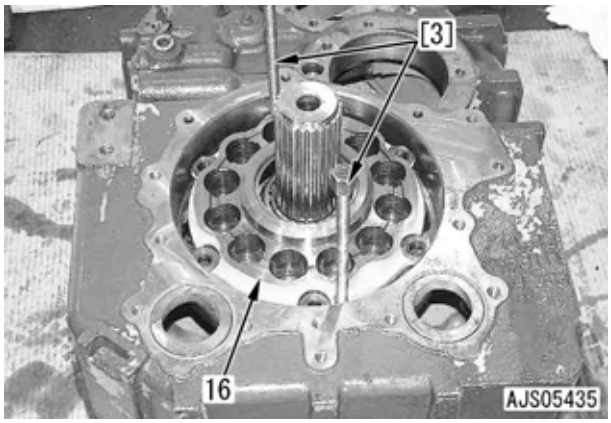


5. Spring and spring case

1) Remove springs (large and small) (14) and gear (15).

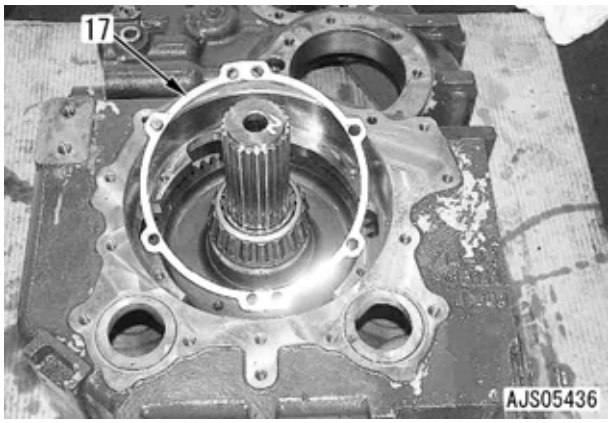


2) Remove the mounting bolts. Then, using forcing screw [3], remove spring case (16).

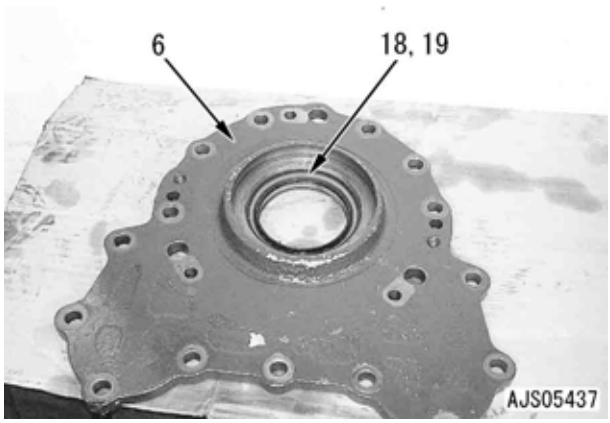


3) Remove shim (17).

★ Take a record of the thickness and quantity of the shim for assembly.



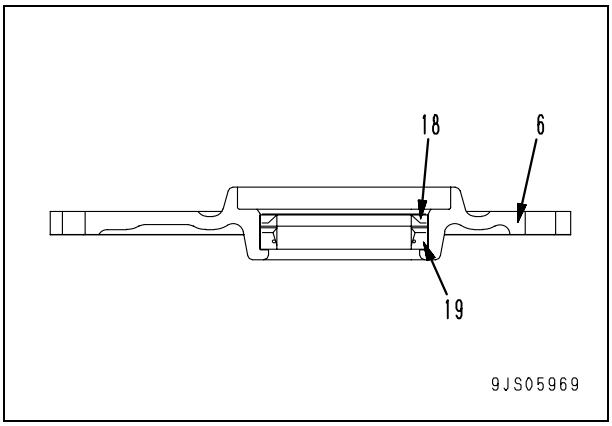
6. Remove dust seal (18) and oil seal (19) from cover (6).



Assembly

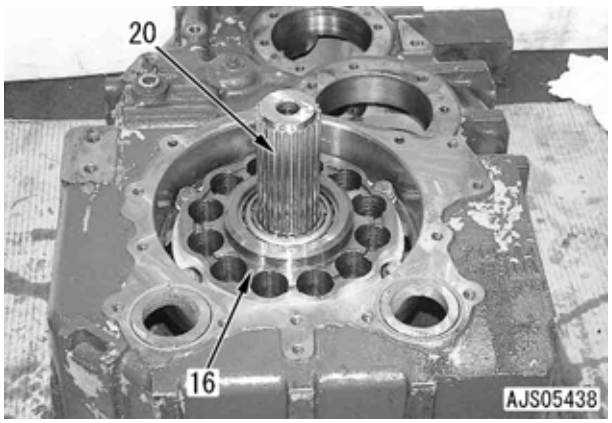
1. Oil seal and dust seal

1) Install oil seal (19) to cover (6).
   - Press fitting surface of oil seal:
     Gasket sealant (THREEBOND 1110B)
   - ★ Apply gasket sealant thinly to the inside of the housing hole and wipe off the projected part.
   - Oil seal lip surface:
     Silicone grease (THREEBOND 1855)
   - ★ Apply grease to a degree that it is not piled up on the lip.
2) Install dust seal (18) to cover (6).
   - Dust seal lip surface:
     Silicone grease (THREEBOND 1855)
   - ★ Apply grease to a degree that it is not piled up on the lip.
   - ★ Apply grease to the gap between the oil seal and dust seal, too.

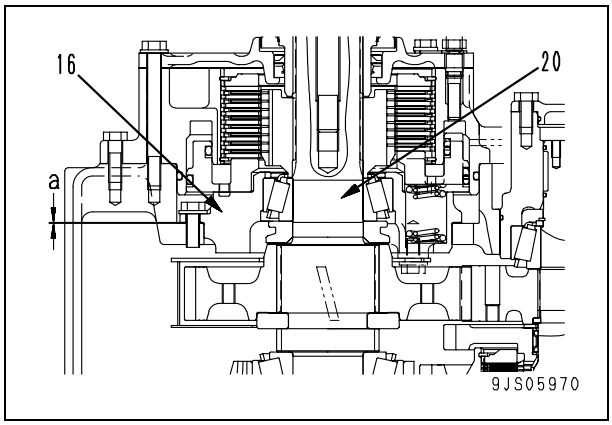


2. Procedure for adjusting shim of output shaft (20)

1) Tighten the mounting bolts of spring case (16) temporarily without inserting the shim.
   - Spring case mounting bolt:
     9.8 ± 0.98 Nm {1.0 ± 0.1 kgm}

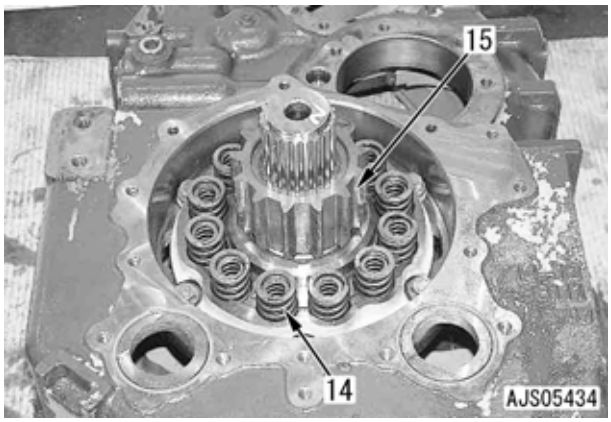


2) Rotate output shaft (20) 10 turns to the right and 10 turns to the left and then check the tightening torque.
   - ★ If the tightening torque has changed, repeat 1) and 2).
3) If the tightening torque has not changed, measure clearance (a).
   - Clearance (a): **0.85 – 1.42 mm**



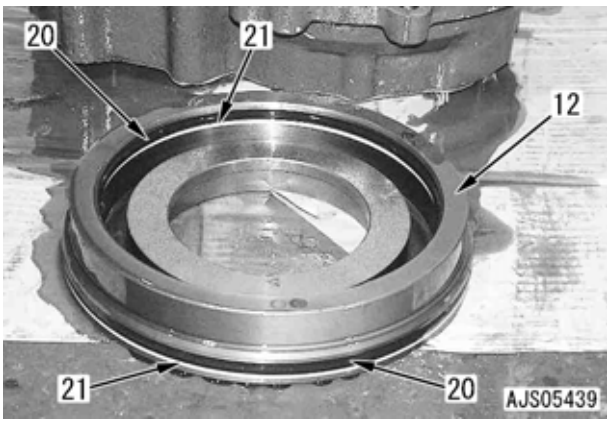
4) Insert the selected shim and tighten the mounting bolts.
   Reference: Standard shim thickness: 1.0 mm
   - Mounting bolt:
     98.0 – 122.5 Nm {10 – 12.5 kgm}
5) After adjusting the shim, check that the free rotation torque is in the following range.
   - Free rotation torque:
     0.74 – 1.46 Nm {0.076 – 0.149 kgm}
   - ★ After the shim is adjusted, the output shaft must not have end play.

3. Install springs (large and small) (14) and gear (15).

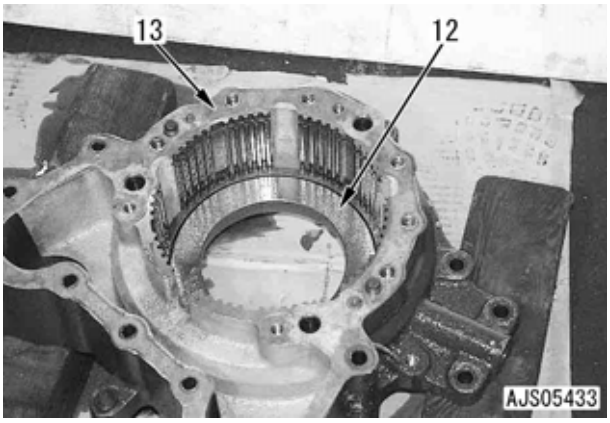


4. Piston and case

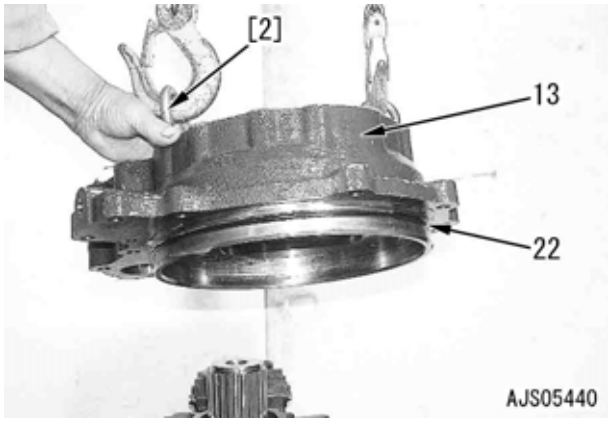
1) Install O-ring (20) and backup ring (21) to piston (12).
   ★ Take care of the installing positions of the O-ring and backup ring.
   O-ring and backup ring: **Grease (G2-LI)**



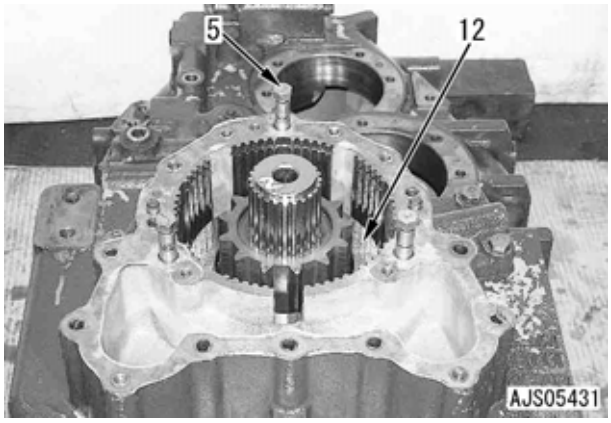
2) Insert piston (12) in parking brake case (13).



3) Fit O-ring (22) to parking brake case (13). Then, using eyebolts [2], install the parking brake case.
   ★ Take care not to damage the O-ring.
   ★ Connect the parking brake case so that the spring force will be applied to the piston evenly.
   O-ring: **Grease (G2-LI)**
   Parking brake case mounting bolt: **98 – 123 Nm {10 – 12.5 kgm}**

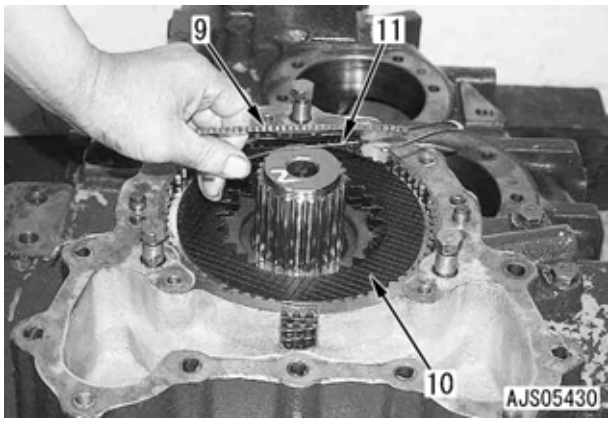


4) Tighten 3 emergency reset bolts (5) to push in piston (12).
   ★ Tighten the bolts evenly to compress the brake spring.

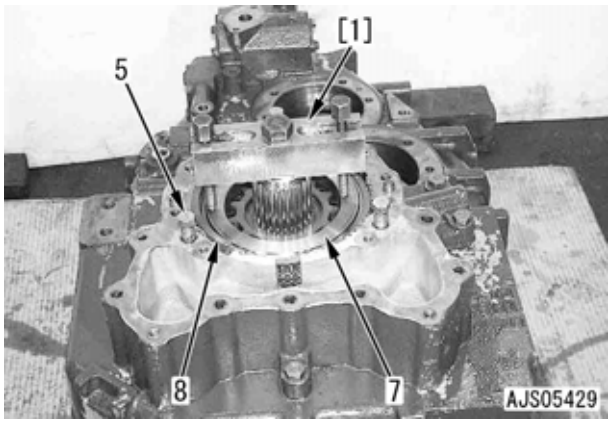


5. Plate and disc

1) Install plates (9), springs (11), and discs (10) alternately.
   ★ Take care that the spring will not be on the disc.
   ★ Plate: 9 pieces, Spring: 8 pieces, Disc: 8 pieces

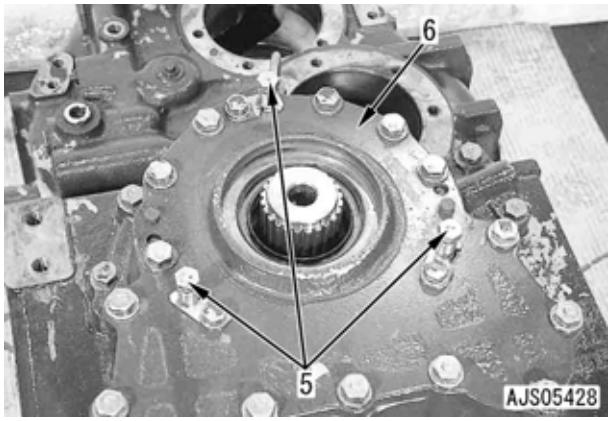


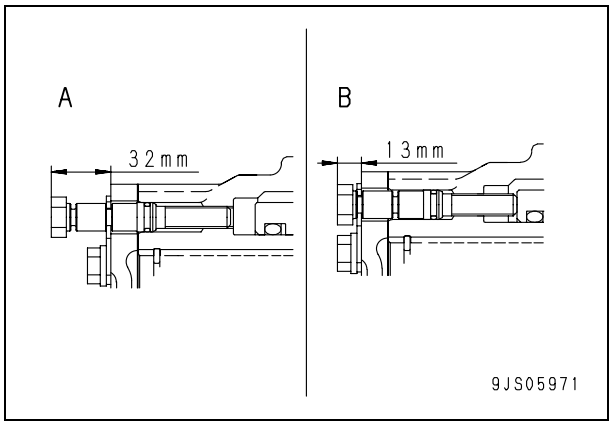
2) Using tool [1], press end plate (7) and install snap ring (8).
   ★ Check that the snap ring is fitted to the groove securely.
3) Remove emergency reset bolts (5).
   ★ Since the bolts are pushed by the brake spring, loosen them evenly.



6. Cover

1) Install cover (6).
   Cover mounting bolt:
   98 – 123 Nm {10 – 12.5 kgm}
2) Tighten 3 emergency reset bolts (5).
   ★ Tighten the bolts evenly to compress the brake spring.
   Emergency reset bolt:
   59 – 74 Nm {6 – 7.5 kgm}

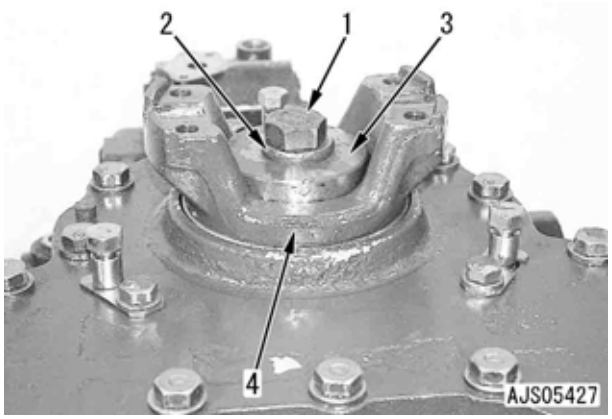




A. Normal state
B. Emergency reset state

7. Coupling (center drive shaft side)

1) Install coupling (4).
2) Fit the O-ring, install holder (3) and washer (2), and tighten bolt (1).
   Coupling mounting bolt:
   Adhesive (LT-2)
   Coupling mounting bolt:
   490 – 608 Nm {50 – 62 kgm}

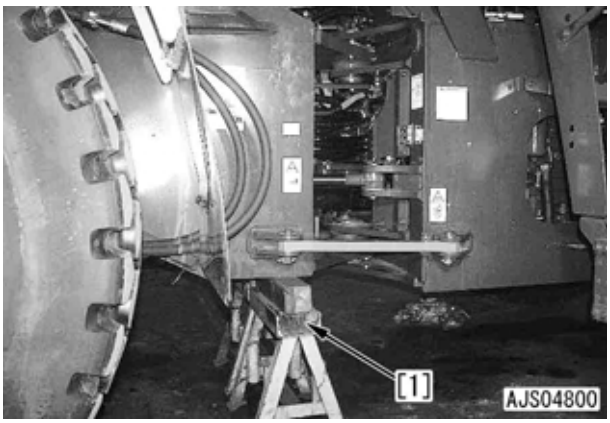


Removal and installation of front axle assembly

Removal

⚠ Stop the machine on a level place, set the safety bar to the frame, and lock the rear tires with chocks.

1. Push up the machine with the work equipment, place block [1] under the frame in front of the front wheels to raise the rear part of the machine.

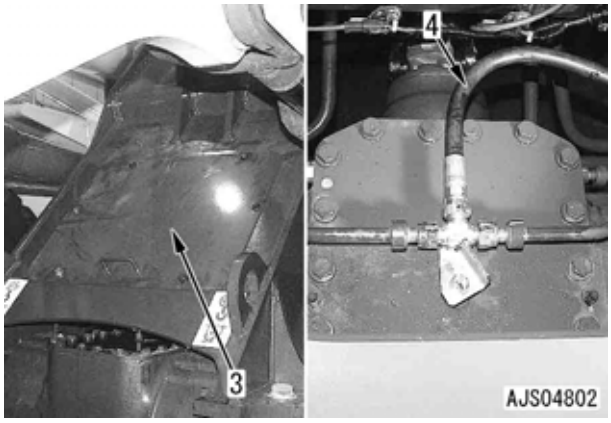


2. Wrap the sling around tire (1), lift up the tire, remove mounting bolts (2), and remove the tire. [*1]

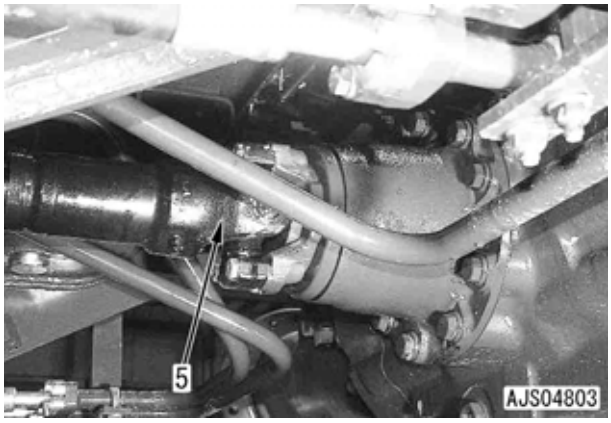


3. Remove cover (3) from the front of the machine.

4. Disconnect brake tube (4). [*2]

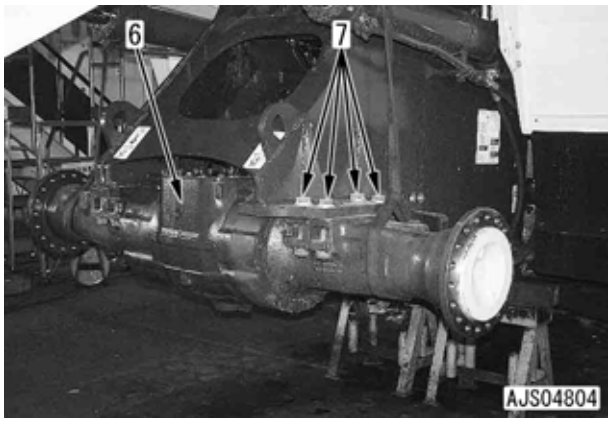


5. Disconnect front drive shaft (5). [*3]



6. Sling front axle assembly (6) temporarily and remove 4 mounting bolts (7) each from the right and left sides.

Front axle assembly: **900 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]
Mounting bolt:
823 – 1,029 Nm {84 – 105 kgm}

[*2]
★ Bleed air from the brake system. For details, see Testing and adjusting, “Bleeding air from brake system”.

[*3]
★ When installing the drive shaft, check that the key of the spider cap is fitted to the key way of the mating yoke and then tighten the mounting bolts.

[*4]
Front axle assembly mounting bolt:
1,029 ± 98 Nm {105 ± 10 kgm}

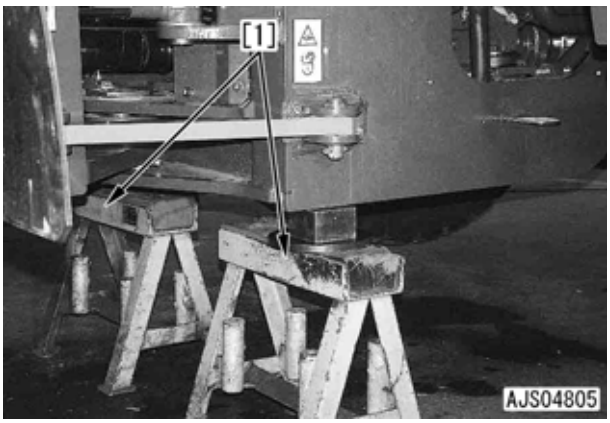
Removal and installation of rear axle assembly

Removal

⚠ **Stop the machine on a level place, set the safety bar to the frame, and lock the rear tires with chocks.**

1. Remove the fuel tank assembly. For details, see “Removal and installation of fuel tank assembly”.

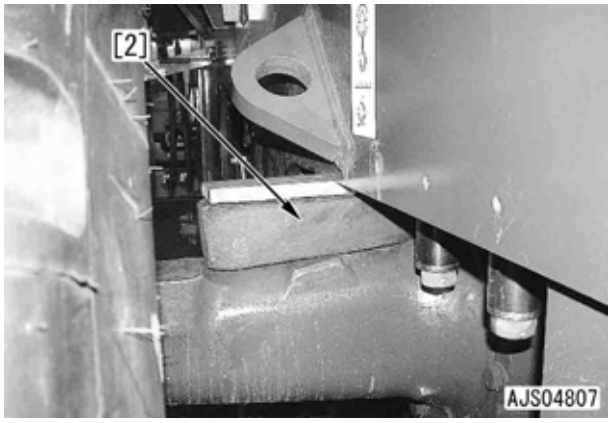
2. Push up the machine with the work equipment, place blocks [1] under the frame in front of the rear wheels to raise the rear part of the machine.



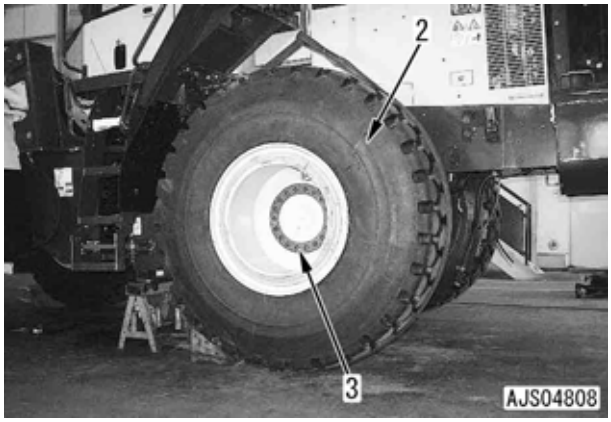
3. Sling fender (1) temporarily, remove the mounting bolts, and lift off the fender.



4. Put block [2] between the rear frame bottom and rear axle.
   - Height of block: **Approx. 110 mm**
   - ★ Put this block to prevent the rear axle from rocking.

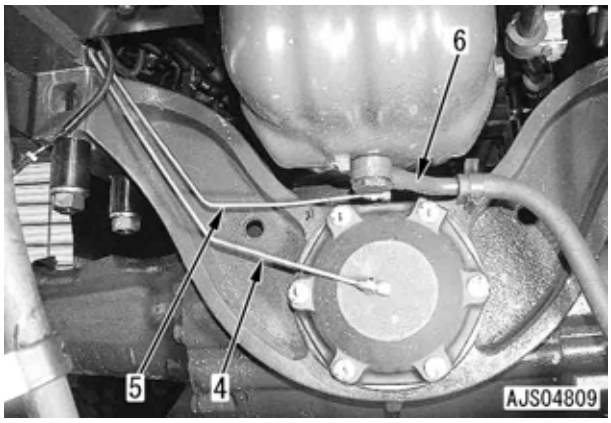


5. Wrap the sling around rear tire (2), lift up the tire, remove mounting bolts (3), and remove the tire. [*1]



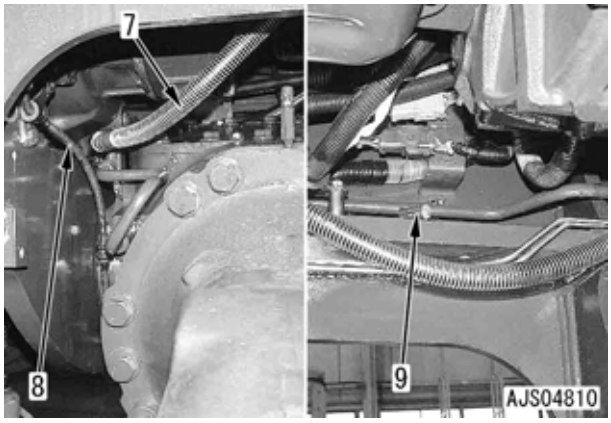
6. Remove grease tubes (4) and (5).

7. Direct engine oil drain tube (6) toward the rear.
   - ★ The tube must be set as above to prevent interference when the rear frame is removed.

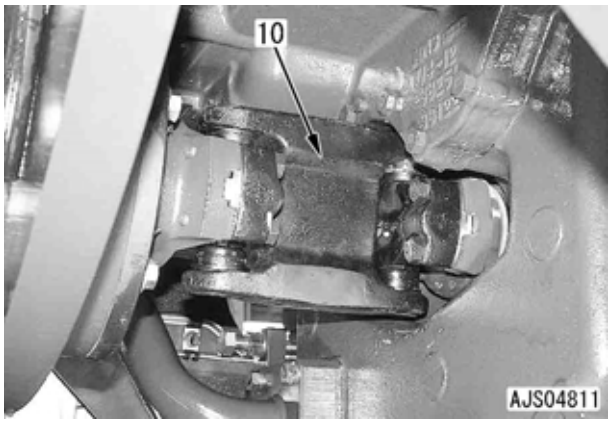


8. Remove brake hose (7). [*2]

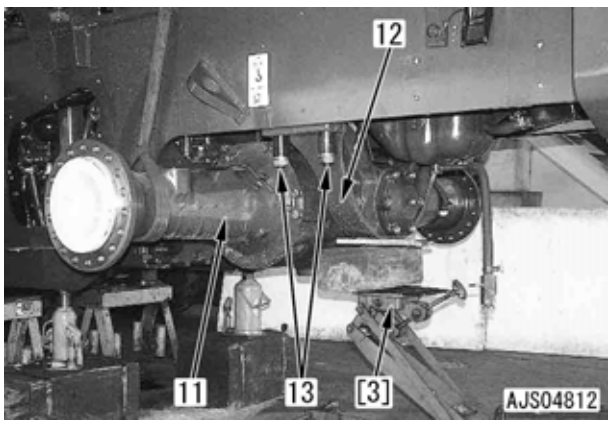
9. Remove the clamp of wiring (8) and disconnect brake oil temperature sensor connector R60 (9).



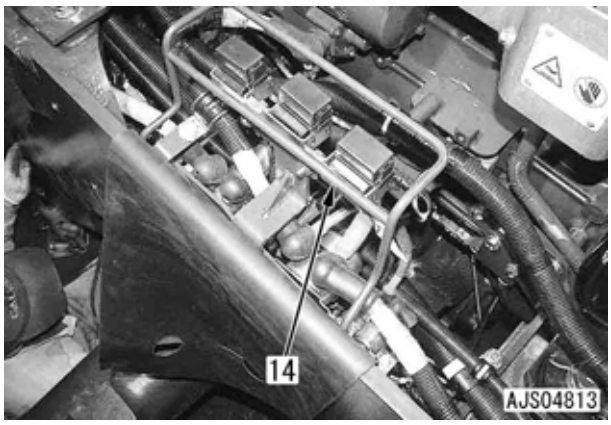
10. Remove rear drive shaft (10). [*3]



11. Sling rear axle (11) temporarily, hold support (12) with transmission jack [3], and remove right and left mounting bolts (13). [*4]



★ When removing the mounting bolts on the left side of the rear axle, move the emergency relay, battery relay, and relay mount (14).

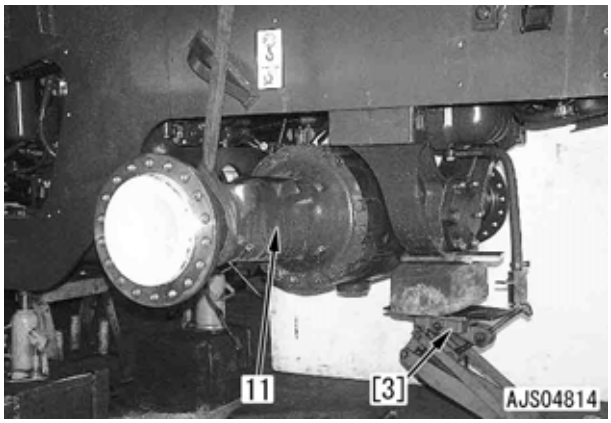


12. Lower the crane and transmission jack [3] simultaneously and remove rear axle assembly (11). [*5] [*6]

★ Take care that the support will not turn.

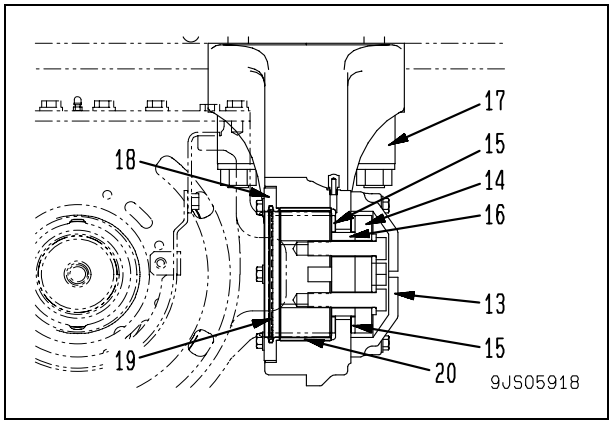
★ Take care that the rear axle assembly will not interfere with the oil pan.

Rear axle assembly (with support): **1,000 kg**



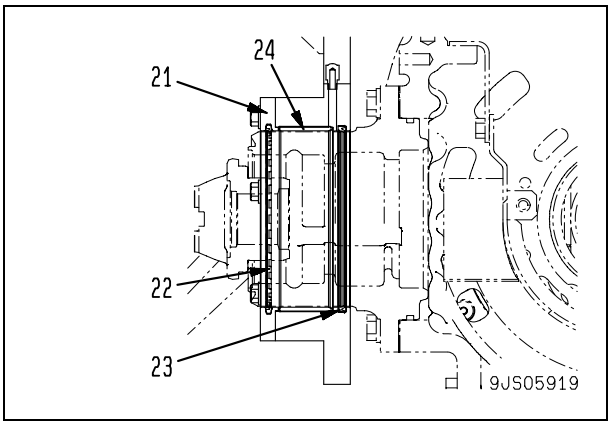
13. Removal of rear support

1) Remove cover (13), holder (14), thrust washer (15), and spacer (16) and then remove rear support (17). [*7]
   Rear support: **140 kg**
2) Remove cover (18) from the rear support and remove dust seal (19) and bushing (20). [*8] [*9]



14. Removal of front support

- Remove cover (21) from the front support and remove dust seals (22) and (23) and bushing (24). [*10]



Installation

- Carry out installation in the reverse order to removal.

[*1]
Tire mounting bolt:
823 – 1,029 Nm {84 – 105 kgm}

[*2]
★ Bleed air from the brake system. For details, see Testing and adjusting, “Bleeding air from brake system”.

[*3]
Rear drive shaft mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}

[*4]
Support mounting bolt:
1,029 ± 98 Nm {105 ± 10 kgm}

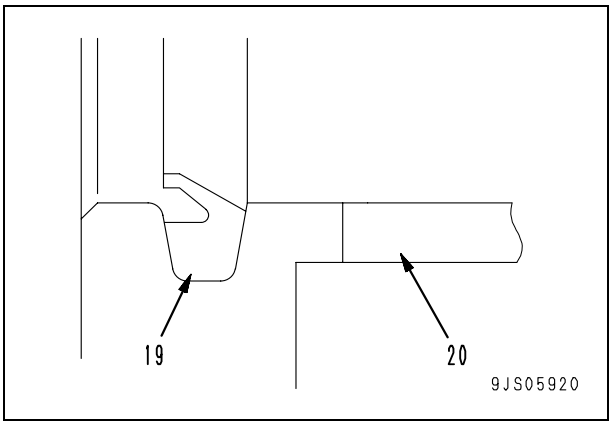
[*5]
★ Since the support leans to the right or left, fix it to the axle with a lever block.
★ When inserting in the front support, take care extremely not to damage the seal lip.

[*6]
★ Bushing of support: **Grease (G2-LI)**

[*7]
★ When installing the rear support, take care extremely not to damage the seal lip.
Mounting bolt of cover (13) and holder (14):
Adhesive (LT-2)
Mounting bolt of cover (13) and holder (14):
245 – 309 Nm {25 – 31.5 kgm}

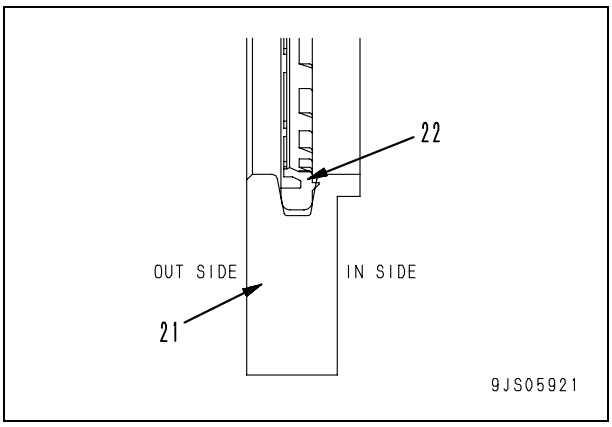
[*8]
★ When installing the bushing, direct its chamfered side toward the opposite side of cover (18).

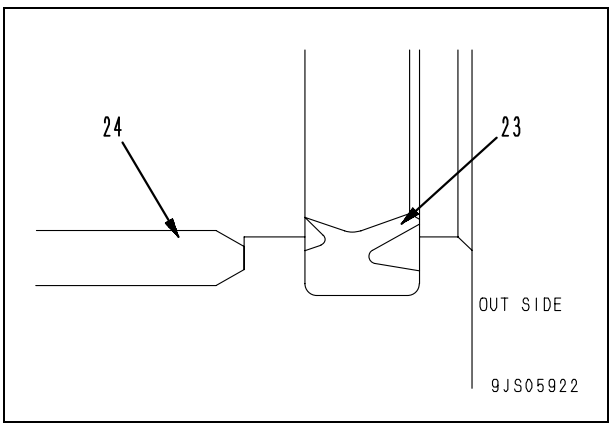
[*9]
★ When installing dust seal (19), direct its lip out.
- Part (20) is the bushing.



[*10]
★ When installing dust seal (22), direct the “thicker lip” out.
- Part (21) is the cover.

★ When installing dust seal (23), direct its lip out.
- Part (24) is the bushing.





Disassembly and assembly of axle housing

Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
J	1	793T-522-1140	Push tool	■	1		
		793T-522-1150	Spacer	■	1		
	2	797T-423-1290	Push tool	■	1		
	3	793T-522-1160	Push tool	■	2		
	4	793T-522-1171	Seal support	■	2		
		01016-30860	• Bolt	■	6		

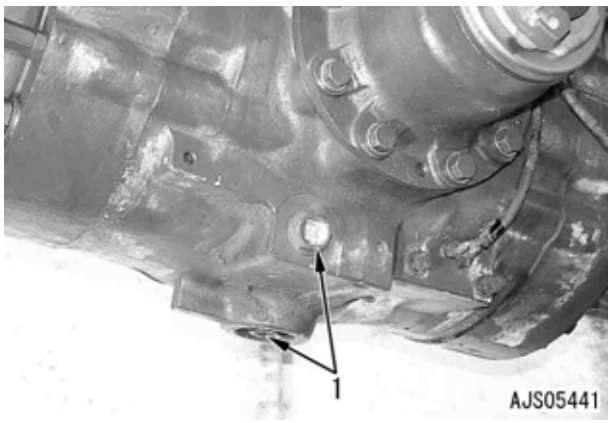
Disassembly

★ The following photos and illustrations show the front axle housing as an example.
★ The front axle housing and rear axle housing have different outside shapes but have the same internal structure.

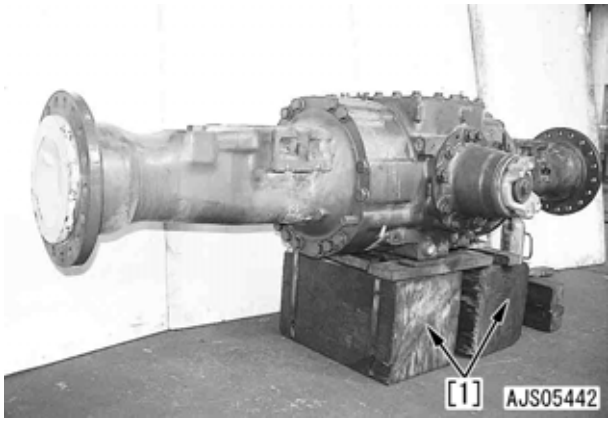
1. Draining oil
Remove plugs (1) and drain the oil.

Front axle housing: **40 ℓ**

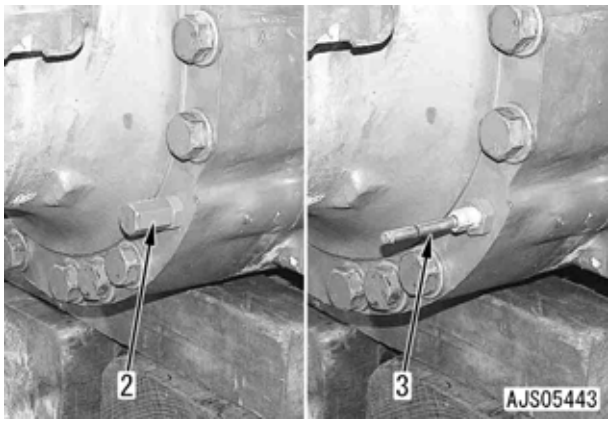
Rear axle housing: **40 ℓ**



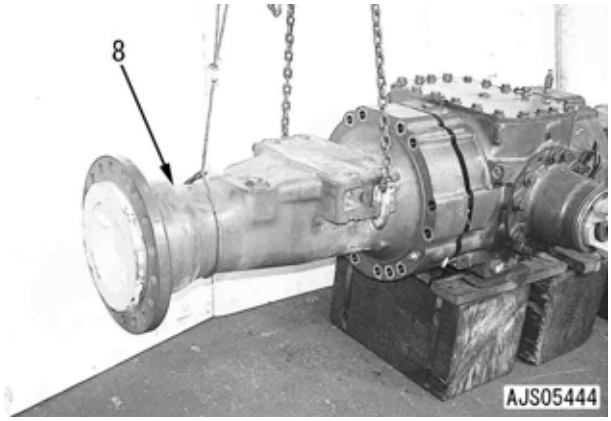
2. Axle assembly
Set the axle assembly on blocks [1].
★ Set block [1] so that the axle assembly will not lean when the housing assembly on one side is removed.



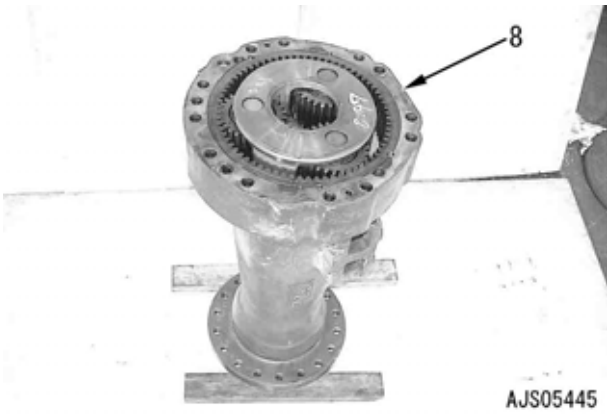
3. Axle housing assembly
1) Remove cap (2) and brake wear gauge (3).



2) Sling axle housing assembly (8) temporarily and remove the housing mounting bolts.
★ When removing both axle housing assemblies, make match marks on the housings and differential cases so that the housing assemblies will not be mistaken.
3) Remove axle housing assembly (8).

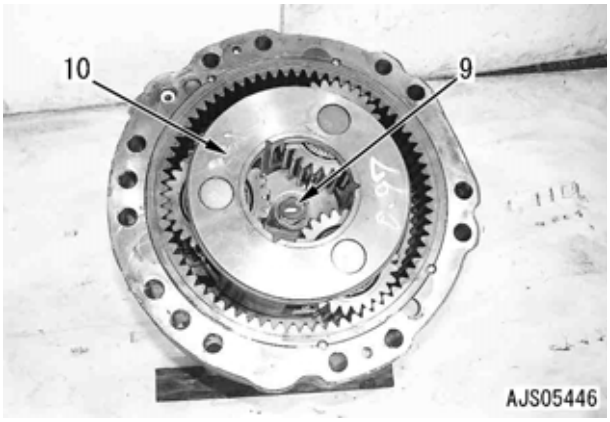


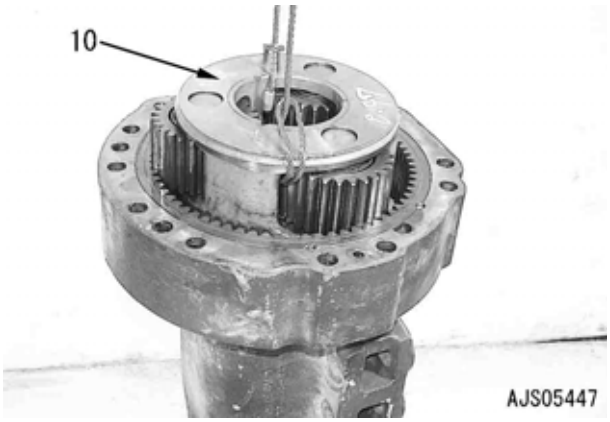
4) Change the hooking position of the sling and erect axle housing assembly (8).



4. Planetary carrier assembly

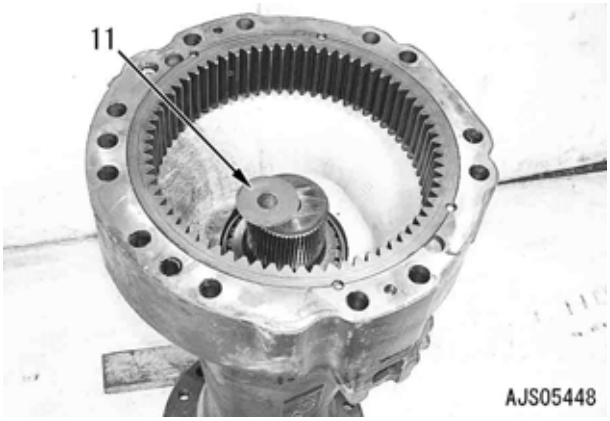
1) Remove axle shaft mounting bolt (9) and remove planetary carrier assembly (10).





2) Remove shim (11).

★ Take a record of the thickness and quantity of the shim for assembly.

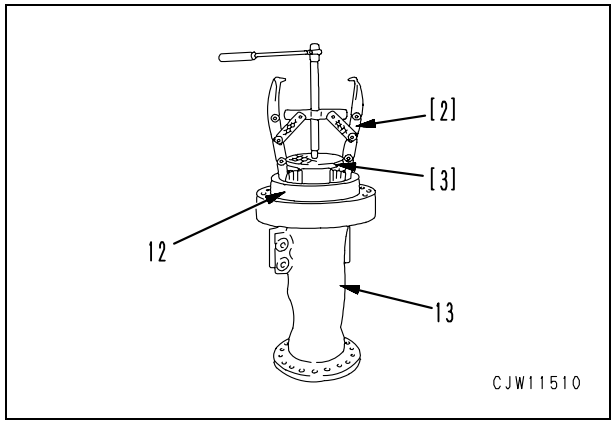


5. Ring gear

Using puller [2], pull up ring gear (12) evenly to remove it from housing assembly (13).

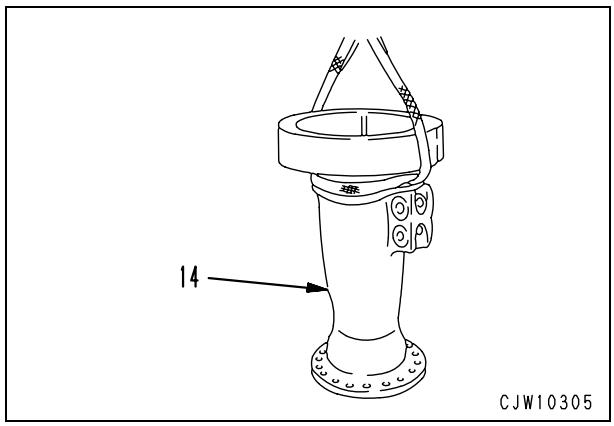
★ Install spacer [3] to the bolt end of the puller to adjust the height.

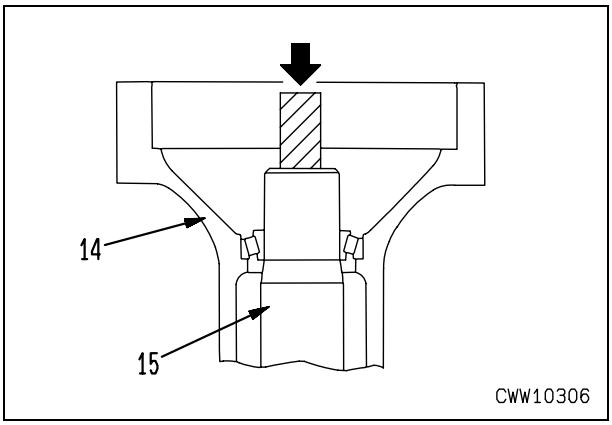
★ Take care that the claws of the puller will not come off the ring gear.



6. Axle shaft

1) Sling axle housing (14).
2) Hit the end of axle shaft (15) with a copper hammer etc. to drive it out.

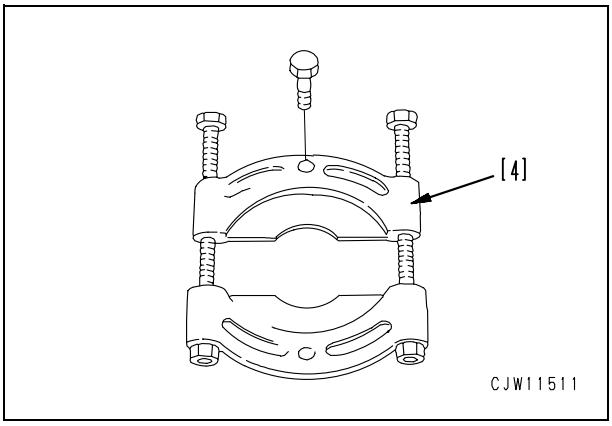


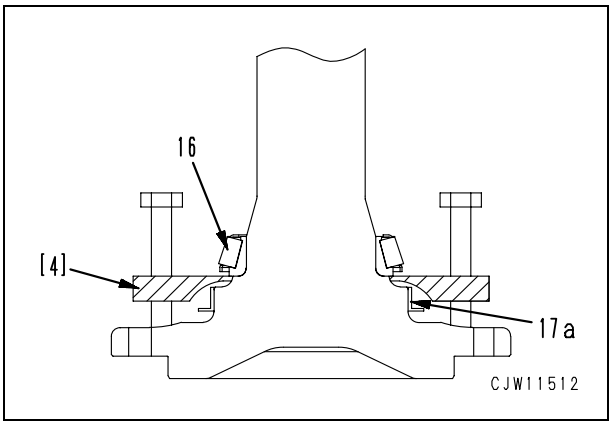


7. Axle shaft bearing

⚠ **Do not heat the bearing to remove it or cut it with gas.**

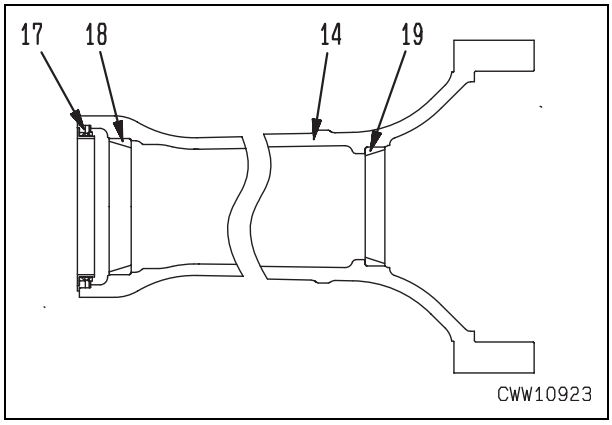
1) Install bearing race puller [4] under bearing (16) and fix it securely.
2) Tighten the bolts to remove bearing (16).
3) Remove sleeve (17a).





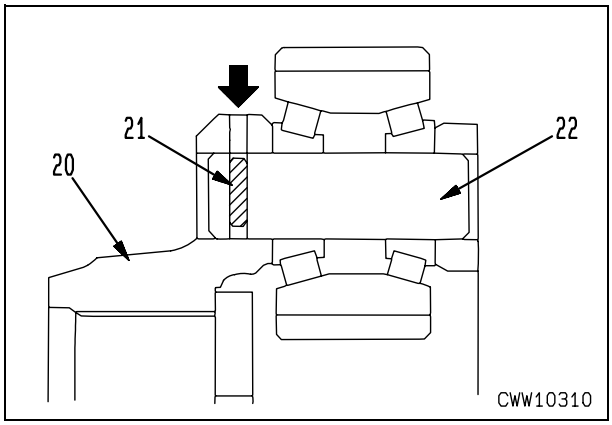
8. Axle housing

Remove outer races (18) and (19) and oil seal (17) from axle housing (14).

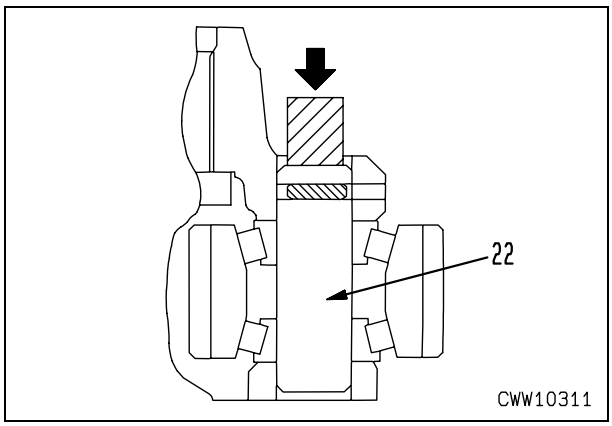


9. Planetary carrier

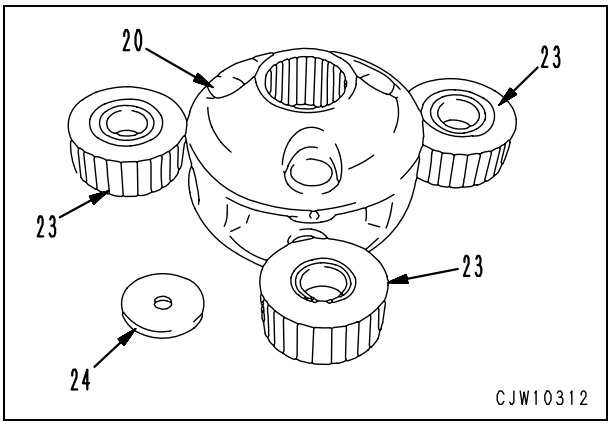
1) Drive in spring pin (21) of planetary carrier (20) until it is in the range of shaft (22).
   ★ Take care not to drive in the spring pin too deep.



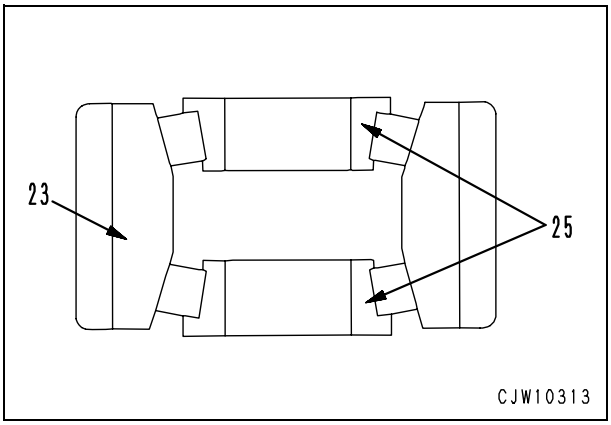
2) Using a press, pull out shaft (22).



3) Remove spring pin (21) from the removed shaft (22).
4) Remove pinion gear (23) and spacer (24) from planetary carrier (20).



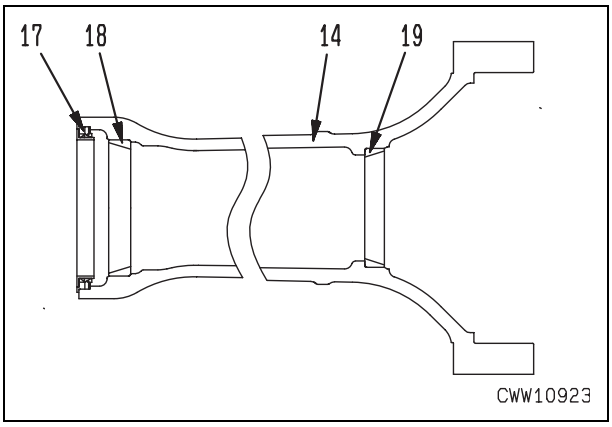
5) Remove bearings (25) from pinion gear (23).



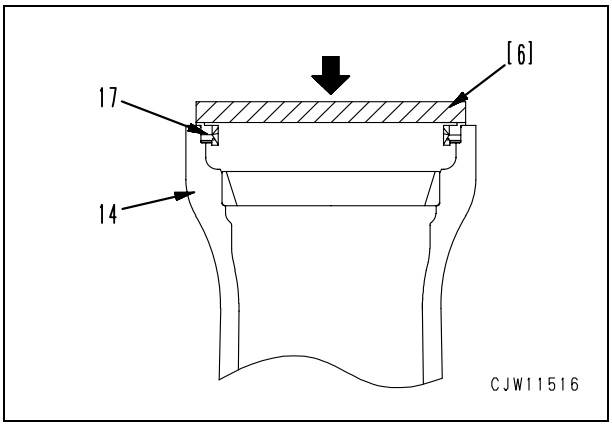
Assembly

1. Axle housing

1) Press fit bearing outer races (18) and (19) to axle housing (14).

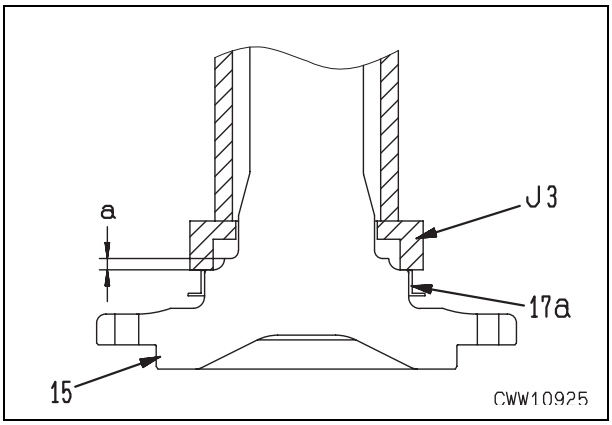


2) Using push tool [6], install oil seal (17) to housing (14).
   - Oil seal lip surface: **Grease (G2-LI)**
   - ★ Fit the oil seal flange to the housing end.
   - ● Clearance between oil seal flange and housing end: **Max. 0.2 mm**

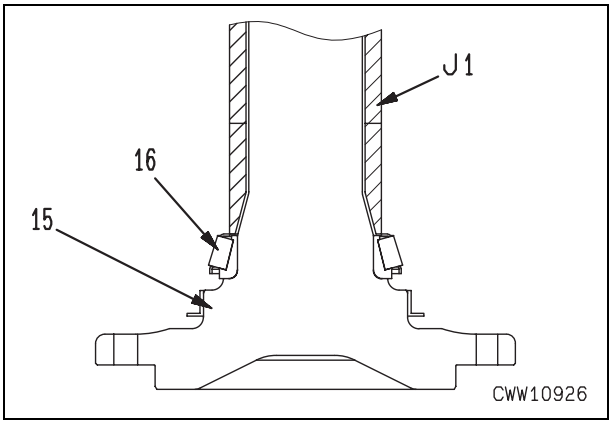


2. Axle housing and shaft

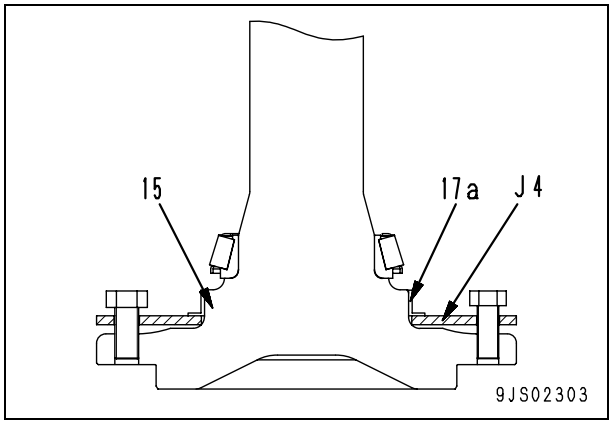
1) Using tool **J3**, install oil seal sleeve (17a) to shaft (15).
   - Sleeve mounting face: **Axle oil or molybdenum disulfide grease (LM-P)**
   - ★ Check that dimension (a) from the bearing mounting face is 10.1 ± 0.2 mm.



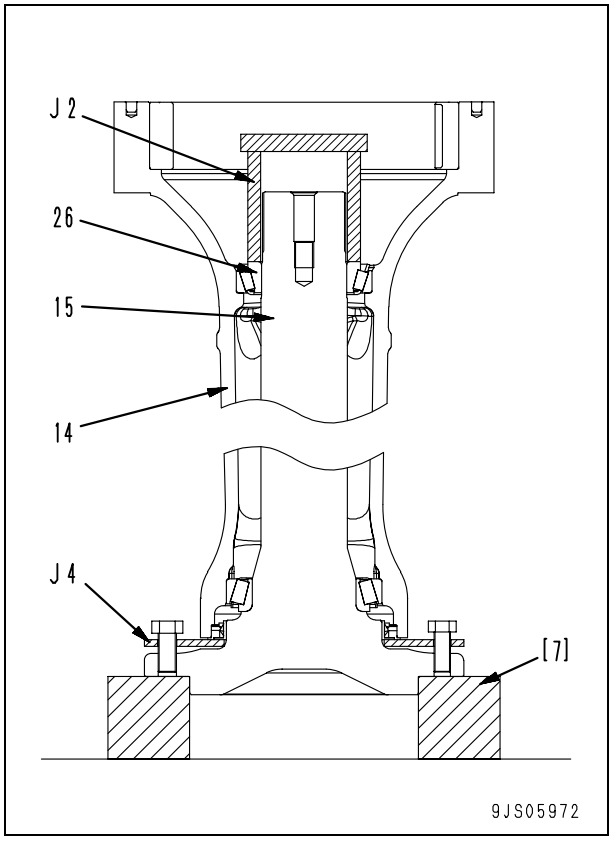
2) Using tool **J1**, press fit bearing (16) to axle shaft (15).



3) Erect axle shaft (15) on block [7] and fix it securely.
4) Install tool **J4** under oil seal sleeve (17a).
   - ★ Install tool **J4** so that its top will touch oil seal sleeve (17a) lightly and the clearance will be even.

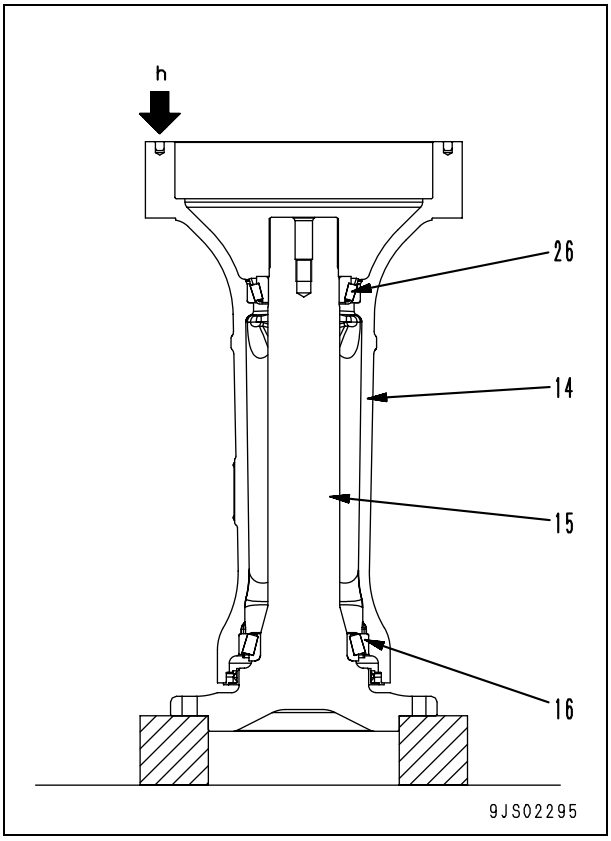


5) Sling axle housing (14) horizontally and install it to the shaft by utilizing its weight.
6) Using tool **J2**, press fit bearing (26).
   - ★ Rotate the housing to fit the bearing.
   - ★ Press fit the bearing until the end play is 0 – 0.100 mm.
   - Bearing: **Axle oil**
7) Remove tool **J4** horizontally.



3. Selection of shim

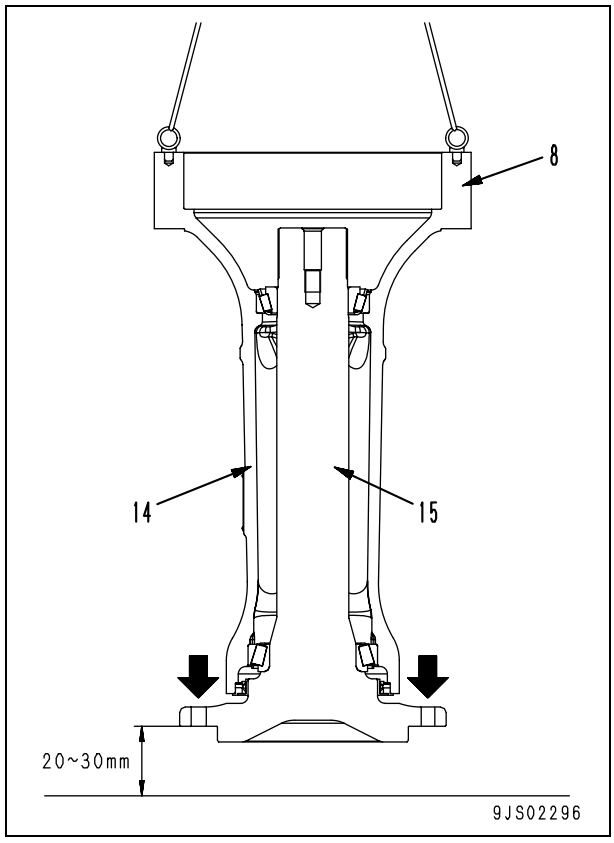
1) After fitting bearings (16) and (26) thoroughly, measure the starting force at hole (h) of axle housing (14).
   - Starting force: **49.0 – 93.1 N {5 – 9.5 kg} (Front, rear)**
   - ★ Do not install planetary carrier (20) at this time.
   - ★ The starting force shall include the sealing resistance.



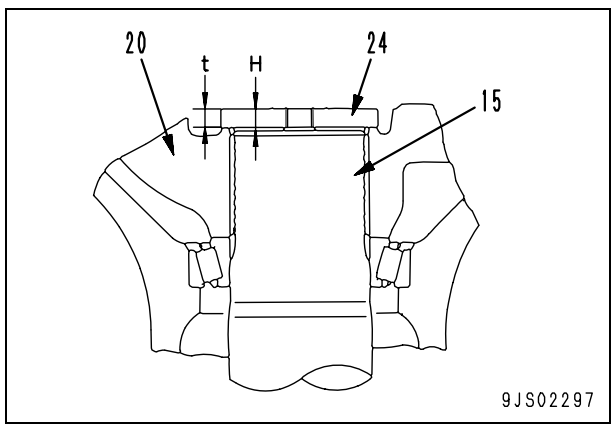
★ If the starting force is less than the standard value, press fit the bearings again and repeat the work of step 1).

★ If the starting force exceeds the standard value, adjust it according to the following procedure.

2) Sling axle shaft and housing assembly (8) 20 – 30 mm by installing wire ropes to 2 parts, similarly to installation of the axle housing.
3) While rotating axle shaft (15), hit the flange with a copper hammer in the direction of the arrow several times to drive out axle shaft (15) from axle housing (14).
4) Repeat step 1) so that the starting torque will be in the standard range.

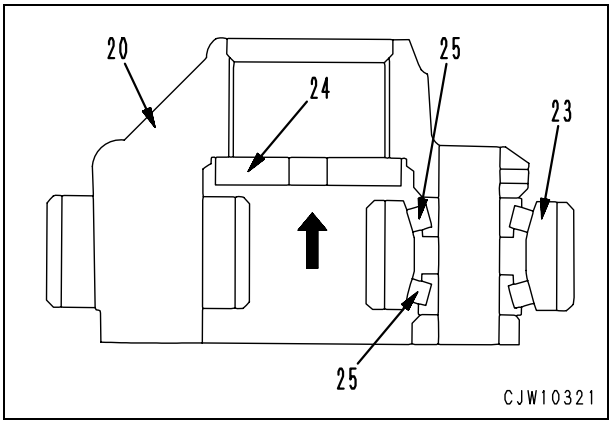


5) Install planetary carrier (20) to the spline of axle shaft (15) without the gear and place spacer (24) on it.
   - ★ Just place spacer (24) on planetary carrier (20). Do not bolt it.
6) Using a depth micrometer, measure distance (H) from the end of spacer (24) to the end of the axle shaft.
   Set the value obtained by subtracting thickness (t) of spacer (24) from dimension (H) as (H – t).
   - Thickness of shim:
     (H – t) = 1.05 ± 0.5 mm
7) After deciding the thickness of the shim, remove spacer (24) and planetary carrier (20).

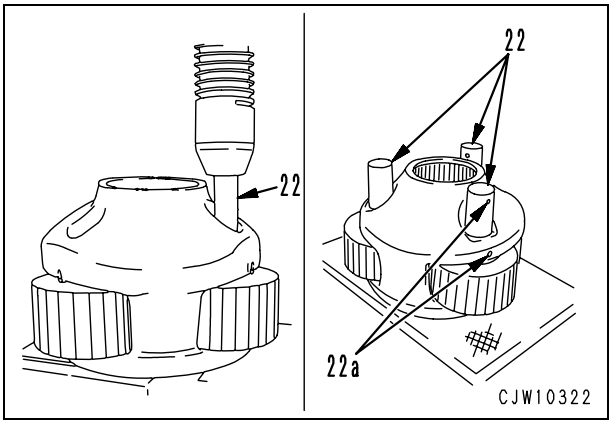


4. Planetary carrier

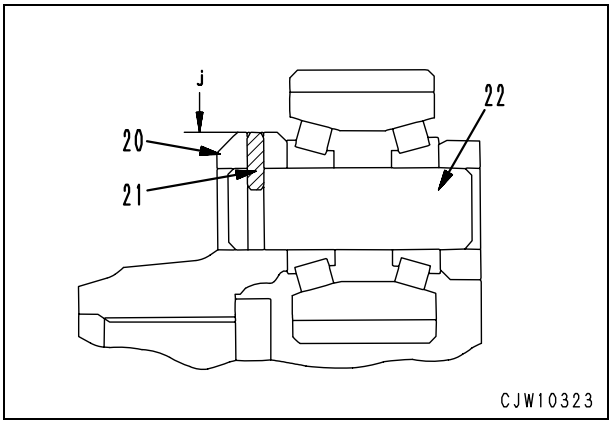
1) Install spacer (24) in planetary carrier (20) in advance.
   ★ Insert the spacer from the brake housing side.
2) Install bearing (25) to gear (23), raise spacer (24), and install gear (23).



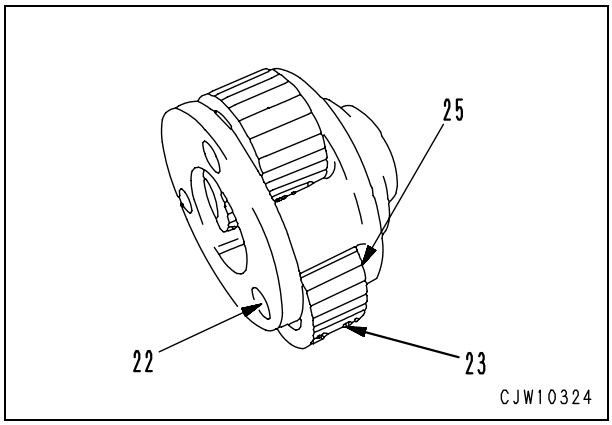
3) While matching shafts (22) to spring pin holes (22a), press fit them.
   Shaft: **Oil (Axle oil)**



   ★ Match the hole of shaft (22) to the hole of spring pin (21) and drive spring pin (21) so that it will be flush with planetary carrier (20). (part j)



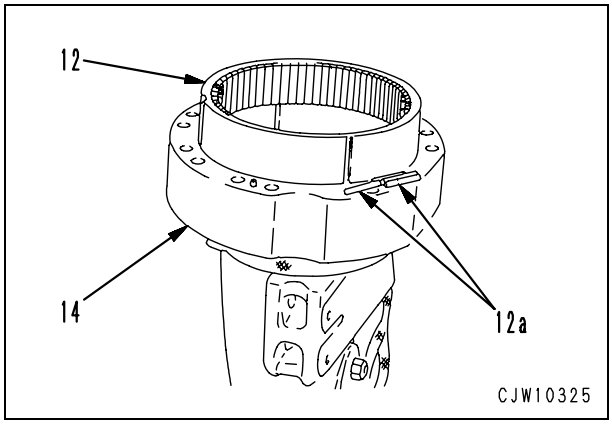
4) Hit the end of shaft (22) and the differential side of gear (23) lightly to push back bearing (25) and check that the gear rotates smoothly.



5. Ring gear

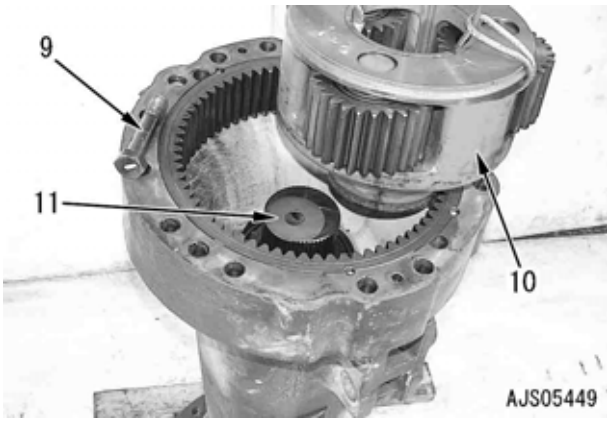
Press fit ring gear (12) to axle housing (14) and insert pins (12a).

★ Match the pin holes of the housing and ring gear.
★ Press fit the ring gear horizontally and do not lean it.

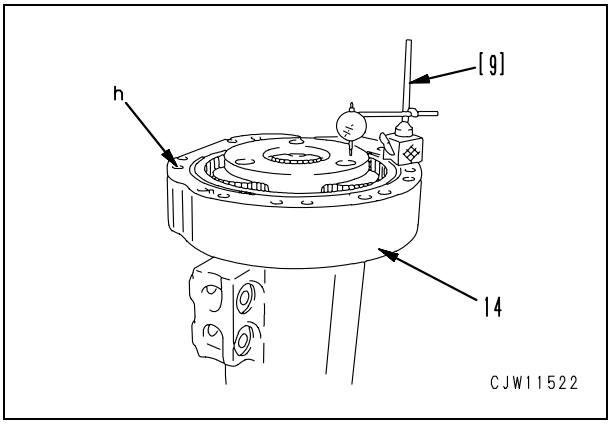


6. Planetary carrier assembly

1) Install shim (11) selected in steps 3.-6) to the end of the axle shaft.
2) Install planetary carrier assembly (10) and tighten mounting bolts (9).
   ★ Degrease and clean the bolt holes of the axle shaft and mounting bolts.
   ⚠ **When installing the planetary carrier, take care not to catch your fingers in the gear.**
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt:
   662 – 829 Nm {67.5 – 84.5 kgm}
   ★ Clean the shaft end and planetary carrier spline thoroughly before installing.

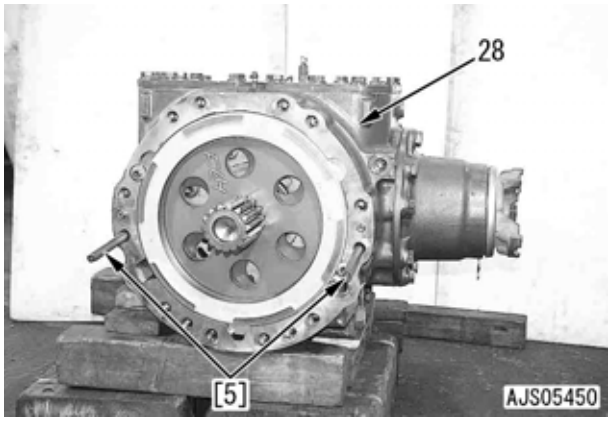


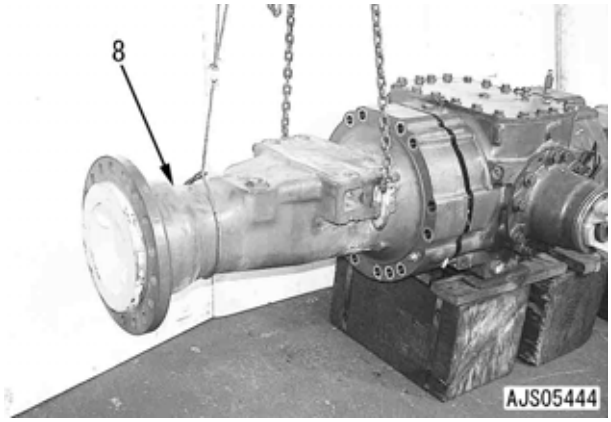
3) After fitting the bearing thoroughly, measure starting force at hole (h) of axle housing (14).
   ★ See step 3, Selection of shim.
4) Install stand [9] of a dial gauge to axle housing (14) and measure the end play of the planetary carrier.
   ★ Reference value
   End play of planetary carrier:
   0 – 0.1 mm



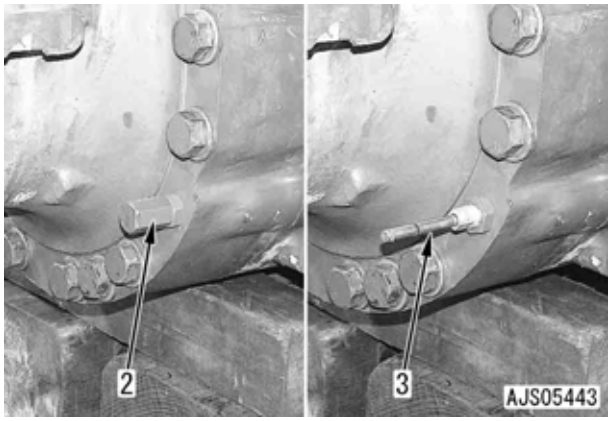
7. Axle housing assembly

1) Degrease and clean the mating faces of axle housing (8) and differential housing (28) and apply gasket sealant all over them.
   Mating faces of housings:
   Gasket sealant (LOCTITE 515)
2) Install guide bolts [5] to differential housing (28).
3) Sling axle housing assembly (8) horizontally and install it carefully, matching it to the spline grooves and guide bolts [5].
   ★ Take care not to damage the plate surface.





4) Install and tighten the axle housing mounting bolts in the diagonal order.
   Mounting bolt:
   490 – 608 Nm {50 – 62 kgm}
5) Install brake wear gauge (3) and cap (2).
   Cap: **29.4 – 39.2 Nm {3.0 – 4.0 kgm}**



8. Refilling with oil

1) Tighten the drain plug and add oil through the oil filler to the specified level.
   Axle oil (Each of front and rear):
   40 ℓ
2) Remove the oil plug and check that the oil level is near the lower rim of the plug hole.

Disassembly and assembly of differential assembly

Special tools

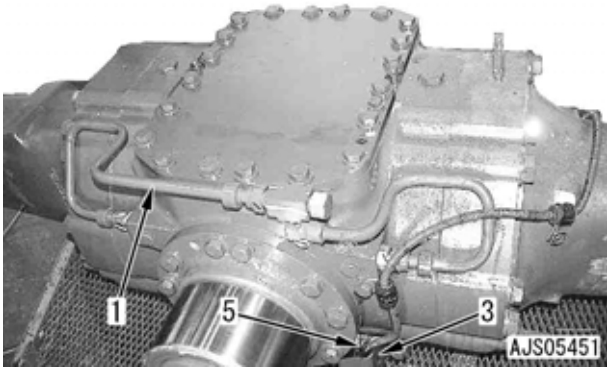
Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
H1	1	790-501-5000 or 790-501-5200	Unit repair stand	●	1		
	2	790-901-2110	Bracket	●	1		
	3	790-901-1331	Plate	●	1		
H2	1	790-301-1720	Adapter	■	1		
	2	799-101-5002	Hydraulic kit	■	1		
	3	793-605-1001	Brake tester	■	1		
	4	790-101-1102	Hydraulic pump	■	1		

Disassembly

★ The following photos and illustrations show the front differential as an example, unless otherwise specified.
★ The front differential and rear differential have different outside shapes but have the same internal structure.

1. Brake piping
Disconnect tube (1).

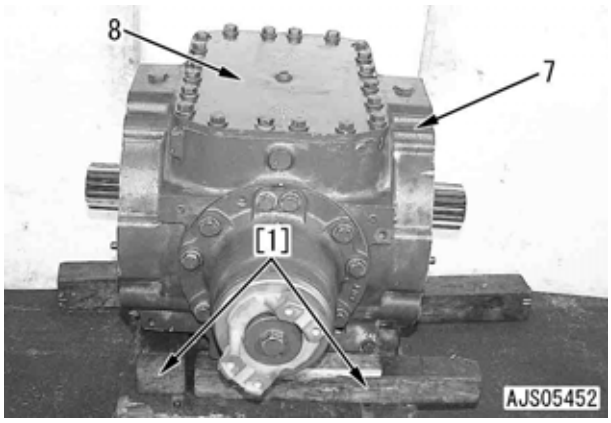
2. Oil temperature sensor (Rear differential)
1) Remove cover (3).
2) Disconnect the connector and remove oil temperature sensor (5).



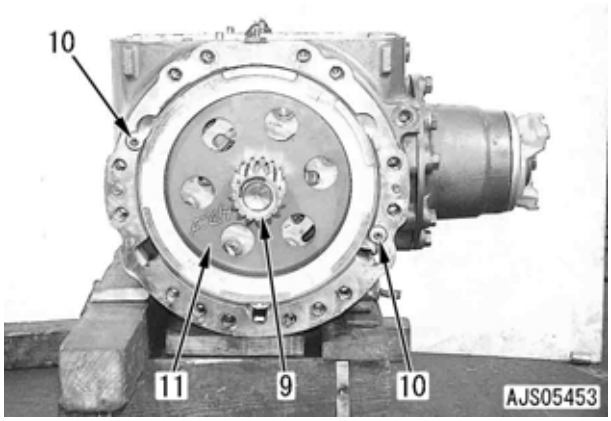
3. Axle housing assembly
Remove the axle housing assembly. For details, see “Disassembly and assembly of axle housing assembly”.

4. Differential assembly
Place and stabilize differential assembly (7) on blocks [1] (or install it to tool **H1**).
★ When using tool **H1**, remove the cage assembly, referring to step 7.

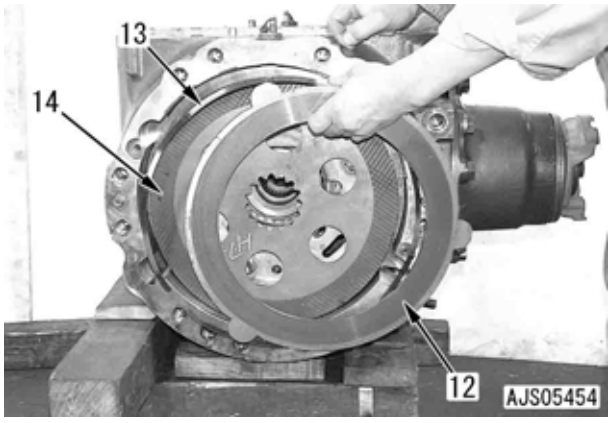
5. Cover
Remove cover (8).



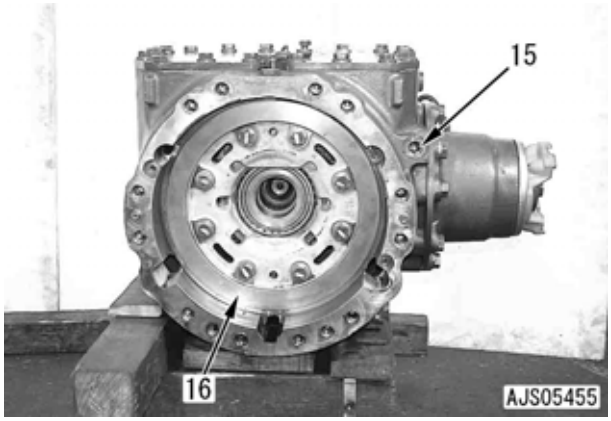
6. Brake
1) Remove shaft (9).
2) Remove bolts (10) and outer plate (11).



3) Remove plate (12), spring (13), and disc (14).
★ Make match marks on the parts on the right and left side so that they will not be mixed up.

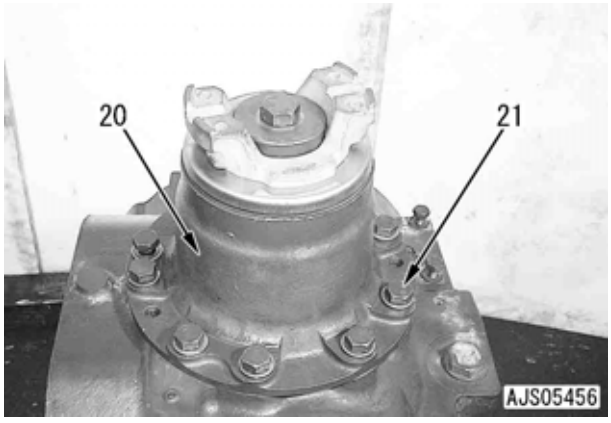


4) Supply compressed air into brake tube joint (15) to remove piston (16).

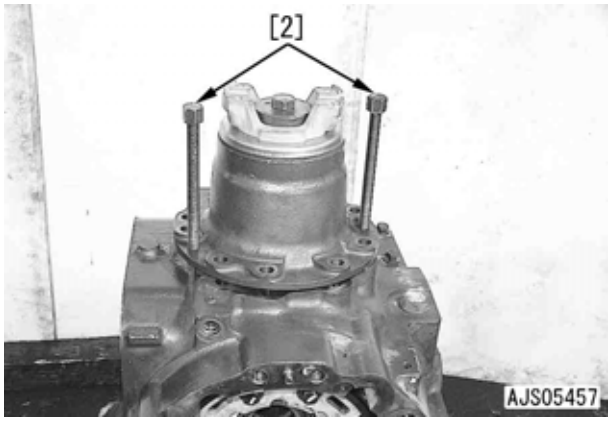


7. Cage assembly

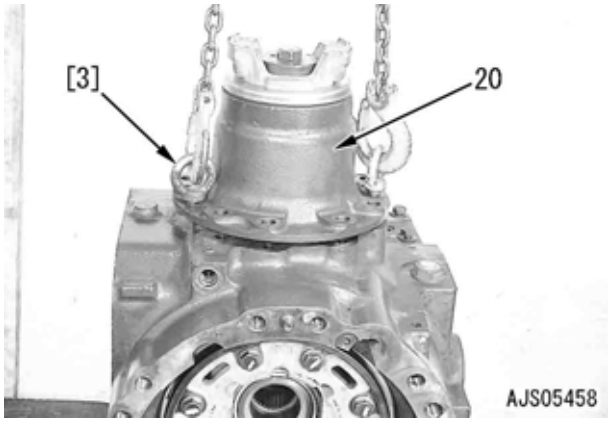
1) Sling the differential case and set the cage assembly up.
2) Remove mounting bolts (21) of cage assembly (20).



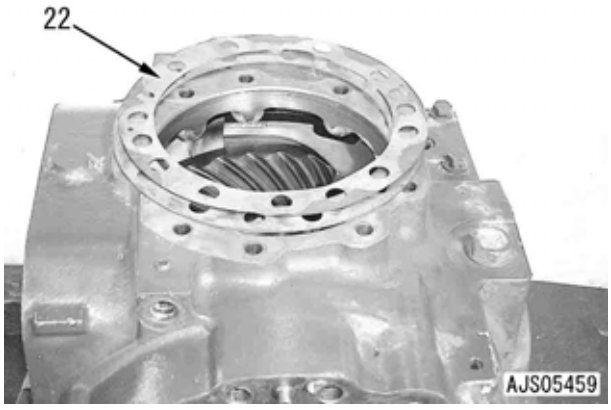
3) Tighten forcing screws [2] and pull out the cage assembly until the O-ring is seen.



4) Using eyebolts [3], lift off cage assembly (20).
★ Make match marks on the cage and differential case for assembly.

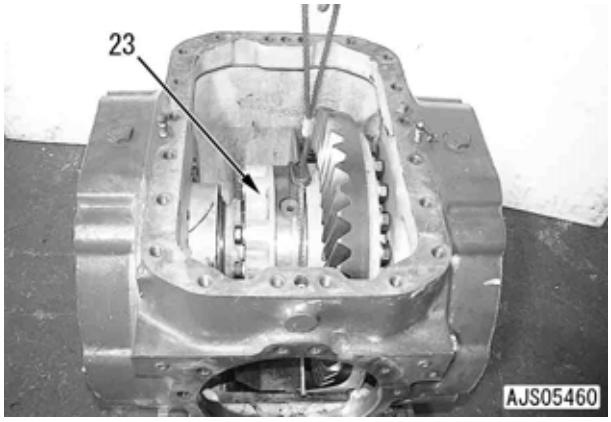


5) Remove shim (22).
★ Take a record of the thickness and quantity of the shim for assembly.

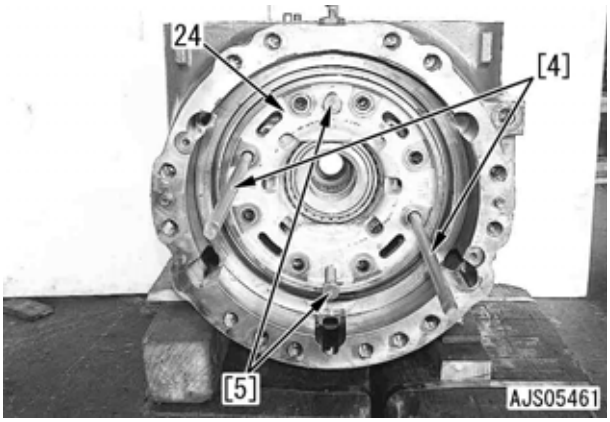


8. Bearing carrier

1) Sling differential carrier assembly (23) temporarily.

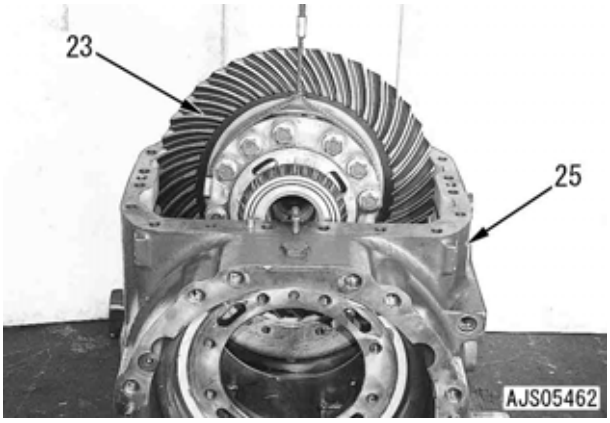


2) Remove all the bearing carrier mounting bolts and install guide bolts [4].
3) Tighten forcing screws [5] to remove bearing carrier (24).
   ★ Bearing carriers so that they will not be mixed up.
   ★ Take a record of the thickness and quantity of the shim for assembly.

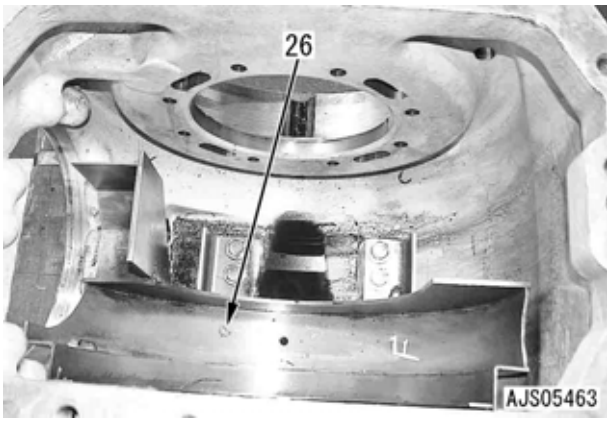


9. Differential carrier assembly

1) Remove differential carrier assembly (23) from differential case (25).
   ★ Take care that the sling will not come off.



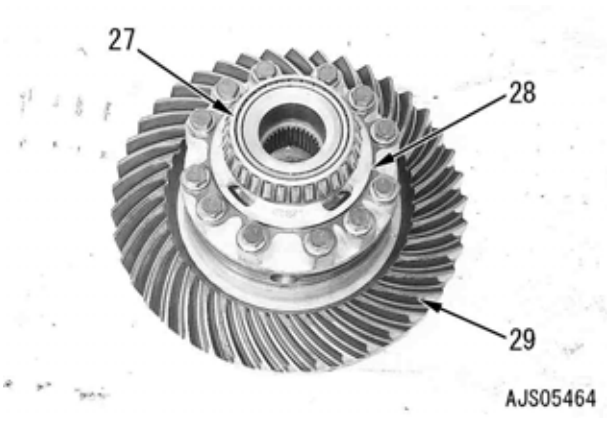
2) Remove oil receiver (26) from the differential case.



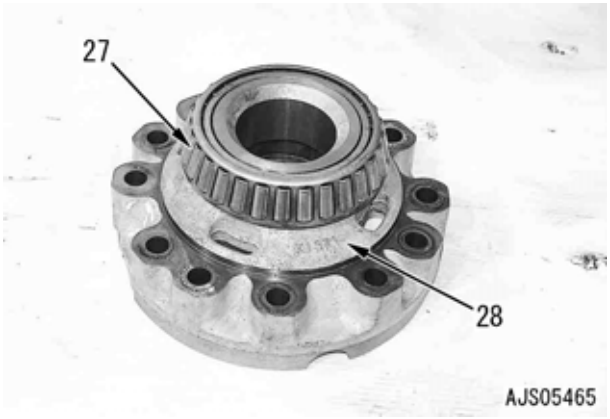
10. Disassembly of differential carrier assembly

★ Make marks on the right and left parts so that they will not be mixed up.

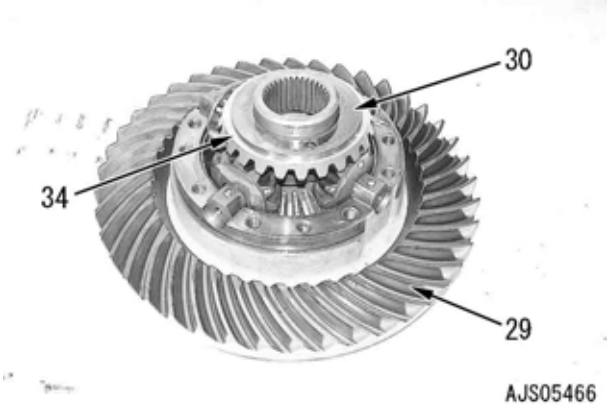
1) Remove bearing (27) and plain half cover (28) together.
   ★ Make match marks on plain half cover (28) and bevel gear and flange half assembly (29).



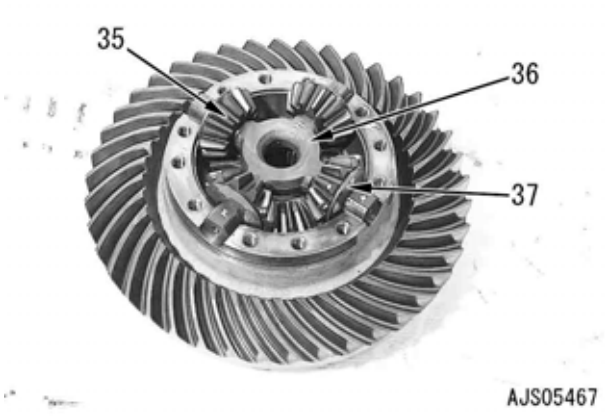
2) Remove bearing (27) from plain half cover (28).



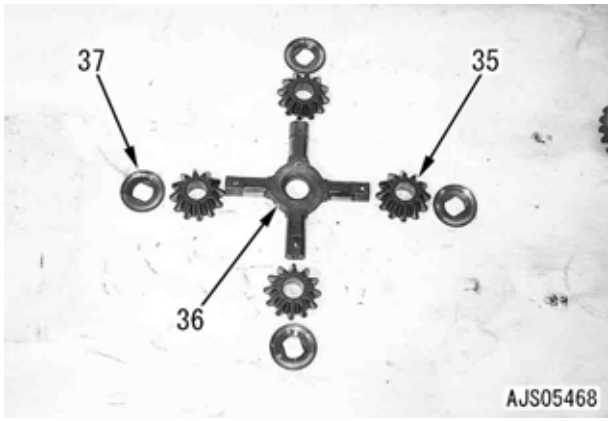
3) Remove thrust washer (30) from bevel gear and flange half assembly (29) and remove side gear (34).



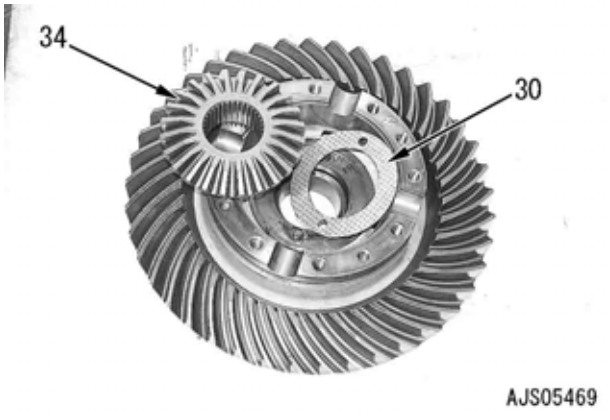
4) Remove pinion gear (35), spider shaft (36), and spherical bushing (37) together.



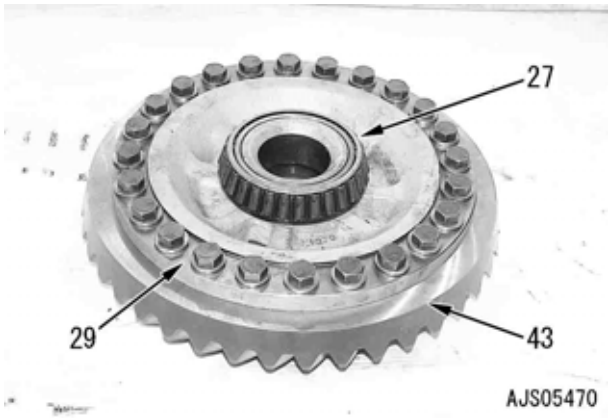
5) Remove spherical washer (37) and pinion gear (35) from removed spider shaft (36).



6) Remove side gear (34) and thrust washer (30).

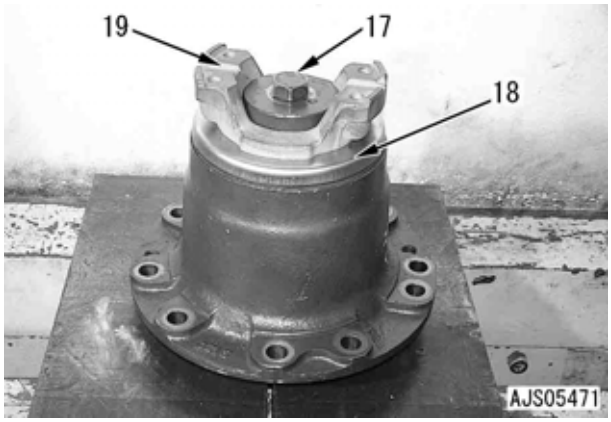


7) Reverse bevel gear and flange half assembly (29) and remove bevel gear (43) and bearing (27).

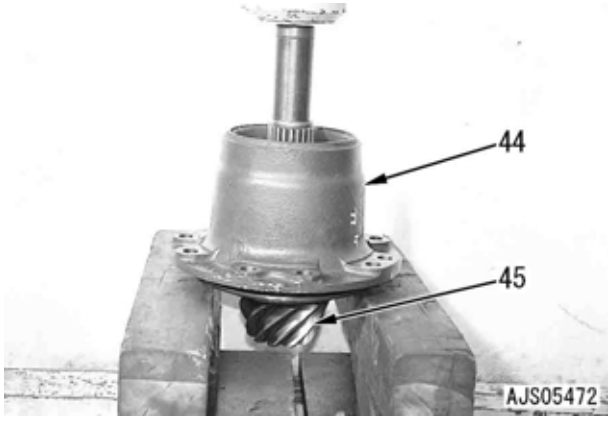


11. Pinion gear and cage

1) Remove bolt (17) and remove protector (18) and coupling (19) together.
   ★ Remove the protector from the coupling only when necessary.

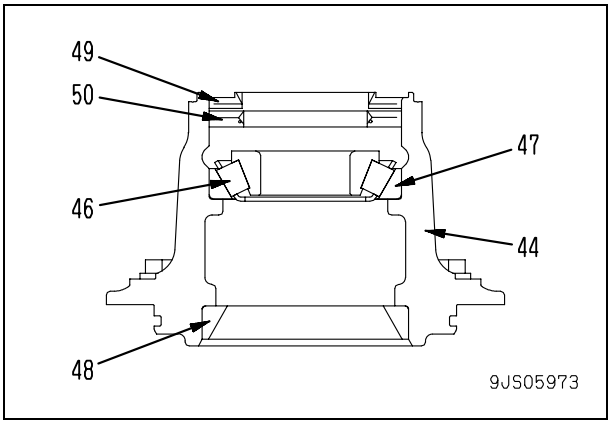


2) Using a press, pull pinion gear (45) out of cage (44).

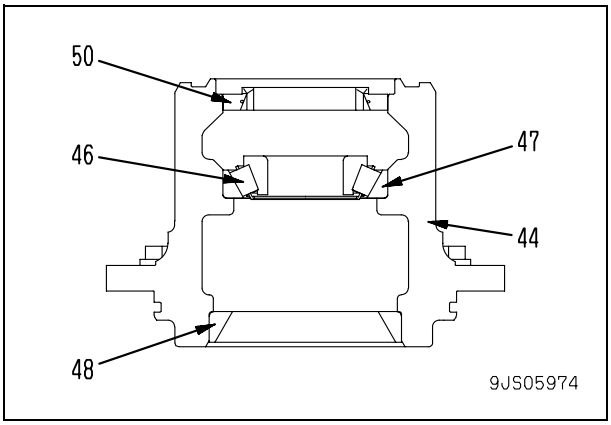


3) Remove dust seal (49), oil seal (50), bearing (46), and outer races (47) and (48) from cage (44).
★ The dust seal is installed to only the front side.

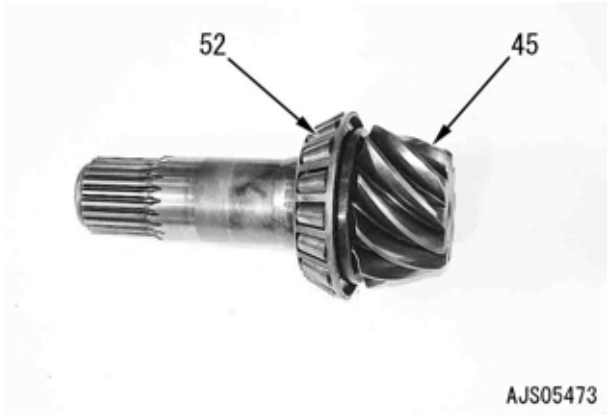
Front



Rear



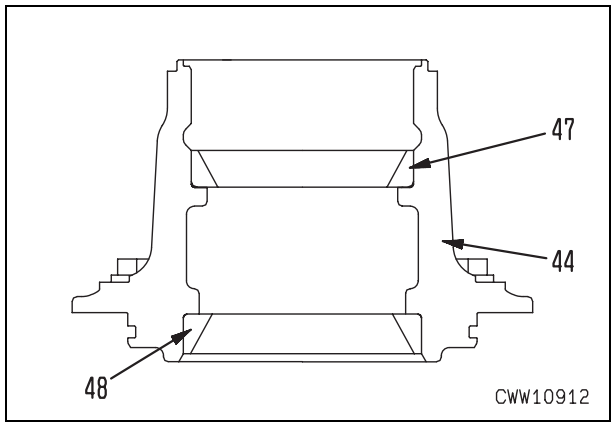
4) Remove bearing inner race (52) from pinion gear (45).



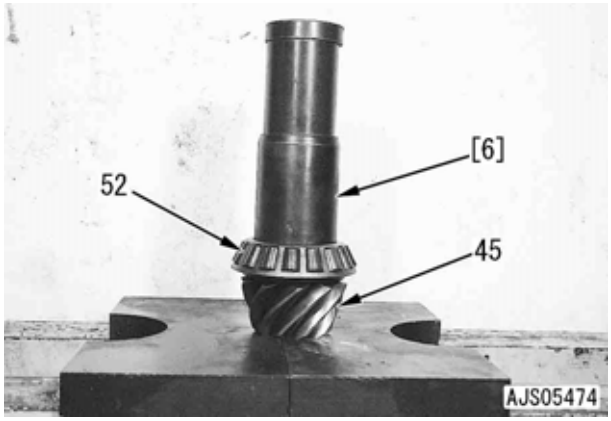
Assembly

1. Pinion gear and cage

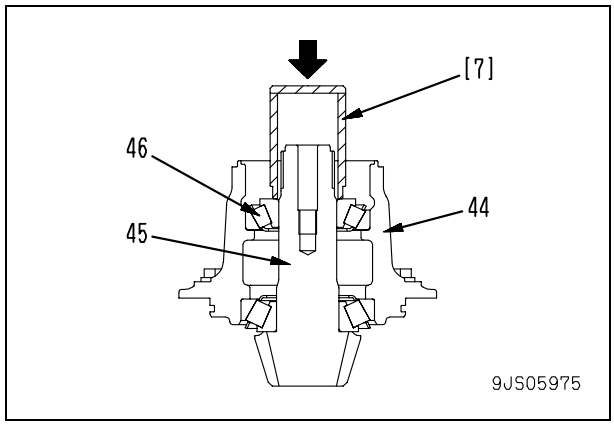
1) Install bearing outer races (47) and (48) to cage (44).



2) Using tool [6], press fit bearing inner race (52) to pinion gear (45).



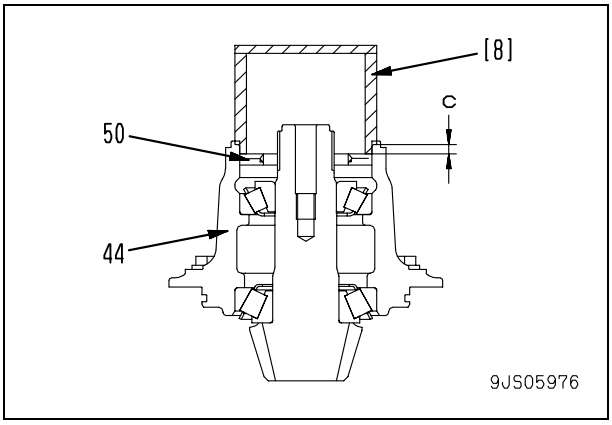
3) Erect pinion gear (45) and install cage (44).
4) Using tool [7] and rotating cage (44), press fit bearing (46) to the pinion gear.
★ Apply axle oil to the bearing inner race.



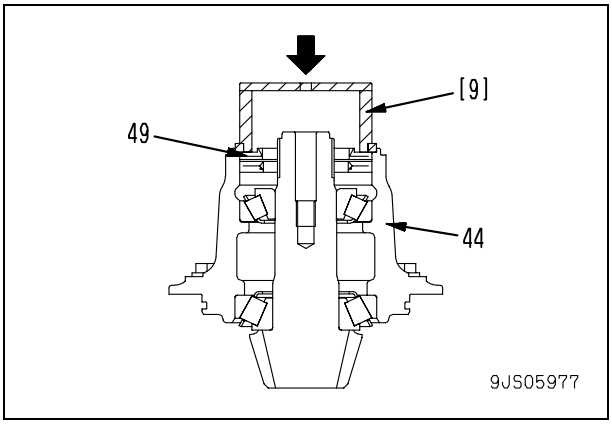
2. Oil seal and dust seal

Front side

1) Using tool [8], press fit oil seal (50) to cage (44).
   ★ Check that dimension (c) is 10 ± 0.5 mm.
   Oil seal lip: **Grease (G2-LI)**



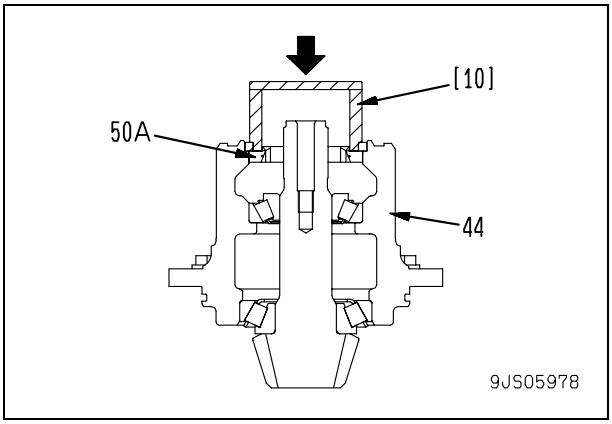
2) Using tool [9], press fit dust seal (49) to cage (44) until it is flush with the end of cage.
   Dust seal lip: **Grease (G2-LI)**



Rear side

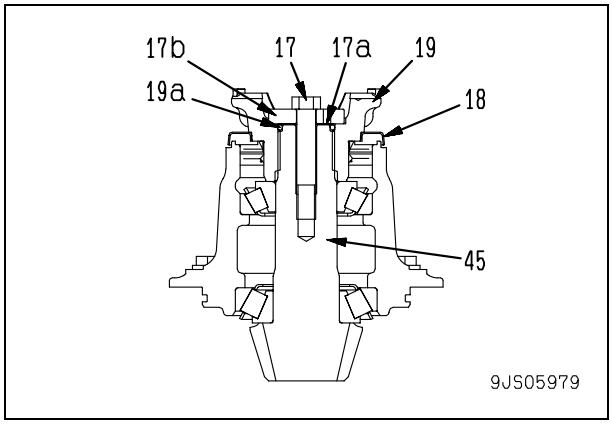
- Using tool [10], press fit oil seal (50A) to cage (44) until it is flush with the end of cage.

Oil seal lip: **Grease (G2-LI)**



3. Coupling

1) Install coupling (19), O-ring (19a), shim (17a), and holder (17b) to pinion gear (45) and tighten mounting bolt (17).
   ★ Tighten mounting bolt (17) temporarily at this time and tighten it permanently after adjusting the shim.
   ★ When inserting coupling (19), take care extremely not to damage the seal.
   Coupling mounting bolt: **Adhesive (LT-2) (for permanent tightening)**
   Coupling mounting bolt: **490 – 608 Nm {50 – 62 kgm} (for permanent tightening)**



2) Select shim (17a) so that the preload and end play will be as follows.
   ★ Set the thicker shim on the holder side.

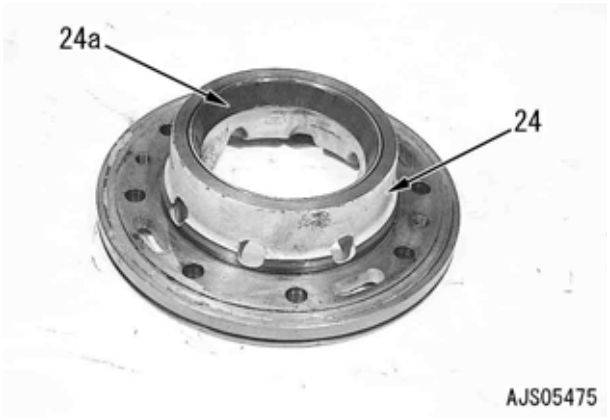
   Front side
   Preload: **0 – 3,920 N {0 – 400 kg}**
   End play: **0 – 0.08 mm**

   Rear side
   Preload: **0 – 2,650 N {0 – 270 kg}**
   End play: **0 – 0.08 mm**

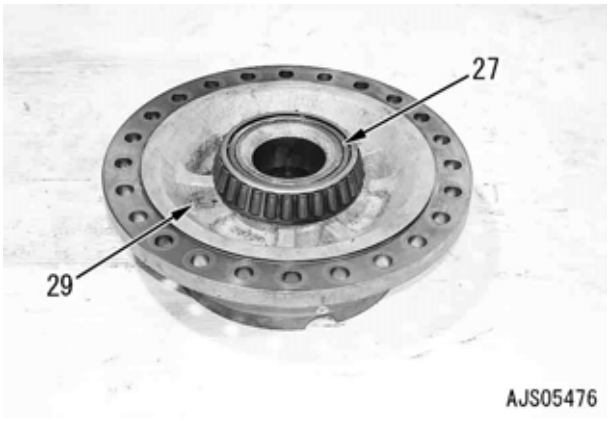
4. Assembly of differential carrier assembly

★ Assemble the parts on the right and left sides according to the marks made when they were removed.

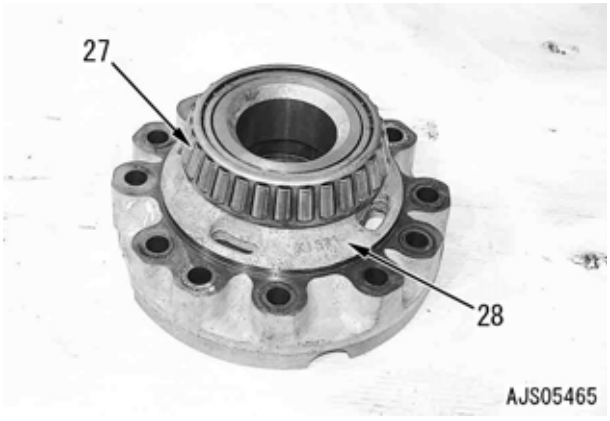
1) Press fit bearing outer races (24a) to right and left bearing carrier (24) until they are stopped.



2) Press fit bearing (27) to flange half (29).

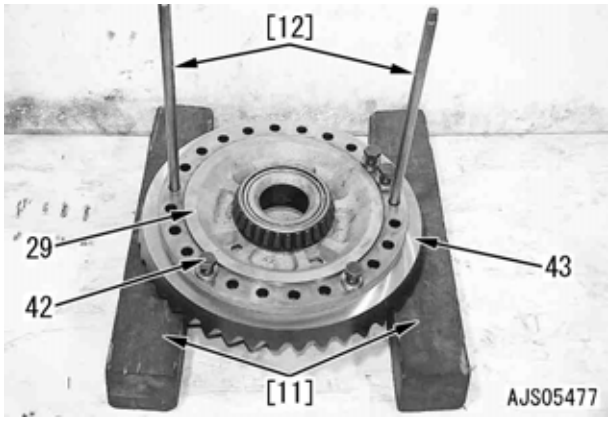


3) Press fit bearing (27) to plain half cover (28).



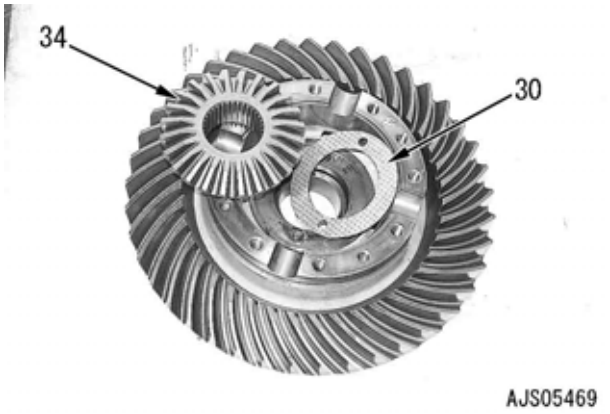
4) Place bevel gear (43) on blocks [11] with the gear side down.
5) Install guide bolts [12] to bevel gear (43).
6) Lift down flange half (29), install it to bevel gear (43), and tighten bevel gear mounting bolts (42).

Mounting bolt: **Adhesive (LT-2)**
Mounting bolt:
157 – 196 Nm {16 – 20 kgm}

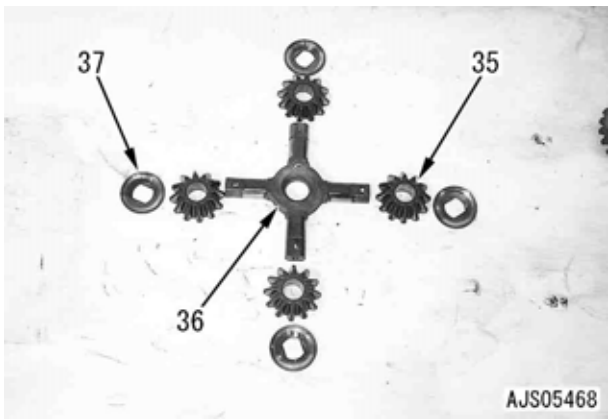


7) Install thrust washer (30) and side gear (34).

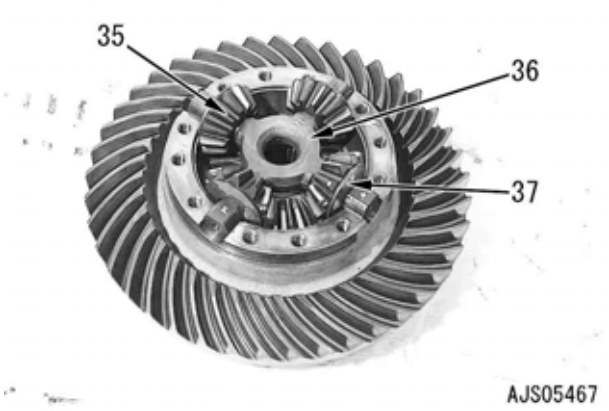
★ Install the thrust washer with the thrust face up.



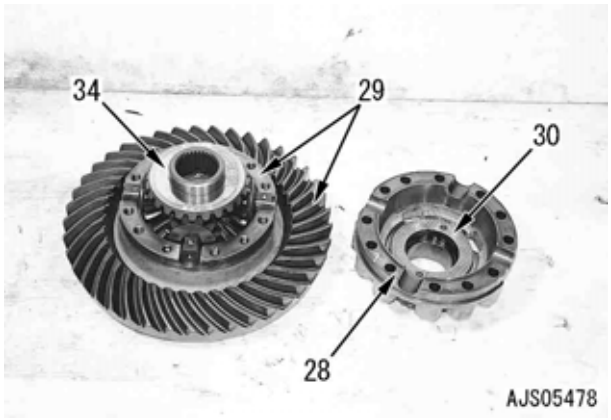
8) Install pinion gear (35) and spherical washer (37) to spider shaft (36).



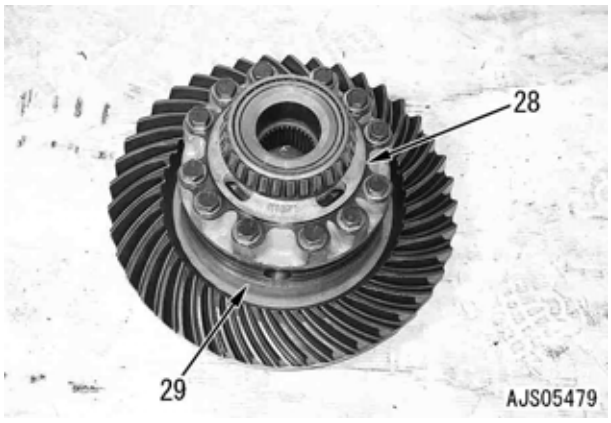
9) Install spider shaft (36), pinion gear (35), and spherical bushing (37).



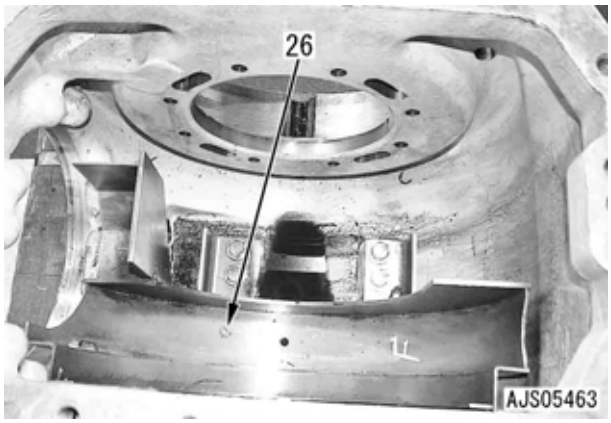
10) Install side gear (34) to bevel gear and flange half assembly (29).
11) Coat thrust washer (30) with grease and stick it to plain half cover (28), matching it to the dowel pin of the plain half cover, so that it will not fall when assembled.
★ Install the thrust washer with the thrust face up.
Thrust washer: **Grease (G2-LI)**
★ Take care not to apply too much grease.



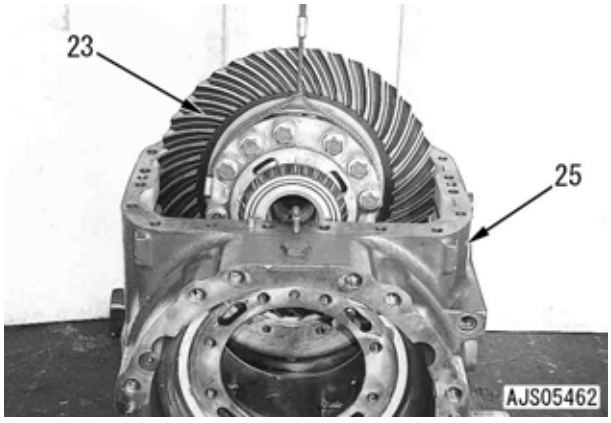
12) Install plain half cover (28) to flange half (29).
★ Combine these parts according to the match marks made when removed.
Mounting bolt:
157 – 196 Nm {16 – 20 kgm}



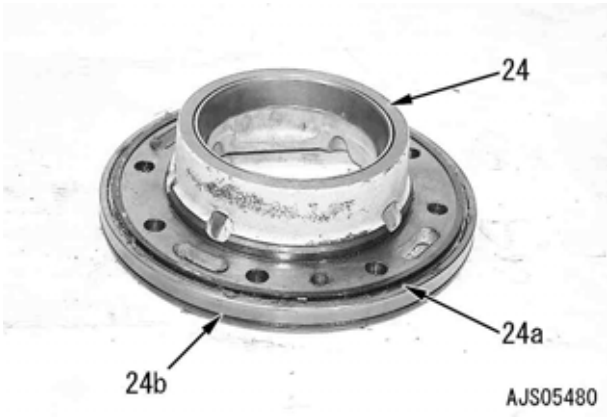
5. Gear cover
Install oil receiver (26) to the differential case.



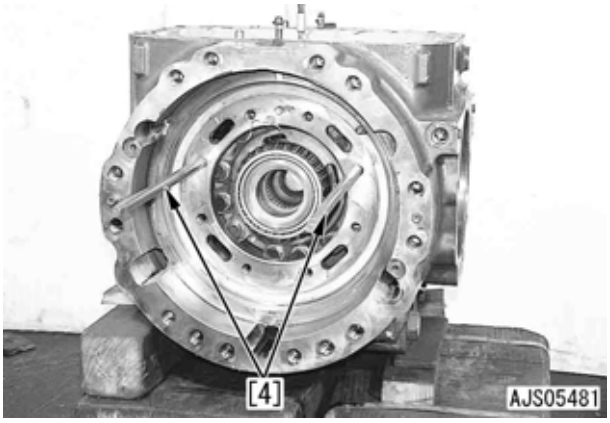
6. Adjusting bearing carrier shim
1) Sling differential carrier assembly (23) and set it to the mounting portion of differential case (25).



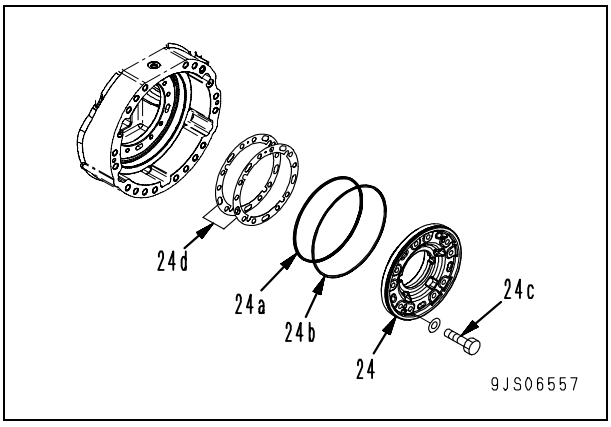
2) Install O-ring (24a) and seal (24b) to right and left bearing carriers (24).



3) Install guide bolts [4] to the right and left bearing cage mounting holes of the differential case.



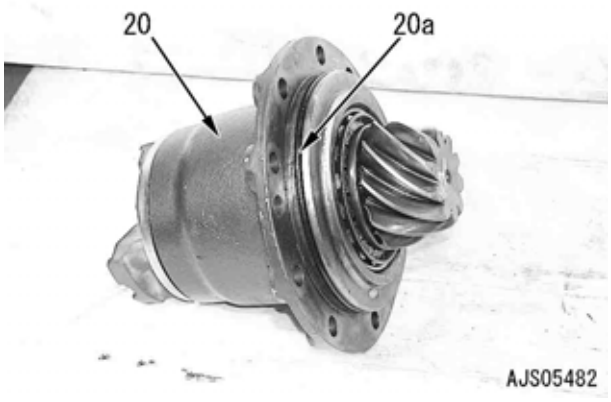
4) Install removed shims (24d) to right and left bearing carriers (24) and then install the bearing carriers and tighten mounting bolts (24c).
   ★ While rotating the bevel gear, tighten the mounting bolts.
   Bearing: **Axle oil**
   Mounting bolt:
   157 – 196 Nm {16 – 20 kgm}



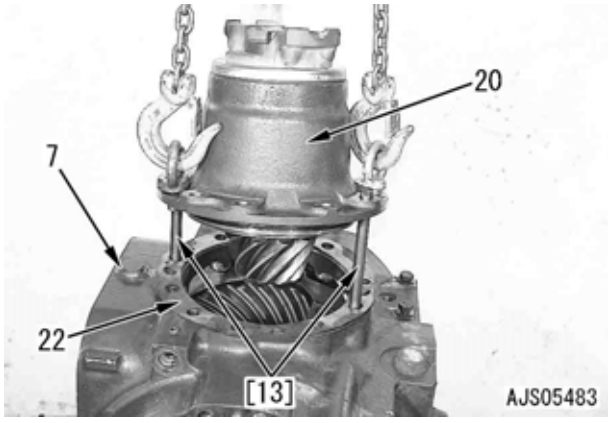
5) Select shims (24d) to obtain the following preload.
   Preload: **4.9 – 12.74 kN {500 – 1,300 kg}**
   ★ Divide the shim between the right and left so that the normal backlash at the outside diameter of the bevel gear will be 0.25 – 0.41 mm.
   ★ The dispersion of the backlash measured at 3 places on the periphery must not exceed 0.1 mm.
   ★ The shim thickness after adjustment must be 0.3 – 1.25 mm on each side.

7. Cage assembly

1) Fit O-ring (20a) to the groove of cage assembly (20).
   O-ring: **Oil (Axle oil)**
   ★ Apply oil thinly.

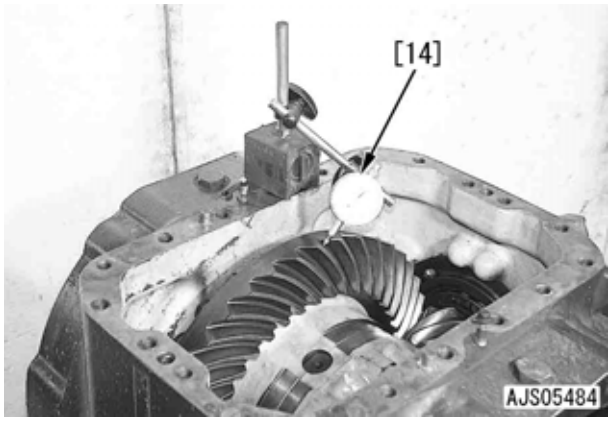


2) Install guide bolts [13] to differential carrier assembly (7), insert removed shim (22), and install cage assembly (20).
   Mounting bolt:
   245 – 309 Nm {25 – 31.5 kgm}

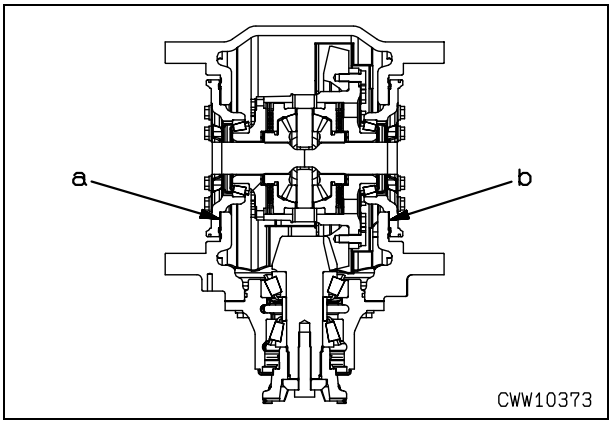


8. Adjusting backlash

1) Measure the backlash of the bevel gear with dial gauge [14].
   - ★ Standard backlash: **0.25 – 0.41 mm**
   - ★ Measure the backlash at 3 places on the periphery of the bevel gear and check that its dispersion does not exceed 0.1 mm.
   - ★ The shim thickness after adjustment must be 0.3 – 1.25 mm on each side.



2) Adjust the backlash to the standard range by moving a part of the shims on either side to the opposite side.
   - ★ Do not change the total thickness of the shims on both sides.
   - ★ If the backlash is too large, move a part of shim (b) to shim (a).
   - ★ If the backlash is insufficient, move a part of shim (a) to shims (b).



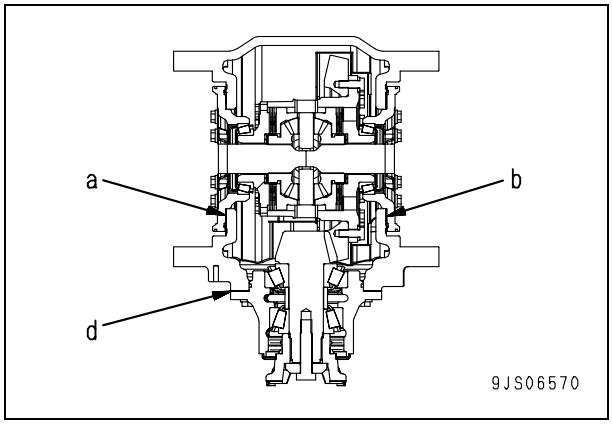
9. Testing tooth contact

1) Knead red lead and spindle oil and apply the mixture to the surfaces of 7 – 8 teeth of the bevel gear.
2) While holding the bevel gear with the hand to brake it, rotate the pinion gear in the forward and reverse directions, and then check the tooth contact pattern made on the bevel gear.
   - ★ The tooth contact must be as follows.
   - ● The contact area must start at about 5 mm from the toe toward the heel around the pitch line and must be 50% of the whole tooth surface.

10. Adjusting tooth contact

If the obtained tooth contact pattern is not proper, adjust the tooth contact according to the following procedure.

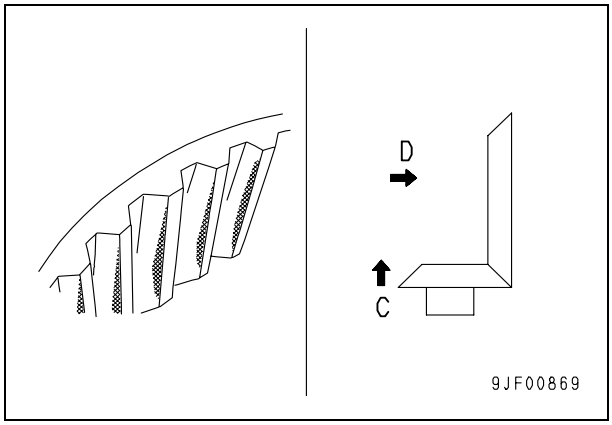
- ★ Adjust the tooth contact by increasing or decreasing shims (a) and (b) (to move the bevel gear) and shim (d) (to move the pinion gear).
- ★ Do not change the total thickness of shims (a) and (b) to prevent a change of the preload on the bearing.
- ★ After adjusting the tooth contact, check the backlash again.



If the pinion gear is too far from the bevel gear

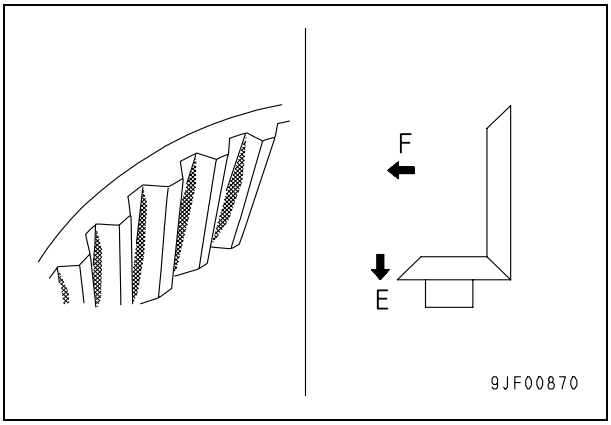
★ The tooth contact pattern is as follows.

1) Decrease shim (d) to move the pinion gear in direction (C).
2) Adjust shims (a) and (b) to move bevel gear in direction (D).



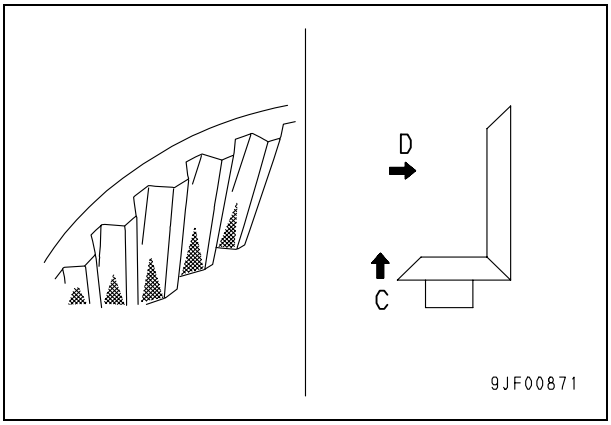
If the pinion gear is too close to the bevel gear

★ The tooth contact pattern is as follows.
1) Increase shim (d) to move the pinion gear in direction (E).
2) Adjust shims (a) and (b) to move bevel gear in direction (F).



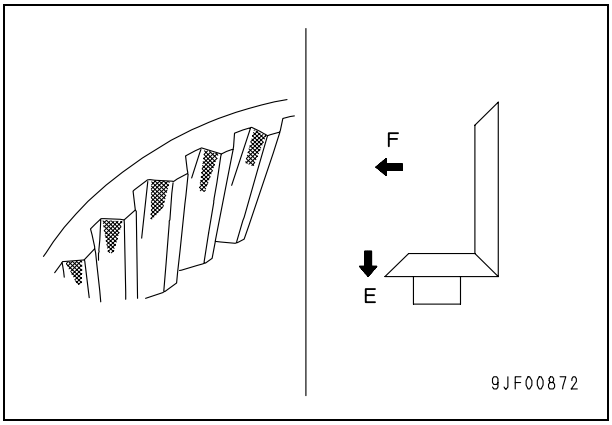
If the bevel gear is too close to the pinion gear

★ The tooth contact pattern is as follows.
1) Decrease shim (d) to move the pinion gear in direction (C).
2) Adjust shims (a) and (b) to move bevel gear in direction (D).



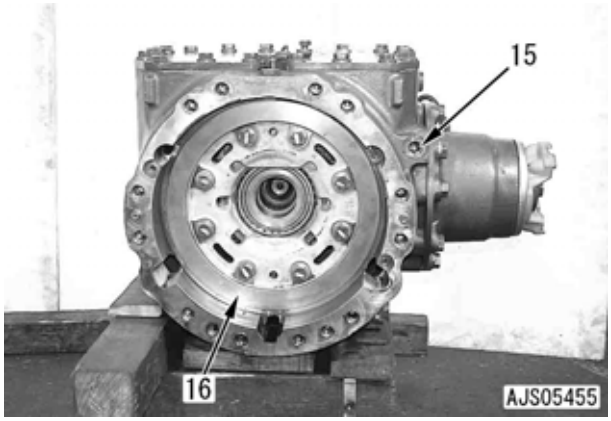
If the bevel gear is too far from the pinion gear

★ The tooth contact pattern is as follows.
1) Increase shim (d) to move the pinion gear in the direction (E).
2) Adjust shims (a) and (b) to move the bevel gear in direction (F).

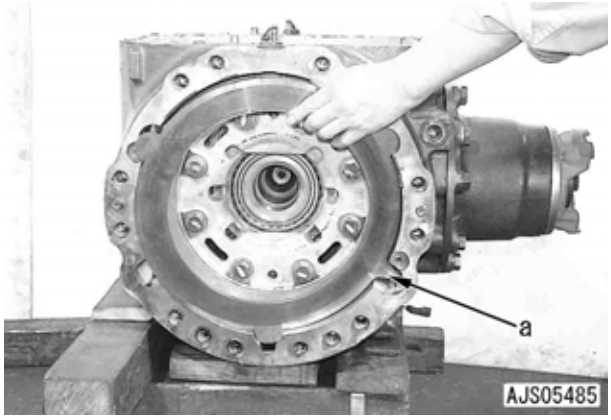


11. Brake

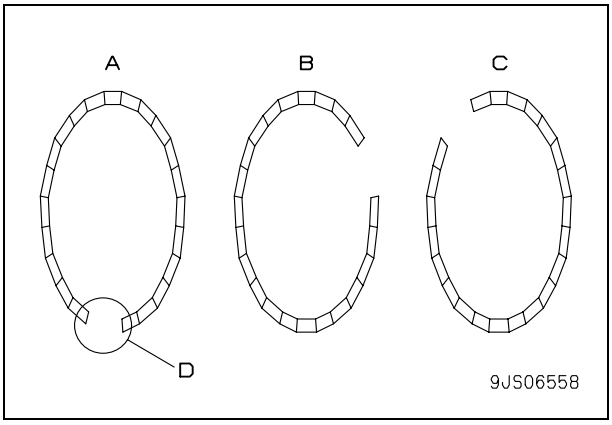
1) Install the seal to piston (16) and install them to the differential and carrier assembly.
★ Part (15) is the brake tube joint.



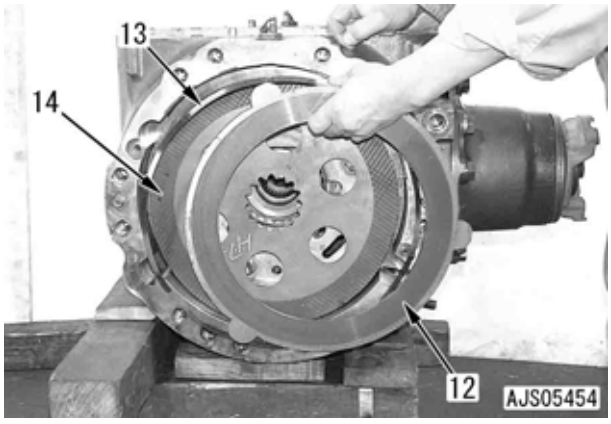
2) Install plate (12), spring (13), and disc (14) in order.
★ First, insert the plate on the piston side having face “a” which will be in contact with the wear gauge.



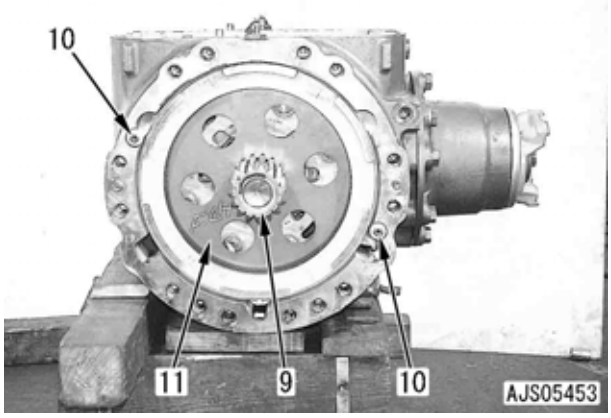
★ The springs must be shifted from each other by 120° in the circumferential direction.



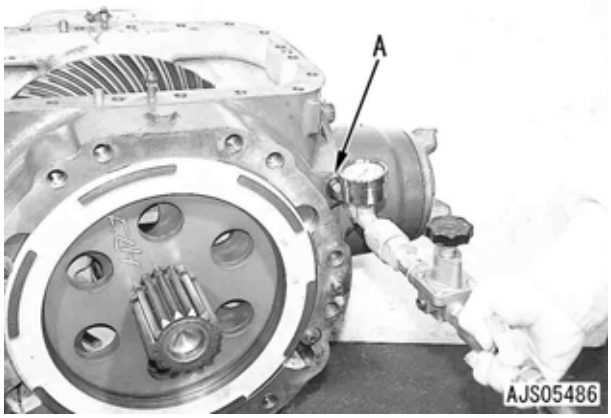
A: 1st line
B: 2nd line
C: 3rd line
D: Opening of spring



3) Install outer plate (11) and shaft (9) and tighten bolts (10).



4) Supply compressed air into brake oil port (A) to fit the piston.

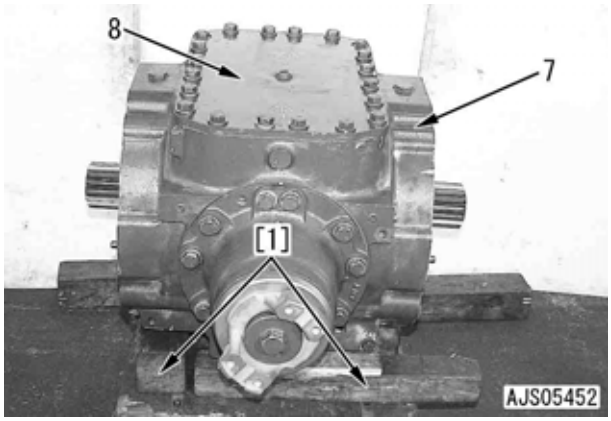


12. Cover

Install cover (8) to differential case (7).

Cover mounting face:
Gasket sealant (LOCTITE 515)

Mounting bolt:
157 – 196 Nm {16 – 20 kgm}

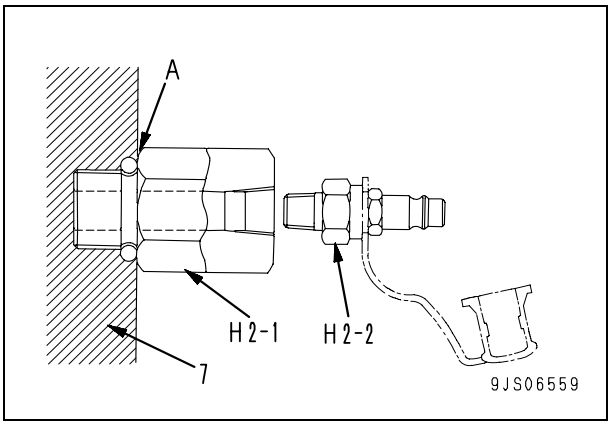


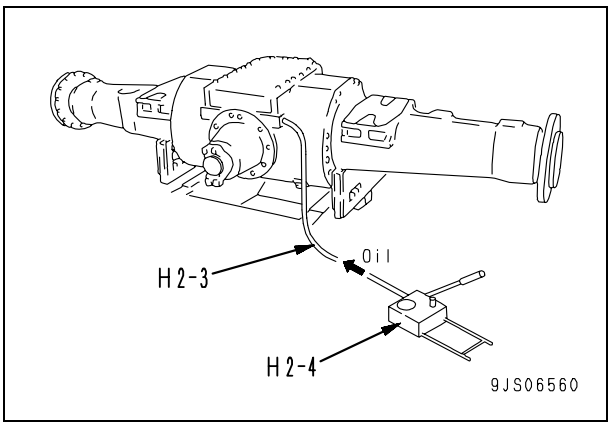
13. Axle housing

Install the right and left axle housing assemblies. For details, see “Disassembly and assembly of axle housing”.

14. Testing brake oil leakage

1) Install tools **H2-1** and **H2-2** to brake tube adapter (A) of differential case (7) and bleed air from the cylinder.
2) Operate tool **H2-4** to raise the pressure to 98 kPa {1.0 kg/cm^2}.
   ★ Leave the system at 98 kPa {1.0 kg/cm^2} for 5 minutes and check that the pressure does not lower at all.
3) If oil leakage is not detected by the above test, raise the pressure to 4.9 MPa {50 kg/cm^2}.
   ★ Leave the system at 4.9 MPa {50 kg/cm^2} for 5 minutes and check that the pressure does not drop more than 98 kPa {1.0 kg/cm^2}.
   ★ If the oil leaks, remove the brake piston and check the O-rings and seals for damage, and then install them again.



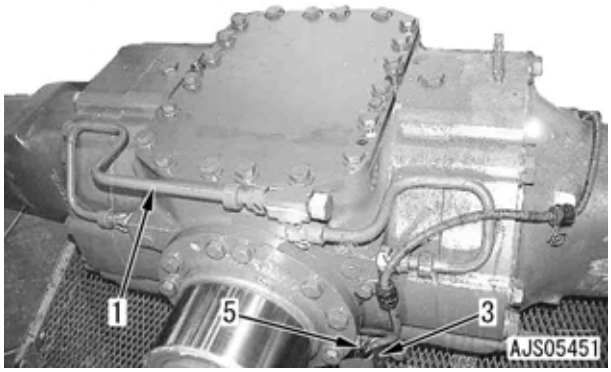


15. Oil temperature sensor (rear differential)

1) Install oil temperature sensor (5) and connect the connector.
   Threaded portion of oil temperature sensor: **Gasket sealant (LG-5)**
   Oil temperature sensor: **29.4 – 49.0 Nm {3 – 5 kgm}**
2) Install cover (3).

16. Brake piping

1) Install tube (1).



17. Refilling with oil

Tighten the drain plug and add oil through the oil filler to the specified level.

Axle oil: **40 ℓ**

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

50 Disassembly and assembly

Steering system

Steering system 2
Removal and installation of steering demand valve assembly 2

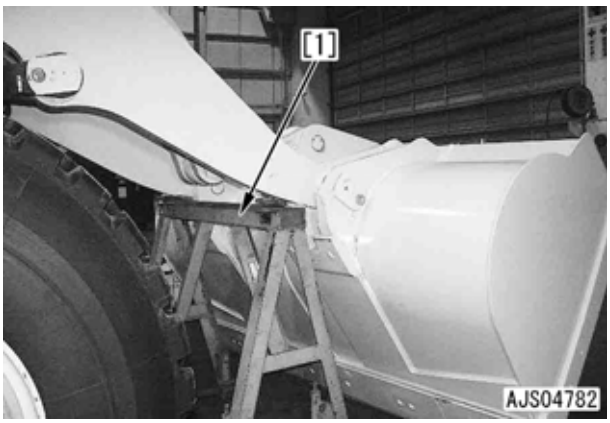
Steering system

Removal and installation of steering demand valve assembly

Removal

⚠ **Stop the machine on a level place, steer it to the "left" fully, apply the parking brake, stop the engine, and lock the tires with chocks.**

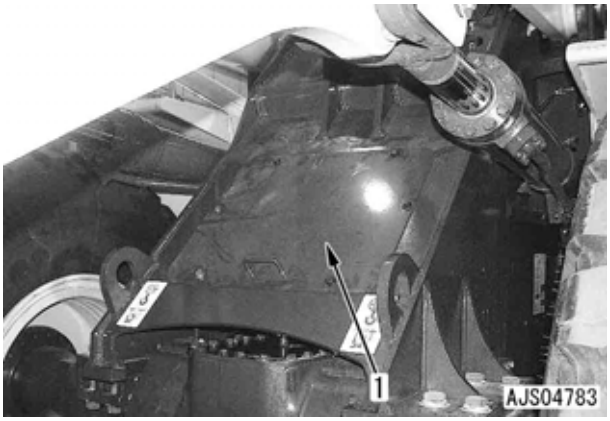
⚠ **Set the bucket in the dump position and support the lift arm with block [1].**



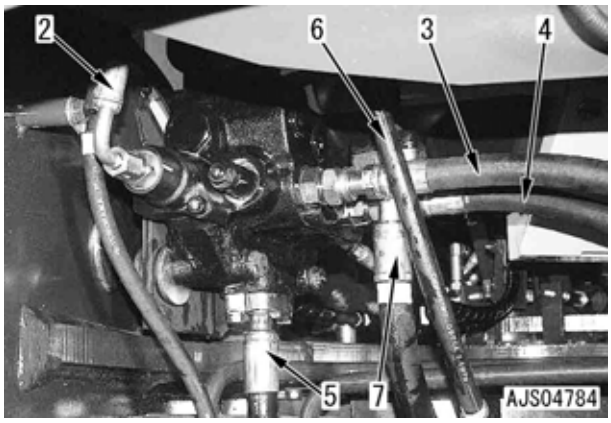
1. Drain the oil from the hydraulic tank.

   Hydraulic tank: **139 ℓ**

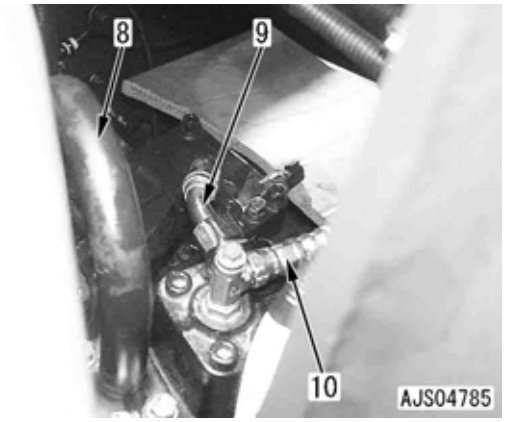
2. Remove cover (1) from the front of the machine.



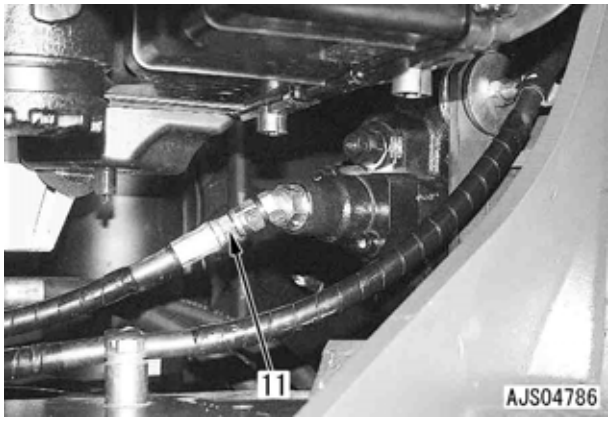
3. Disconnect the following hoses from the steering demand valve.
   - Hose (2) connected to stop valve
   - Hoses (3) and (4) connected to steering cylinder
   - Drain hoses (5) and (6)
   - Hose (7) connected to steering pump



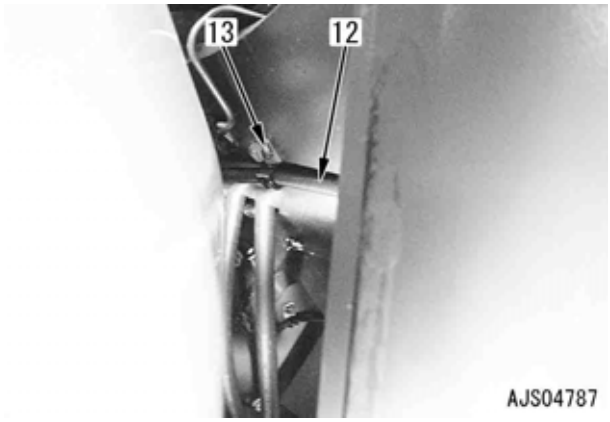
   - Tube (8) connected to steering pump
   - Hoses (9) and (10) of steering valve port (Pr)



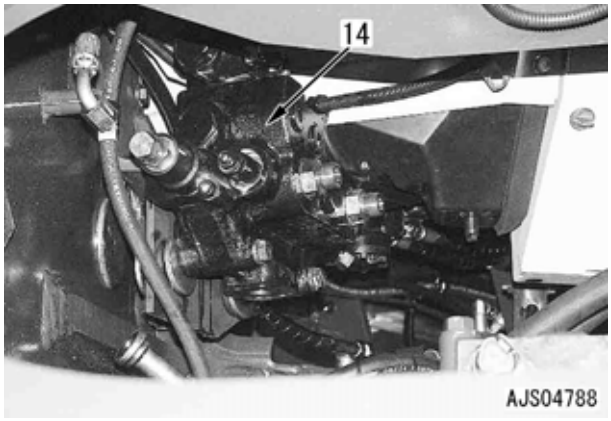
   - Hose (11) connected to stop valve



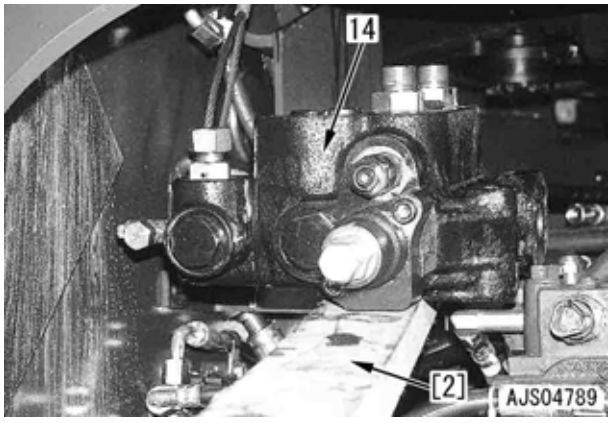
4. Remove clamp (13) of front frame wiring (12).
   ★ Move the wiring aside so that it will not interfere with the wires when the steering demand valve is slung.



5. Sling steering demand valve (14) temporarily with wires between the operator's cab and front frame and remove the 3 mounting bolts.
   [*1]



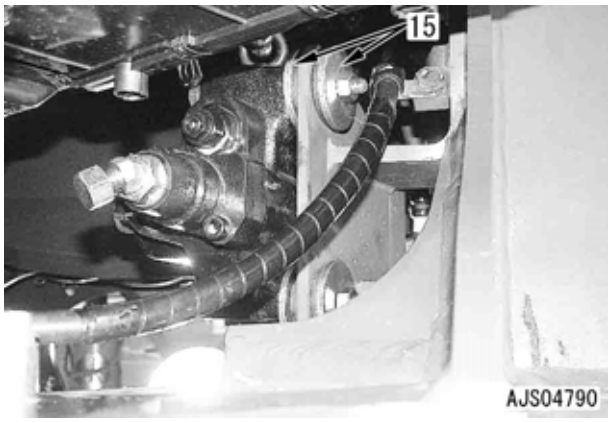
6. Lower steering demand valve (14) onto wood bars etc. and remove it by pulling it to this side.
   ★ Prepare wood bars in advance.
   Steering demand valve assembly: **30 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]
★ Be sure to fit washers (15) to the steering demand valve mounting bolts.



- **Refilling with oil (Hydraulic tank)**
  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.
  Hydraulic tank: **139 ℓ**

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

50 Disassembly and assembly

Brake system

Brake system 2
Removal and installation of parking brake discs and plates..... 2

Brake system

Removal and installation of parking brake discs and plates

Removal

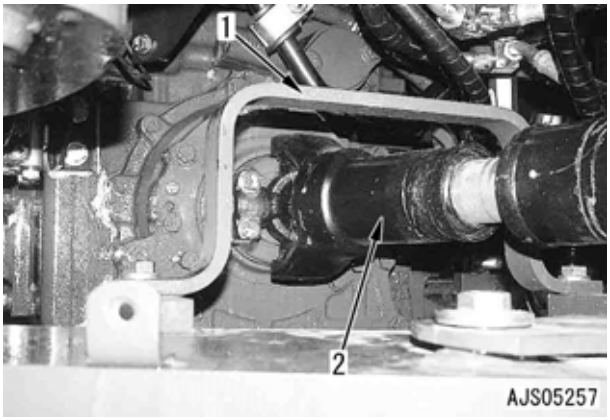
⚠ **Stop the machine on a level place and set the safety bar to the frame.**

⚠ **Lower the work equipment to the ground, stop the engine, and lock the tires with chocks.**

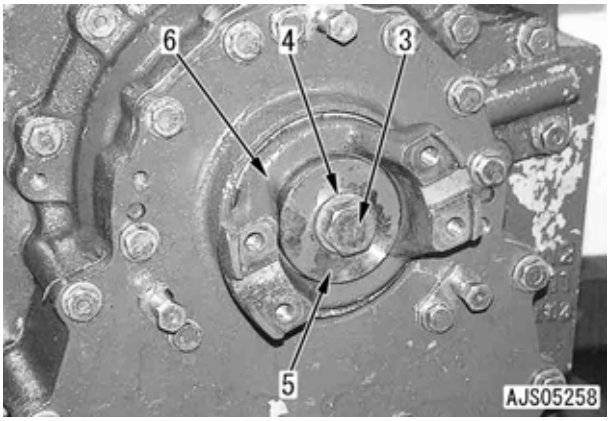
1. Drain the oil from the transmission.

   Transmission case: **38 ℓ**

2. Remove guard (1) and disconnect center drive shaft (2) from the transmission. [*1]

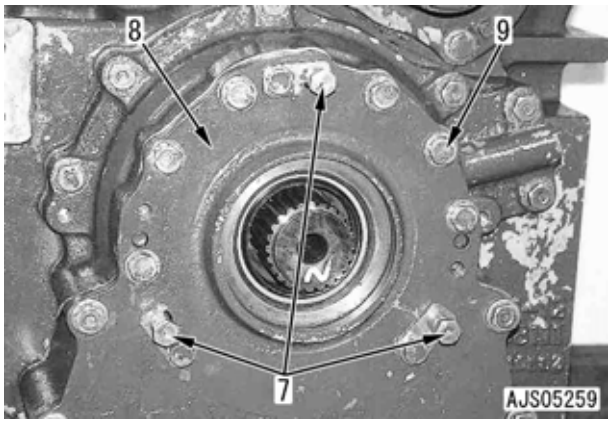


3. Remove bolt (3), washer (4), holder (5), and coupling (6). [*2]

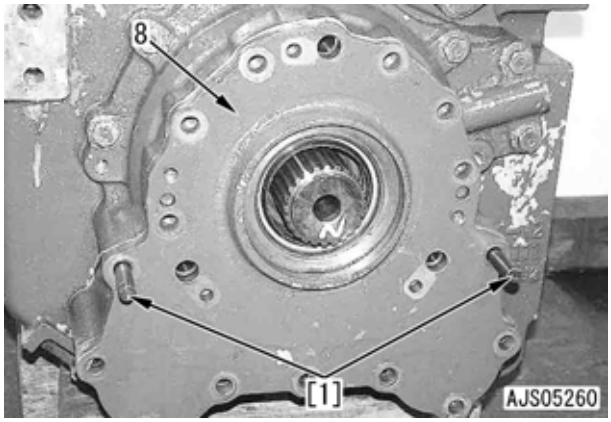


4. Remove 3 emergency reset bolts (7). [*3]
   ★ Since the bolts are pushed back by the brake spring, loosen them evenly.

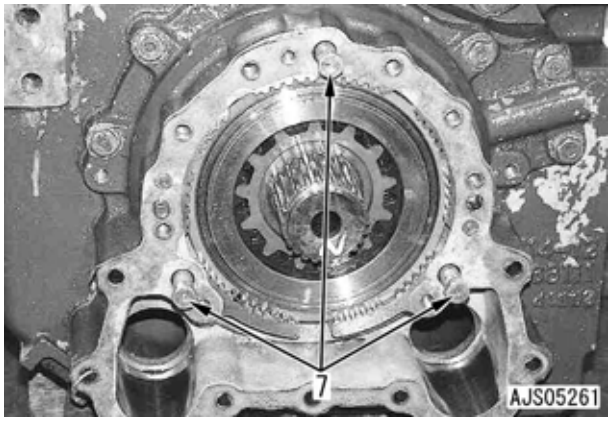
5. Remove 15 mounting bolts (9) of cover (8). [*4]



6. Install 2 guide bolts [1] and remove cover (8).

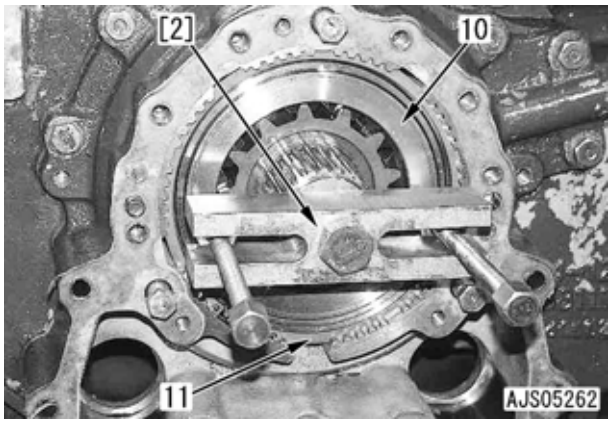


7. Tighten 3 emergency reset bolts (7) again.
   ★ Tighten the bolts evenly to push in the brake spring.
   ⚠ **Never loosen the emergency reset bolts during the following work.**

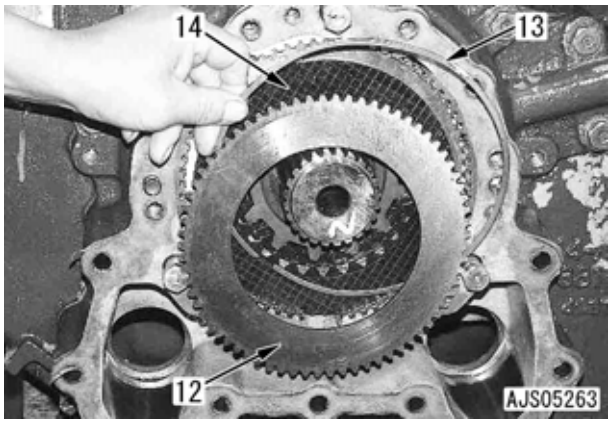


8. Using tool [2], push end plate (10).

9. Remove snap ring (11) and end plate (10).



10. Remove plates (12), springs (13), and discs (14). [*5]
    ★ Plate: 9 pieces, Spring: 8 pieces, Disc: 8 pieces



Installation

- Carry out installation in the reverse order to removal.

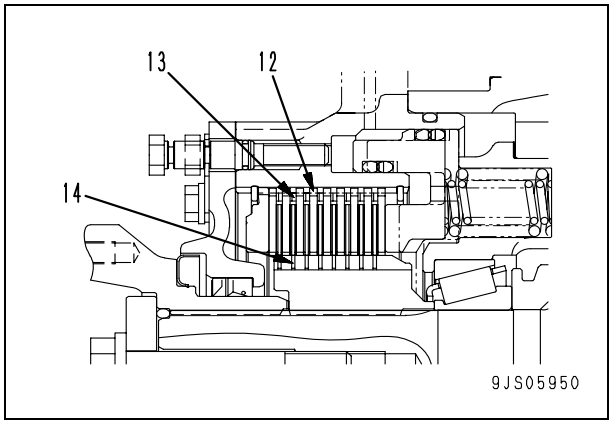
[*1]
★ When installing the drive shaft, check that the key of the spider cap is fitted to the key way of the mating yoke and then tighten the mounting bolts.
Drive shaft mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}

[*2]
★ When installing the coupling, install the O-ring, holder, washer, and bolt.
Coupling mounting bolt: **Adhesive (LT-2)**
Coupling mounting bolt:
490 – 608 Nm {50 – 62 kgm}

[*3]
Emergency reset bolt:
59 – 74 Nm {6 – 7.5 kgm}

[*4]
Cover mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}

[*5]
★ Install plate (12), spring (13), and disc (14) in order.
★ Take care that spring (13) will not be caught.



Refilling with oil

- Supply oil into the transmission case through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.
  Transmission case: **38 ℓ**

★ When replacing a part other than the disc and plate, see “Disassembly and assembly of parking brake assembly”.

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 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 10

Undercarriage and frame

Removal and installation of center hinge pin

Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
D	1	790-101-2300	Push puller	■	1		
	2	793-520-2370	Push tool	■	1		
	3	793-520-2350	Push tool	■	1		
	4	793-520-2540	Guide	■	1		
	5	793-520-2360	Bar	■	2		
	6	790-101-1102	Hydraulic pump	■	1		
	7	790-101-2102	Puller (294.2 kN {30 ton})	■	1		

Removal

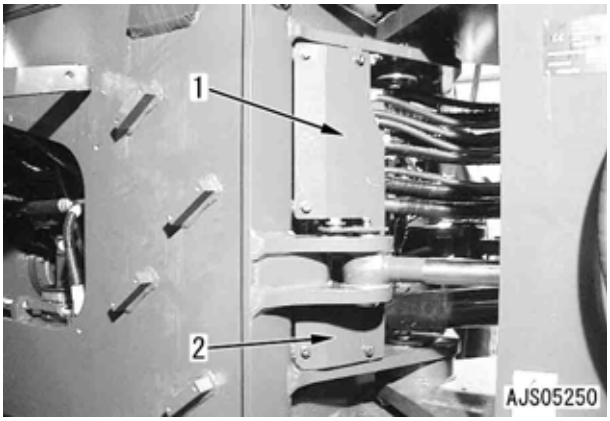
⚠ **Stop the machine on a level place and lower the bucket to the ground.**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Remove the work equipment assembly. For details, see “Removal and installation of work equipment assembly”.

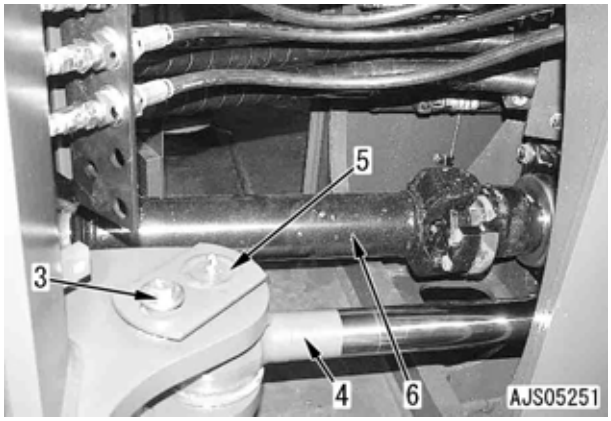
2. Remove the operator's cab and floor frame assembly. For details, see “Removal and installation of operator's cab and floor frame assembly”.

3. Remove covers (1) and (2).

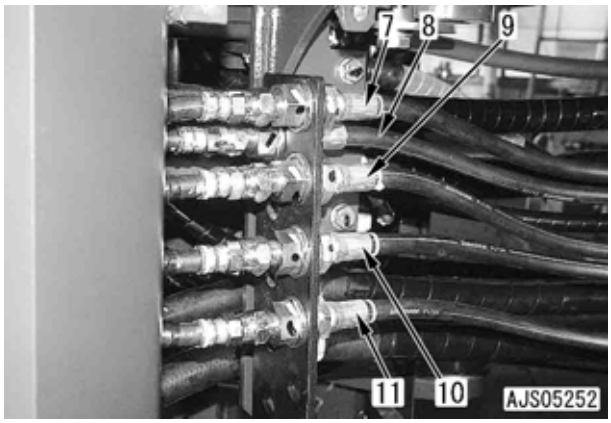


4. Remove lock bolt (3) and pin (5) on the rod side of steering cylinder assembly (4). [*1]
   - ★ If there is any shim, check its quantity and thickness.
   - ★ Remove the same parts on the opposite side, too.

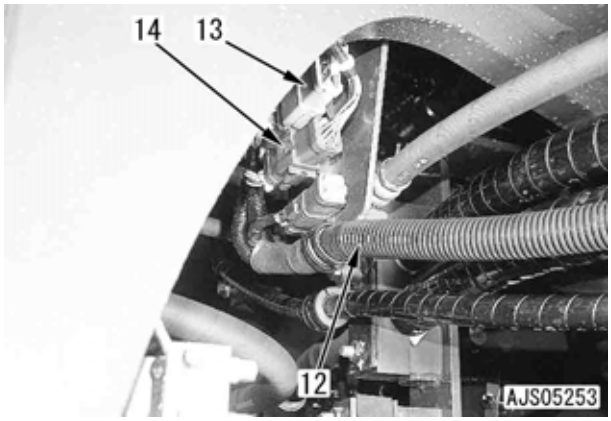
5. Remove center drive shaft (6). [*2]



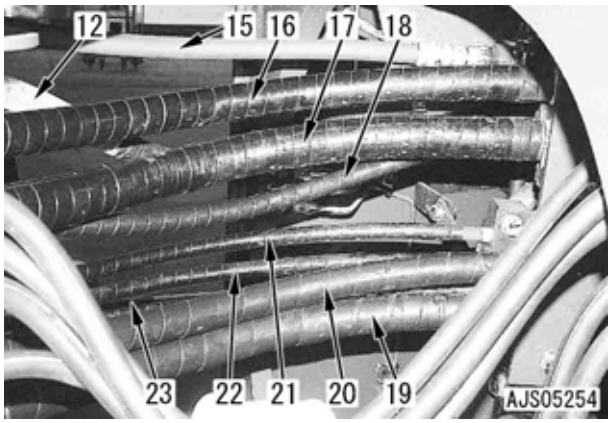
6. Disconnect 5 hoses (7) – (11). [*3]



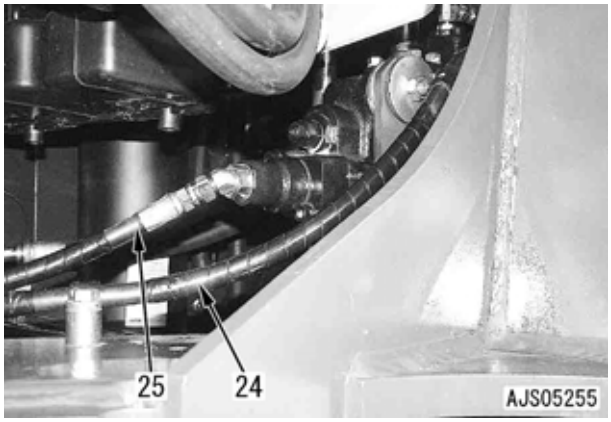
7. Disconnect connectors FF1 (13) and FF2 (14) of wiring (12).



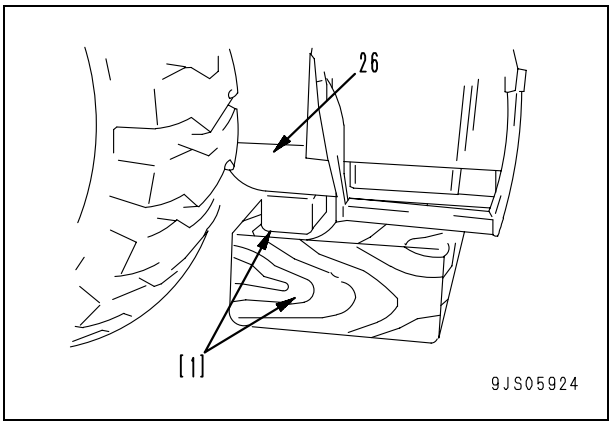
8. Disconnect 9 hoses (15) – (23).
   ★ Put tags to the disconnected hoses distinction.



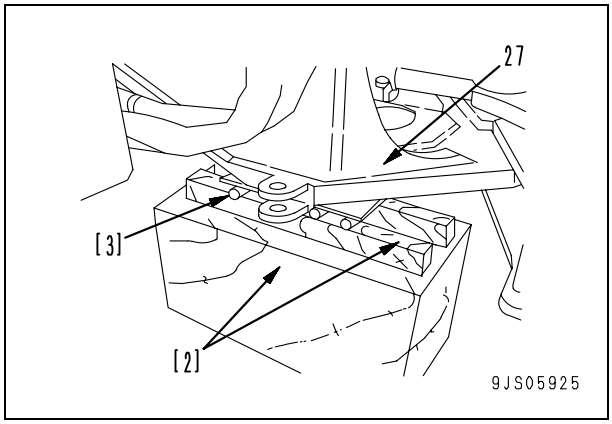
9. Disconnect hoses (24) and (25) from the steering demand valve.



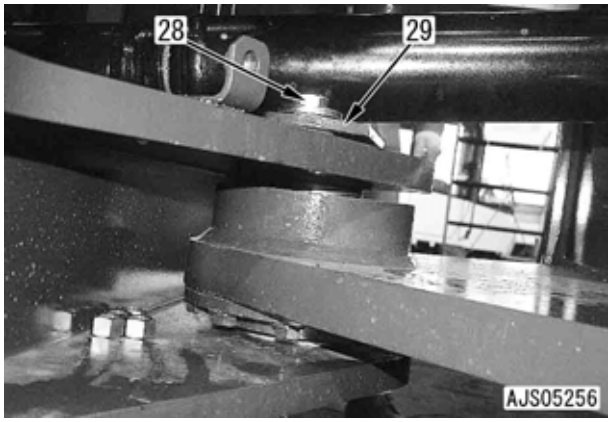
10. Jack up rear frame (26) and put blocks [1] under its right and left portions, while adjusting its height.



11. Jack up front frame (27) and put blocks [2] under its right and left portions, while adjusting its height.
   ★ Place rollers [3] between blocks [2] and front frame so that the front frame can be pulled out.

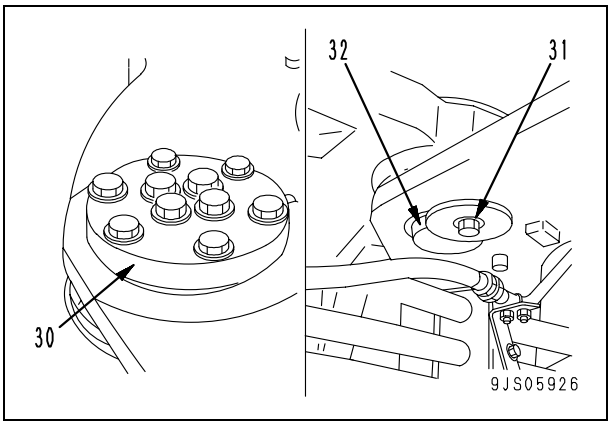


12. Remove lock bolt (28) and lower hinge pin (29). [*4]

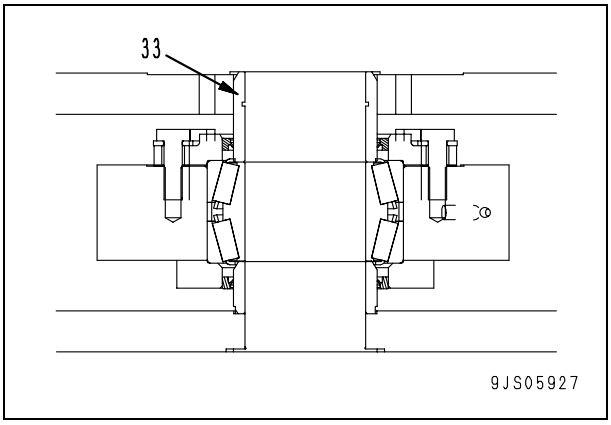


13. Remove the mounting bolts and retainer (30) of the upper hinge.
    ★ Check the quantity and thickness of the shim between the retainer and frame.

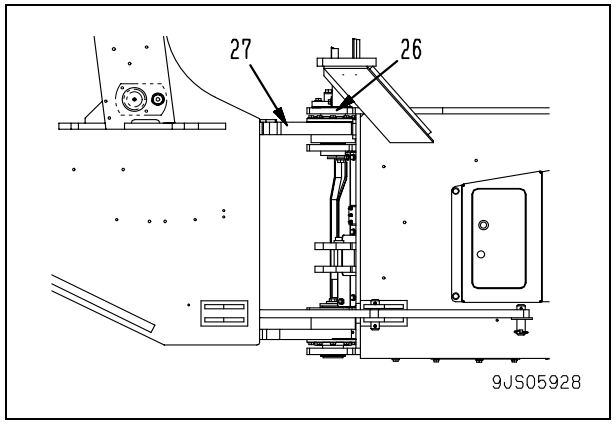
14. Remove lock bolt (31) and pull out upper hinge pin (32), while adjusting the height. [*4]
    ★ Adjust the height carefully so that you can pull out the pin with the hand.



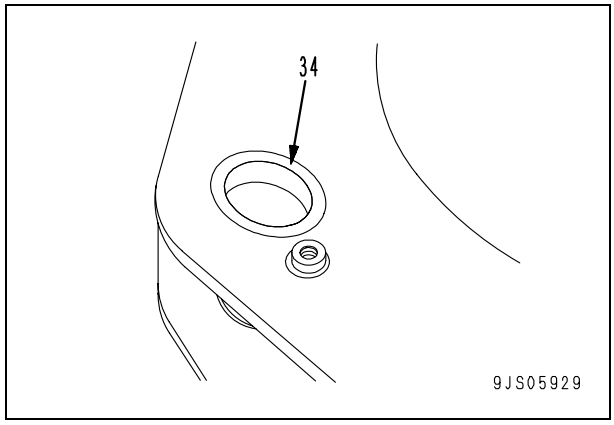
15. Remove spacer (33).



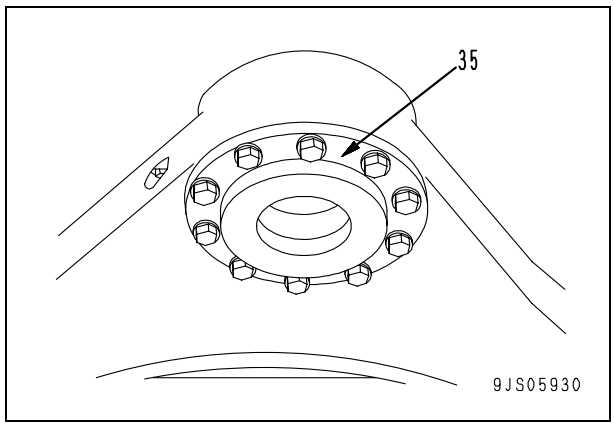
16. Pull out front frame (27) forward slowly to disconnect it from rear frame (26).
    ★ Check that all the parts are disconnected.
    ★ Remove the safety bar.
    ★ Take care that the spacer under the upper hinge will not be caught in the rear frame.
    ★ When disconnecting, take care of balance.



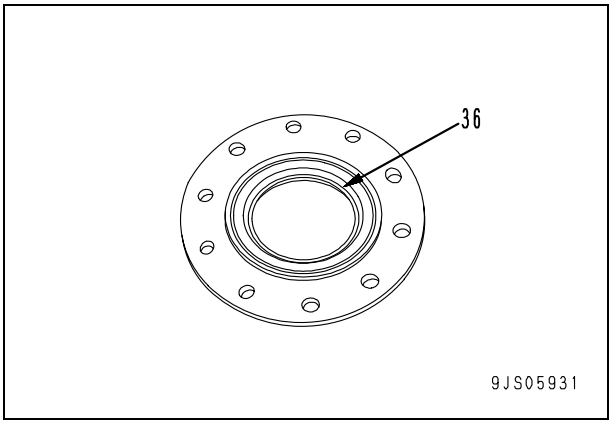
17. Pull bushing (34) out of the rear frame. [*4]
    ★ Pull out both upper and lower bushings of the lower hinge.



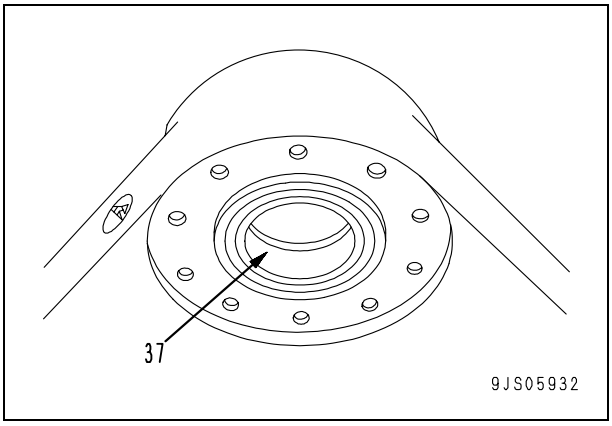
18. Remove retainer (35) on the lower side of the front frame. [*4]
    ★ Check the quantity and thickness of the shim between the retainer and frame.



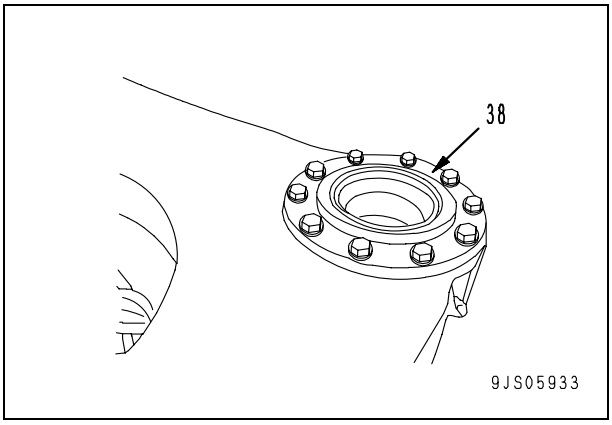
19. Remove dust seal (36) from the retainer. [*4]
    ★ Remove the dust seal from the frame, too.



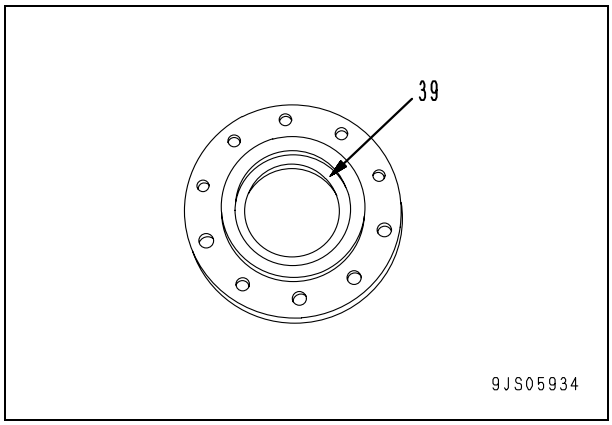
20. Remove bearing (37) from the front frame. [*4]



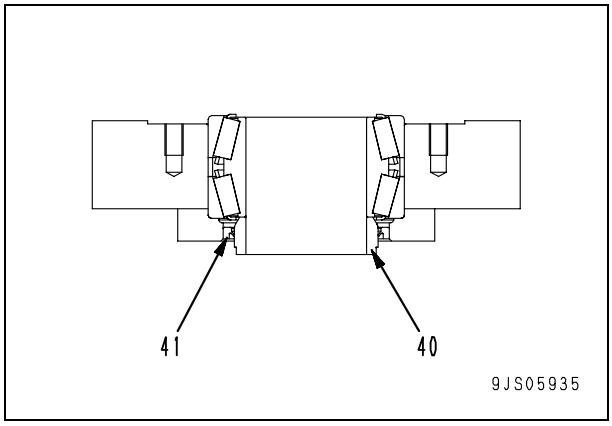
21. Remove the mounting bolts and retainer (38) on the upper side of the front frame. [*4]
    ★ Check the quantity and thickness of the shim between the retainer and frame.



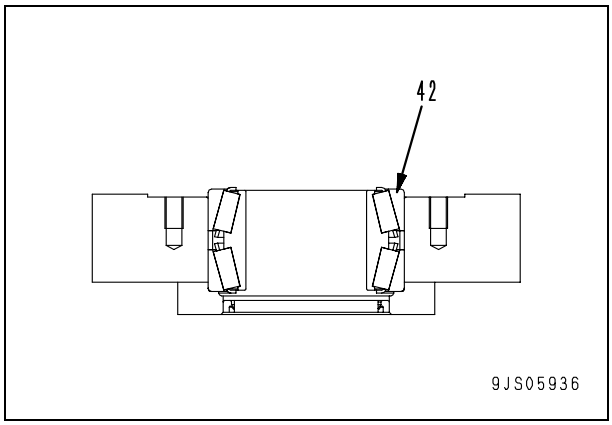
22. Remove dust seal (39) from the retainer.



23. Remove spacer (40) and dust seal (41) from the front frame.



24. Remove bearing (42).



Installation

- Carry out installation in the reverse order to removal.

[*1]

★ Adjust the shim so that the clearance between the frame and cylinder will be 0.5 mm or less.
- Standard shim thickness: **3 mm**
- Set shim thickness: **0.5, 1.0 mm**

Inside of bushing on cylinder side and dust seal:
Molybdenum disulfide grease (LM-P)

[*2]

★ Check that the key of the spider cap is fitted to the key way of the mating yoke and then tighten the mounting bolts.

Center drive shaft mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}

[*3]

★ When connecting the PPC hoses, match the colors of the identification bands.

[*4]

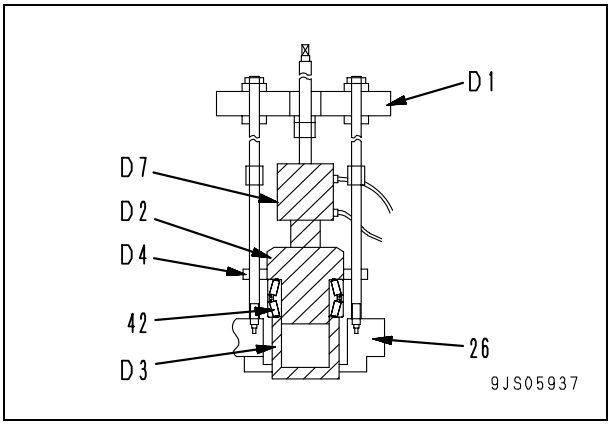
Procedure for inserting center pins

1. Install tool **D1** to the top of the upper hinge of rear frame (26).

2. Set bearing (42) to tool **D2** and install it to the press fitting section from above and press fit it.
   - ★ When press fitting, use tool **D4** as a guide.
   - ★ Take care that the bearing will not lean.
   - ★ Apply lubricating oil to the inside wall of the bearing.
   - ★ The clearance of bearing (42) is adjusted. Accordingly, when bearing (42) needs to be replaced, replace it and spacers (33) and (44) as a set.

   Inside wall of bearing:
   Molybdenum disulfide grease (LM-P)

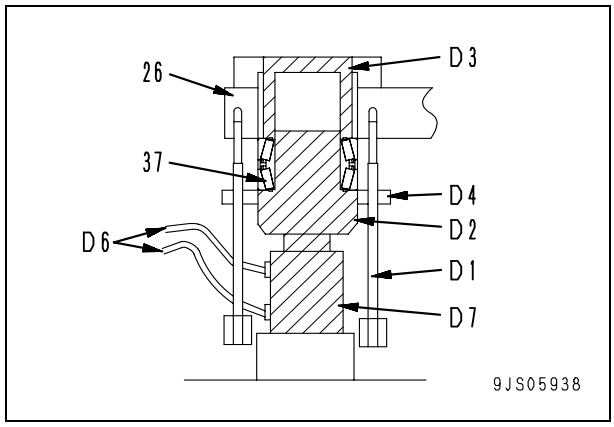
   Inside wall of spacer (40):
   Molybdenum disulfide grease (LM-P)



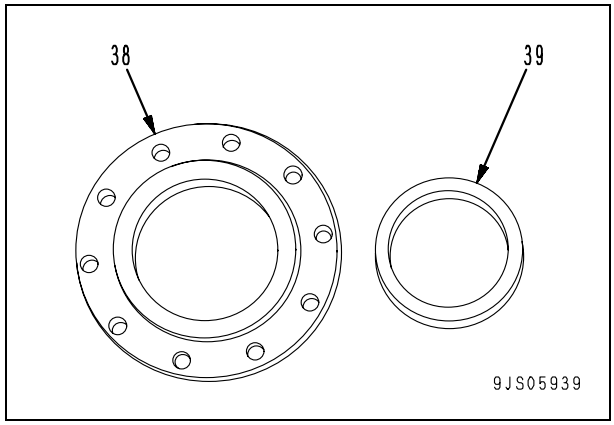
3. Set bearing (37) on the lower hinge of rear frame (26).

4. Using tool **D1**, press fit bearing (37).
   - ★ Use tool **D4** as a guide.
   - ★ Take care that the bearing will not lean.
   - ★ Apply lubricating oil to the inside wall of the bearing.

   Inside wall of bearing:
   Molybdenum disulfide grease (LM-P)

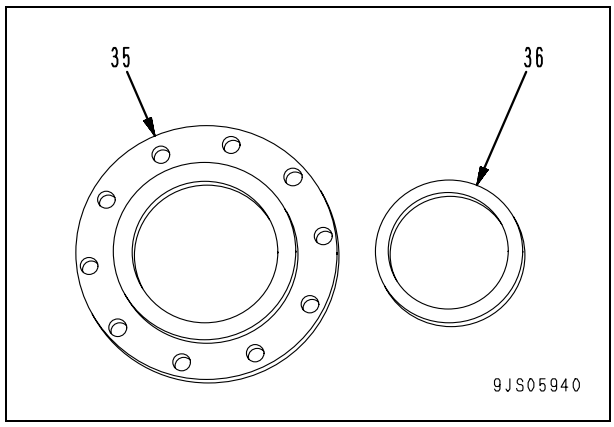


5. Press fit dust seal (39) to retainer (38).
   - ★ Direct the lip face of the dust seal out.



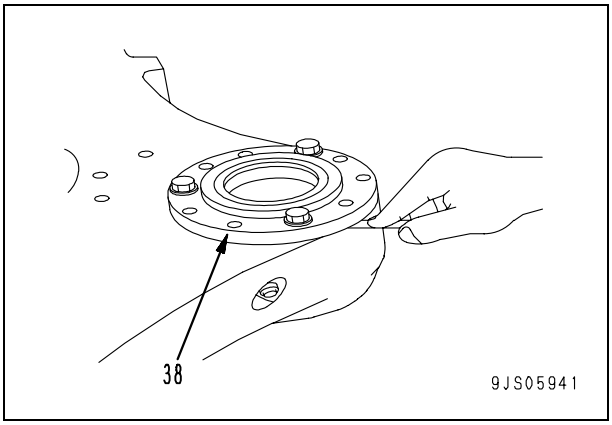
6. Press fit dust seal (36) to retainer (35).
   - ★ Direct the lip face of the dust seal out.

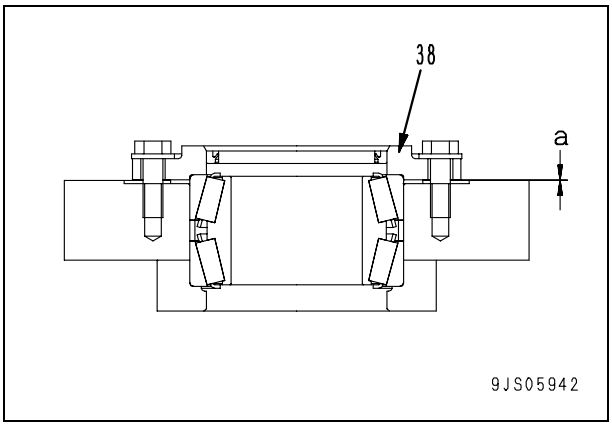
   Dust seal: **Grease (G2-LI)**



7. Adjust the shim of the retainer (on the upper side).
   1) Install retainer (38), tighten the 3 mounting bolts evenly, and insert the shim so that clearance (a) between the retainer and hinge will be 0.1 mm or less.
      - Set shim thickness:
        0.1 mm, 0.5 mm, 1.0 mm

      Mounting bolt: **20 ± 2 Nm {2.0 ± 0.2 kgm} (For adjusting shim)**





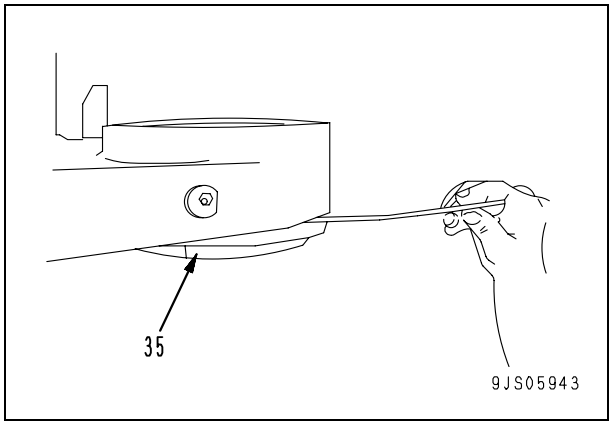
   2) After adjusting the shim, tighten all the retainer mounting bolts to the specified torque.

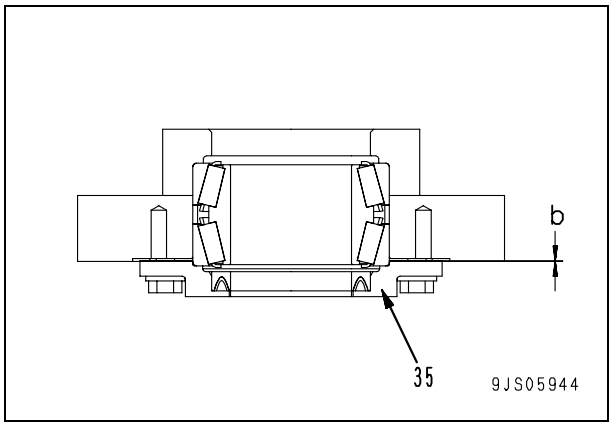
      Mounting bolt:
      Adhesion (LOCTITE 2701)

      Mounting bolt:
      98 – 123 Nm {10.0 – 12.5 kgm}

8. Adjust the shim of the retainer (on the lower side).
   1) Install retainer (35), tighten the 3 mounting bolts evenly, and insert the shim so that clearance (b) between the retainer and hinge will be 0.1 mm or less.
      - Set shim thickness:
        0.1 mm, 0.5 mm, 1.0 mm

      Mounting bolt: **20 ± 2 Nm {2.0 ± 0.2 kgm} (For adjusting shim)**



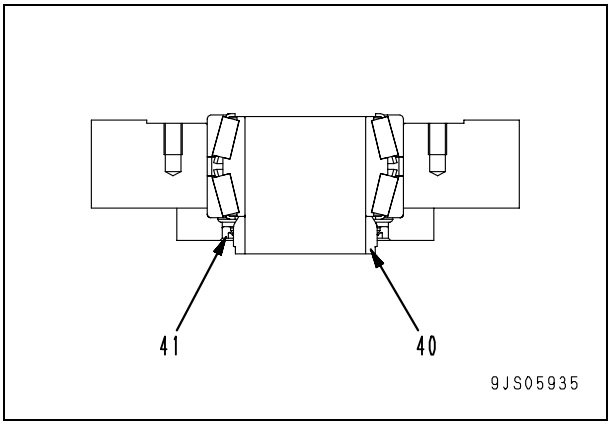


   2) After adjusting the shim, tighten all the retainer mounting bolts to the specified torque.

      Mounting bolt:
      Adhesion (LOCTITE 2701)

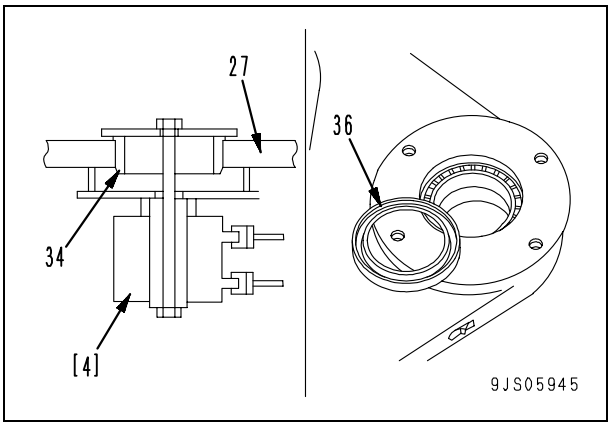
      Mounting bolt:
      98 – 123 Nm {10.0 – 12.5 kgm}

9. Install dust seal (41) and spacer (40) from below the front frame.
   ★ Direct the lip face of the dust seal out.
   ★ Install spacer (40) from underside, directing the more chamfered side toward the bearing.
   Inside wall of spacer:
   Molybdenum disulfide grease (LM-P)

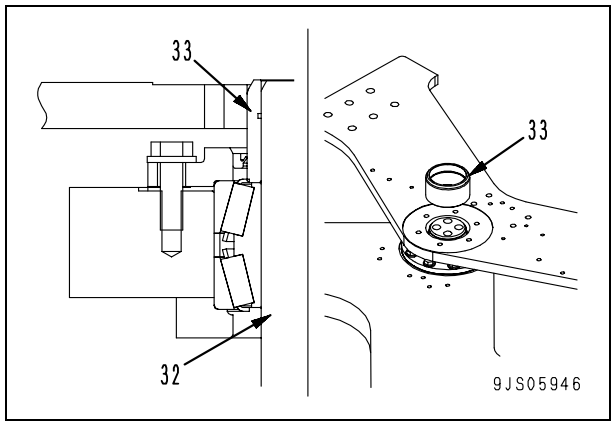


10. Press fit dust seal (36) from above the front frame.
    ★ Direct the lip face of the dust seal out.
    Dust seal lip: **Grease (G2-LI)**

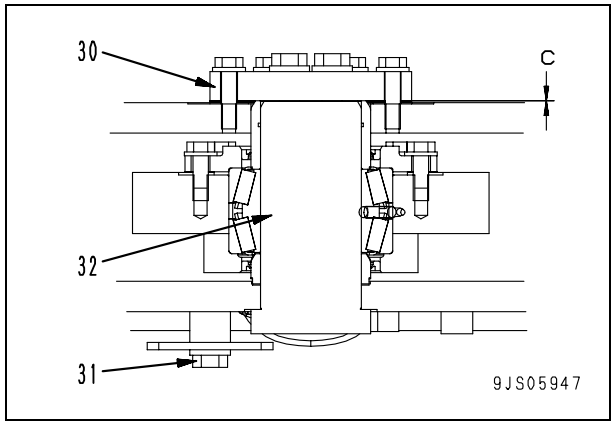
11. Press fit bushing (34) to the lower hinge of the rear frame with puller [4].
    ★ Press fit the upper and lower bushings similarly.

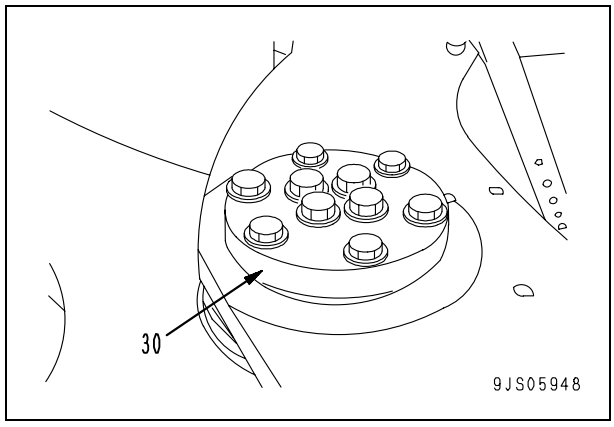


12. Insert upper hinge pin (32) and install spacer (33).
    ⚠ **When aligning the pin holes, use a bar. Never insert your fingers in the pin holes.**
    ★ Align the pin holes accurately.



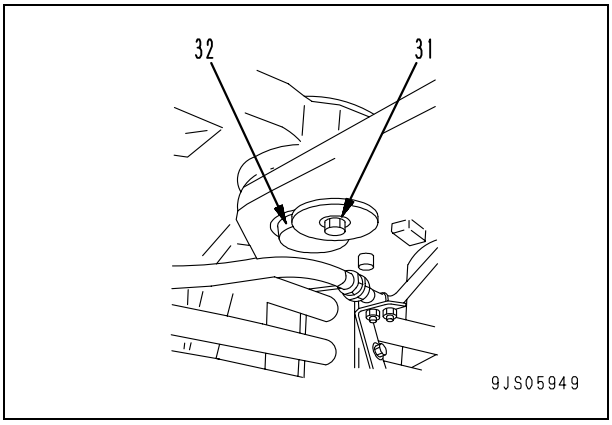
13. Install retainer (30) to upper hinge pin (32), tighten the 3 mounting bolts evenly, and insert the shim so that clearance (c) between the hinge and retainer will be 0.2 mm or less.
    ★ Measure the clearance between the retainer and hinge at 3 places.
    ★ After adjusting the shim, tighten the retainer mounting bolts temporarily to lock the retainer.
    • Kinds of shim thickness:
    0.1 mm, 0.2 mm, 0.5 mm
    Mounting bolt:
    20 ± 2 Nm {2.0 ± 0.2 kgm}
    (For adjusting shim)



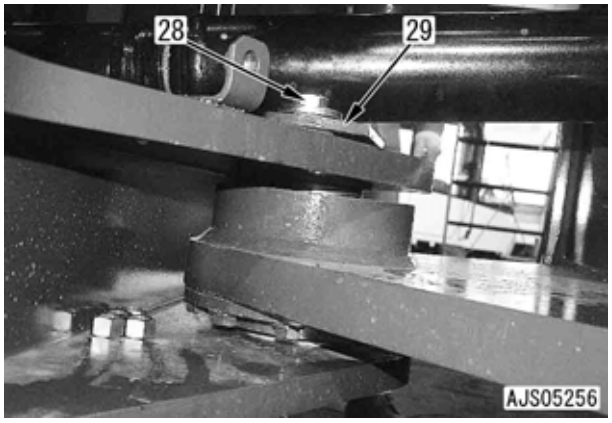


14. Tighten all the pin and retainer mounting bolts to the specified torque.
    - Pin and retainer mounting bolt: **Adhesion (LOCTITE 2701)**
    - Retainer mounting bolt: **98 – 123 Nm {10 – 12.5 kgm}**
    - Pin mounting bolt: **206 ± 20 Nm {21 ± 2 kgm}**

15. Tighten lock bolt (31) of upper hinge pin (32).



16. Insert lower hinge pin (29) and tighten lock bolt (28).



Removal and installation of counterweight

Removal

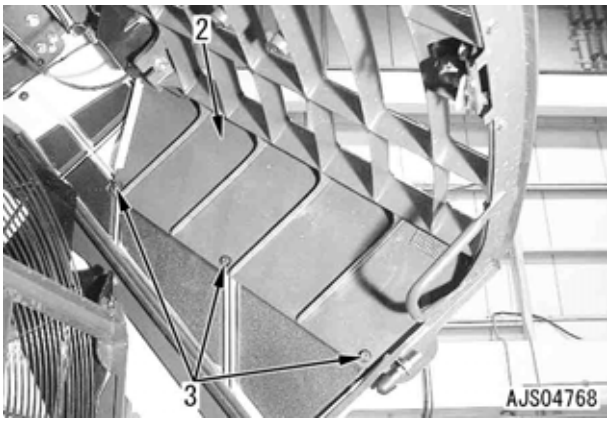
⚠ Disconnect the cable from the negative (–) terminal of the battery.

1. Grille

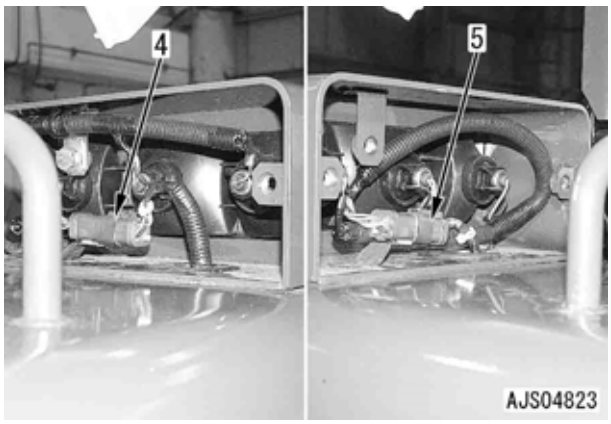
1) Open the grille and disconnect left connector G04 and right connector G05 (1) of the rear working lamp.



2) Remove mounting bolts (3) of grille (2); 3 pieces from the right and left, 3 pieces from the top, and 6 pieces from the bottom, and then remove grille (2).



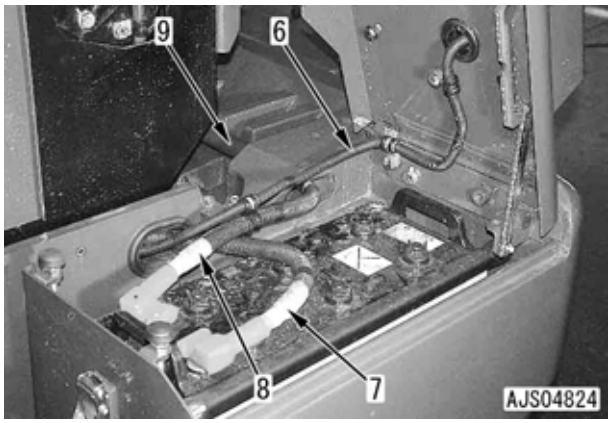
2. Disconnect combination lamp connector left R30 (4) and right R31 (5).



3. Release combination lamp wiring (6) and battery wiring (7) from the clamp and remove them from the battery case.

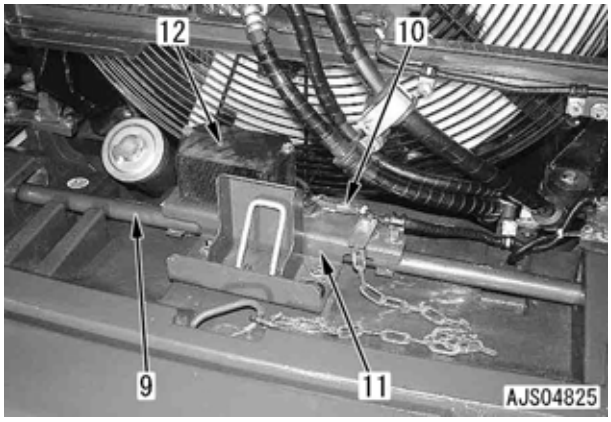
★ Remove battery wiring (8) and pipe (9) together.

★ The photo shows the left side. Work on the right side similarly.



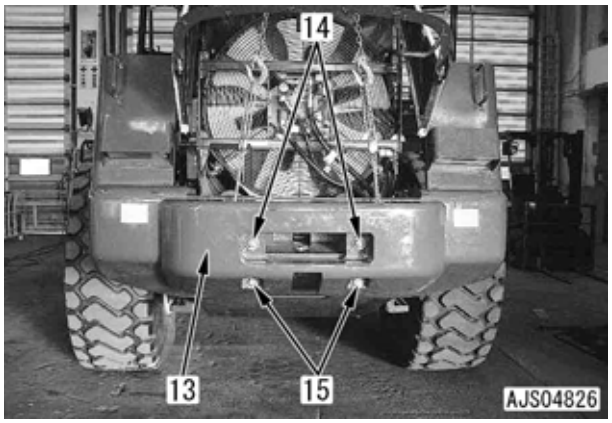
4. Bracket

1) Disconnect connector R58 (10).
2) Remove bracket (11) and backup buzzer (12) together. [*1]
3) Remove pipe (9) and battery wiring (8) together.



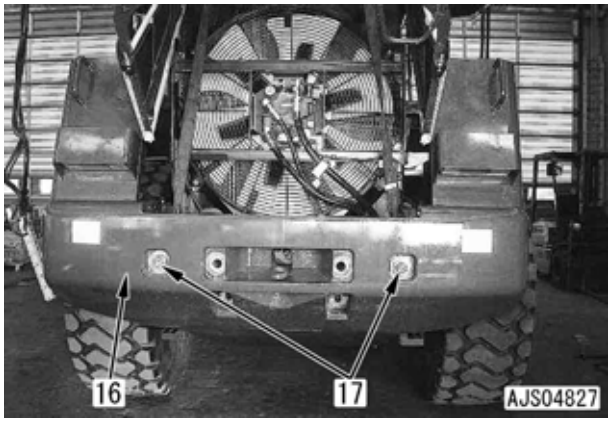
5. Sling additional counterweight (13) temporarily, remove 2 bolts (14) and 2 bolts (15), and lift off the additional counterweight. [*2]
★ Lower mounting bolts (15) have collars.

Additional counterweight: **330 kg**



6. Sling counterweight (16) temporarily, remove 2 bolts (17), and lift off the counterweight. [*3]

Counterweight (including 2 batteries): **1,760 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]
★ When installing the bracket, match it to the lock position of the grille.

[*2]
Additional counterweight mounting bolts (14) and (15): **824 – 1,034 Nm {84 – 105 kgm}**

[*3]
Counterweight mounting bolt: **824 – 1,034 Nm {84 – 105 kgm}**

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

50 Disassembly and assembly

Hydraulic system

Hydraulic system 2
Removal and installation of work equipment control valve assembly 2
Removal and installation of power train pump and work equipment pump assembly 4
Removal and installation of steering pump and cooling fan pump assembly 5
Removal and installation of hydraulic tank assembly 6

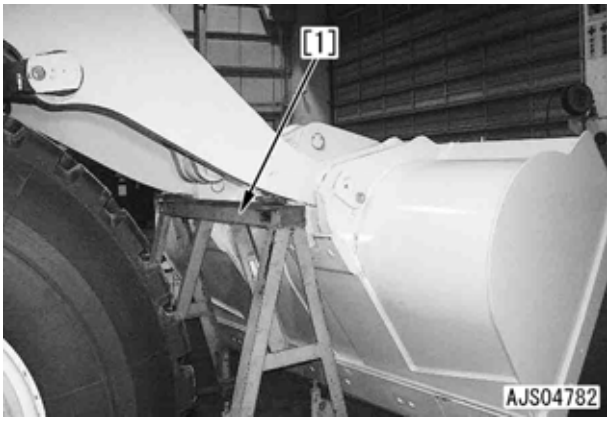
Hydraulic system

Removal and installation of work equipment control valve assembly

Removal

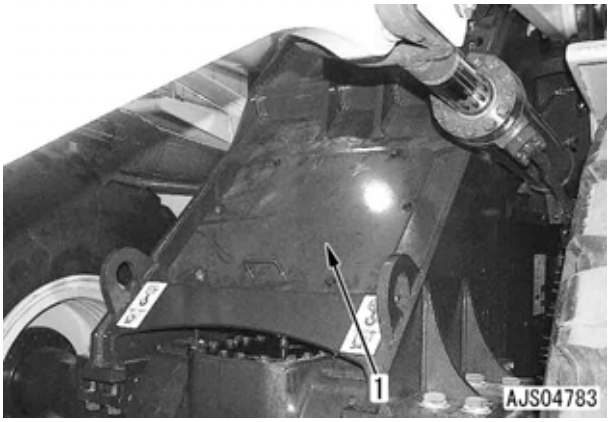
⚠ Stop the machine on a level place, set the safety bar to the frame, apply the parking brake, stop the engine, and lock the tires with chocks.

⚠ Set the bucket in the dump position and support the lift arm with block [1] or release the pressure from the accumulator.



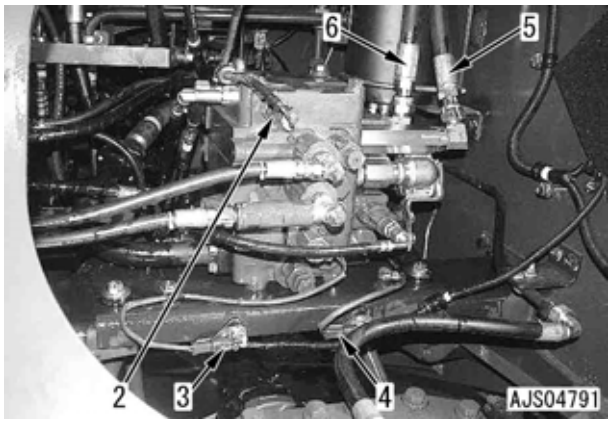
1. Drain the oil from the hydraulic tank.
   Hydraulic tank: **139 ℓ**

2. Remove cover (1) from the front of the machine.



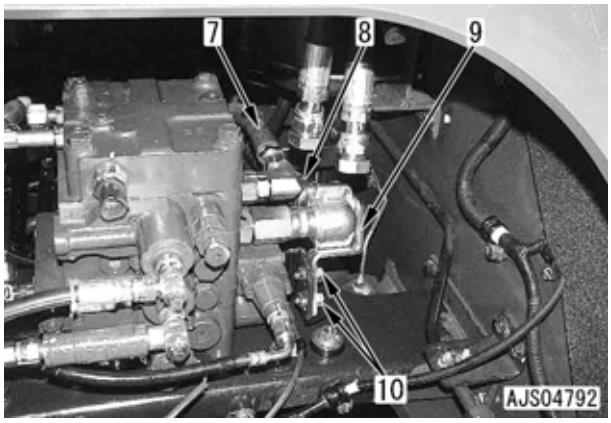
3. Release connectors F12 (2), F13 (3), and F14 (4) from the clamp and disconnect them.

4. Remove bucket cylinder hoses (5) and (6).



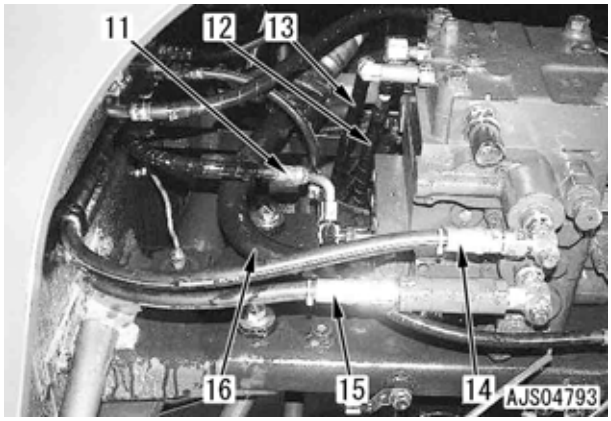
5. Remove lift cylinder hoses (7) and (8).

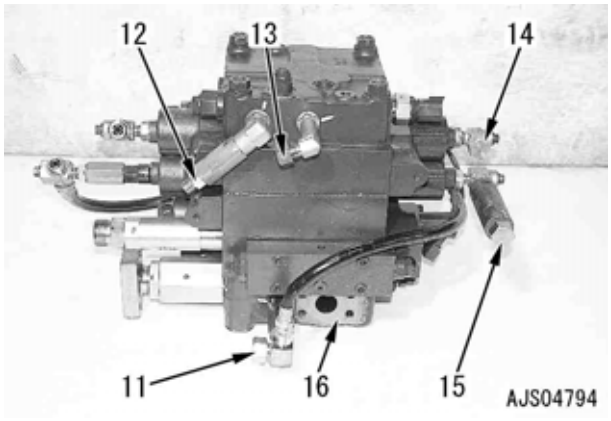
6. Remove bolts (10) of plate (9).



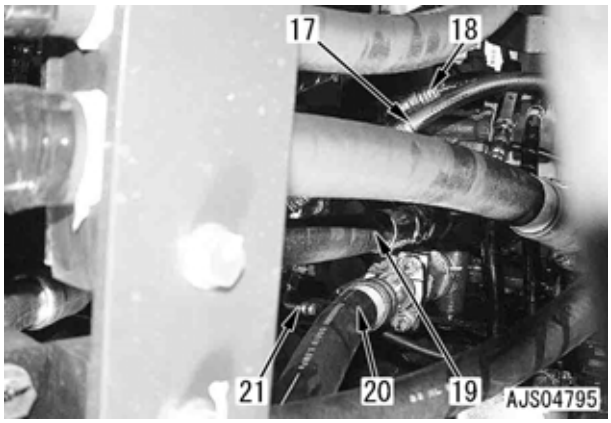
7. Remove hoses (11), (12), (13), (14), and (15).

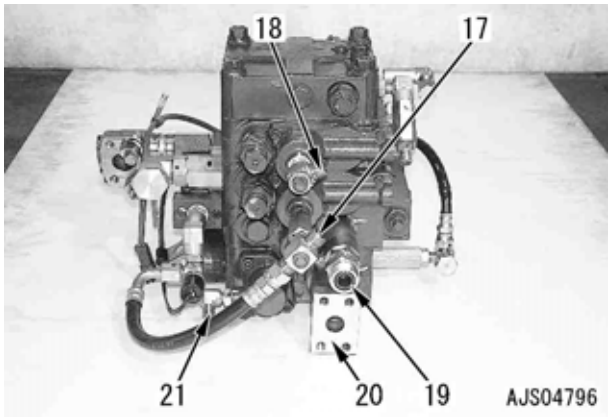
8. Remove work equipment pump inlet tube (16).



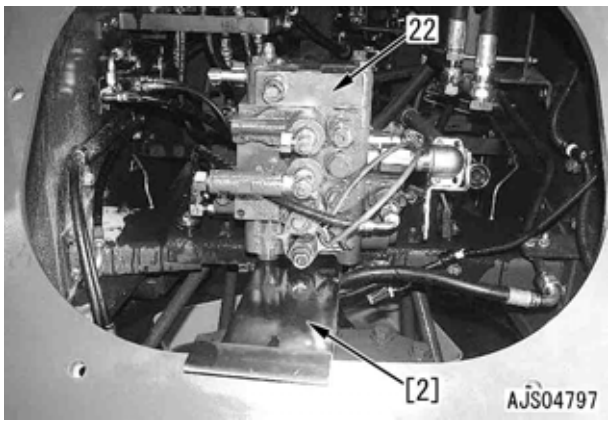


9. Remove hoses (17), (18), (19), (20), and (21) from the rear of the work equipment control valve.

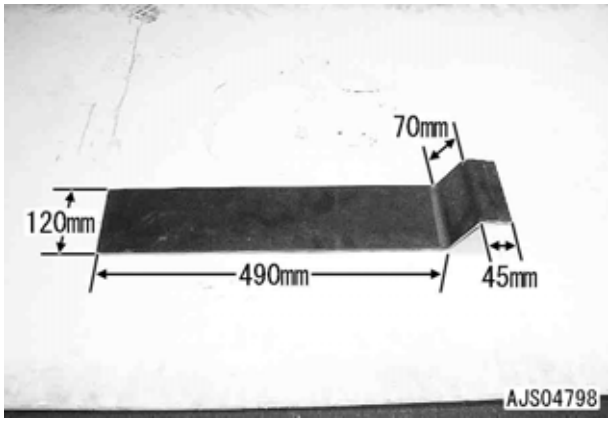




10. Remove the mounting bolts of work equipment control valve assembly (22), place the control valve assembly on plate [2], and pull it to this side.
    ★ Since a sling cannot be used, pull out the control valve assembly on the plate to a place where a sling can be used.

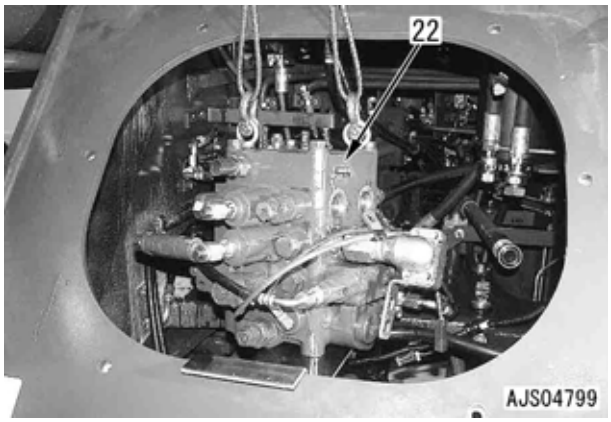


★ Reference dimensions of plate [2]



11. After work equipment control valve assembly (22) is pulled out to a place where a sling can be used, lift it off.

    Work equipment control valve assembly: **70 kg**



Installation

- Carry out installation in the reverse order to removal.
- **Refilling with oil (Hydraulic tank)**
  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.

  Hydraulic tank: **139 ℓ**

Removal and installation of power train pump and work equipment pump assembly

Removal

⚠ Stop the machine on a level place, set the safety bar to the frame, lower the work equipment to the ground, stop the engine, apply the parking brake, and lock the tires with chocks.

⚠ Disconnect the cable from the negative (–) terminal of the battery.

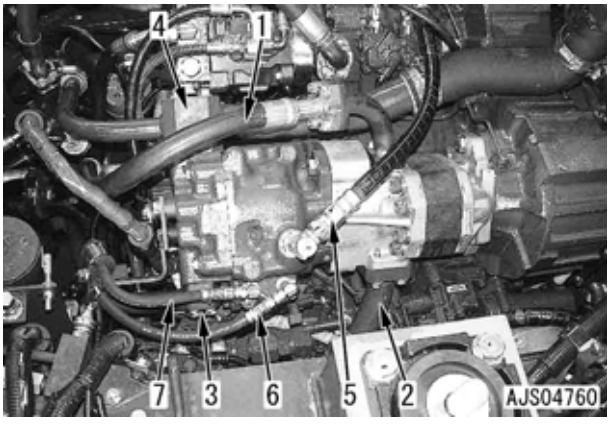
1. Remove the engine hood assembly. For details, see “Removal and installation of engine hood assembly”.

2. Remove the hydraulic tank assembly. For details, see “Removal and installation of hydraulic tank assembly”.

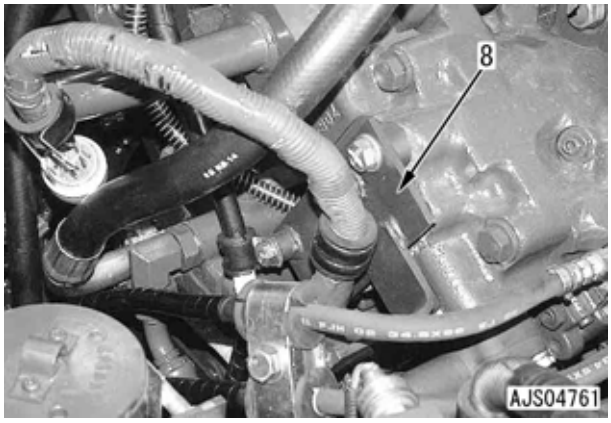
3. Remove the operator's cab and floor frame assembly. For details, see “Removal and installation of operator's cab and floor frame assembly”.

4. Disconnect the following hoses and tubes from the power train pump.
   - Pump discharge port hose (1)
   - Pump suction port hose (2)

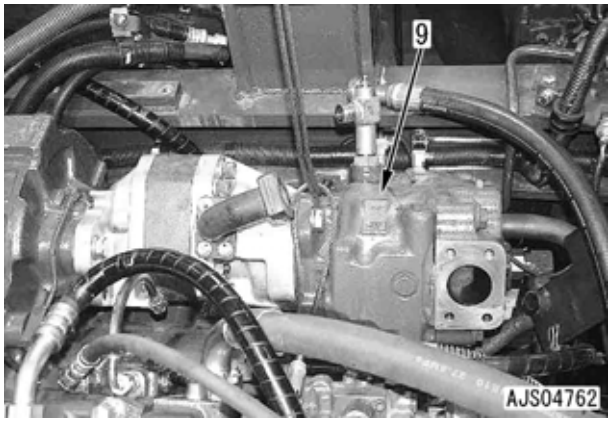
5. Disconnect the following hoses and tubes from the work equipment pump.
   - Pump discharge port hose (3)
   - Pump suction port hose (4)
   - Pump drain port hose (5)
   - Pump discharge pressure input port hose (6)
   - Load pressure input port hose (7)



6. Remove the pump from bracket (8).



7. Sling power train pump and work equipment pump assembly (9), remove the mounting bolts, and lift off the assembly.



Installation

- Carry out installation in the reverse order to removal.

Removal and installation of steering pump and cooling fan pump assembly

Removal

⚠ **Stop the machine on a level place, set the safety bar to the frame, lower the work equipment to the ground, stop the engine, apply the parking brake, and lock the tires with chocks.**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

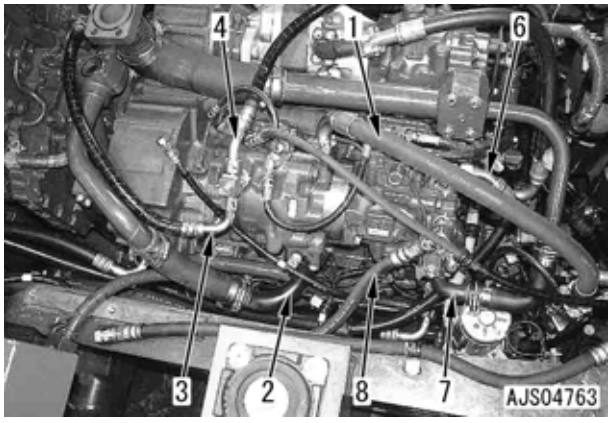
1. Remove the engine hood assembly. For details, see “Removal and installation of engine hood assembly”.

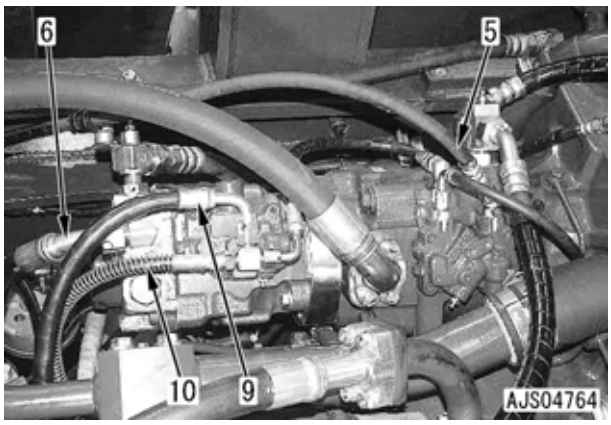
2. Remove the hydraulic tank assembly. For details, see “Removal and installation of hydraulic tank assembly”.

3. Remove the operator's cab and floor frame assembly. For details, see “Removal and installation of operator's cab and floor frame assembly”.

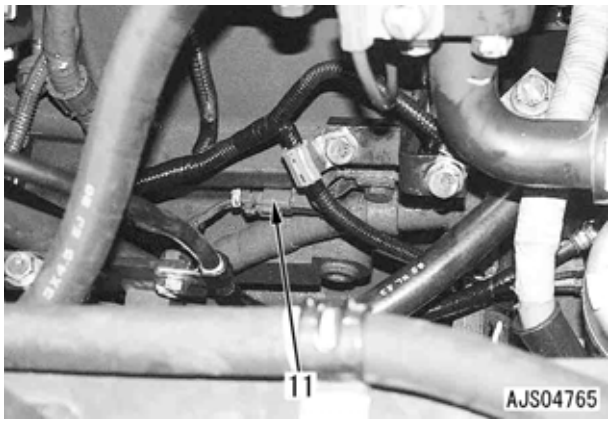
4. Disconnect the following hoses and tubes from the steering pump.
   - Pump discharge port hose (1)
   - Pump suction port hose (2)
   - Pump drain port hoses (3) and (4)
   - Pump pressure input port hose (5)

5. Disconnect the following hoses and tubes from the cooling fan pump.
   - Pump discharge port hose (6)
   - Pump suction port hose (7)
   - Pump drain port hose (8)
   - Pump EPC valve basic pressure input port hoses (9) and (10)

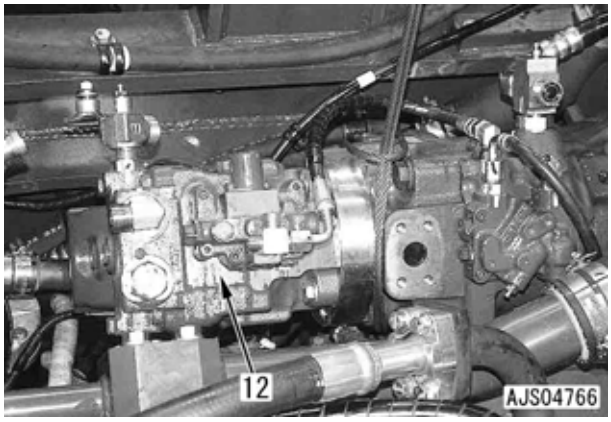




6. Release the 2 clamps and disconnect connector R29 (11).



7. Sling steering pump and cooling fan pump assembly (12), remove the mounting bolts, and lift off the assembly.



Installation

- Carry out installation in the reverse order to removal.

Removal and installation of hydraulic tank assembly

Removal

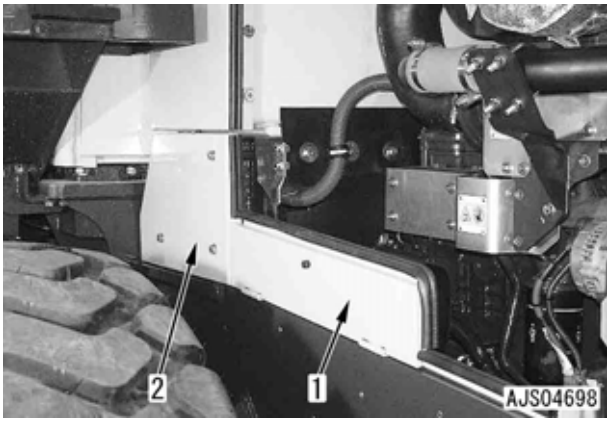
- **Disconnect the cable from the negative (–) terminal of the battery.**
- **Stop the machine on a level place, set the safety bar to the frame, lower the work equipment to the ground, stop the engine, apply the parking brake, and lock the tires with chocks.**
- **Operate the work equipment control lever at least 10 times to release the pressure from the accumulator circuit.**

1. Remove the engine hood assembly. For details, see “Removal and installation of engine hood assembly”.

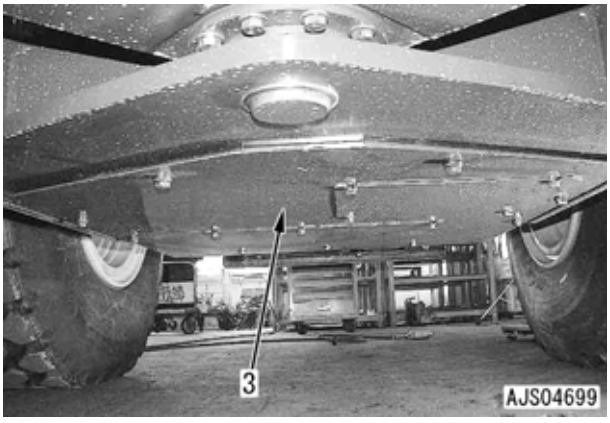
2. Drain the oil from the hydraulic tank.

   Hydraulic tank: **139 ℓ**

3. Remove right and left covers (1) and (2).

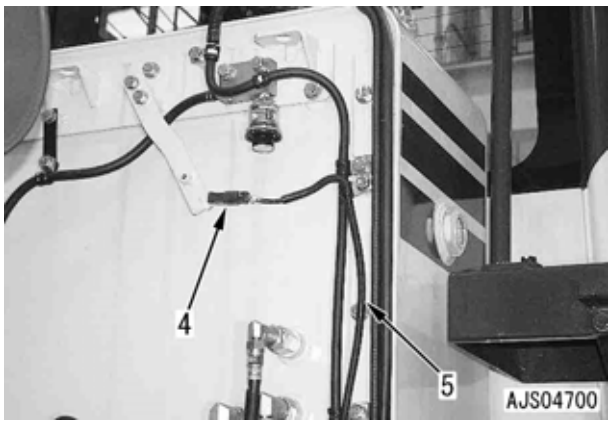


4. Remove undercover (3).



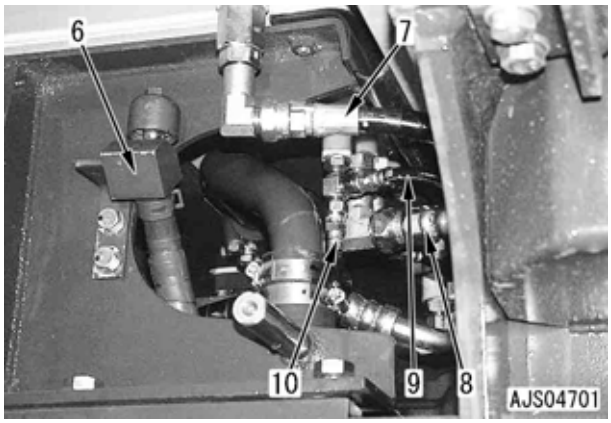
5. Disconnect connector E33 (4).

6. Release wiring (5) from the clamp and remove it from the hydraulic tank.

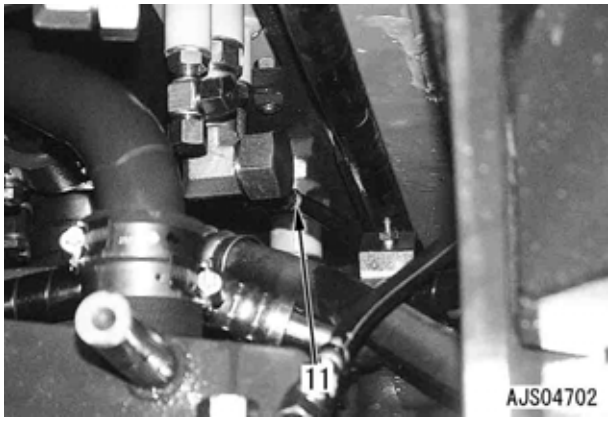


7. Remove breather (6).

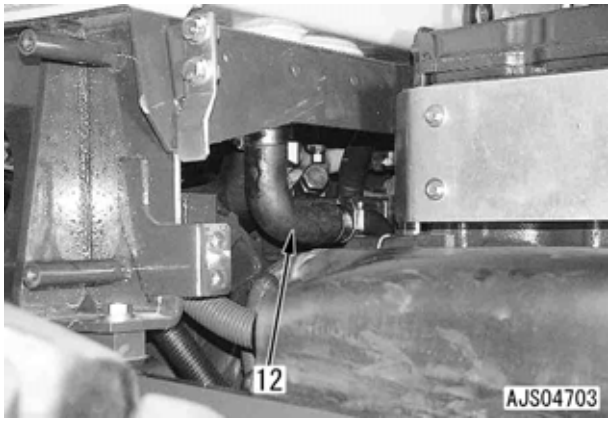
8. Disconnect hoses (7), (8), (9), and (10).



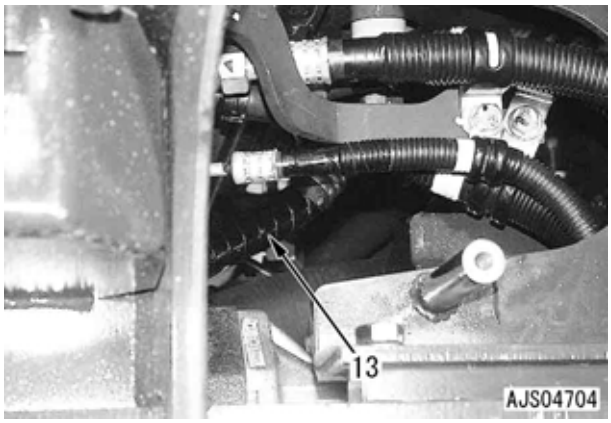
9. Disconnect hose (11).



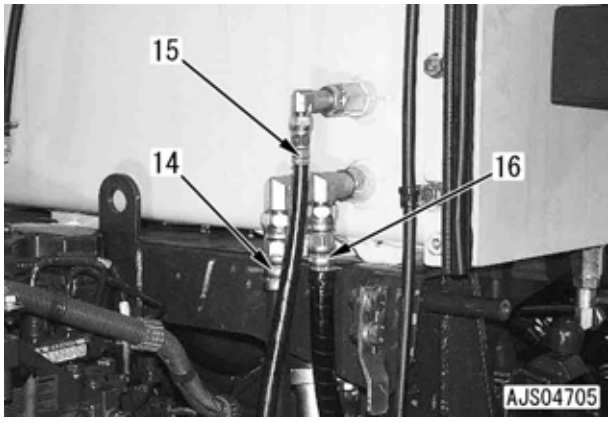
10. Loosen the clamp and remove hose (12).



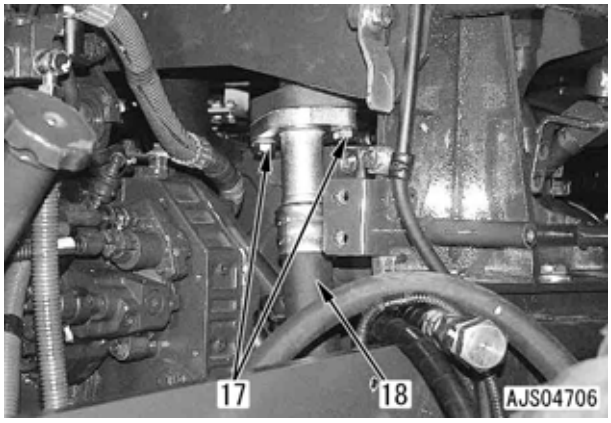
11. Disconnect drain hose (13).



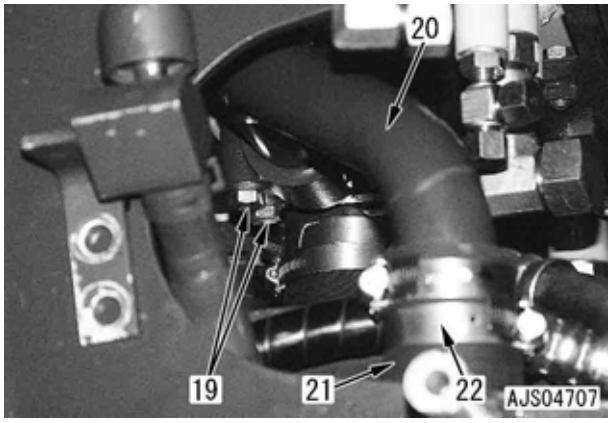
12. Disconnect hoses (14), (15), and (16) from the hydraulic tank.



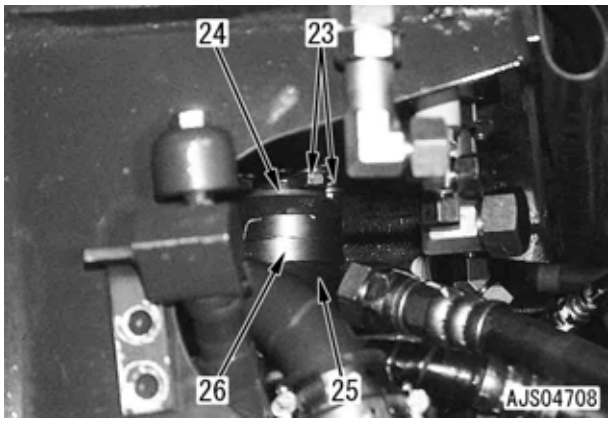
13. Remove 2 bolts (17) and disconnect hose (18).



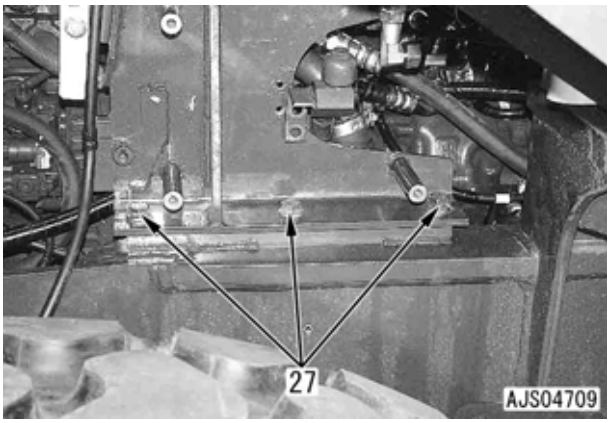
14. Remove 4 bolts (19) and tube (20).
    ★ Loosen clamp (22) of hose (21) and tube (20).



15. Remove 4 bolts (23) and tube (24).
    ★ Loosen clamp (26) of hose (25) and tube (24).

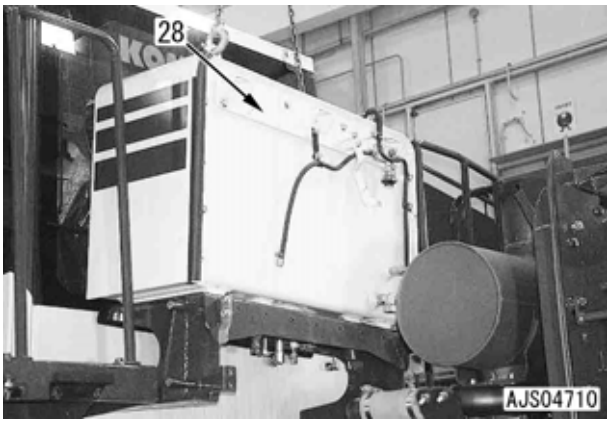


16. Remove 3 hydraulic tank mounting bolts (27) each from the right and left.



17. Lift off hydraulic tank assembly (28).
    ★ Before removing the hydraulic tank, check that all pipings etc. are disconnected.

    Hydraulic tank assembly: **224 kg**



Installation

- Carry out installation in the reverse order to removal.

- **Refilling with oil (Hydraulic tank)**
  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.

  Hydraulic tank: **139 ℓ**

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

50 Disassembly and assembly

Work equipment

Work equipment 2
Removal and installation of work equipment assembly 2
Disassembly and assembly of hydraulic cylinder assembly 6

Work equipment

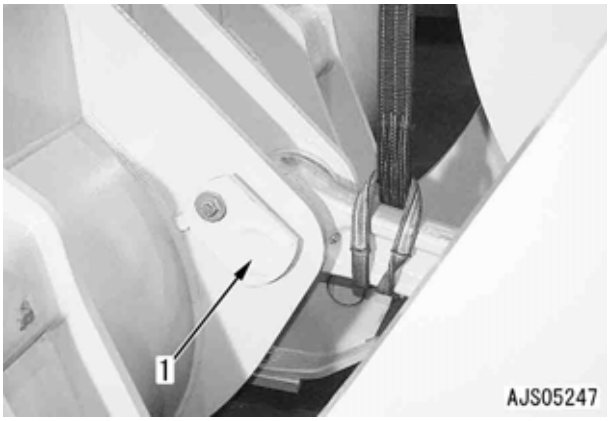
Removal and installation of work equipment assembly

Removal

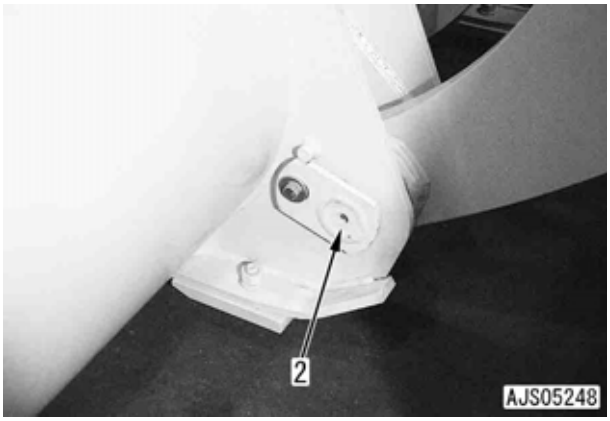
⚠ **Stop the machine on a level place, install the safety bar to the frame, lower the bucket to the ground, stop the engine, apply the parking brake, and lock the tires with chocks.**

1. Bucket

1) Sling the bucket link temporarily and remove mounting pin (1). [*1]
   - ★ Fix the bucket link to the bell crank with wires etc.
   - ★ If any shim is used, check its quantity.



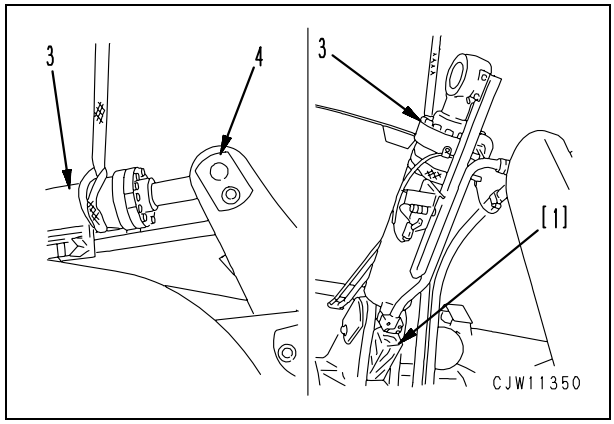
2) Remove bucket hinge pin (2). [*2]
   ⚠ **Never insert your fingers in the pin holes.**
   - ★ If any shim is used, check its quantity.
3) Move the machine in reverse to disconnect the bucket.



2. Bucket cylinder rod pin

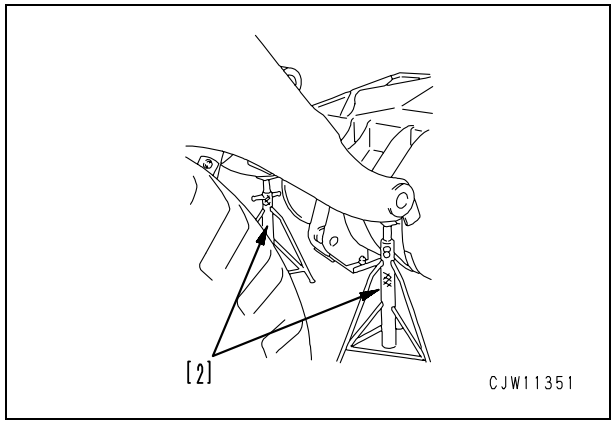
Sling bucket cylinder (3) temporarily, pull out rod pin (4), and disconnect the cylinder rod and bell crank. [*3]
- ★ Place block [1] between the cylinder bottom and frame.

Bucket cylinder assembly: **160 kg**



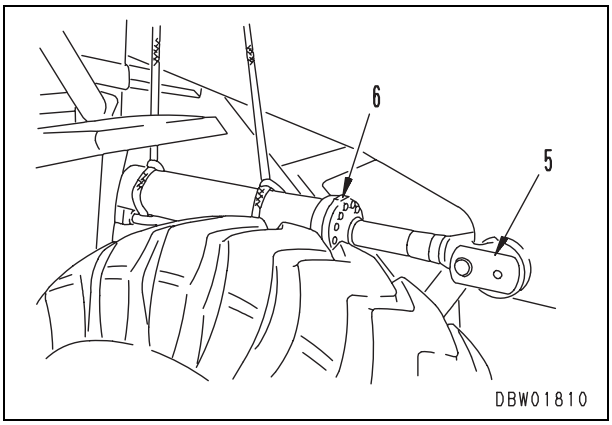
3. Lift cylinder rod pin

1) Raise the lift arm, install stands [2] under the end of the lift arm, and release the residual pressure from the hydraulic piping.



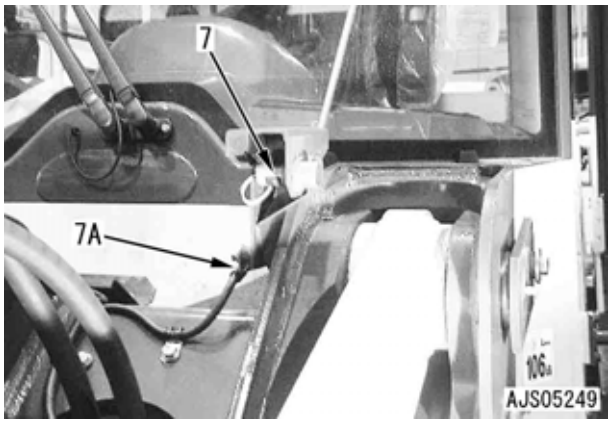
2) Sling lift cylinder assembly (6) temporarily and remove mounting pin (5). [*4]
   - ★ If any shim is used, check its quantity.
   - ★ Place a block on the axle and lower the lift cylinder assembly onto it.

Lift cylinder assembly: **150 kg**

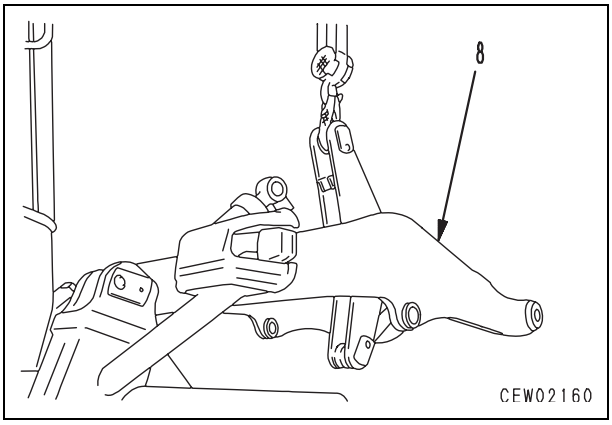


4. Lift arm, bell crank, and bucket link

1) Disconnect connector F10 (7A).
2) Remove boom kick-out switch (7). [*5]

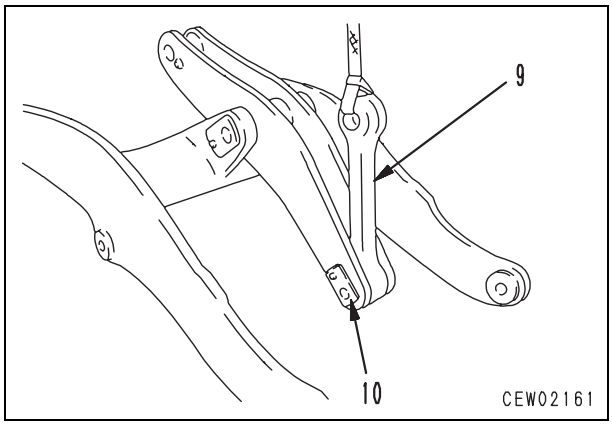


3) Sling lift arm, bell crank, and bucket link assembly (8) temporarily and pull out the lift arm pin. [*6]
4) Lift off lift arm, bell crank, and bucket link assembly (8).
   Lift arm, bell crank, and bucket link assembly: **1,500 kg**
   ★ If any shim is used, check its quantity.

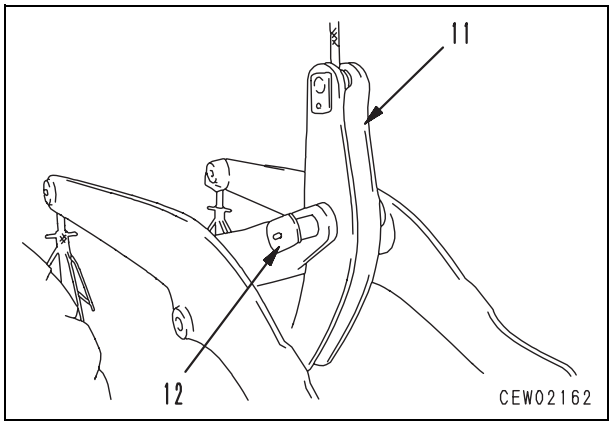


5. Bell crank and bucket link

1) Sling bucket link (9) temporarily, pull out mounting pin (10), and lift off the bucket link from the bell crank. [*7]
   Bucket link: **60 kg**

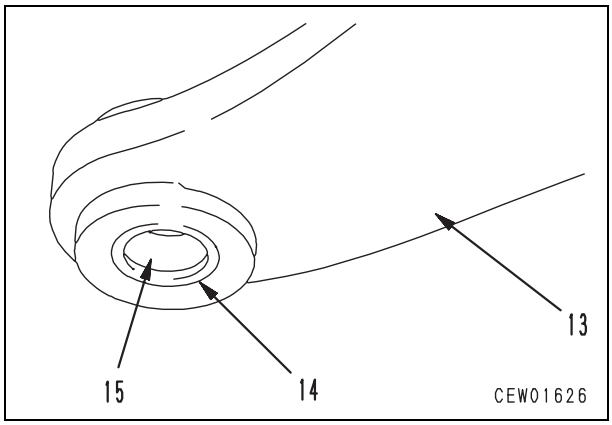


2) Sling bell crank (11) temporarily, pull out mounting pin (12), and lift off the bell crank from the lift arm.
   Bell crank: **350 kg**

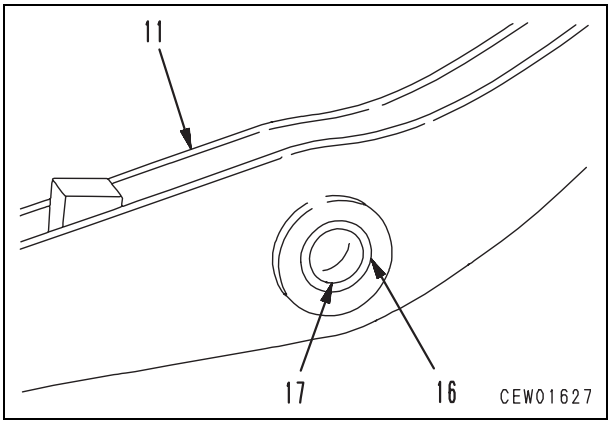


6. Dust seal and bushing

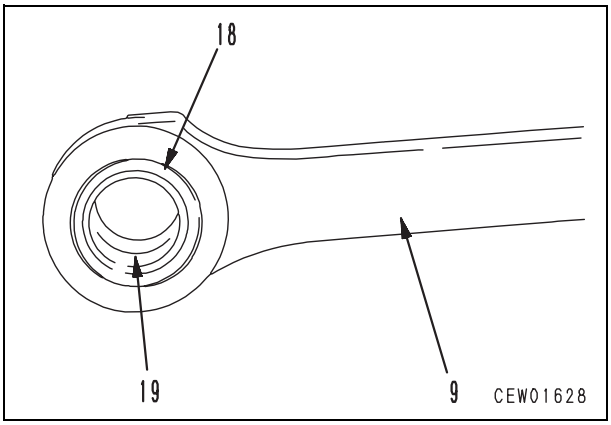
1) Pull dust seal (14) and bushing (15) out of lift arm (13). [*8]



2) Pull dust seal (16) and bushing (17) out of bell crank (11).



3) Pull dust seal (18) and bushing (19) out of bucket link (9).



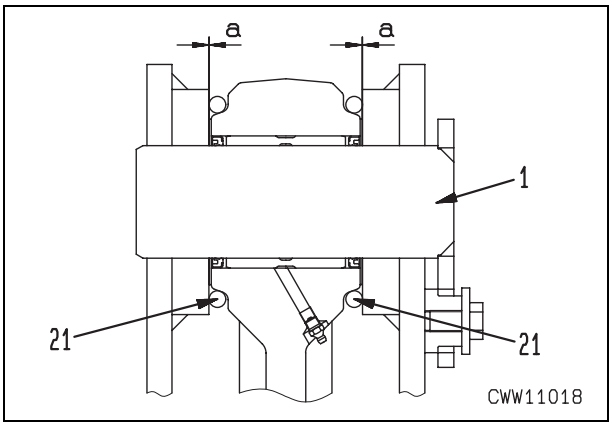
Installation

- Carry out installation in the reverse order to removal.

[*1]

- **Bucket link**
  Sling the bucket link and install cord ring (21) while aligning the holes for mounting pin (1). Insert a shim so that clearances (a) on the right and left sides will be the same, and then install pin (1) and lock it with the bolt.

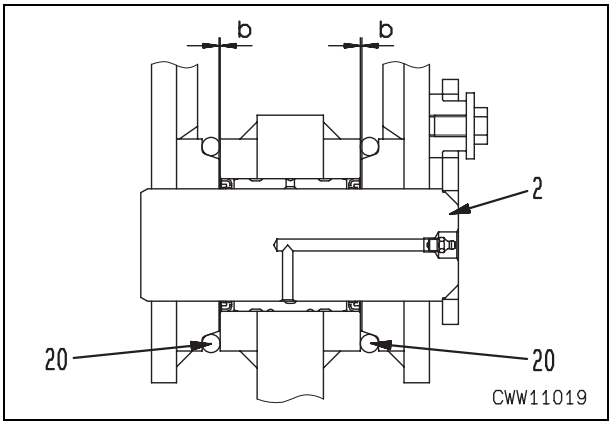
★ Take care that the cord ring will not be caught.
★ Clearance (a): **Max. 1.5 mm**
⚠ **When aligning the pin holes, use a bar. Never insert your fingers in the pin holes.**



[*2]

- **Bucket**
  Operate the control lever to align the holes for bucket pin (2) and install cord ring (20). Insert a shim so that clearances (b) on the right and left sides will be the same, and then install the mounting pin and lock it with the bolt.

★ Take care that the cord ring will not be caught.
★ Clearance (b): **Max. 1.5 mm**
⚠ **When aligning the pin holes, use a bar. Never insert your fingers in the pin holes.**



[*3]
- **Bucket cylinder**

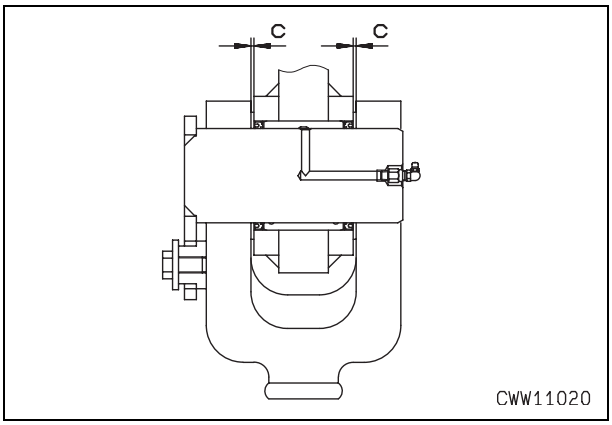
⚠ **When aligning the pin holes, use a bar. Never insert your fingers in the pin holes.**
- Adjust the bucket positioner. For details, see Testing and adjusting, “Testing and adjusting bucket positioner”.

[*4]
- **Lift cylinder**

⚠ **When starting the engine, check that the directional lever is in neutral and the parking brake is applied.**

⚠ **When aligning the pin holes, use a bar. Never insert your fingers in the pin holes.**

★ Clearance (c): **Max. 1.5 mm**



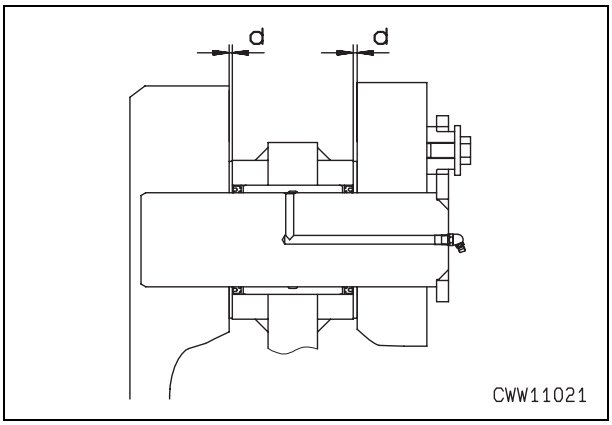
[*5]

★ Adjust the boom kick-out and check its operation. For details, see Testing and adjusting, “Testing and adjusting boom kick-out”.

[*6]

⚠ **When aligning the pin holes, use a bar. Never insert your fingers in the pin holes.**

★ Clearance (d): **Max. 1.5 mm**



[*7]

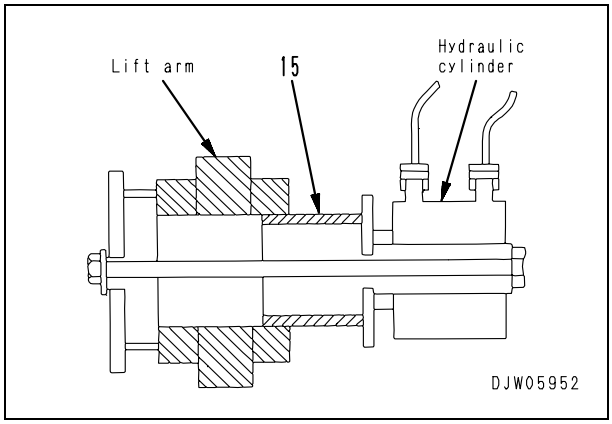
★ Fix the bucket link to the bell crank with wires etc.

★ Take care that the cord ring will not be caught.

[*8]
- **Bushing**

Press fit bushings (15) to the bucket link, bell crank, and lift arm with a press etc. and then install the dust seals.

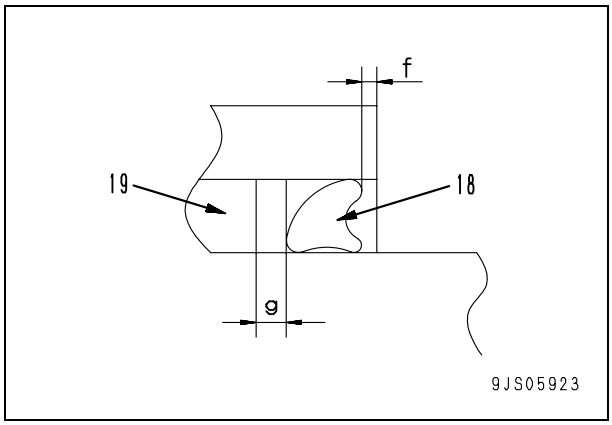
Bushing: **Grease (G2-LI)**



- **Dust seal**

When installing dust seal (18), direct its lip face out.

Part (19) is the bushing.
- Dimension (f): 0.25 – 0.8 mm
- Dimension (g): 2 – 3 mm



Greasing

Supply grease to each pin.

★ Supply grease until it flows out of the joint.

Pin: **Molybdenum disulfide grease (LM-G) or Hyper white grease (G1-T)**

Disassembly and assembly of hydraulic cylinder assembly

Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
I	1	790-502-1003	Repair stand	●	1		
		790-101-1102	Hydraulic pump	●	1		
	2	790-102-2303 or 790-330-1100	Wrench assembly	●	1		
	3	790-302-1270	Socket (Width across flats: 50 mm)	●	1		
	4	790-102-4300	Wrench assembly	●	1		
		790-102-4310	Pin	●	1		
	5	790-720-1000	Expander	●	1		
	6	796-720-1640	Ring	●	1		
		07281-00909	Clamp	●	1		
		796-720-1670	Ring	●	1		
		07281-01279	Clamp	●	1		
		796-720-1680	Ring	●	1		
		07281-01589	Clamp	●	1		

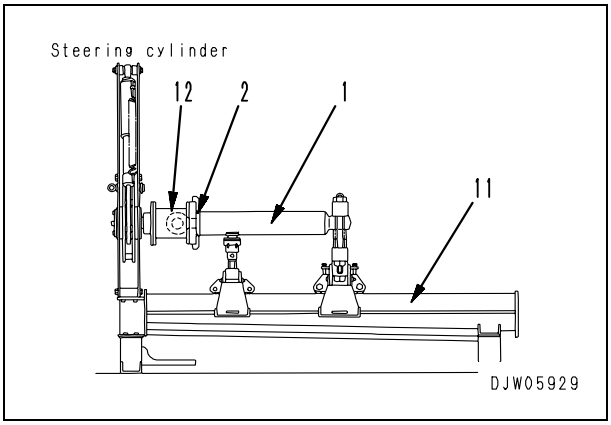
Disassembly

1. Set cylinder assembly (1) to tool **I1**.

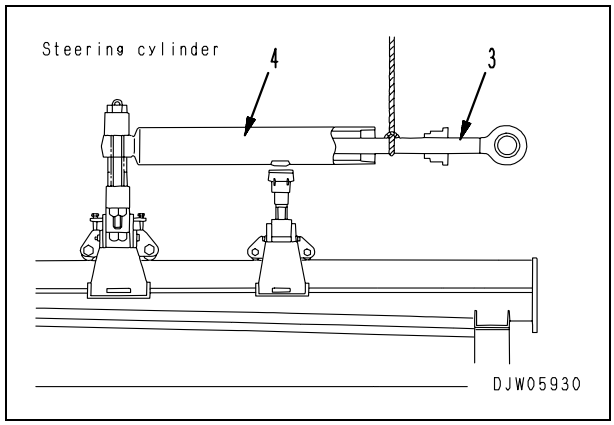
2. Cylinder head and piston rod assembly

- Steering cylinder assembly

1) Using tool **I2**, remove cylinder head (2) from the cylinder.



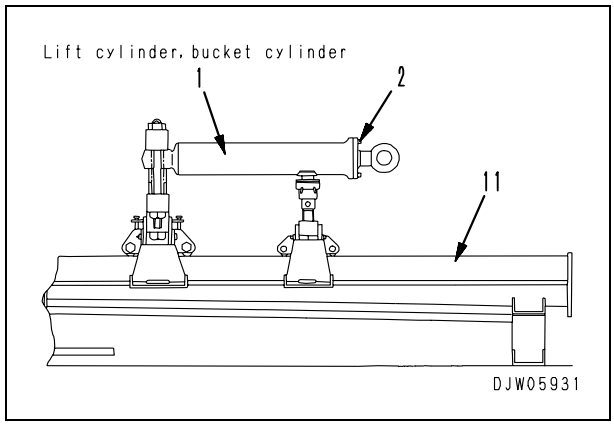
2) Pull cylinder head and piston rod assembly (3) out of cylinder (4).
   ★ Since oil flows out when the piston rod assembly is pulled out of the cylinder, prepare an oil receiver.



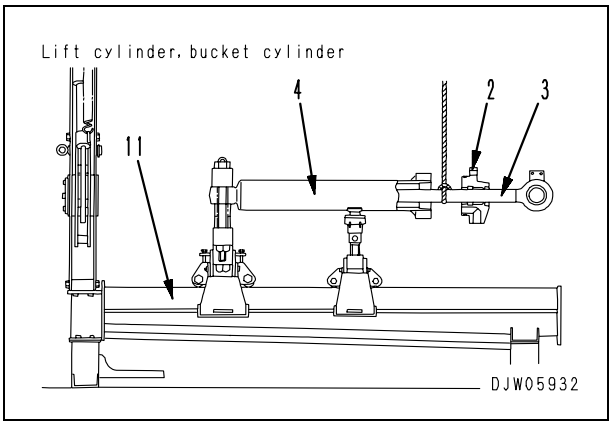
- Lift/Bucket cylinder assembly

1) Remove the mounting bolt of cylinder head assembly (2).

Cylinder	Width across flats (mm)
Lift cylinder	24
Bucket cylinder	30

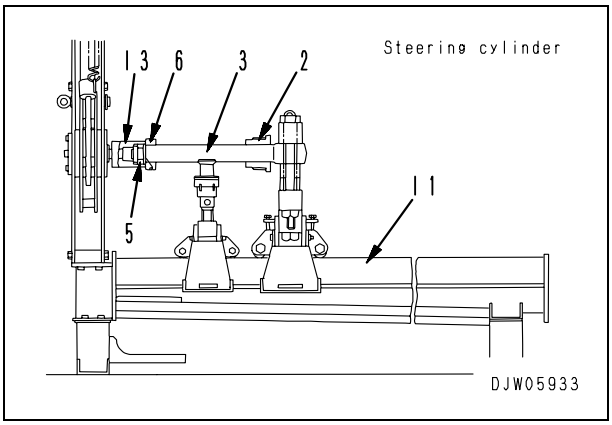


2) Pull cylinder head and piston rod assembly (3) out of cylinder (4).
★ Since oil flows out when the piston rod assembly is pulled out of the cylinder, prepare an oil receiver.



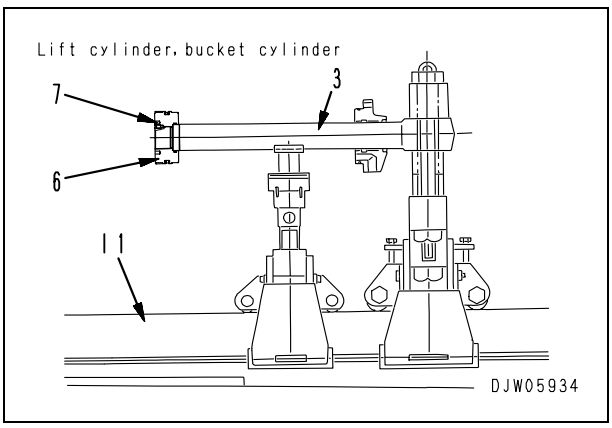
3. Piston and cylinder head
- Steering cylinder assembly

1) Set cylinder head and piston rod assembly (3) to tool **I1**.
2) Using tool **I3**, remove nut (5).
★ Width across flats of nut: **46 mm**
3) Remove piston (6) and cylinder head (2).

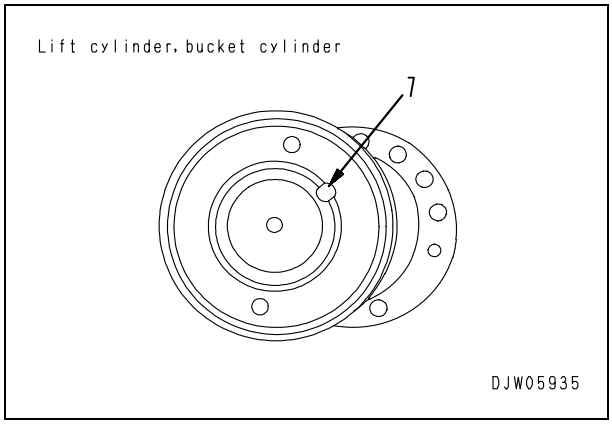


- Lift/Bucket cylinder assembly

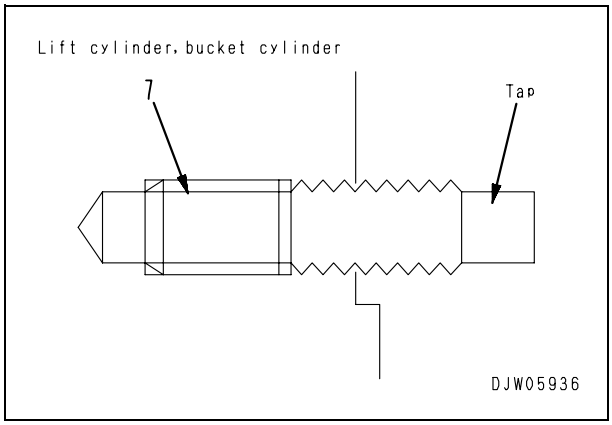
1) Set cylinder head and piston rod assembly (3) to tool **I1**.



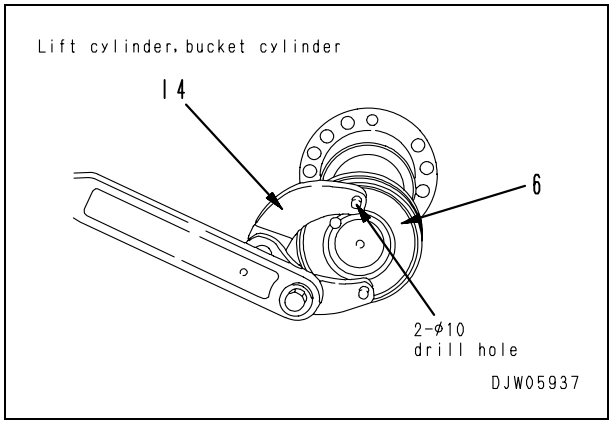
2) Remove lock screw (7) of the piston assembly.
★ Screw size: M12 × Pitch size of 1.75



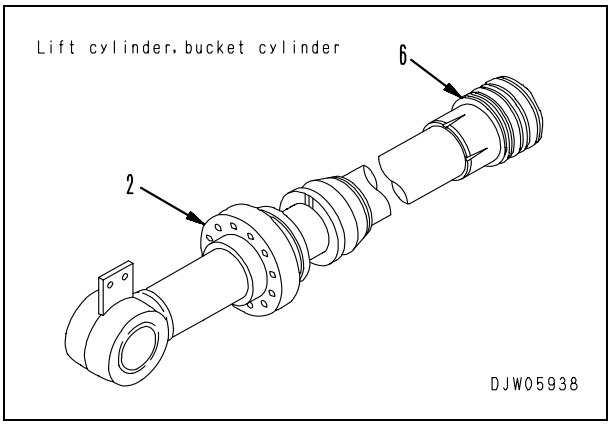
★ If screw (7) is so caulked that it cannot be removed, tighten it and apply a tap to its threads, and then remove it.



3) Using tool **I4**, remove piston assembly (6).
★ When not using tool **I4**, loosen the piston assembly by using the holes (ø 10, 2 places).

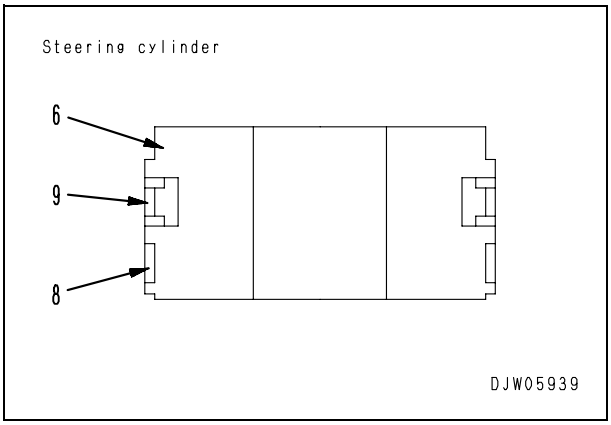


4) Remove cylinder head assembly (2).

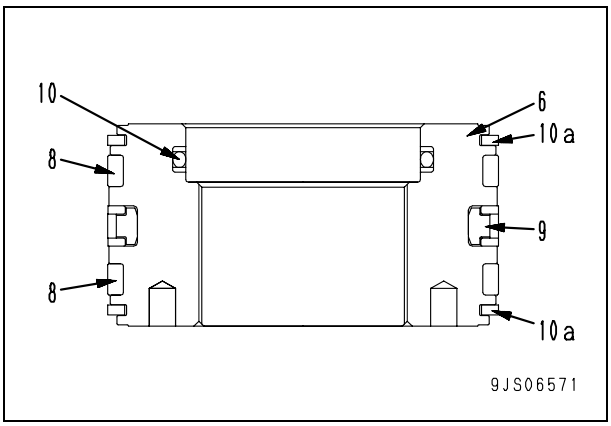


4. Disassembly of piston assembly

- Steering cylinder assembly
  Remove wear ring (8) and piston ring (9) from piston (6).



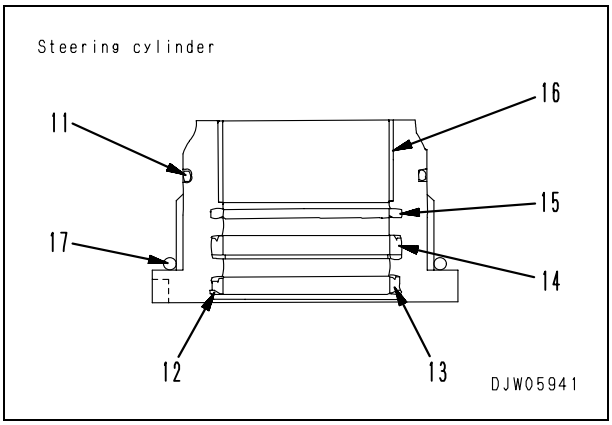
- Lift/Bucket cylinder assembly
  Remove wear ring (8), piston ring (9), O-ring, backup ring (10), and ring (10a) from piston (6).



5. Disassembly of cylinder head assembly

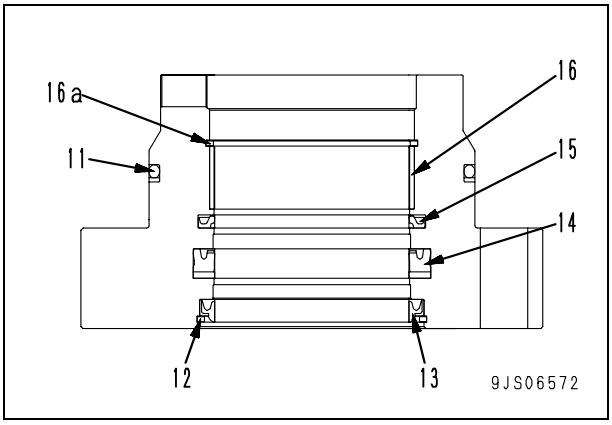
- Steering cylinder assembly

1) Remove O-ring and backup ring (11).
2) Remove snap ring (12) and dust seal (13).
3) Remove rod packing (14).
4) Remove buffer ring (15).
5) Remove bushing (16).
6) Remove O-ring (17).



- Lift/Bucket cylinder assembly

1) Remove O-ring and backup ring (11).
2) Remove snap ring (12) dust seal (13).
3) Remove rod packing (14).
4) Remove buffer ring (15).
5) Remove snap ring (16a) and bushing (16).

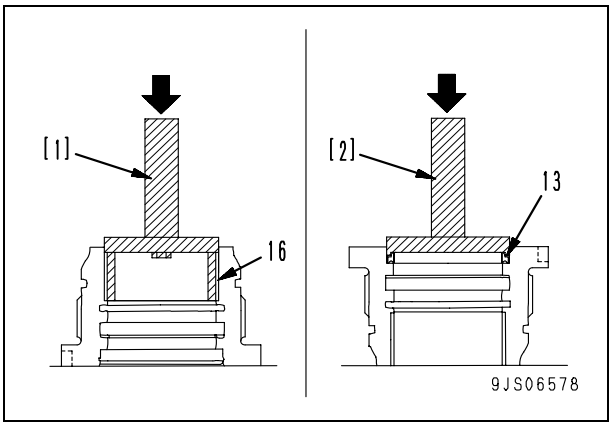


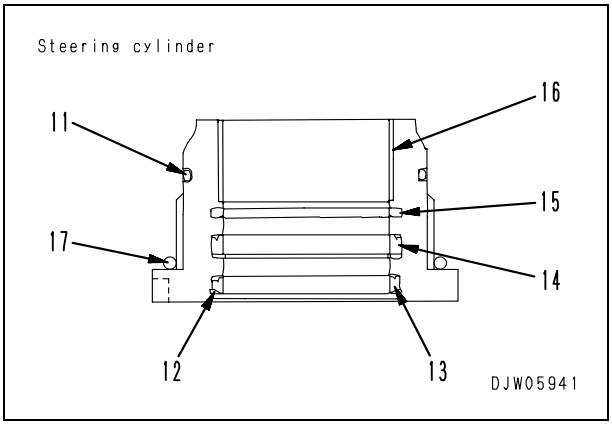
Assembly

★ Take care not to damage the packings, dust seals, O-rings, etc.
★ Do not insert each backup ring forcibly, but warm it in water at 50 – 60°C and then insert it.

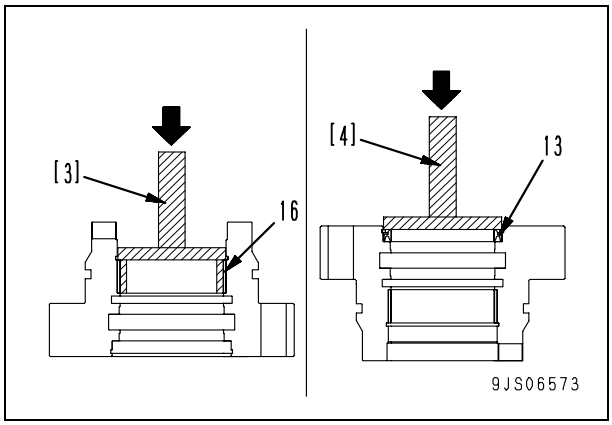
1. Assembly of cylinder head assembly

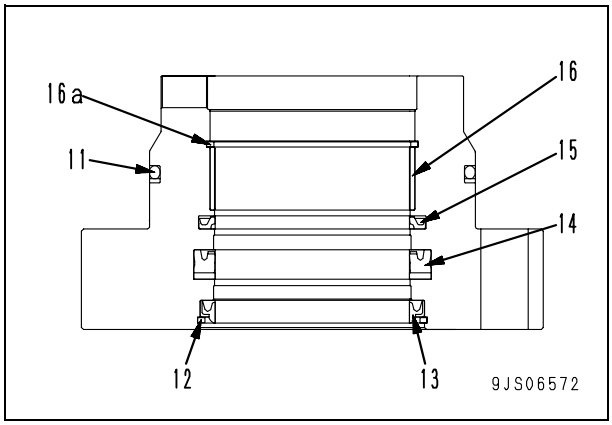
● Steering cylinder assembly
1) Using tool [1], press fit bushing (16).
2) Install buffer ring (15).
3) Install rod packing (14).
4) Using tool [2], install dust seal (13) and secure it with snap ring (12).
5) Install backup ring and O-ring (11).
6) Install O-ring (17).





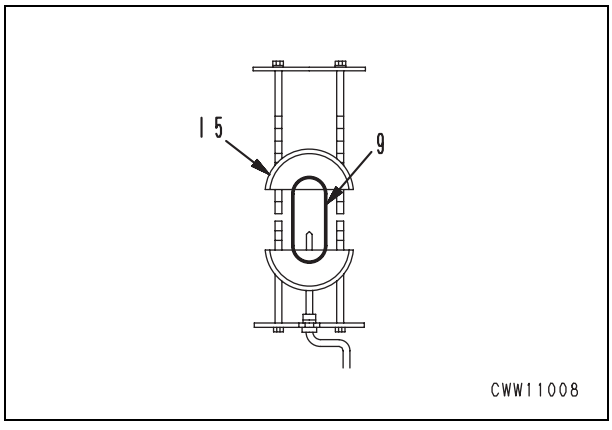
● Lift/Bucket cylinder
1) Using tool [3], press fit bushing (16) and install snap ring (16a).
2) Install buffer ring (15).
3) Install rod packing (14).
4) Using tool [4], install dust seal (13) and secure it with snap ring (12).
5) Install backup ring and O-ring (11).



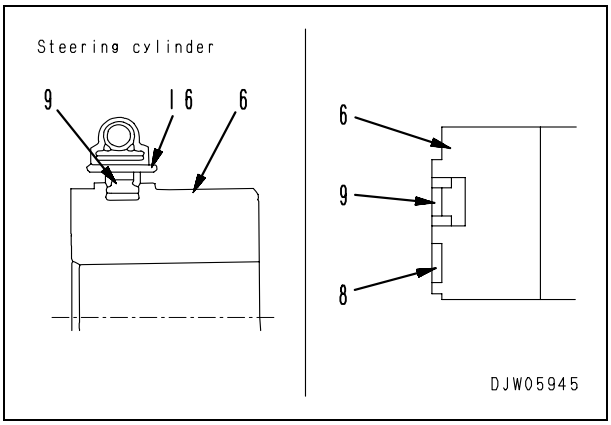


2. Assembly of piston assembly

● Steering cylinder assembly
1) Using tool **I5**, expand piston ring (9).
★ Set the piston ring to the tool and rotate the handle of the tool by 8 – 10 turns to expand the piston ring.

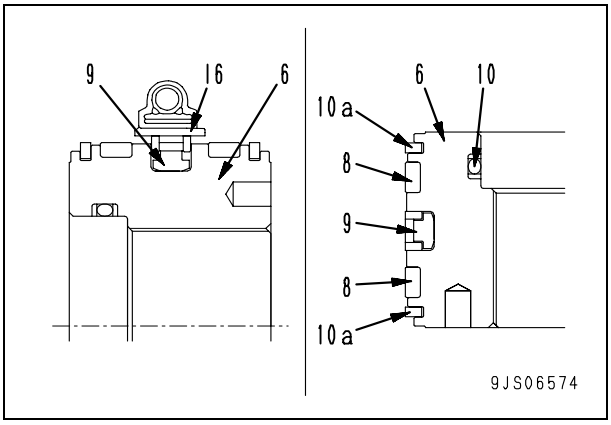


2) Remove piston ring (9) from tool **I5** and install it to piston (6).
3) Using tool **I6**, shrink piston ring (9).
4) Install wear ring (8).



- Lift/Bucket cylinder assembly

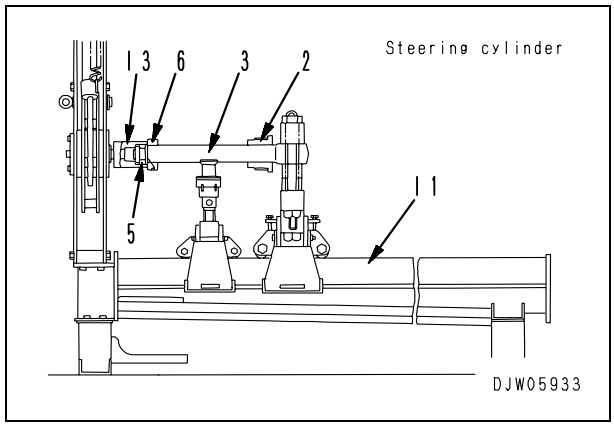
1) Using tool **I5**, expand piston ring (9).
   ★ Set the piston ring to the tool and rotate the handle of the tool by 8 – 10 turns to expand the piston ring.
   ★ For illustration, see CWW1108.
2) Remove piston ring (9) from tool **I5** and install it to piston (6).
3) Using tool **I6**, shrink piston ring (9).
4) Install wear ring (8).
5) Install O-ring and backup ring (10).
   ★ Do not insert the backup ring forcibly, but warm it in water at 50 – 60°C and then insert it.
6) Install ring (10a).



3. Cylinder head and piston rod assembly

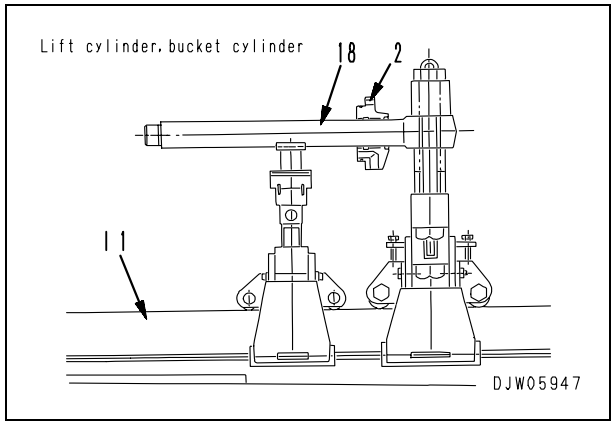
- Steering cylinder assembly

1) Set piston rod (3) to tool **I1**.
2) Install cylinder head (2) and piston (6) to the piston rod.
3) Using tool **I3**, tighten nut (5) to the specified torque.
   ★ Width across flats of nut: **46 mm**
   Threads of piston rod: **Adhesive (LOCTITE No. 262)**
   Nut: **785 ± 78.5 Nm {80 ± 8 kgm}**



- Lift/Bucket cylinder assembly

1) Set piston rod (18) to tool **I1**.
2) Install cylinder head assembly (2).

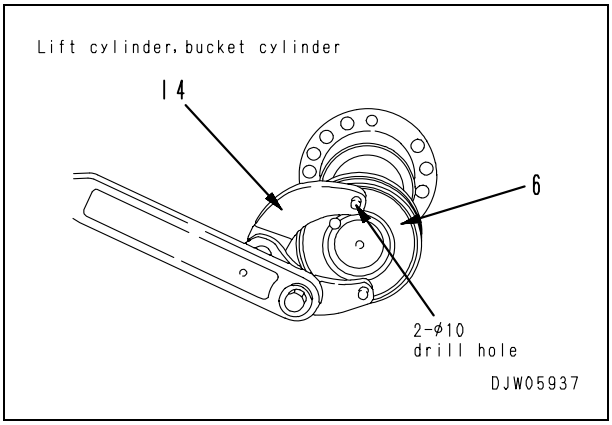


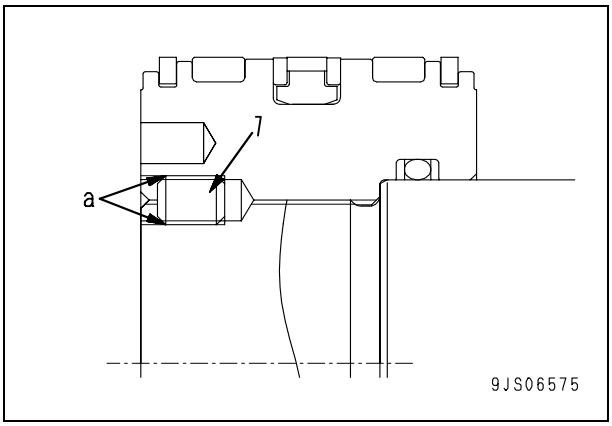
3) Assemble piston assembly (6) according to the following procedure.
   - When reusing rod and piston assembly (6)
     - ★ Clean the parts thoroughly and remove metal chips and dirt.
   i) Using tightening tool **l4**, tighten piston assembly (6) until the screw holes are aligned.
      - ★ Remove burrs and fins from the threads with a file etc.
   ii) Tighten screw (7).

Threads of screw:
Adhesion (LOCTITE No. 262)

Screw: **58.9 – 73.6 Nm {6 – 7.5 kgm}**

iii) Caulk 4 points of the threaded part with punch (a).

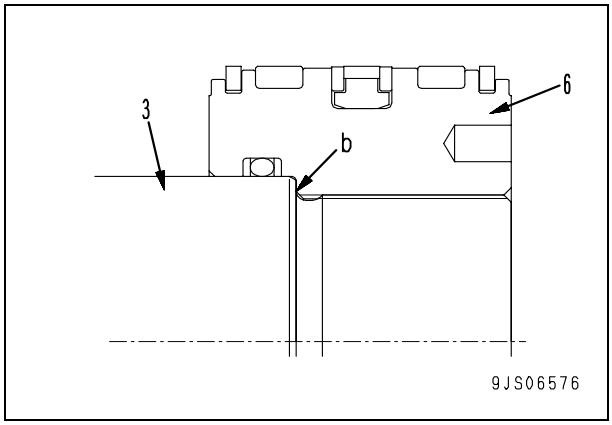




- When replacing either or both of the rod and piston

i) Using tool **l4**, screw in piston assembly (6) until it touches end (b) of the rod, and then tighten it to the specified torque.

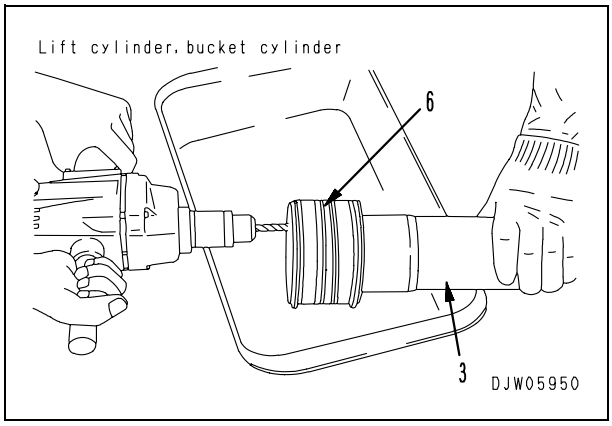
Piston assembly:
294 ± 29.4 Nm {30 ± 3.0 kgm}



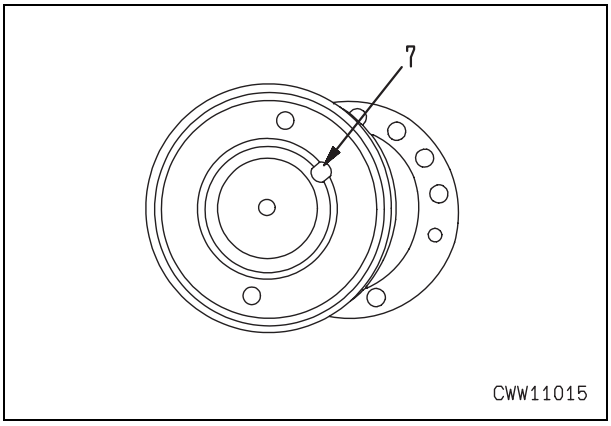
ii) Make 1 screw hole to install screw (7).
   - ★ Make 1 hole horizontally with a drill at the V-groove of the threaded part of piston (6) and rod (3).
   - Threading dimensions (mm)

Diameter of tap drill hole	Depth of tap drill hole	Tap to be used	Tapping depth
10.3	27	12 × 1.75	20

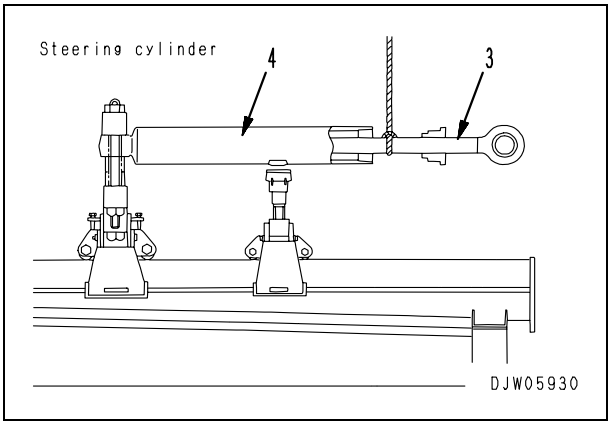
iii) After making the hole, remove the all chips and dirt and clean thoroughly.



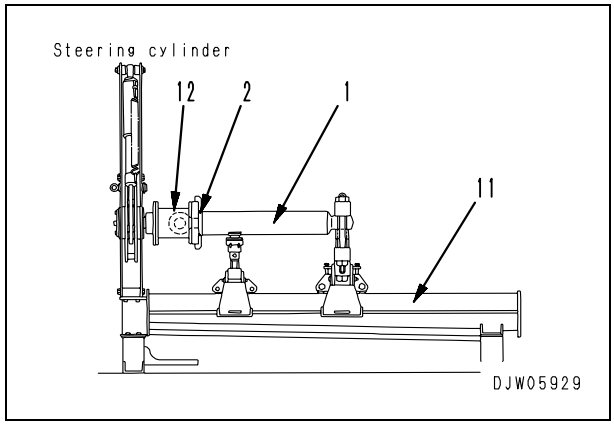
iv) Tighten screw (7).
Threads of screw:
Adhesion (LOCTITE No. 262)
Screw:
58.9 – 73.6 Nm {6 – 7.5 kgm}
v) Caulk 4 points of the threaded part with a punch.



4. Cylinder head
- Steering cylinder assembly
1) Set cylinder (4) to tool **I1**.
2) Sling cylinder head and piston rod assembly (3) and install it to cylinder (4).



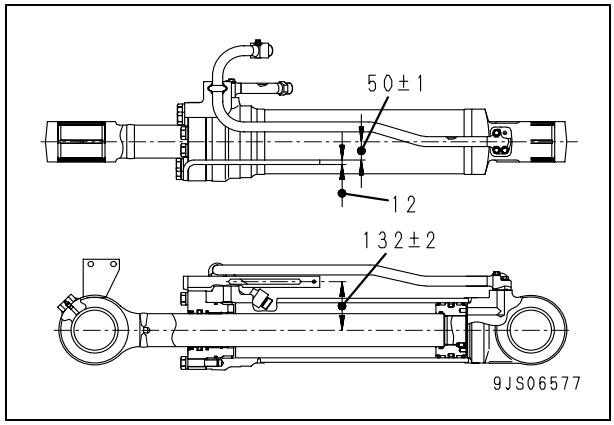
3) Using tool **I2**, install cylinder head assembly (2) to the cylinder.
Cylinder head:
569 ± 57 Nm {58 ± 5.8 kgm}
4) Remove cylinder assembly (1) from tool **I1**.



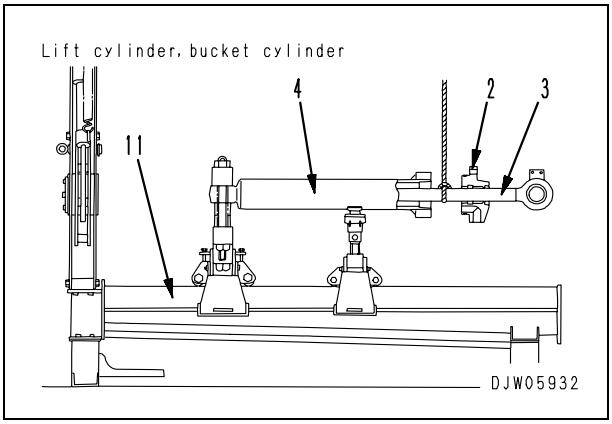
- Lift/Bucket cylinder assembly
1) Set cylinder (4) to tool **I1**.
2) Sling cylinder head and piston rod assembly (3) and install it to cylinder (4).
3) Install cylinder head assembly (2) to the cylinder.
★ Tighten the bolts of the leveler plate of the bucket cylinder to obtain the dimensions shown in drawing.

Mounting bolt:

Cylinder	Nm {kgm}
Lift cylinder	270 ± 39 {27.5 ± 4}
Bucket cylinder	529.7 ± 78.5 {54 ± 8}



4) Remove cylinder assembly (1) from tool **I1**.



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

50 Disassembly and assembly

Cab and its attachments

Cab and its attachments 2
Removal and installation of operator's cab and floor frame assembly 2
Removal and installation of operator's cab glass (stuck glass) 5
Removal and installation of air conditioner unit assembly 13

Cab and its attachments

Removal and installation of operator's cab and floor frame assembly

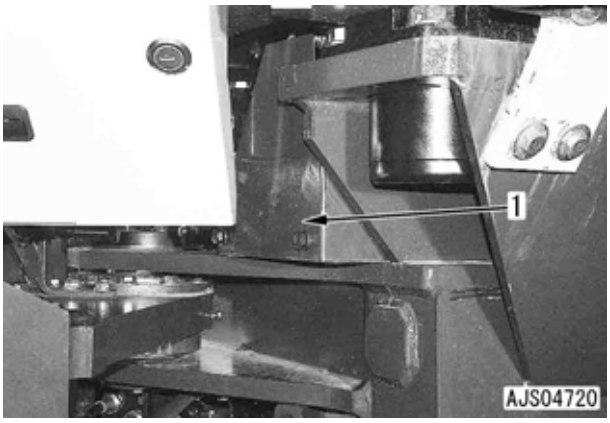
Removal

- ⚠ **Stop the machine on a level place, set the safety bar to the frame, lower the bucket to the ground, stop the engine, apply the parking brake, and lock the tires with chocks.**
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**
- ⚠ **Collect the air conditioner refrigerant (R134a).**

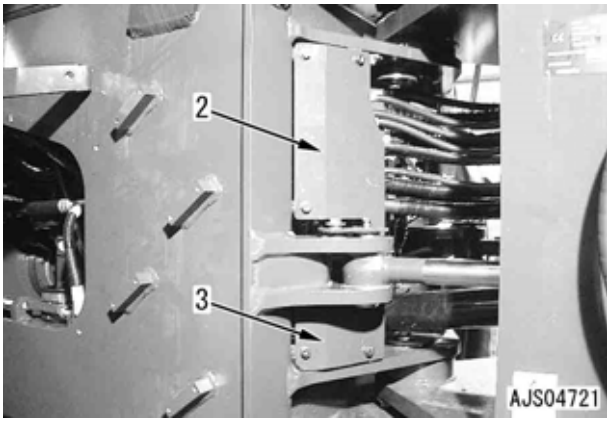
1. Remove the engine hood assembly. For details, see “Removal and installation of engine hood assembly”.

2. Remove the hydraulic tank assembly. For details, see “Removal and installation of hydraulic tank assembly”.

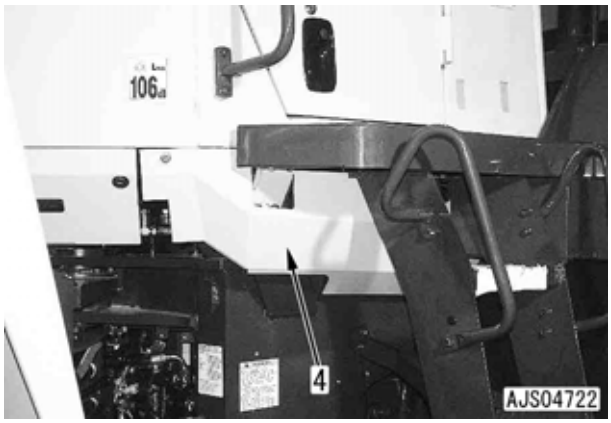
3. Remove left side cover (1).



4. Remove right side covers (2) and (3).

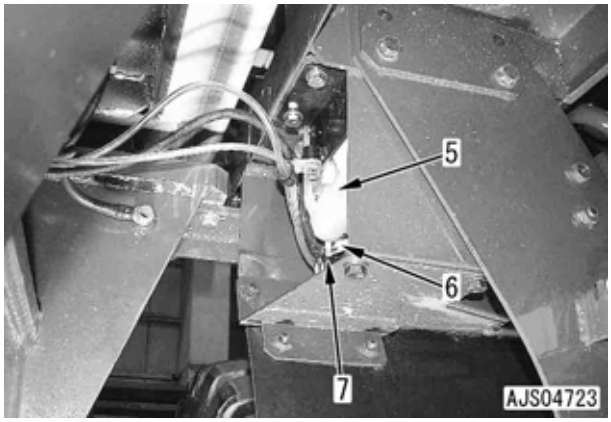


5. Remove the right and left covers (4).



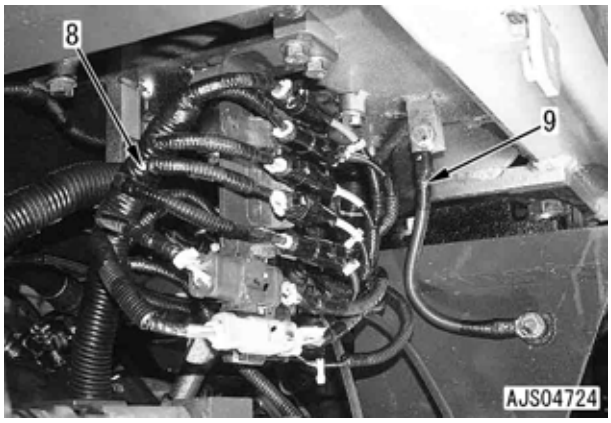
6. Disconnect connectors R45 (6) and R43 (7) of window washer tank (5).
   R45 (Front: White), R43 (Rear: Black)

7. Remove window washer tank (5).

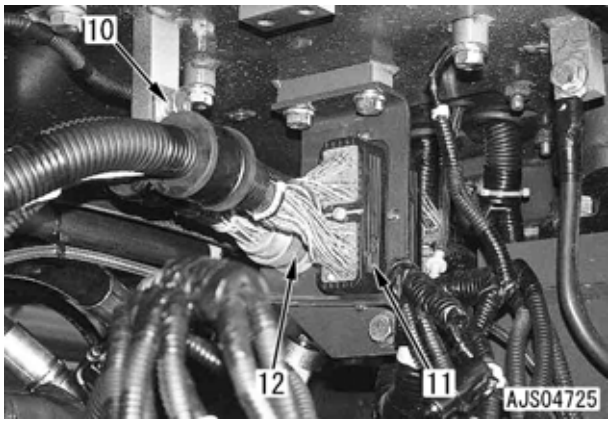


8. Disconnect 9 connectors from wiring (8).
   Front side, from top: LR1, LR8, LR4, LR12, LR6, FL2, LR11
   Rear side, from top: LR5, R87

9. Disconnect ground wire (9).

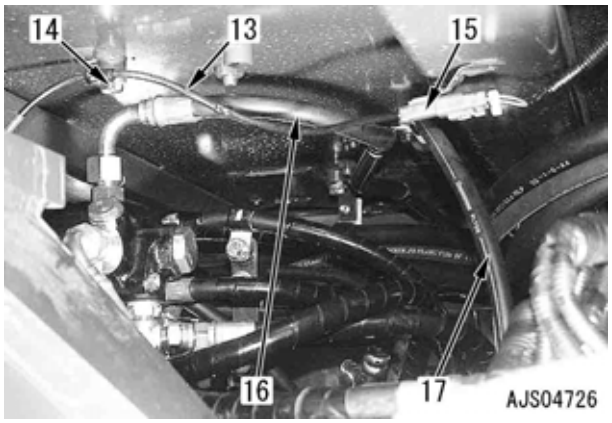


10. Release clamp (10) and disconnect heavy duty wire connectors FL1 (11) and LT1 (12).

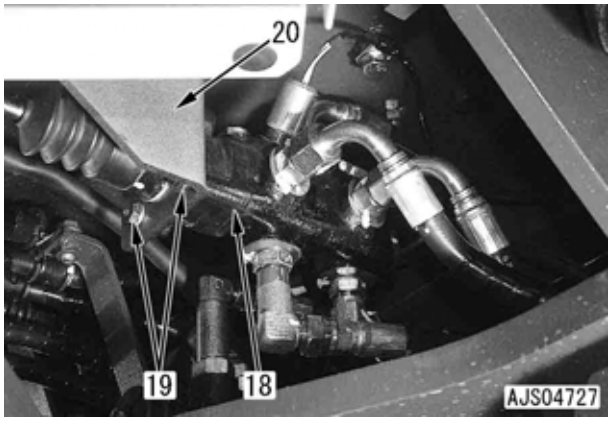


11. Release clamp (14) of wiring (13) and disconnect connector L09 (15).

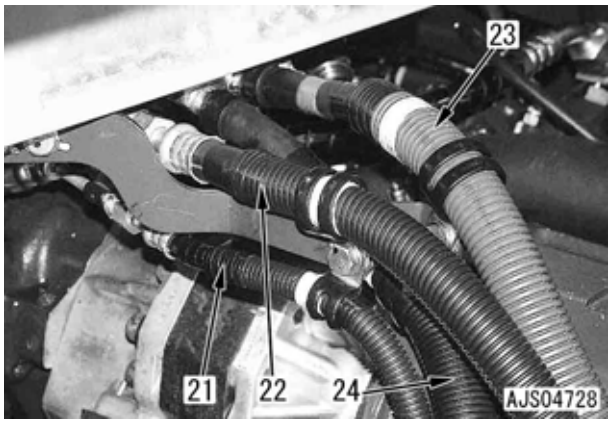
12. Disconnect hoses (16) and (17).



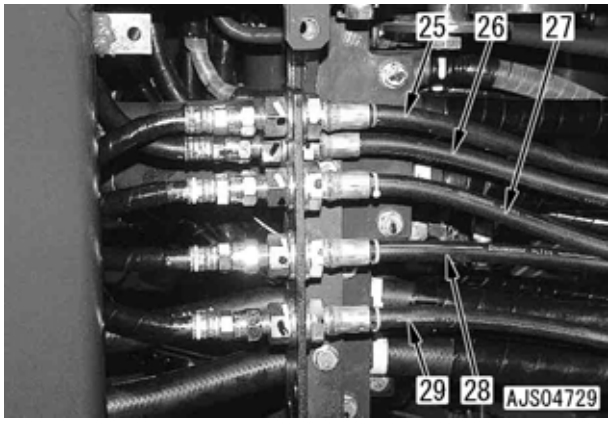
13. Remove 4 mounting bolts (19) of brake valve (18) and remove brake valve (18) from bracket (20).



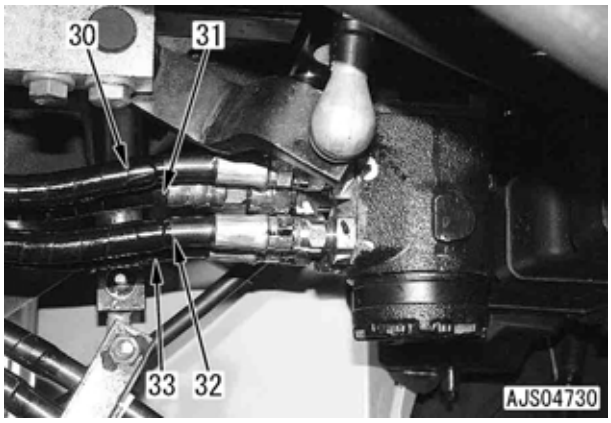
14. Remove air conditioner hoses (21) and (22) and heater hoses (23) and (24).



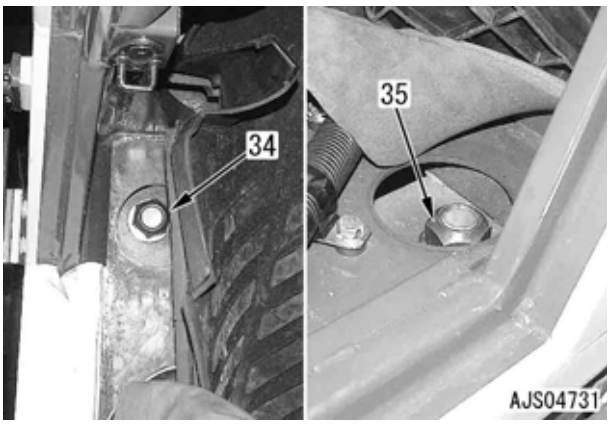
15. Disconnect 5 PPC hoses (25), (26), (27), (28), and (29). [*1]



16. Disconnect 4 hoses (30), (31), (32), and (33) from the Orbit-roll valve.



17. Remove the floor mat and then remove 2 left mounting nuts (34) and 2 right mounting nuts (35) of the operator's cab and floor frame assembly. [*2]



18. Lift off operator's cab and floor frame assembly (36).
    ★ Check that all the wirings and pipings are disconnected.

    Operator's cab and floor frame assembly:
    1,000 kg



Installation

- Carry out installation in the reverse order to removal.

[*1]

- Connect the PPC hoses according to the collar bands.

[*2]

Mounting nut:
1,180 – 1,470 Nm {120 – 150 kgm}

Removal and installation of operator's cab glass (stuck glass)

Special tools

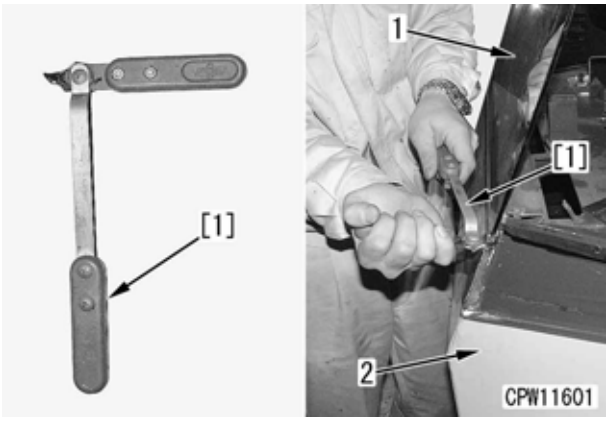
Symbol			Part number	Part name	Necessity	Q'ty	N/R	Sketch
X	2	1	793-498-1120	Clear plate	■	2		
		2	793-498-1130	Plate	■	2		
		3	793-498-1110	Magnet	■	2		
	3		793-498-1210	Lifter (Suction cup)	■	2		

Removal

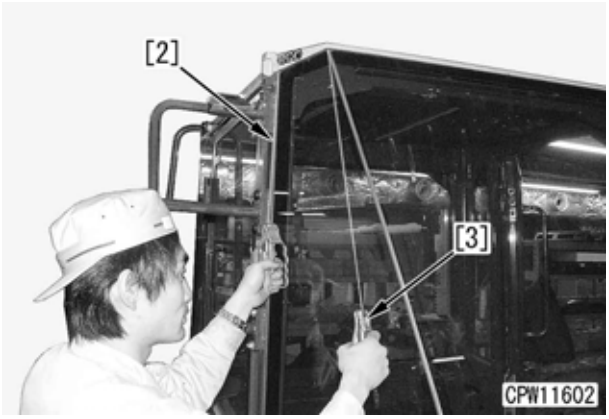
★ The operator's cab glasses of this machine are fully stuck with adhesive.

★ Remove the window glass to be replaced according to the following procedure.

1. Using seal cutter [1], cut the adhesive between broken window glass (1) and operator's cab (2).

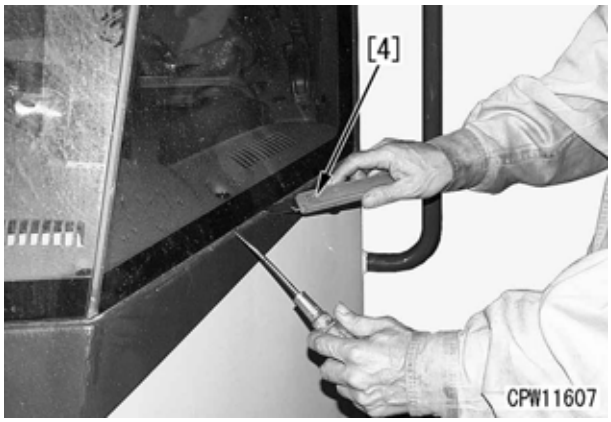


★ If the glass is narrow, you may cut the adhesive by the following method; Insert a fine wire (piano wire, etc.) [2] in the adhesive and grip its both ends with pliers [3], etc. (or hold them by winding them onto something) and cut the adhesive with the wire.



★ If the window glass is broken finely, it may be removed with knife [4] and a screwdriver. (If the screwdriver is applied directly to the normal window glass, the glass will be probably broken.)

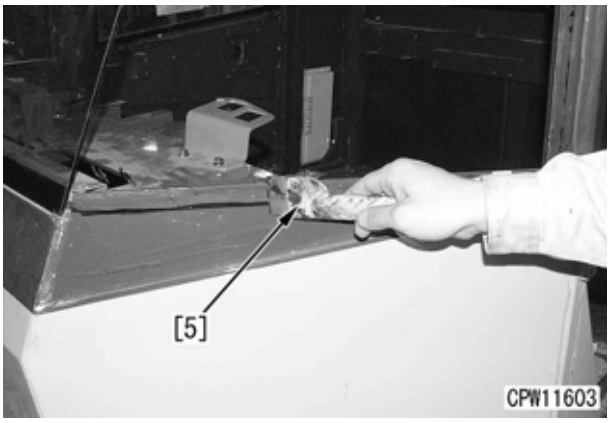
★ When using knife [4], insert a screwdriver in the cut to widen it and move the knife forward.



2. Remove the window glass.

Installation

1. Using scraper [5], remove the remaining adhesive.
   ★ Do not scratch the paint.



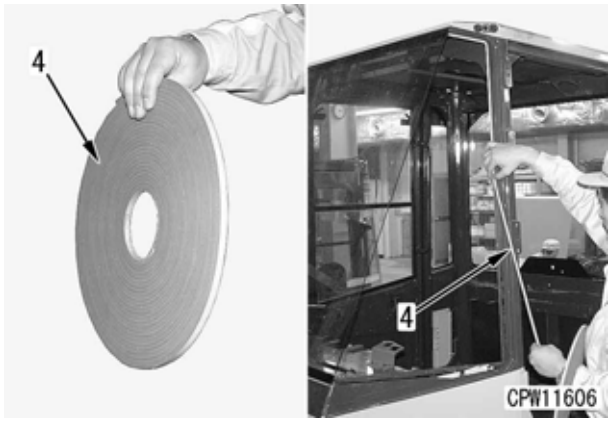
2. Remove oil, dust, dirt, etc. from the sticking surfaces of cab (2) and window glass (3) with white gasoline.
   ★ If the sticking surfaces are not cleaned well, the glass may not be stuck perfectly.
   ★ Clean all the black part on the back side of the window glass.
   ★ After cleaning the sticking surfaces, leave them for at least 5 minutes to dry.



3. When the adhesive was removed with the scraper, if any paint was flaked off, coat the bare part with paint.
   ★ If the glass is installed without repairing the bare part, that part will be rusted.
   ★ Do not apply paint to a part which will be coated with primer.



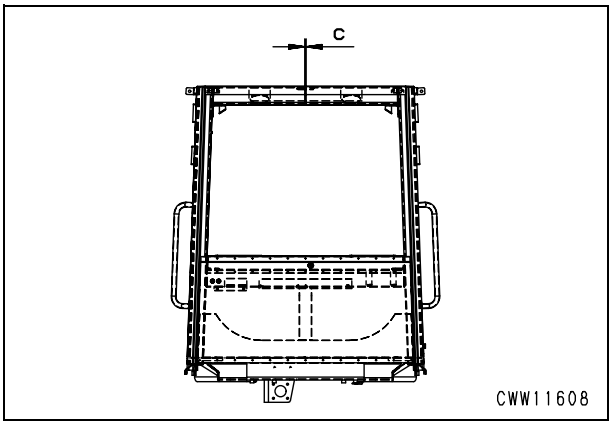
4. Stick both-sided adhesive tape (4) along the inside edge of the glass sticking section.
   ● Size of both-sided adhesive tape: **7 × 4.8 mm**
   ★ When sticking the both-sided adhesive tape, do not touch the cleaned surface as long as possible.
   ★ Do not remove the release tape of the both-sided adhesive tape on the glass sticking side before sticking the glass.



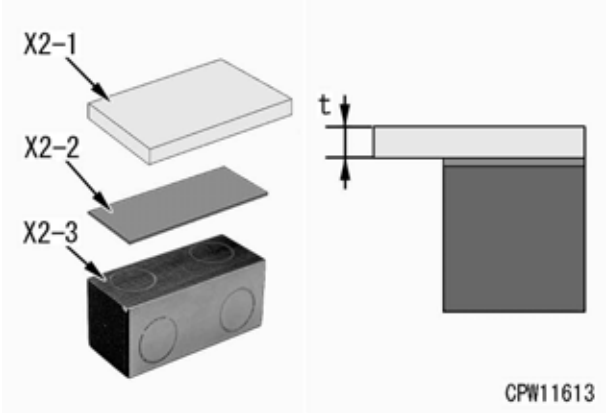
★ Take care that the corner (part (b)) of both-sided adhesive tape (4) will not float.

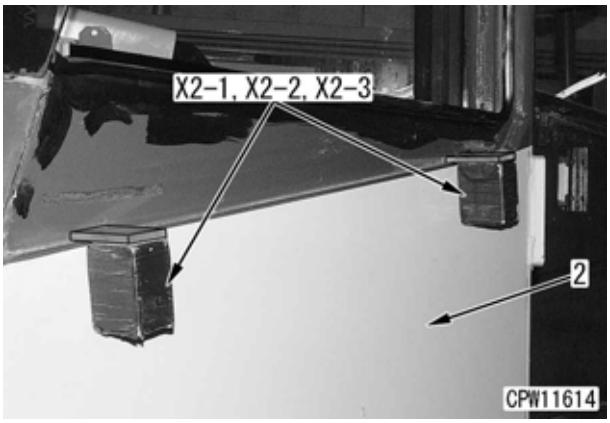


★ When sticking the both-sided adhesive tape around a side or a rear window glass, start at center of the top and make a clearance of about 5 mm at end joint (c).

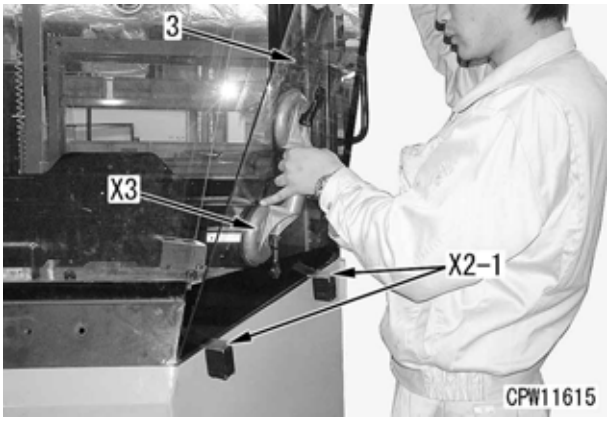


5. Position the replacement glass.
   1) Stick **X2-2** (thin steel sheet) to tool **X2-1** (spacer) with adhesive.
      - Spacer thickness (t): **5 mm**
   2) Match tool **X2-3** (magnet) to tools **X2-1** and **X2-2** and set them to the 2 lower places of the window glass sticking part of operator's cab (2).

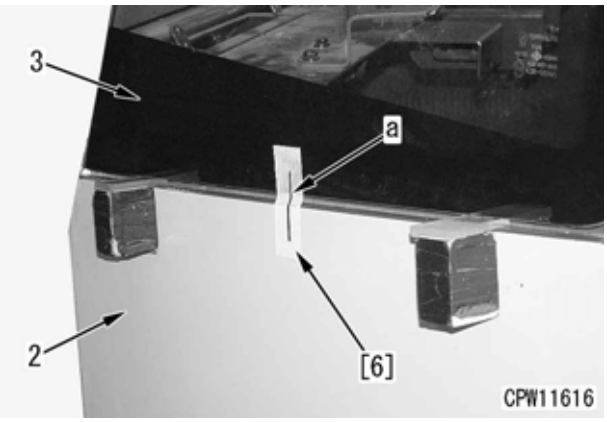




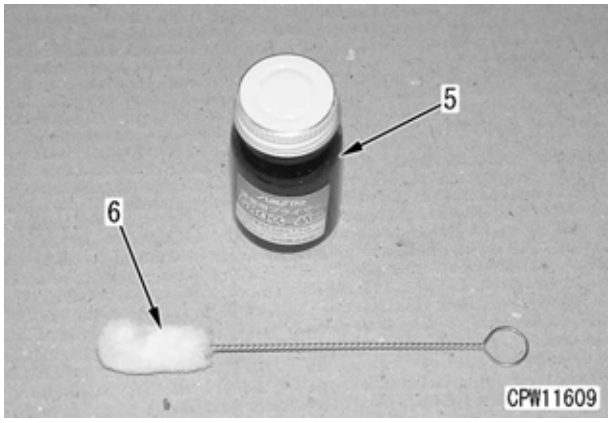
   3) Using tool **X3** (suction cup), place window glass (3) on tool **X2-1** (5 mm spacer) and match it to the operator's cab.



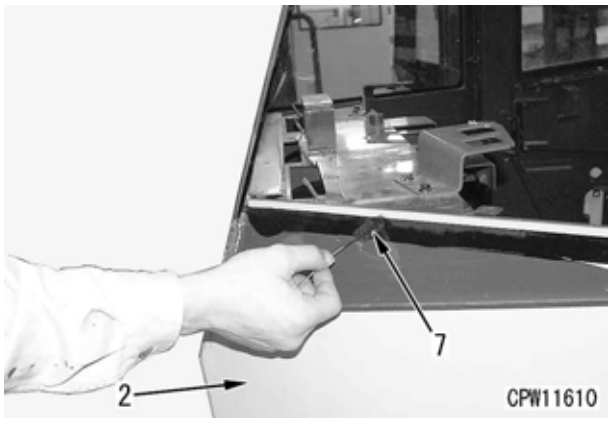
4) Check the clearance between window glass (3) and operator's cab (2) on the right and left sides and adjust it evenly.
5) Stick tape [6] between window glass (3) and operator's cab (2) and draw positioning line (a) on the tape.
6) Cut the tape between window glass (3) and operator's cab (2) with a knife, and then remove the window glass.
   ★ Do not remove the tapes left on the window glass and operator's cab before installing the window glass.

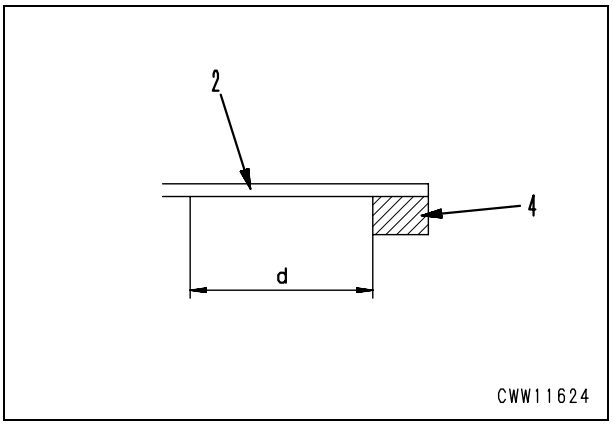


6. Apply primer.
   ★ The using limit of primer (5) is 4 months after the date of manufacture. Do not use the primer after this limit.
   ★ Use the primer within 2 hours after unpacking it.
   ★ Even if the primer is packed again just after it is unpacked, use it within 24 hours after it is unpacked for the first time. (Discard the primer 24 hours after it is packed.)
   1) Stir the primers for 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 (6), wash it in white gasoline.
      ★ After washing the brush, check it again for dirt and foreign matter.
      ★ Prepare respective brushes for the paint primer glass primer.

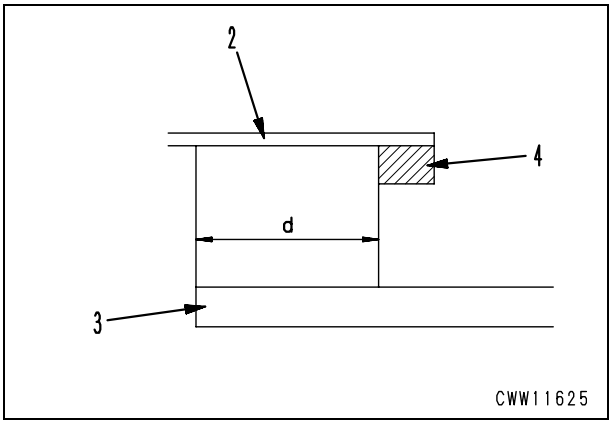


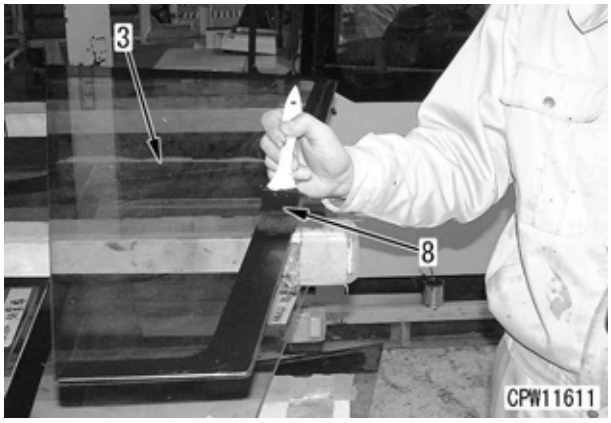
3) Evenly apply paint primer (7) to the parts on the outside of both-sided adhesive tape on operator's cab (2) which will be coated with the adhesive.
   Paint primer:
   SUNSTAR PAINT PRIMER 580 SUPRE
   ★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)
   ★ Parts to be coated with primer: Apply the primer all over dimension (d) on the outside of the both-sided adhesive tape.
      ● Dimension to apply primer (d): **23 mm**
   ★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.
   ★ If the glass primer is applied by mistake, wipe it off with white gasoline. (If wrong primer is applied, the glass will not be stuck.)





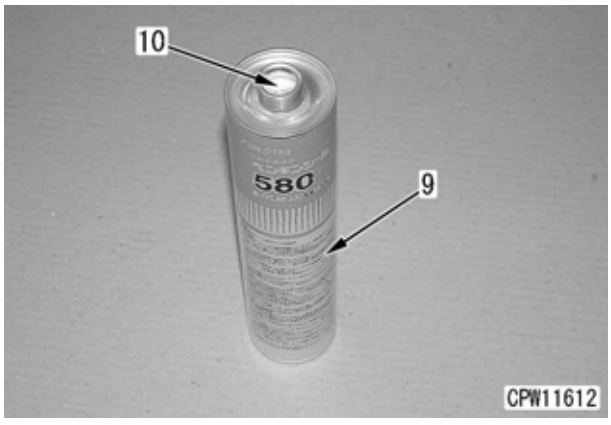
4) Evenly apply glass primer (8) to the black part of window glass (3) to be stuck.
   Glass primer:
   SUNSTAR GLASS PRIMER 580 SUPRE
   - ★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)
   - ★ Parts to be coated with primer: Apply the primer to the sticking surface of window glass (3) and all over dimension (d) on both-sided adhesive tape (4) and operator's cab (2).
     - Dimension to apply primer (d): **23 mm**
   - ★ Do not apply the primer to the boarder about 5 mm wide between the black part and transparent part of the glass.
   - ★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.
   - ★ If the paint primer is applied by mistake, wipe it off with white gasoline. (If wrong primer is applied, the glass will not be stuck.)



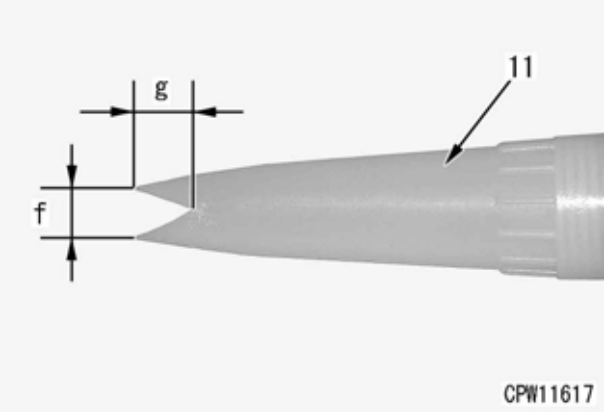


7. Apply adhesive.
   - ★ Use either of the 2 types of the adhesive, depending on the season.
   Adhesive (April – October):
   SUNSTAR PENGUINE SEAL 580 SUPER “S”
   Adhesive (October – April):
   SUNSTAR PENGUINE SEAL 580 SUPER “W”
   - ★ The using limit of the adhesive is 4 months after the date of 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 from the nozzle tip.

   1) Break aluminum seal (10) of the outlet of adhesive cartridge (9) and install the nozzle.



2) Cut the tip of the adhesive nozzle (11) so that dimensions (f) and (g) will be as follows.
   - Dimension (f) : **10 mm**
   - Dimension (g): **12 mm**



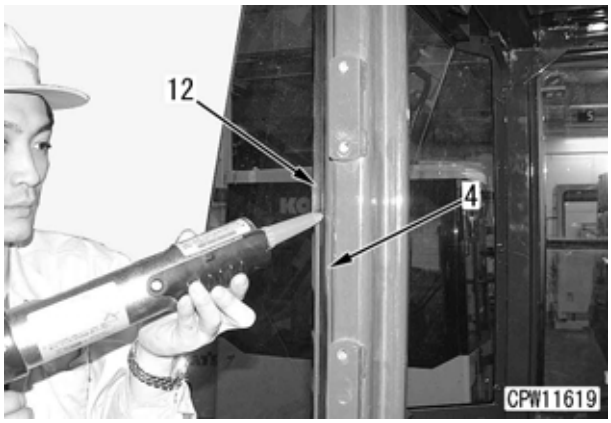
3) Set adhesive cartridge (9) to caulking gun [7].
   ★ An electric caulking gun is more efficient.



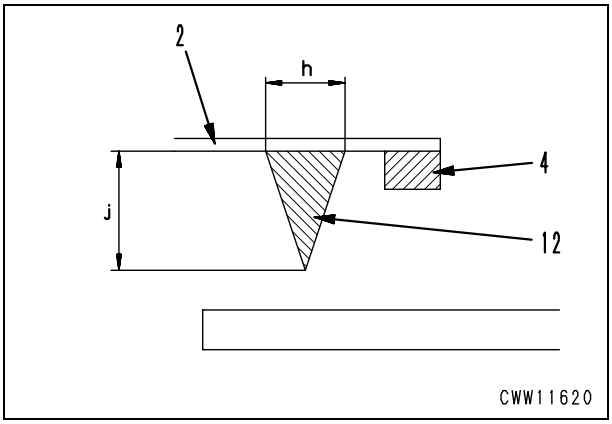
4) Remove release tape (13) of the both-sided adhesive tape on the glass side.



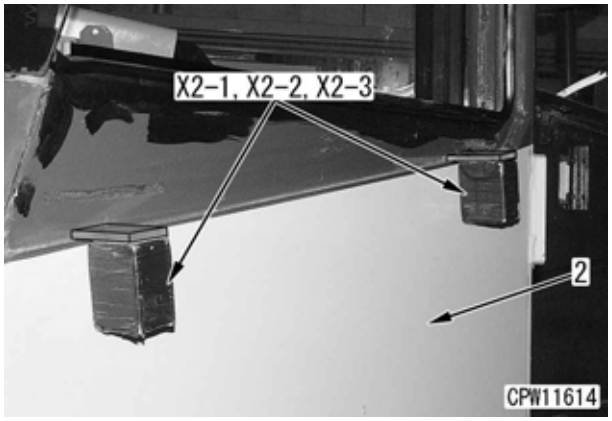
5) Apply adhesive (12) to the outside of both-sided adhesive tape (4) of the operator's cab.
   ★ Before applying the adhesive, check that the primer is applied to the surface to which the adhesive will be applied.



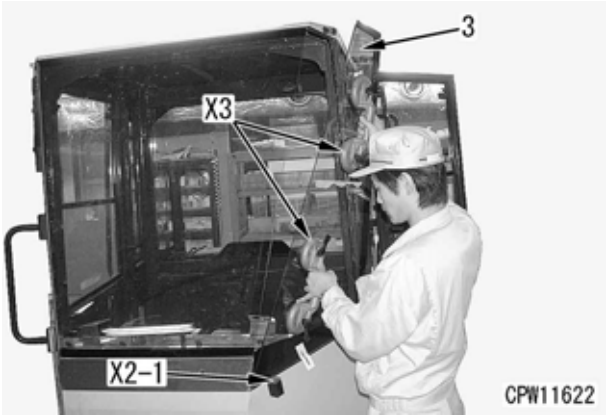
   ★ Apply adhesive (12) to dimensions (h) and (j) of both-sided adhesive tape (4) of operator's cab (2).
      - Dimension (h): **10 mm**
   ★ Apply adhesive (12) higher than both-sided adhesive tape (4).
   ★ Apply the adhesive evenly in height.



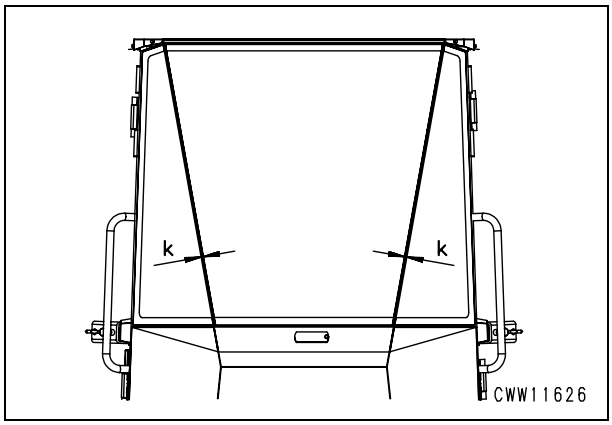
8. Install window glass (3).
   ★ If the glass is positioned wrongly, the adhesive must be removed and cleaned, and then the primer and adhesive must be applied again. Accordingly, position the glass very carefully when sticking it.
   1) Similarly to step 5, match tools **X2-1**, **X2-2**, and **X2-3** and set them to the 2 lower places of the window glass sticking part of operator's cab (2).



   2) Using tool **X3**, raise and place window glass (3) on tool **X2-1** (5 mm spacer) and stick it to the operator's cab.
      ★ Match the lines of the match tapes stuck in step 5.
      ★ Stick the glass within 10 minutes after applying the adhesive.
      ★ Before sticking the glass, check that the primer is applied to the surface to which the glass will be stuck.



      ★ Check that clearance (k) between the front side of the front glass and right and left side glasses is even.
         ● Clearance (k): **5 mm**

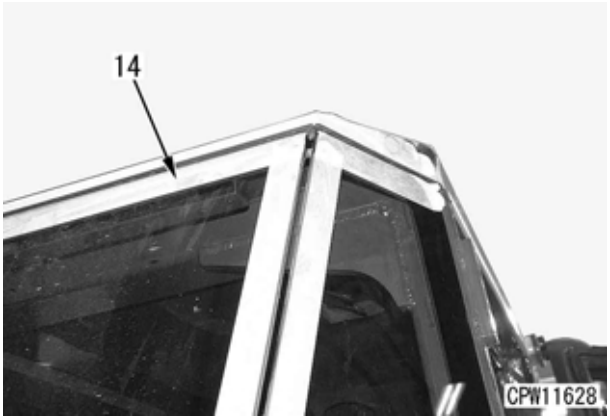


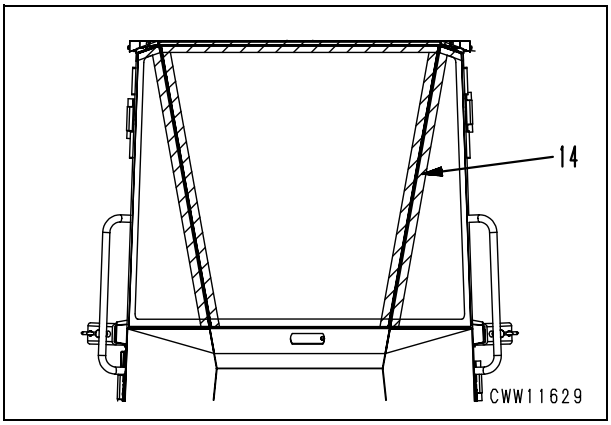
   3) After sticking window glass (3), press it evenly.
      ★ Press all over the window glass to the degree that the window glass will be stuck to the both-sided adhesive tape.
      ★ Do not press the window glass too strongly.



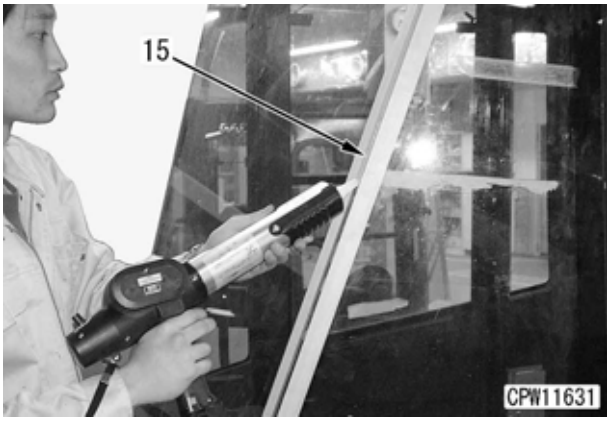
9. Cure the stuck window glass for a certain time.
   ★ Curing time before removing tool **X2-1** (5 mm spacer) (at temperature of 20°C and humidity of 60%): **10 hours**
   ★ Curing time before operating vehicle after application of adhesive: **24 hours (1 day)**

10. If the front glass and the right and left front glasses are replaced, seal them.
    1) Stick masking tapes (14) along the parts to be sealed shown in the figure.
       ★ Stick the masking tapes to both inside and outside of the operator's cab.





    2) Fill the joint of the glasses with caulking material (15).
       ★ The using limit of the following caulking material is 4 months after the date of manufacture. Do not use the caulking material after this limit.
       Caulking material:
       SUNSTAR PENGUINE SEAL No. 2505



    3) Remove the caulking material projected from the joint with cardboard [8] etc.



    4) Remove the masking tapes from the window glass.

11. Remove the primer and adhesive from the operator's cab and window glass.
    ★ Using white gasoline, wipe off the adhesive before it dries.
    ★ When cleaning the glass, do not give an impact to it.

Removal and installation of air conditioner unit assembly

Special tools

Symbol	Part number	Part name	Necessity	Q'ty	N/R	Sketch
X	799-703-1200	Service tool kit	■	1		
	799-703-1100	Vacuum pump (100 V)	■	1		
	799-703-1110	Vacuum pump (220 V)	■	1		
	799-703-1120	Vacuum pump (240 V)	■	1		
	799-703-1401	Gas leak detector	■	1		

Removal

⚠ **Stop the machine on a level place, steer it to the "right" fully, apply the parking brake, stop the engine, and lock the tires with chocks.**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

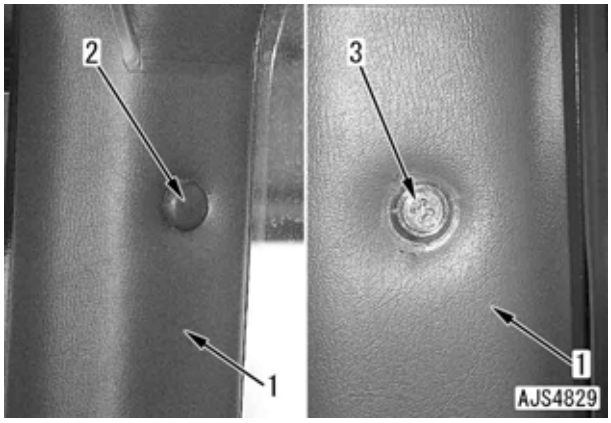
1. Collect the air conditioner refrigerant (R134a). [*1]

2. Cab interior cover (1)

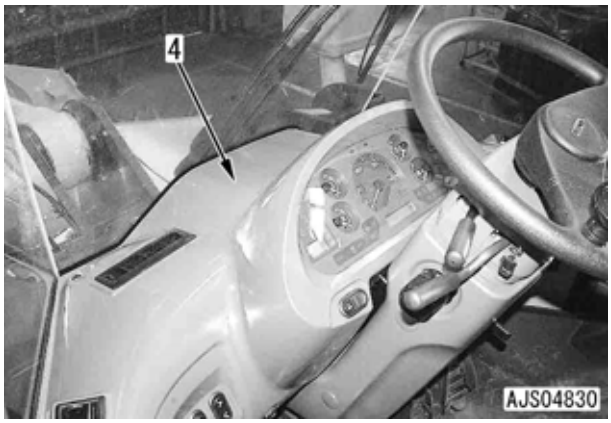


1) Remove cap (2), taking care not to damage cover (1).
★ Do not reuse the cap.

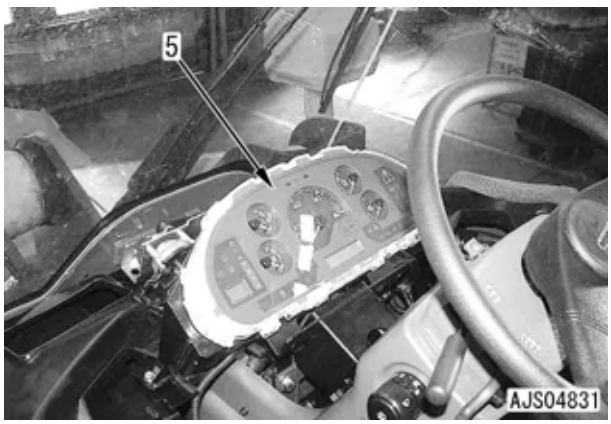
2) Remove screw (3) and cover (1).



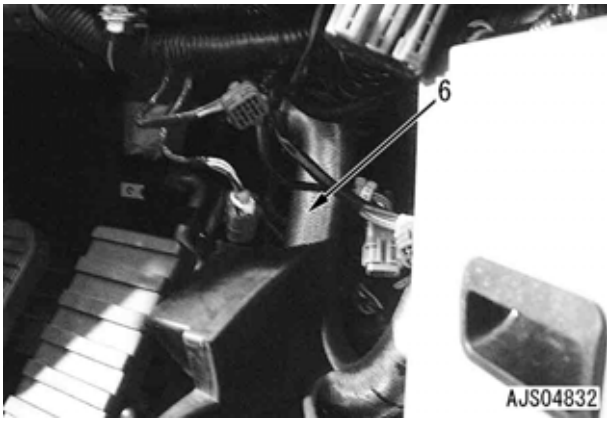
3. Disconnect the connectors of each switch and remove cover (4).



4. Disconnect the connector and remove monitor assembly (5).

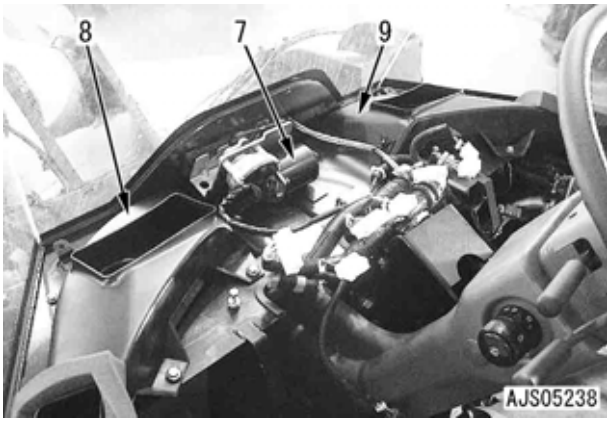


5. Disconnect hose (6) from the right side duct.

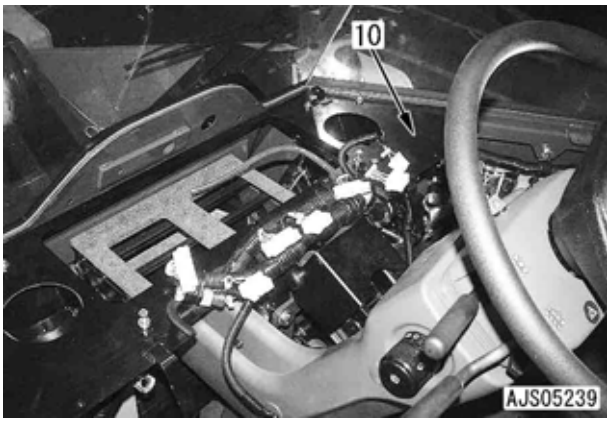


6. Remove the wiper blade and wiper motor assembly (7).

7. Remove right duct (9) and left duct (8).

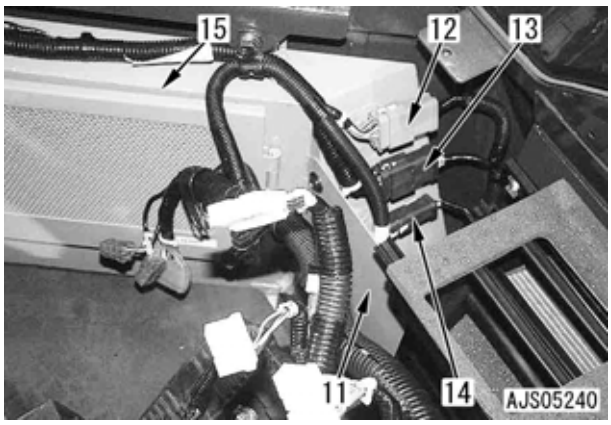


8. Remove plate (10).



9. Remove cover (11) and disconnect connectors C50 (12), C49 (13), and AL1 (14).

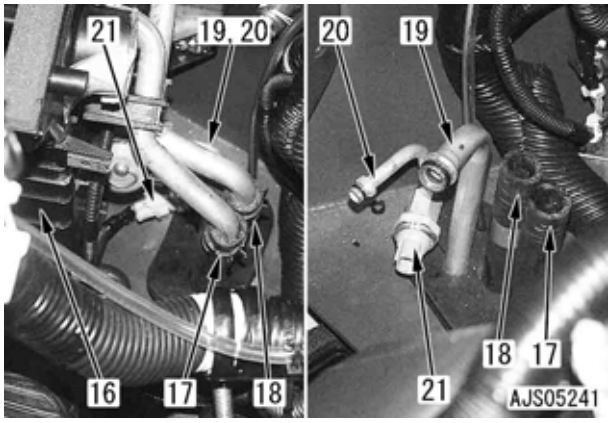
10. Remove air conditioner internal air filter case (15).



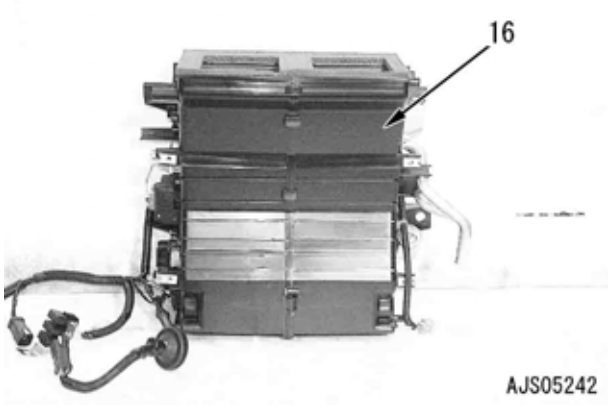
11. Disconnect heater hoses (17) and (18) and air conditioner tubes (19) and (20) under the right of air conditioner unit (16).

★ After disconnecting the hoses and tubes, stop them and the openings on the air conditioner side with plugs etc. to prevent foreign matter from entering. [*2]

12. Disconnect connector (21).

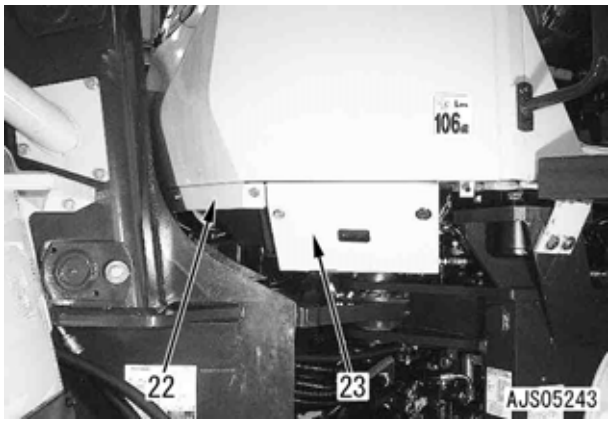


13. Remove the mounting bolts and air conditioner unit assembly (16).

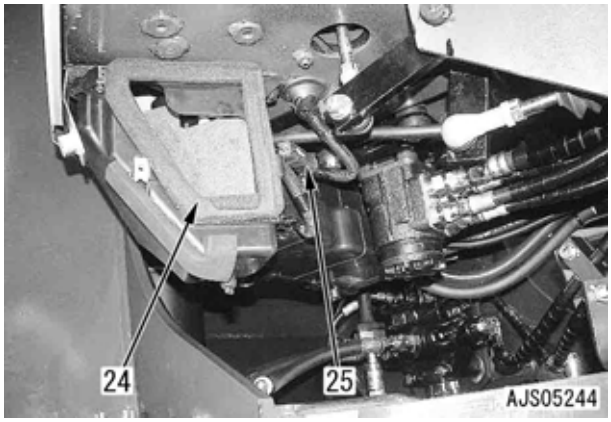


14. Blower motor assembly

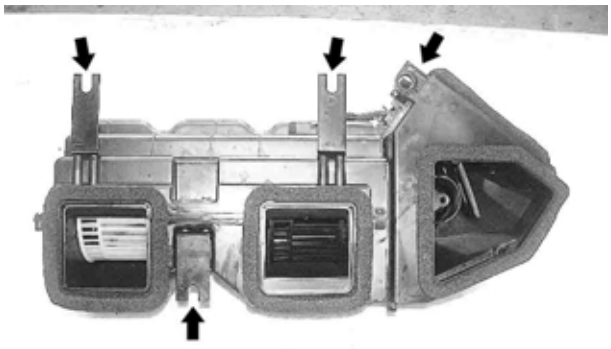
1) Remove cover (22) and air conditioner external air filter case (23).

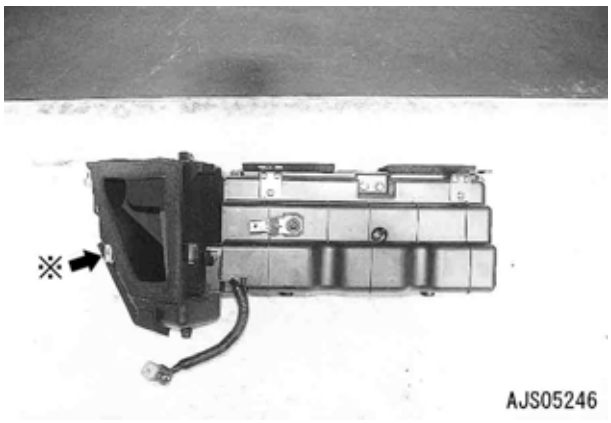


2) Disconnect connector (25) of blower motor (24) from under the left of the floor.



3) Remove the mounting bolts and blower motor assembly (24).
   ★ Number of mounting bolts: 5 (The one marked with * is used to secure external air filter case, too)





Installation

- Carry out installation in the reverse order to removal.

[*1]

★ Using tool **X**, charge the air conditioner unit with refrigerant (R134a).

[*2]

★ Do not remove the plugs used to stop the piping until just before installing the piping.

O-ring and threads: **Compressor oil for R134a (DENSO: ND-OIL8, ZEXEL: ZXL100PG (equivalent to PAG46))**

WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

50 Disassembly and assembly

Electrical system

Electrical system 2
Removal and installation of engine controller assembly 2

Electrical system

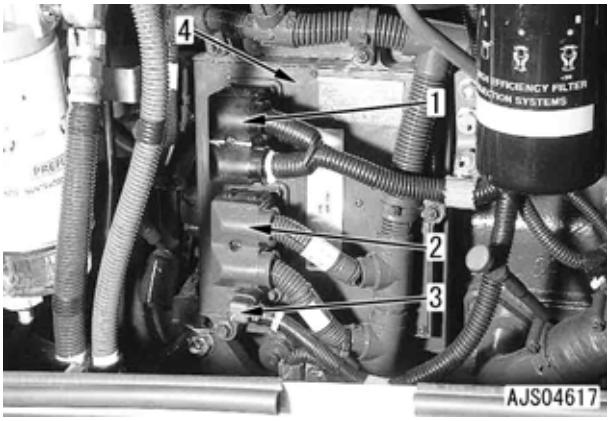
Removal and installation of engine controller assembly

Removal

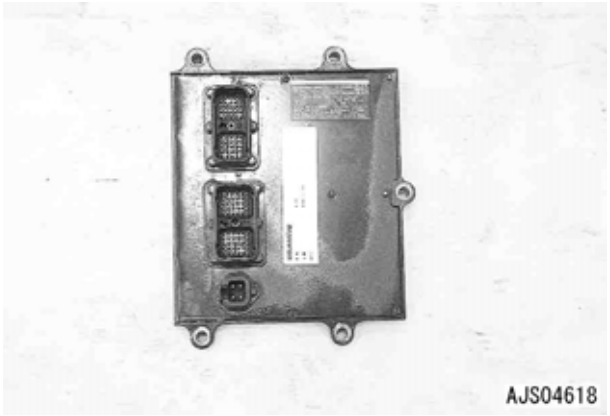
⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Open the right side of the engine hood.

2. Disconnect connectors EC2 (1), ENGINE MODULE (2), and EC3 (3) from engine controller assembly (4).
   ★ Connectors (1) and (2) are fixed with bolts.



3. Remove the 5 mounting bolts and engine controller assembly (4). [*1]



Installation

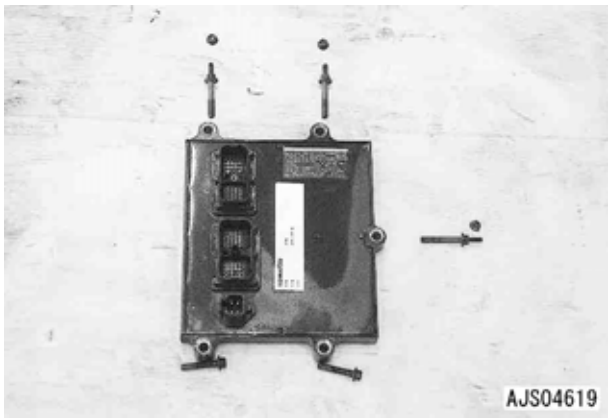
- Carry out installation in the reverse order to removal.

[*1]

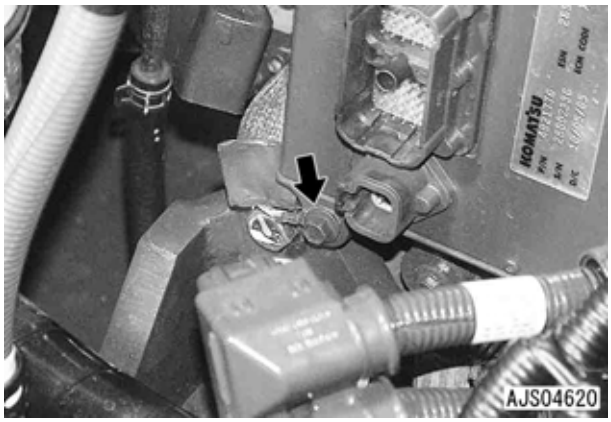
Engine controller assembly mounting bolt (5 pieces): **24 ± 4 Nm {2.45 ± 0.41 kgm}**

- Install the clamps to the 3 engine controller assembly mounting bolts.

Clamp mounting nut: **10 ± 2 Nm {1.0 ± 0.2 kgm}**



- Use the left lower one of the engine controller assembly mounting bolts to secure the ground wire, too.



WHEEL LOADER

WA380-6

Machine model	Serial number
WA380-6	H60051 and up

90 Diagrams and drawings

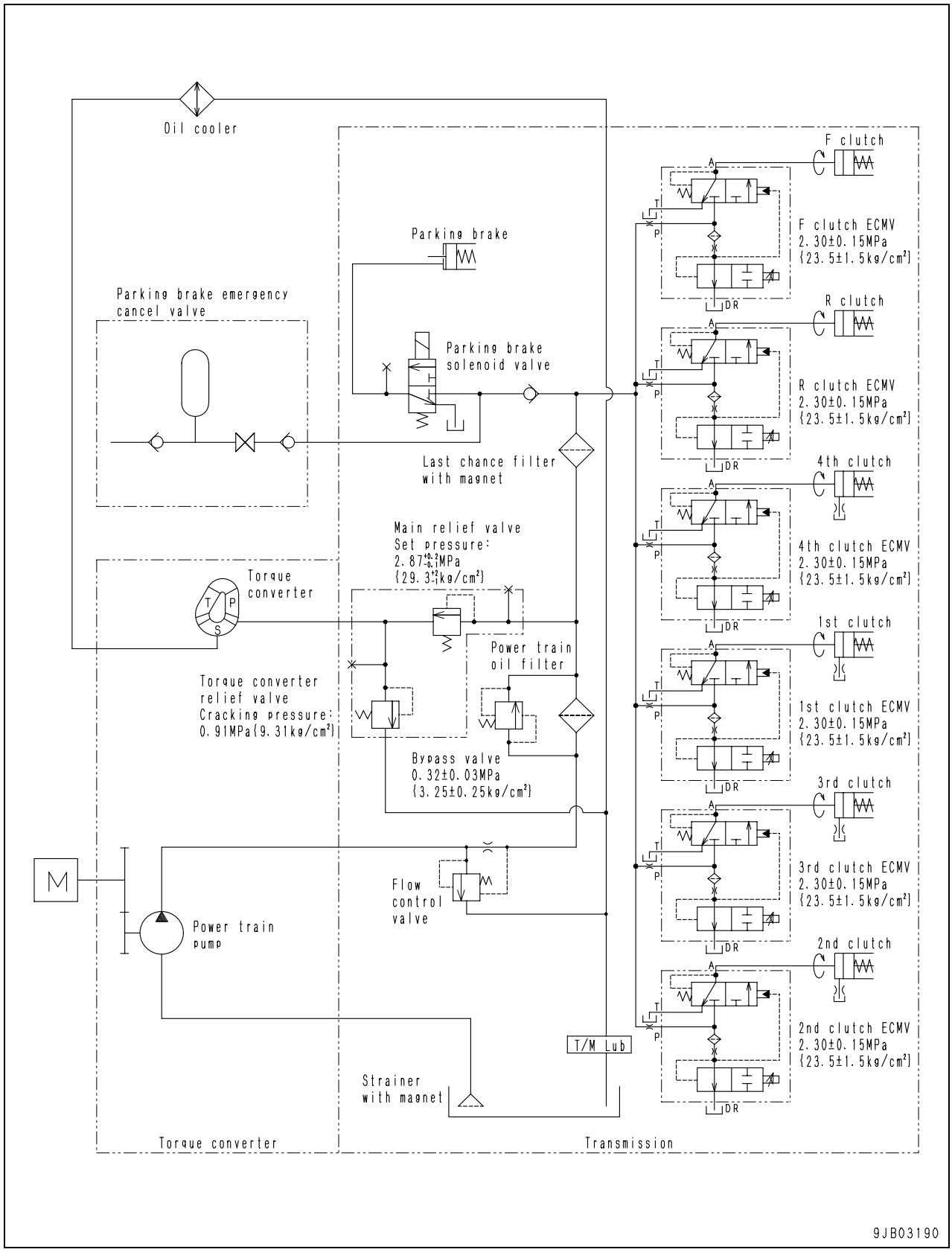
Hydraulic diagrams and drawings

Hydraulic diagrams and drawings 2
Power train hydraulic circuit diagram 2
Hydraulic circuit diagram 5

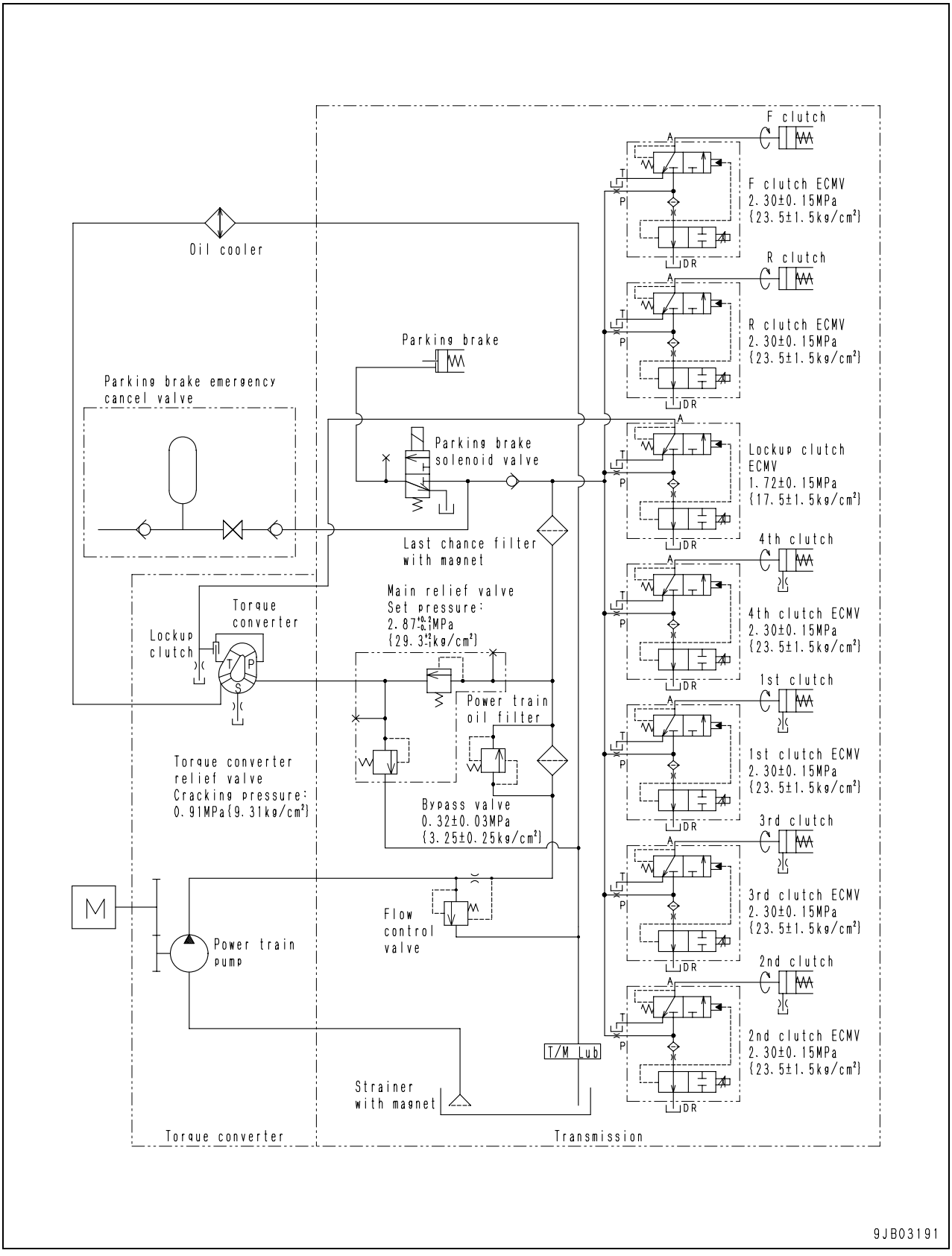
Hydraulic diagrams and drawings

Power train hydraulic circuit diagram

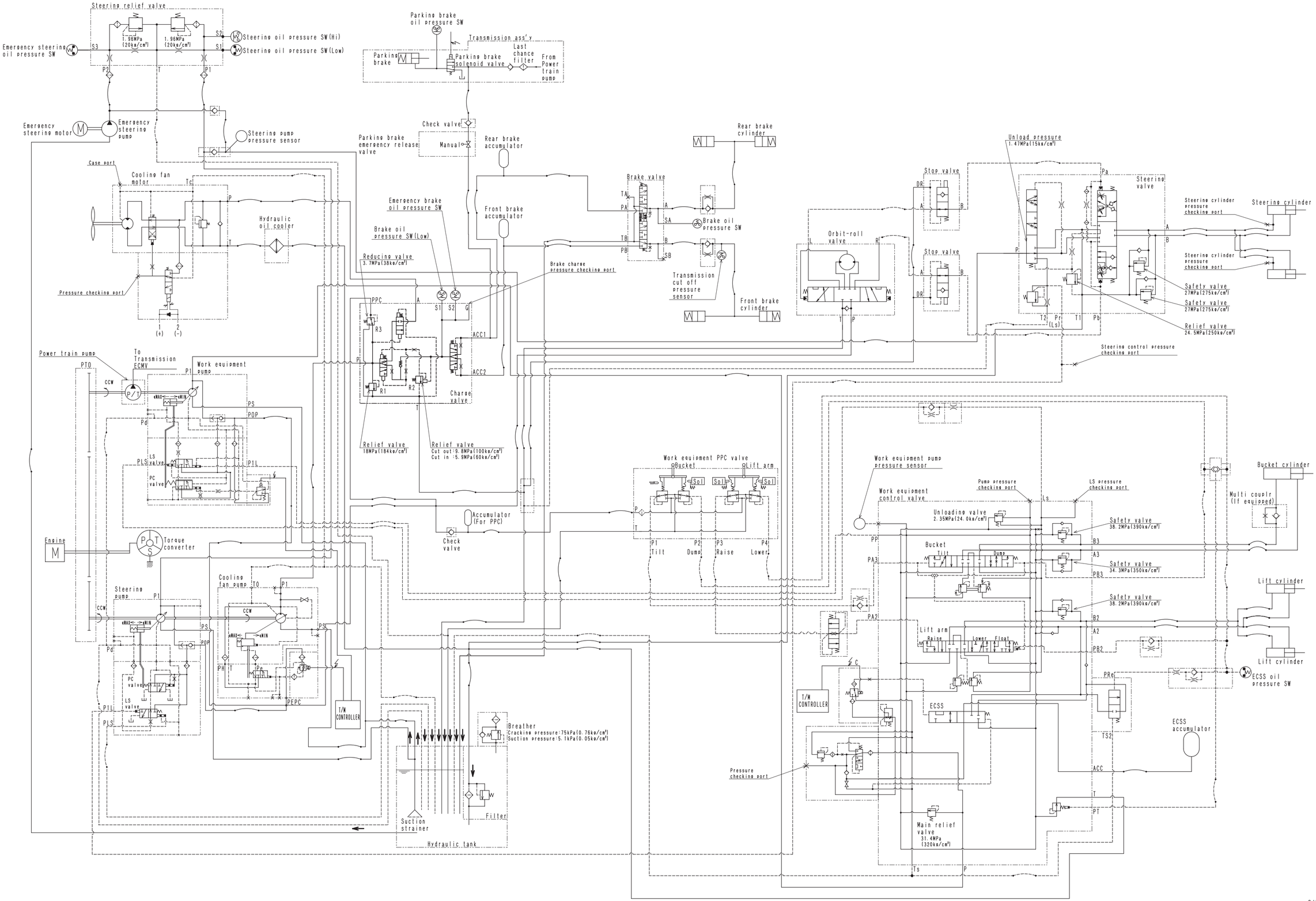
Without lockup clutch



With lockup clutch



Hydraulic circuit diagram



9JB03380

WHEEL LOADER

WA380-6

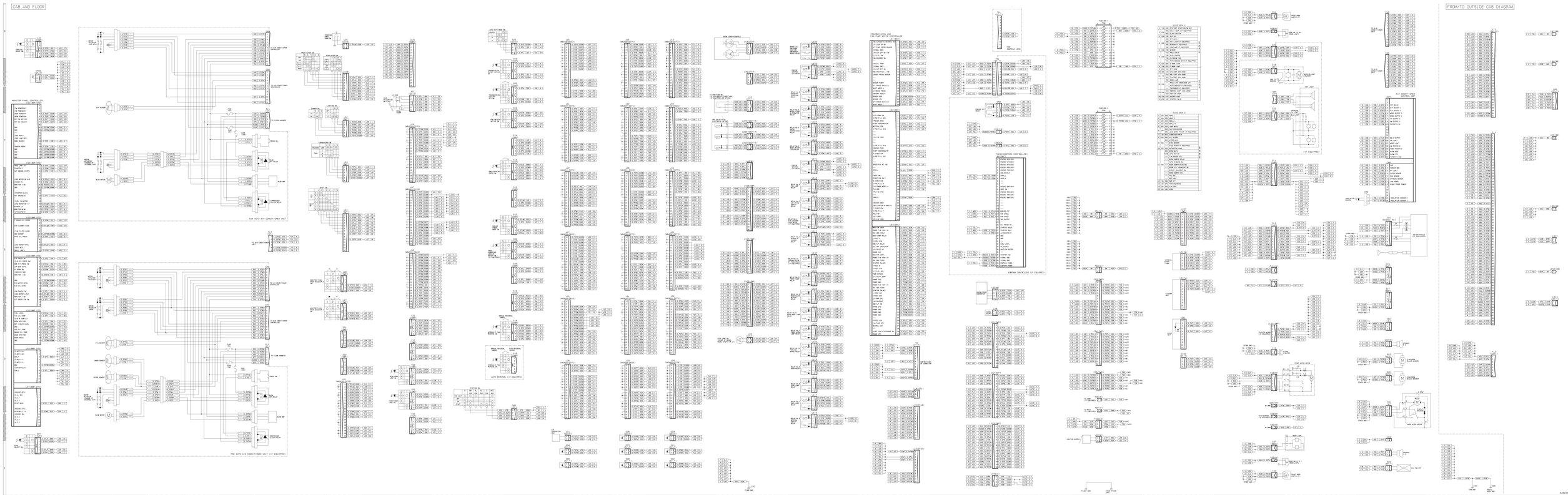
Machine model	Serial number
WA380-6	H60051 and up

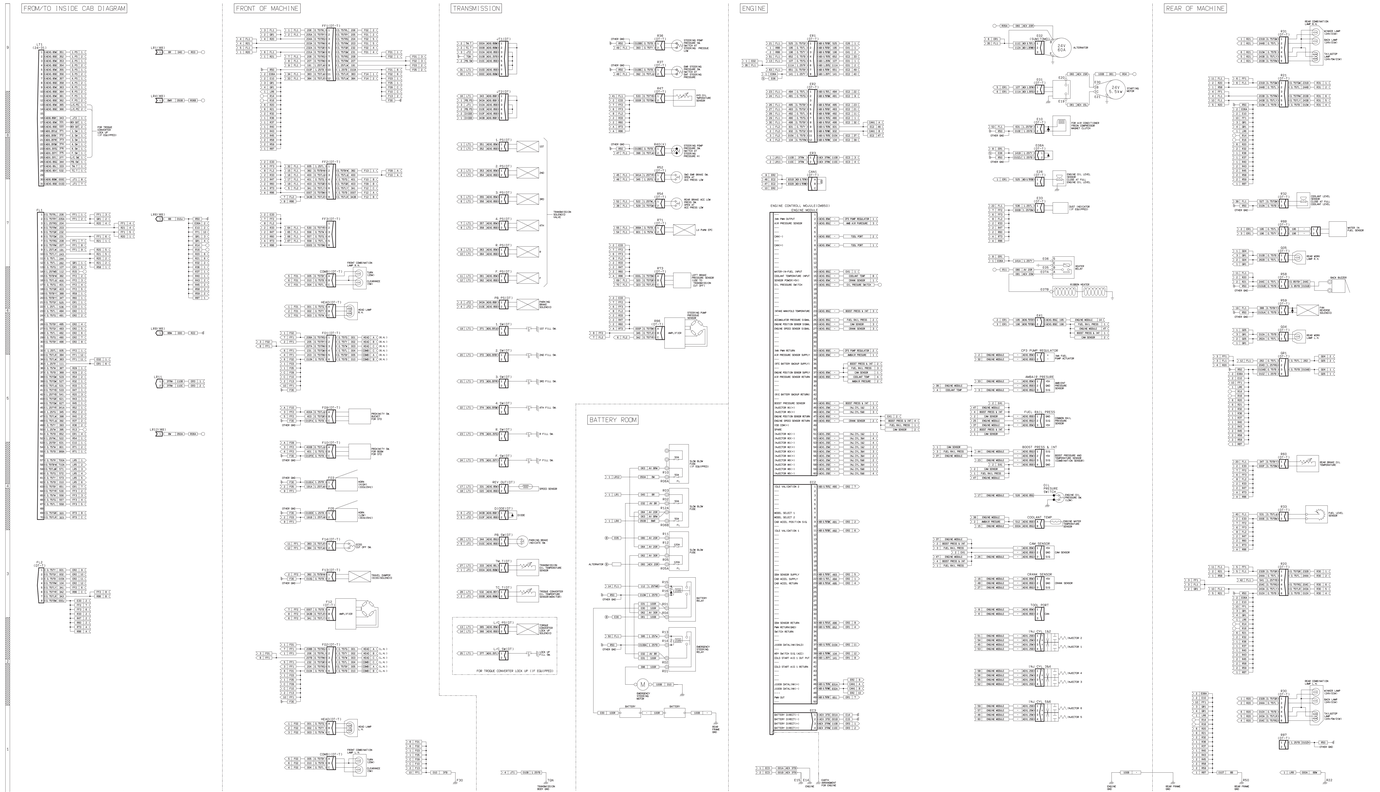
90 Diagrams and drawings

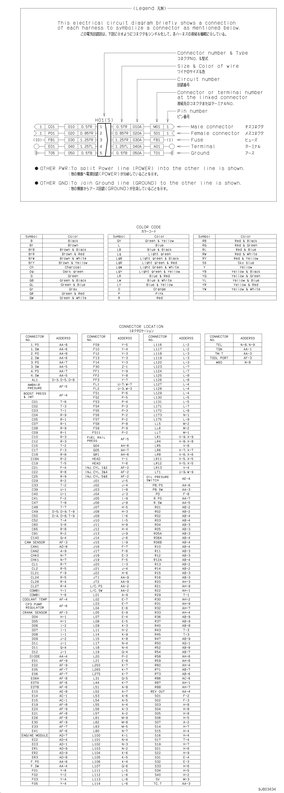
Electrical diagrams and drawings

Electrical diagrams and drawings 3
Electrical circuit diagram (1/2) 3
Electrical circuit diagram (2/2) 5
Connector arrangement diagram 7

CAB AND FLOOR







(Legend (EN))

This electrical circuit diagram briefly shows a connection of each harness to symbols in a connector as mentioned below.
この配線回路図は、下記に示すようなシンボルをもとに、各ハーネスの接続を簡略に示したもの。

COLOR CODE
ワイヤの色

SYMBOL	COLOR	SYMBOL	COLOR	SYMBOL	COLOR
B	BLACK	GY	GRAY / 灰色	RB	RED & BLACK
BR	BROWN / 茶色	L	BLUE / 青色	RG	RED & GREEN
BrB	BROWN & BLACK	LB	LIGHT BLUE / 水色	RL	RED & BLUE
BrR	BROWN & RED	LB/B	LIGHT BLUE & BLACK	RW	RED & WHITE
BrW	BROWN & WHITE	LB/R	LIGHT BLUE & RED	RY	RED & YELLOW
BrY	BROWN & YELLOW	LB/W	LIGHT BLUE & WHITE	W	WHITE / 白色
Dg	DARK GREEN / 濃い緑色	LB/Y	LIGHT BLUE & YELLOW	WB	WHITE & BLACK
G	GREEN / 緑色	LG	LIGHT GREEN / 黄緑色	WG	WHITE & GREEN
GB	GREEN & BLACK	LG/B	LIGHT GREEN & BLACK	WL	WHITE & BLUE
GL	GREEN & BLUE	LG/R	LIGHT GREEN & RED	WR	WHITE & RED
GR	GREEN & RED	LG/W	LIGHT GREEN & WHITE	WY	WHITE & YELLOW
GW	GREEN & WHITE	O	ORANGE / 橙色	Y	YELLOW / 黄色
		P	PINK / 桃色	YB	YELLOW & BLACK
		PU	PURPLE / 紫色	YG	YELLOW & GREEN
		R	RED / 赤色	YL	YELLOW & BLUE
				YR	YELLOW & RED
				YW	YELLOW & WHITE

CONNECTOR LOCATION
コネクタ位置

CONNECTOR No.	ADDRESS	CONNECTOR No.	ADDRESS	CONNECTOR No.	ADDRESS	CONNECTOR No.	ADDRESS
E.FS	A4-C	F28	I-5	L116	L-12	TCL	M-9, N-9
E.IG	A4-D	F29	I-6	L117	L-13	TFT	M-11
E.SW	A4-E	F30	I-7	L118	L-14	TPS	M-11
E.TM	A4-F	F31	I-8	L119	L-15	TOOL PORT	M-12
E.TP	A4-G	F32	I-9	L120	L-16	WIF	N-9
E.TS	A4-H	F33	I-10	L121	L-17		
E.VS	A4-I	F34	I-11	L122	L-18		
F1	A-1	F35	I-12	L123	L-19		
F2	A-2	F36	I-13	L124	L-20		
F3	A-3	F37	I-14	L125	L-21		
F4	A-4	F38	I-15	L126	L-22		
F5	A-5	F39	I-16	L127	L-23		
F6	A-6	F40	I-17	L128	L-24		
F7	A-7	F41	I-18	L129	L-25		
F8	A-8	F42	I-19	L130	L-26		
F9	A-9	F43	I-20	L131	L-27		
F10	A-10	F44	I-21	L132	L-28		
F11	A-11	F45	I-22	L133	L-29		
F12	A-12	F46	I-23	L134	L-30		
F13	A-13	F47	I-24	L135	L-31		
F14	A-14	F48	I-25	L136	L-32		
F15	A-15	F49	I-26	L137	L-33		
F16	A-16	F50	I-27	L138	L-34		
F17	A-17	F51	I-28	L139	L-35		
F18	A-18	F52	I-29	L140	L-36		
F19	A-19	F53	I-30	L141	L-37		
F20	A-20	F54	I-31	L142	L-38		
F21	A-21	F55	I-32	L143	L-39		
F22	A-22	F56	I-33	L144	L-40		
F23	A-23	F57	I-34	L145	L-41		
F24	A-24	F58	I-35	L146	L-42		
F25	A-25	F59	I-36	L147	L-43		
F26	I-3	F60	I-37	L148	L-44		
F27	I-4	L101	A-3	L149	L-45		
		L102	A-4	L150	L-46		
		L103	A-5	L151	L-47		
		L104	A-6	L152	L-48		
		L105	A-7	L153	L-49		
		L106	A-8	L154	L-50		
		L107	A-9	L155	L-51		
		L108	A-10	L156	L-52		
		L109	A-11	L157	L-53		
		L110	A-12	L158	L-54		
		L111	A-13	L159	L-55		
		L112	A-14	L160	L-56		
		L113	A-15	L161	L-57		
		L114	A-16	L162	L-58		
		L115	A-17	L163	L-59		

3UB03434

Connector arrangement diagram

Connector No.	Model	Number of pins	Component name	Address of stereogram
1.PS	DT	2	1st ECMV solenoid	AG-6
1.SW	DT	2	1st ECMV fill switch	AG-6
2.PS	DT	2	2nd ECMV solenoid	AG-6
2.SW	DT	2	2nd ECMV fill switch	AF-5
3.PS	DT	2	3rd ECMV solenoid	AF-1
3.SW	DT	2	3rd ECMV fill switch	AF-1
4.PS	DT	2	4th ECMV solenoid	AE-1
4.SW	DT	2	4th ECMV fill switch	AE-1
AL1	DT	6	Intermediate connector (Air conditioner wiring harness)	S-1
AMB AIR PRESURE	—	3	Ambient pressure sensor	AJ-1
BOOST PRESS & INT	—	4	Boost pressure sensor	AK-4
C01	YAZAKI	9	AM/FM radio	G-9
C02	M	2	Speaker, right	I-9
C03	M	2	Speaker, left	J-9
C04	DT-T	2	Front working lamp, right	F-8
C05	DT-T	2	Front working lamp, left	J-9
C07	KES1	2	Room lamp	J-9
C08	M	1	Door switch, right	F-8
C09	M	1	Door switch, left	J-9
C10	YAZAKI	2	Cigarette lighter	F-7
C12	M	6	Front wiper motor	E-7
C140	DT-T	4	Tachograph (if equipped)	Z-5
C141	DT-T	6	Tachograph (if equipped)	Z-4
C15	M	4	Rear wiper motor	K-9
C17	SWP	6	Caution lamp, yellow rotary lamp (if equipped)	Q-5
C18	DT	2	Caution lamp (if equipped)	
C18A	M	1	W/lamp	
C19	SWP	6	Rear glass heater switch	H-9
C21	SWP	6	Caution lamp, rotary lamp (if equipped)	Q-5
C22	DT	3	Rotary lamp (if equipped)	
C25		4	Intermediate connector (Caution lamp, rotary lamp)	F-8
C29	M	1	Intermediate connector	F-9
C33	(Terminal)	1	Rear glass heater	I-9
C35	(Terminal)	1	Rear glass heater	K-9
C39	(Terminal)	1	GND (Radio body)	G-9
C40	(Terminal)	1	GND()	G-9
C41	SWP	6	Fog lamp (if equipped)	Q-4
C47	(Terminal)	1	GND (Beacon)	
C47	JAE IL-AG5	22	Air conditioner controller	H-9
C48	JAE IL-AG5	14	Air conditioner controller	G-9
C49	DT2(B)	12	Intermediate connector (Air conditioner controller)	D-6
C50	DT2(Gr)	12	Intermediate connector (Air conditioner controller)	E-6
C52	S	3	Multi-coupler switch (if equipped)	H-9
C60	AMP	2	Daylight sensor	F-7
C61	SHINAGAWA	5	Caution lamp, yellow rotary lamp relay (if equipped)	X-9
C62	JIDOSYA DENKI KOGYO	5	Caution lamp, rotary lamp relay (if equipped)	X-9
C63	JIDOSYA DENKI KOGYO	6	Caution lamp, rotary lamp relay (if equipped)	X-9
C64	SHINAGAWA	6	Fog lamp relay (if equipped)	X-9
C65	DT	3	Rotary lamp (if equipped)	
C91	M	1	Intermediate connector (Warning lamp)	
CAM SENSOR	—	3	Bkup speed sensor	AK-1
CAN1	DT-T	3	Diode	AM-1
CAN2	DT-T	3	CAN terminal resistor	Q-2
CHK0	X	1	KOMTRAX test connector	Y-8
CHK1	X	1	KOMTRAX test connector	X-8
CL1	SWP	8	Intermediate connector (Cab wiring harness)	WA-4, O-6W
CL2	SWP	12	Intermediate connector (Cab wiring harness)	WA-5, O-7W
CL21	SWP	16	Intermediate connector	O-7
CL24	X	2	Intermediate connector (Multi-coupler)	A-4
CL26	X	2	Intermediate connector (Cab wiring harness)	O-5
CL26	X	2	Intermediate connector	A-3
CL27	SWP	6	Side wiper (if equipped)	A-4
COMBI	DT-T	3	Combination lamp, right	D-6
COMBI	DT-T	3	Combination lamp, left	H-1
COOLANT TEMP	—	2	Engine coolant temperature sensor	AJ-4
CP3 PUMP REGULATOR	—	2	Supply pump actuator	AN-5
CRANK SENSOR	—	3	Ne speed sensor	AK-1
D04	DT-T	2	Diode	Z-4
D05	DT-T	2	Diode	W-1
D06	DT-T	2	Diode	Z-4
D07	DT-T	2	Diode	Z-4
D08	DT-T	2	Diode	W-1
D09	DT-T	2	Diode	W-2
D11		11	Diode unit	
D11	DT-T	2	Diode	Z-3
D12	DT-T	2	Diode	Z-3
DIODE	DT	2	Diode	AG-7
E01	DT-T	2	Starting motor	AK-5
E02	SUMITOMO	3	Alternator	N-4
E03	(Terminal)	1	Alternator B terminal	N-5
E05	(Terminal)	1	Heater relay	B-8
E06	(Terminal)	1	Heater relay	C-6
E06A	DT-T	2	Diode	B-6
E07A	(Terminal)	1	Heater relay	AL-6
E07B	(Terminal)	1	Electrical intake air heater	AN-2
E10	DT-T	2	Air conditioner compressor magnet clutch	N-3
E14	(Terminal)	1	GND (Engine)	AN-2
E15	(Terminal)	1	GND (Engine)	AM-1
E19	(Terminal)	1	Engine safety relay	AL-6
E20	(Terminal)	1	Engine safety relay	AK-5
E21	(Terminal)	1	Starting motor	AJ-4
E26	DT-T	2	Engine oil level sensor	AK-5
E30	(Terminal)	1	Starting motor	AJ-5
E33	DT-T	2	Dust indicator	K-9
E41	DT-T	2	Intermediate connector (Engine controller)	AM-1
EC2	DRC26	50	Engine controller	AL-1
EC3	DTP	4	Engine controller	AL-1
ENGINE MODULE	DRC26	60	Engine controller	AL-1
ER1	DT-T	8	Intermediate connector (Engine controller)	WD-7, AJ-5W
ER2	DT-T	12	Intermediate connector (Engine controller)	WD-8, AK-5W
ER3	L	2	Intermediate connector (Engine controller)	WD-8, AK-5W
F.PS	DT	2	F (Forward) ECMV solenoid	AE-2

Connector No.	Model	Number of pins	Component name	Address of stereogram
F.SW	DT	2	F (Forward) ECMV fill switch	AE-1
F01	DT-T	6	Intermediate connector (headlamp, right)	C-5
F02	DT-T	6	Intermediate connector (Headlamp, left)	H-1
F03	090U	2	Horn, Hi	F-1
F05	090U	2	Horn, Lo	E-1
F09	DT-T	3	Bucket proximity switch	C-3
F10	DT-T	3	Boom proximity switch	C-5
F12	DT-T	3	Work equipment pump pressure sensor	E-1
F13	DT-T	2	E.C.S.S. solenoid	F-1
F14	DT-T	2	E.C.S.S. cut-off switch	F-1
F15	DT-T	3	Boom potentiometer	C-5
F16	DT-T	3	Boom bottom pressure sensor	G-1
F17	DT-T	3	Boom head pressure sensor	G-1
F18	DT2	2	Lift arm angle potentiometer (Lift arm/bucket EPC specification) (if equipped)	
F19	DT2	2	Bucket positioner (Lift arm/bucket EPC specification) (if equipped)	
F20	DT2	2	Lift arm raise EPC (Lift arm/bucket EPC specification) (if equipped)	
F21	DT2	2	Lift arm lower EPC (Lift arm/bucket EPC specification) (if equipped)	
F22	DT2	2	Bucket tilt EPC (Lift arm/bucket EPC specification) (if equipped)	
F23	DT2	2	Bucket dump EPC (Lift arm/bucket EPC specification) (if equipped)	
F24	DT2	2	3-spool valve (Attachment) extension EPC (Lift arm/bucket EPC specification) (if equipped)	
F25	DT2	2	3-spool valve (Attachment) retraction EPC (Lift arm/bucket EPC specification) (if equipped)	
F26	DT2	2	Lift arm EPC cut-off solenoid (Lift arm/bucket EPC specification) (if equipped)	
F30	(Terminal)	1	GND (Front frame)	C-4
F30	(Terminal)	1	GND (Front frame)	
F31	DT-T	2	Multi-coupler extension solenoid	
F32	DT-T	2	Diode	
F33	DT-T	2	Multi-coupler retraction solenoid	
F34	DT-T	2	Diode	
F35	(Terminal)	1	Fog lamp, right (if equipped)	
F35A	(Terminal)	1	Fog lamp (right) (if equipped)	
F36	(Terminal)	1	Fog lamp, left (if equipped)	
F36A	(Terminal)	1	Fog lamp (left) (if equipped)	
FF1	DT-T	12	Intermediate wiring harness (Front wiring harness – rear wiring harness)	G-1
FF2	DT-T	8	Intermediate wiring harness (Front wiring harness – rear wiring harness)	H-1
FF3	DT-T	6	Intermediate wiring harness (Front wiring harness – rear wiring harness)	G-1
FL1	DRC12	70	Intermediate connector (Floor wiring harness – rear wiring harness)	Z-3
FL2	DT-T	8	Intermediate connector (Floor wiring harness – rear wiring harness)	X-2
FL7	DT2(Br)	8	Intermediate connector (Lift arm EPC) (Joystick steering specification) (if equipped)	
FL8	DT2(G)	8	Intermediate connector (Lift arm EPC) (Joystick steering specification) (if equipped)	
FL9	DT2	4	Intermediate connector (3-spool valve) (Attachment EPC) (Joystick steering specification) (if equipped)	
FS1	L	2	Intermediate connector (Fuse box B)	Y-1
FS11	X	3	Intermediate connector (Fuse box B)	Z-1
FS2	L	2	Intermediate connector (Fuse box A)	Y-1
FS3	SWP	16	Intermediate connector (Fuse box B)	Y-2
FS4	SWP	12	Intermediate connector (Fuse box A)	Y-2
FS5	SWP	6	Intermediate connector (Fuse box A)	Y-1
FS6	X	1	Intermediate connector (Fuse box B)	Z-1
FS7	X	1	Intermediate connector (Fuse box B)	Z-1
FUEL RAIL PRESS	—	3	Common rail pressure sensor	AM-5
G04	DT-T	2	Left rear working lamp	N-9
G05	DT-T	2	Right rear working lamp	L-9
GR1	DT-T	4	Intermediate connector (Rear working lamp)	N-6
HEAD	DT-T	3	Headlamp, right	D-6
HEAD	DT-T	3	Headlamp, left	H-1
INJ. CYL. 1&2	—	4	Injectors #1 & #2	AJ-4
INJ. CYL. 3&4	—	4	Injectors #3 & #4	AK-5
INJ. CYL. 5&6	—	4	Injectors #5 & #6	AL-5
J01	M6409-0073	20	Junction connector	V-1
J02	M6409-0073	20	Junction connector	V-1
J03	M6409-0071	20	Junction connector	U-1
J04	M6440-0128	20	Junction connector	V-1
J05	M6409-0075	20	Junction connector	U-1
J06	M6409-0603	20	Junction connector	U-9
J07	M6409-0603	20	Junction connector	U-1
J08	M6409-0071	20	Junction connector	U-1
J09	M6440-0128	20	Junction connector	U-1
J10	M6409-0075	20	Junction connector	U-1
J11	M6409-0075	20	Junction connector	U-1
J12	M6409-0603	20	Junction connector	U-1
J13	M6409-0073	20	Junction connector	U-9
J14	M6409-0075	20	Junction connector	U-9
J15	M6409-0603	20	Junction connector	U-1
J16	M6409-0075	20	Junction connector	Q-6
J17	M6440-0128	20	Junction connector	Q-6
J18	M6409-0075	20	Junction connector	U-1
J19	M6409-0603	20	Junction connector	Q-5
J20	M6409-0603	20	Junction connector	U-1
J21	M6409-0075	20	Junction connector	U-1
J22	M6409-0071	20	Junction connector	
J41	M6409-0128	20	Junction connector (Joystick steering specification) (if equipped)	
J42	M6409-0128	20	Junction connector (Joystick steering specification) (if equipped)	
J44	M6409-0071	20	Junction connector (Joystick steering specification) (if equipped)	
J45	DT2(B)	8	Junction connector (Joystick steering specification) (if equipped)	
J46	DT2	6	Junction connector (Joystick steering specification) (if equipped)	
JL1	DT2(Gr)	8	Junction connector (Joystick steering specification) (if equipped)	AA-4
JL2	DTM	12	Joystick lever switch	AA-4
JS1	SWP	6	Joystick ON/OFF switch	AB-6
JS2	SWP	6	Steering speed mode switch	AA-6
JS3	DT2	4	Joystick lever potentiometer	AA-6
JS4	DT2	2	Joystick neutral lock switch	AB-4
JT1	DT	8	Junction connector	AF-5

Connector No.	Model	Number of pins	Component name	Address of stereogram
JT2	DT	6	Junction connector	AD-4
L/C.PS	DT	2	Torque converter lockup ECMV solenoid (if equipped)	AE-1
L/C.SW	DT	2	Torque converter lockup ECMV fill switch (if equipped)	AE-1
L01	SWP	6	Parking brake switch	R-7
L02	SWP	6	Lighting switch	S-8
L03	SWP	6	Turn & Hazard switch	S-8
L04	SWP	14	Intermediate connector (Shift switch)	T-8
L05	DT-T	2	Steering wheel horn switch	S-7
L07	SWP	6	Machine monitor mode selector switch 1	T-1
L08	SWP	6	Machine monitor mode selector switch 2	T-1
L09	DT-T	2	Stop lamp switch	W-1
L100	(Terminal)	1	GND (Floor)	Y-3
L101	SWP	16	Intermediate connector (Relay)	Z-2
L102	SWP	16	Intermediate connector (Relay)	Z-2
L103	SWP	16	Intermediate connector (Relay)	Z-3
L104	SWP	16	Intermediate connector (Relay)	W-9
L105	SWP	12	Intermediate connector (Relay)	V-9
L106	SWP	16	Intermediate connector (Relay)	V-9
L107	SWP	12	Intermediate connector (Wiper timer)	Z-5
L11	DT-T	2	Intermediate connector (Air suspension seat)	WU-9, AA-6W
L111	YAZAKI	5	Relay No. 1 winker & hazard	Z-8
L112	YAZAKI	5	Relay No. 2 air cleaner clock (if equipped)	Z-8
L113	YAZAKI	5	Relay No. 3, joystick safety relay	Y-8
L114	YAZAKI	5	Relay No. 4, fog lamp (1)	Y-8
L116	YAZAKI	5	Relay No. 6, neutral safety	Z-8
L117	YAZAKI	5	Relay No. 7, backup lamp	Z-8
L118	YAZAKI	5	Relay No. 8, stop lamp	Z-8
L119	YAZAKI	5	Relay No. 9, horn	Y-8
L12	DT-T	4	Right FNR (Directional) switch or multi-function lever (if equipped)	P-1
L120	YAZAKI	5	Relay No. 10, parking brake	Y-9
L123	YAZAKI	5	Relay No. 3, boom detent	Y-9
L124	YAZAKI	5	Relay No. 4, bucket detent	Y-9
L125	YAZAKI	5	Relay No. 5, boom detent alternate	X-9
L126	YAZAKI	5	Relay No. 6, emergency steering	X-9
L127	YAZAKI	5	Relay No. 7, front working lamp	Y-9
L128	YAZAKI	5	Relay No. 8, rear working lamp	Y-9
L129	YAZAKI	5	Relay No. 9, rear glass with heater	X-9
L13	DT2	2	Lift arm neutral lock switch (joystick steering specification) (if equipped)	
L130	YAZAKI	5	Relay No. 10, transmission bypass	X-9
L131	YAZAKI	5	Relay No. 11, headlamp	X-9
L14	DT-T	4	Lift arm kick-down & hold switch or multi-function lever (if equipped)	WO-4, P-2W
L141	JIDOSYA DENKI KOGYO	5	Front washing relay	
L142	DT	2	Diode	
L143	DT	2	Diode	
L144	DT	2	Diode	
L145	DT	2	Diode	
L146	DT	2	Diode	
L147	DT	2	Diode	
L15	DT-T	4	Bucket lever (Load meter specification) (if equipped)	WO-4, P-2W
L17	M	4	DC24V/DC12V converter	W-9
L171	YAZAKI	5	Engine controller cut relay	Y-8
L172	YAZAKI	5	Engine controller cut relay	Z-8
L173	X	4	Intermediate connector (Relay)	Z-2
L175	YAZAKI	6	Brake oil pressure caution, emergency brake relay	Y-8
L18	YAZAKI	2	12VDC socket	W-9
L19	M	4	Flasher unit	Z-1
L20	M	2	Caution buzzer	Z-5
L21	S	10	Intermediate connector (Front/Rear wiper switch)	R-7
L25E	DT2	2	Bucket dump detent solenoid (Joystick steering specification) (if equipped)	
L25S	DT-T	2	Electrical detent PPC valve	P-1
L26E	DT2	2	Lift arm raise detent solenoid (Joystick steering specification) (if equipped)	
L26S	DT-T	2	Electrical detent PPC valve	P-1
L27	DT2	2	Lift arm lower detent solenoid (Joystick steering specification) (if equipped)	
L27S	DT-T	2	Electrical detent PPC valve	P-1
L28	DT2	4	Lift arm EPC lever (Joystick steering specification9 (if equipped)	
L29	DT2	4	Bucket EPC lever (Joystick steering specification9 (if equipped)	
L30	DT2	4	3-spool valve (Attachment) EPC lever (Joystick steering specification) (if equipped)	
L31	M	6	Interval wiper timer	Z-2
L34	DT2	4	Joystick steering potentiometer (Joystick steering specification) (if equipped)	
L35	DT2	2	Joystick steering right EPC (Joystick steering specification) (if equipped)	
L36	DT2	2	Joystick steering left EPC (Joystick steering specification) (if equipped)	
L36A	DT	4	Intermediate connector (Joystick steering EPC) (Joystick steering specification) (if equipped)	
L37	DTM	12	Joystick steering lever switch (Joystick steering specification) (if equipped)	
L38	DT2	3	Joystick steering neutral lock switch (Joystick steering specification) (if equipped)	
L39	DT2	6	Joystick steering ON/OFF switch (Joystick steering specification) (if equipped)	
L40	DT2	6	Joystick steering speed mode switch (Joystick steering specification) (if equipped)	
L41	JIDOSYADENK IKOGYO	6	Joystick steering cut-off relay (Joystick steering specification) (if equipped)	
L44	M	6	Intermediate connector (Load meter printer wiring harness)	V-9
L45	D-sub25	25	Printer	
L46	HOSHIDEN	4	Printer	
L51	AMP 070	20	Machine monitor	Q-3
L52	AMP 070	18	Machine monitor	Q-3
L53	AMP 070	12	Machine monitor	Q-3
L54	AMP 070	18	Machine monitor	R-7
L55	AMP 070	12	Machine monitor	Q-6
L56	AMP 070	12	Machine monitor	Q-3
L57	AMP 070	14	Machine monitor	Q-6
L61	DRC26	24	Transmission controller	Y-7
L62	DRC26	40	Transmission controller	Y-8
L63	DRC26	40	Transmission controller	Y-8
L71	DRC26	24	Work equipment controller (Joystick steering specification) (if equipped)	
L72	DRC26	40	Work equipment controller (Joystick steering specification) (if equipped)	

Connector No.	Model	Number of pins	Component name	Address of stereogram
L73	DRC26	40	Work equipment controller (Joystick steering specification) (if equipped)	
L80	DRC26	40	KOMTRAX controller	
LL5	DT-T	3	Intermediate connector (Work equipment controller)	Z-9
LL6	DT-T	12	Intermediate connector (Work equipment controller)	Z-8
LL7	DT-T	12	Intermediate connector (Work equipment controller)	Z-8
LL8	DT2(Gr)	8	Intermediate connector (Joystick steering specification) (if equipped)	
LR1	DTHD	1	Intermediate connector (Floor wiring harness – rear wiring harness)	Y-3
LR11	DT-T	2	Intermediate connector (Floor wiring harness – rear wiring harness)	X-2
LR12	DTHD	1	Intermediate connector (Floor wiring harness – rear wiring harness)	X-2
LR13	DT-T	2	Intermediate connector (Pump bypass solenoid) (if equipped)	X-2
LR2	DT	2	Intermediate connector (Multi-coupler solenoid)	
LR3	DT	1	Intermediate connector	
LR4	DTHD	1	Intermediate connector (Floor wiring harness – rear wiring harness)	Y-2
LR5	DT-T	6	Intermediate connector (Auto grease wiring harness) (if equipped)	A-2
LR6	DTHD	1	Intermediate connector (Floor wiring harness – rear wiring harness)	X-2
LR8	DTHD	1	Intermediate connector (Floor wiring harness – rear wiring harness)	Y-2
LT1	HD30	31	Intermediate connector (Transmission wiring harness)	WY-3, AG-8W
MLT	DTM	12	Multi-function lever switch (if equipped)	
OIL PRESSRE SWITCH	(Terminal)	1	Engine oil pressure switch, Lo	AM-1
PB.PS	DT	2	Parking brake solenoid	AG-7
PB.SW	DT	2	Parking brake indicator switch	AG-8
PD	DT-T	6	Idle validation switch	P-5
PDV		2	Accelerator pedal	O-5
R.PS	DT	2	R (Reverse) ECMV solenoid	AG-7
R.SW	DT	2	R (Reverse) ECMV fill switch	AG-7
R01	(Terminal)	1	Battery relay	N-3
R02	(Terminal)	1	Slow blow fuse	B-8
R02	(Terminal)	1	Emergency steering relay	N-2
R03	(Terminal)	1	Slow blow fuse	B-9
R04	(Terminal)	1	Battery relay	N-3
R05	(Terminal)	1	Slow blow fuse	A-8
R05A	(Terminal)	1	Slow blow fuse	A-9
R06A	(Terminal)	1	Slow blow fuse	B-9
R06B	(Terminal)	1	Slow blow fuse	A-9
R10	(Terminal)	1	Slow blow fuse	B-9
R11	(Terminal)	1	Slow blow fuse	A-9
R12	(Terminal)	1	Slow blow fuse	A-9
R12A	(Terminal)	1	Slow blow fuse	B-8
R13	(Terminal)	1	Emergency steering relay	C-7
R14	(Terminal)	1	Emergency steering relay	C-7
R15	(Terminal)	1	Battery relay	C-7
R16	(Terminal)	1	Battery relay	C-7
R20	DT-T	6	Intermediate connector (Rear combination lamp, left)	N-5
R21	DT-T	6	Intermediate connector (Rear combination lamp, right)	N-7
R22	(Terminal)	1	GND	M-9
R29	DT-T	2	Hydraulic fan EPC	K-1
R30	DT-T	6	Rear combination lamp, left	N-6
R31	DT	6	Rear combination lamp, right	M-9
R32	DT-T	2	Coolant level sensor	N-7
R33	DT-T	2	Fuel level sensor	N-3
R36	DT-T	2	Pressure switch (Steering pump)	I-1
R37	DT-T	2	Pressure switch (Emergency steering)	J-1
R38	DT	6	Auto grease controller	
R40	X	2	Pressure switch (Steering pump)	I-1
R43	KES1	2	Front windshield washer	L-1
R45	KES1	2	Rear windshield washer	L-2
R47	DT-T	2	Hydraulic oil temperature sensor	E-7
R50	(Terminal)	1	GND (Rear frame)	N-5
R52	DT-T	2	Emergency brake switch	I-1
R54	DT-T	2	Rear brake pressure switch	I-1
R58	DT-T	2	Backup buzzer	N-7
R59	DT-T	2	Fan reverse solenoid	N-8
R60	DT-T	2	Rear brake oil temperature sensor	M-2
R71	DT-T	2	Loader pump EPC	K-1
R73	DT-T	3	Brake oil pressure sensor (For transmission cut-off)	J-1
R86	DT-T	3	Steering pump pressure sensor	I-1
R87	DT	2	Intermediate connector	A-2
R88	DT-T	2	Water-in-fuel sensor	N-8
REV OUT	DT	2	Speed sensor	AE-4
S1	DT-T	2	Electric detent PPC valve	O-3
S01	SWP	6	Front working lamp	Q-4
S02	SWP	6	Rear working lamp	Q-5
S03	SWP	6	Transmission cut-off switch	P-9
S04	SWP	6	FNR selector switch	Q-9
S05	SWP	6	Transmission cut-off set switch	Q-9
S06	SWP	6	Torque converter lockup ON/OFF switch	P-8
S07	SWP	6	E.C.S.S. switch	S-1
S14	SWP	6	Upper and lower section remote position ON/OFF switch	Q-9
S15	SWP	6	Automatic digging switch	R-9
S16	SWP	6	Hydraulic fan selector switch	R-9
S17	SWP	6	Auto grease switch (if equipped)	H-9
S19	SWP	6	Emergency steering check switch	Q-9
S21	SWP	6	Engine power mode switch	P-8
S22	DT-T	4	Auto-shift mode switch	P-8
S3	DT-T	2	Electric detent PPC valve	O-3
S31	SWP	6	Load meter mode selector switch (if equipped)	T-1
S32	SWP	6	Load meter display selection (if equipped)	U-1
S33	SWP	6	Remote positioner bucket raise/lower (if equipped)	Q-9
S34	SWP	6	2-stage idle function switch	R-9
S4	DT-T	2	Electric detent PPC valve	O-3
S40	DT	4	Starting motor switch	T-8
SV	DT-T	12	KOM-NET (CAN) SV connector	Z-5
T21	DT	2	Pump bypass solenoid (if equipped)	
TC.T	DT	2	Torque converter oil temperature sensor (Monitor)	AH-1
TEL	DT-T	12	Intermediate connector (KOMTRAX)	U-9
TGN	(Terminal)	1	GND (Transmission body)	AF-5
TM.T	DT	2	Transmission lubricating oil temperature sensor	AH-2
TOOL PORT	—	3	CAN	AK-1
W60	SHINAGAWA	5	KOMTRAX engine cut relay	X-8

